Kathy Noel

From: Annemarie Clisby
Sent: Wednesday, August 21, 2019 11:06 AM
To: Roy Sapau
Subject: FW: AT&T Comments on City of Encinitas' proposed small wireless facility regulations
Attachments: AT&T Comments August 21 2019.pdf

From: Shank, Aaron M. <AShank@porterwright.com>
Sent: Wednesday, August 21, 2019 10:42 AM
To: Catherine Blakespear <cblakespear@encinitasca.gov>; Jody Hubbard <jhubbard@encinitasca.gov>; Tony Kranz <tkranz@encinitasca.gov>; Joe Mosca <jmosca@encinitasca.gov>; Kellie Shay Hinze <khinze@encinitasca.gov>
Cc: Council Members <council@encinitasca.gov>; Annemarie Clisby <Aclisby@encinitasca.gov>; 'MCGEE, KEVIN' <km4510@att.com>
Subject: AT&T Comments on City of Encinitas' proposed small wireless facility regulations

Dear Mayor Blakespear, Deputy Mayor Hubbard and Councilmembers Kranz, Mosca and Hinze: Please accept this letter on behalf of AT&T to provide comments on the city's small wireless facilities policy and resolution adopting fees for right-of-way administrative design review permits. Please feel free to contact us if you have questions.

Aaron M. Shank
Outside Legal Counsel for AT&T

AARON M. SHANK

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August 21, 2019

VIA ELECTRONIC MAIL

City of Encinitas City Council
505 S. Vulcan Ave.
Encinitas, CA 92024

RE: AT&T's Comments on the City of Encinitas' Policy Regulating Small Wireless Facilities and Other Infrastructure Deployments in the Public Rights-of-Way and Resolution Adopting Fees for Review and Issuance of Right-of-Way Administrative Design Review Permits

Dear Mayor Blakespear, Deputy Mayor Hubbard and Councilmembers Kranz, Mosca and Hinze:

I write on behalf of New Cingular Wireless PCS, LLC d/b/a AT&T Mobility (AT&T) to provide comments on the City of Encinitas' policy regulating small wireless facilities and other infrastructure deployments in the public rights-of-way ("Proposed Policy") and resolution adopting fees for review and issuance of right-of-way administrative design review permits ("Proposed Resolution"). AT&T appreciates that the city recognizes the need to address changes in applicable state and federal laws, including the Federal Communications Commission's *Infrastructure Order*.[1] With more than 72% of Americans relying exclusively or primarily on wireless telecommunications, it is especially important to encourage responsible deployments consistent with applicable law.

Unfortunately, the Proposed Policy and Proposed Resolution would establish new rules at odds with state and federal laws. AT&T respectfully asks that the city consider these and other comments from the wireless industry to help make needed changes. AT&T offers the following summary of applicable laws along with specific comments on the Proposed Policy and Proposed Resolution.

[1] *See Accelerating Wireless Broadband Deployment by Removing Barriers to Infrastructure Investment,* Declaratory Ruling and Third Report and Order, FCC 18-133 (September 27, 2018) ("*Infrastructure Order*").

Key Legal Concepts

The Federal Telecommunications Act of 1996 ("Act") establishes key limitations on local regulations. The Act defines the scope and parameters of the city's review of AT&T's applications. Under the Act, the city must take action on AT&T's applications "within a reasonable period of time."[2] The FCC has established and codified application "shot clocks" to implement this timing requirement.[3] And the FCC has made clear that the city must grant all necessary approvals and authorizations within the applicable shot clock.[4] The Act also requires that the city's review of AT&T's applications must be based on substantial evidence.[5] Under the Act, state and local governments may not unreasonably discriminate among providers of functionally equivalent services.[6]

The Act prohibits a local government from denying an application for a wireless telecommunications facility where doing so would "prohibit or have the effect of prohibiting" AT&T from providing wireless telecommunications services.[7] The FCC has ruled that an effective prohibition occurs when the decision of a local government materially inhibits wireless services.[8] The FCC explained that a local government "could materially inhibit service in numerous ways – not only by rendering a service provider unable to provide existing service in a new geographic area or by restricting the entry of a new provider in providing service in a particular area, but also by materially inhibiting the introduction of new services or the improvement of existing services."[9]

Under the *Infrastructure Order*, the FCC established a standard for lawful fees, which requires that: "(1) the fees are a reasonable approximation of the state or local government's costs, (2) only objectively reasonable costs are factored into those fees, and (3) the fees are no higher than the fees charged to similarly-situated competitors in similar situations."[10] And the FCC provides a safe harbor for presumptively reasonable fees: (a) $500 for non-recurring fees for an application including up to five small cells, plus $100 for each small cell beyond five, or

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[2] 47 U.S.C. § 332(c)(7)(B)(ii).
[3] *See* 47 C.F.R. §§ 1.6001, *et seq*.
[4] *See Infrastructure Order* at ¶¶ 132-137 (FCC concluded that shot clocks "apply to all authorizations a locality may require, and to all aspects and steps in the siting process, including license or franchise agreements to access ROW, building permits, public notices and meetings, lease negotiations, electric permits, road closure permits, aesthetic approvals, and other authorizations needed for deployment").
[5] 47 U.S.C. § 332(c)(7)(B)(iii).
[6] 47 U.S.C. § 332(c)(7)(B)(i)(I).
[7] 47 U.S.C. § 332(c)(7)(B)(i)(II).
[8] *See Infrastructure Order* at ¶¶ 35-42; *see also*, *In the Matter of California Payphone Assoc. Petition for Preemption, Etc.*, Opinion and Order, FCC 97-251, 12 FCC Rcd 14191 (July 17, 1997).
[9] *Infrastructure Order* at ¶ 37.
[10] *Id.* at ¶ 50.

$1,000 for non-recurring fees for a new pole to support small cells; and (b) $270 per small cell per year for all recurring fees.[11] Higher fees are presumed to violate the Act.[12]

The FCC also established a standard for local aesthetic regulations that they must be (1) reasonable (i.e., has to be technically feasible), (2) no more burdensome than those applied to other infrastructure deployments, and (3) objective and published in advance.[13] Regulations that do not meet these criteria are preempted as they are presumed to effectively prohibit wireless service in violation if the Act.[14]

AT&T has a statewide franchise right to access and construct telecommunications facilities in the public rights-of-way. Under Public Utilities Code Section 7901, AT&T has the right to access and construct facilities in public rights-of-way in order to furnish wireless services, so long as it does not "incommode" the public use of the public right-of-way. And under Section 7901.1, AT&T's right is subject only to the city's reasonable and equivalent time, place, and manner regulations.

AT&T's Comments on the Proposed Policy

1. Other Permits Required. The Proposed Policy requires an applicant to apply for additional permits and approvals in Section 5(c). The FCC has made clear that all associated permits and approvals are subject to the applicable shot clock.[15]

2. Construction Drawings. In Section 6(a)(3), the city requires wireless providers to provide construction drawings that identify all structures within 500 feet from the proposed project site. AT&T suggests that the city revise this requirement so that providers identify all structures within 25 feet from the proposed project site as construction of a small cell does not impact a very large area.

3. RF Compliance Report. AT&T objects to Section 6(a)(7) requiring an affirmation that a proposed installation will comply with permitted radio frequency emissions "under penalty of perjury" as unreasonable.

4. Pole License Agreement. Section 6(a)(9) states that applicants are not permitted to make any changes to the city's form pole license agreement to attach facilities to structures owned or controlled by the city in the public right-of-way. If applicants make any unpermitted changes, the city can deem the application incomplete. The city should remove this requirement. An

[11] *Id.* at ¶ 79.
[12] *Id.*
[13] *See id.* at ¶ 86.
[14] *See id.*
[15] *See id.* at ¶¶ 132-137, 144.

application should not be considered incomplete if an applicant and the city are negotiating terms under the pole license agreement.

5. Community Meeting. Section 6(b)(2) of the Proposed Policy strongly encourages providers to organize community meetings. While AT&T is happy to work with the city and is interested in hearing from members of the public, an expectation for a community meeting before every small cell application is extremely burdensome and discriminatory to the extent not applied to other infrastructure deployments.

6. Batched Applications. AT&T objects to Section 6(c), which limits submittals to "one application per appointment, or up to five individual applications per appointment as a batch." AT&T will work cooperatively with the city, including being cognizant of staffing resources. But AT&T expects the city to process all applications submitted. In addition, this limit to five applications per batch is inconsistent with the *Infrastructure Order* and the corresponding rule.[16]

7. Incomplete Applications Deemed Withdrawn. Section 6(d) provides that an application is deemed withdrawn if an applicant does not respond to an incomplete notice within 60 calendar days. The city needs to eliminate this procedure. This is inconsistent with the mechanics of the FCC shot clocks. And responses are commonly delayed because the applicant and city staff are working together to resolve issues, which should be encouraged.

8. Peer and Independent Consultant Review. Section 6(f) of the Proposed Policy requires providers to reimburse the city for the costs of consultants related to processing applications. While AT&T appreciates the city's desire to thoroughly review applications, consultants can unnecessarily increase the cost of deployment and slow down the permitting process. Use of consultants should limit review to appropriate and objective criteria, such as a structural safety assessment or compliance with FCC regulations of radio frequency emissions. And the city should be mindful that the cost of a consultant may not pass through to an applicant as only objectively reasonable costs can be passed on through application fees.[17]

9. Notice. AT&T objects to Section 7(a), which requires providers to give notice of installation to all residents within 500 feet of the proposed project site. It does not make sense to require a 500-foot public notice because small cells are by definition small and are not out-of-character given existing infrastructure in the right-of-way. Plus, this notice requirement is preempted by federal law to the extent it is more burdensome than requirements imposed in connection with other infrastructure deployments.

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[16] *See* 47 C.F.R. § 1.6003(c)(2) and *Infrastructure Order* at ¶114.
[17] *See Infrastructure Order* at ¶ 70 (FCC warned that "any unreasonably high costs, such as excessive charges by third party contractors or consultants, may not be passed on through fees even though they are an actual 'cost' to the government").

10. Initial Administrative Decision. Section 8(a) provides the city with "29 shot clock days after the application has been deemed complete" to approve, conditionally approve or deny a permit application. AT&T appreciates that the city recognizes the need for prompt action, but wants to make sure the city is aware that it has only 10 days after submission to review an application for completeness.[18]

11. Prohibited Support Structure. Section 8(b)(3) of the Proposed Policy states that the city will not approve a ROW administrative design review permit application if the proposed project is located on a prohibited support structure. The city defines a prohibited support structure to include decorative poles, traffic signal poles, cabinets or related structures and new, nonreplacement wood poles. The city should strike Section 8(b)(3). First, the FCC made clear that its interpretations apply to all government owned or controlled structures within the right-of-way.[19] These categorical bans will effectively prohibit wireless services in certain parts of the city in violation of the Act.

Moreover, many jurisdictions favor decorative pole designs for small cells, subject to a requirement that new or replacement decorative poles housing small cells are designed to look similar to nearby decorative poles. Further, it makes sense to allow traffic light installations, for instance, because it permits the wireless provider to cover multiple directions from one location, which a mid-block location may not support.

12. Appeals. Section 8(d) authorizes appeals by interested persons. The city must take final action, inclusive of appeals, within the applicable shot clocks. The city should consider eliminating appeals for small cells that may otherwise add unnecessary pressure on the city to meet the FCC's shot clocks.

13. Indemnification and Abandoned Wireless Facilities. The city should not seek indemnity from an underlying property owner, as it does under Section 9(a)(10) of the Proposed Policy. The city also should not seek to impose joint and several liability between the permittee and property owner for all costs and expenses incurred by the city in connection with removal of abandoned facilities in Section 9(a)(14). Not only do these requirements risk interfering with existing leases, they also have the effect of interfering with prospective economic relations between AT&T and property owners. The indemnification provision in the Proposed Policy needs to carve out exceptions to indemnity in instances of the city's own negligence, and AT&T must retain the right to select its own counsel.

14. Cost Reimbursement. Sections 9(a)(16) states that applicants must "reimburse the City for all costs incurred in connection with the permit." It also states that the city has the right to withhold any permits or other approvals unless any outstanding costs have been reimbursed to

[18] *See* 47 C.F.R. § 1.6003(d)(1).
[19] *Infrastructure Order* at ¶ 69.

the city by the permittee. This provision must be revised because only objectively reasonable costs that are recovered on a nondiscriminatory basis can be included in fees.

15. Undergrounding. Several provisions in the Proposed Policy mandate undergrounding of equipment. These requirements must be revised to the extent necessary to avoid unlawful discrimination or effectively prohibiting wireless services in violation of the Act. Wireless facilities cannot operate with all equipment underground. Antennas must be above ground to broadcast and receive and radio units must be placed above ground near antennas to function properly.

16. Reimbursement for Rearrangement and Relocation Costs. Providers have 10 days after a written demand to reimburse the city for all costs and expense related to rearranging or relocating the provider's small wireless facility in Section 6(a)(19). AT&T respectfully requests at least 60 calendar days to reimburse the city for such costs and expenses.

17. Location Requirements. Sections 8(b)(2)&(4) and 10(a) of the Proposed Policy require the applicant to demonstrate that a proposed project will be in the most preferred location and on the most preferred support structure that are technically feasible within 500 feet of the proposed site. The city can articulate appropriate location preferences, but AT&T has a legal right to place its facilities in the public rights-of-way. Further, the FCC's aesthetic standard for small cells precludes the city from requiring this type of analysis for wireless applications when the city does not require it from other infrastructure deployments.

As a practical matter, the city should reconsider naming residential zones as the city's least preferred location for siting wireless facilities. Small cells are low-profile, low-power facilities that need to be placed near customers to provide and improve service. Thus, they need to be placed near where residents rely on wireless connectivity the most: in their homes. To the extent application of this preference materially inhibits AT&T from serving customers, it will violate the Act as an effective prohibition.

18. Separation. The city should eliminate Section 10(a)(9), which provides the city's preference against siting a small wireless facility within 500 feet of another small wireless facility. This type of requirement is more burdensome than applied to other infrastructure deployments and may effectively prohibit wireless services. Moreover, this separation requirement is certainly not needed for concealed sites.

19. Additional Placement Requirements. Section 10(e)(7) requires providers to place small wireless facilities at least 15 feet away from any driveway or established pedestrian pathway between a residential structure and the public rights-of-way. The city should limit this requirement to new poles and apply it to the extent it is not discriminatory.

20. Concealment. Many of the city's design standards in the Proposed Policy require concealment. While AT&T is willing to work with the city on concealment, under the FCC's aesthetic standard for small cells, concealment cannot be required to a greater extent than imposed on other infrastructure deployments in the rights-of-way. For example, there are non-concealed electric distribution facilities throughout the city's rights-of-way.

21. Overall Height. Section 11(h)(3) limits the overall height of small wireless facilities to five feet above the existing support structure. The city should build more flexibility into the Proposed Policy to allow providers to deploy their most stealthy facilities.

22. Accessory Equipment Volume. Section 11(i) limits the volume of accessory equipment. This section must be revised to allow up to 28 cubic feet of equipment to be consistent with 47 C.F.R. §1.6002(l)(3).

23. Ground-Mounted Concealment. In Section 11(l)(1) of the Proposed Policy, the city states that if ground-mounted equipment cannot be concealed using landscaping, AT&T's facilities must be "disguised as other street furniture adjacent to the support structure, such as, for example, mailboxes, benches, trash cans and information kiosks." These preferences are more burdensome than restrictions imposed on other infrastructure deployments in the city, such as electrical distribution facilities. Thus, they are unlawful under the FCC's aesthetic standard for small cells.

24. Preapproved Designs. AT&T applauds the city for developing a procedure that permits the Director to designate one or more preapproved designs for small cells and other infrastructure deployments, which would be subject to expedited review procedures and findings. AT&T requests that the city provide more information on how AT&T can be involved in the preapproved design process, and AT&T would be happy to provide the city with designs for this purpose.

AT&T's Comment on the Proposed Resolution

Fees. AT&T understands that the city is proposing fees of $850 per pole for new permit applications. While an $850 application fee complies with the *Infrastructure Order*'s standard for lawful fees for new poles, this proposed fee seems to run afoul of the FCC's fee standard for collocations. AT&T looks forward to working with the city to ensure its proposed fees comport with state and federal laws.

Conclusion

AT&T appreciates the city's initial efforts to develop wireless facility siting regulations to accommodate new and emerging technologies and changes in law. By addressing the items we

raise here, the city will go a long way toward encouraging deployments consistent with state and federal policies and to the great benefit of the city's residents and businesses.

Sincerely,

Aaron M. Shank

12676511v1

Kathy Noel

From: Salas, Adrian <Adrian.Salas@crowncastle.com>
Sent: Wednesday, August 21, 2019 4:00 PM
To: kburst@encinitasca.gov; Kathy Hollywood
Cc: Roy Sapau
Subject: City Council Meeting 8/21/19 Item 10C - Regulation of Small Cell Wireless Communication Facilities
Attachments: City of Encinitas - Crown Castle Comments - 8.21.19 Item 10C-CCICR90S7QDH.pdf

Hello,

Please find Crown Castle's comments on this item below and on the attached PDF.

Thank you,

ADRIAN SALAS
Government Affairs Manager, San Diego
T:(858) 935-3831
CROWN CASTLE
10301 Meanley Dr. Ste. 200 San Diego, CA 92131
CrownCastle.com

City of Encinitas City Council Attn: City Manager CC: City Clerk 505 S Vulcan Ave, Encinitas, CA 92024

Re: City Council Meeting 8/21/19 Item 10C - Regulation of Small Cell Wireless Communication Facilities; and, Consideration and Possible Adoption of an Urgency Ordinance and Resolution

Honorable Mayor and City Councilmembers,

Crown Castle appreciates the opportunity to address and comment on this important topic. We begin our comments on general trends of the industry and why ubiquitous coverage is becoming more critical, while the supporting networks are straining to keep up. Simply put, wireless access has become a necessity of modern life. According to the Centers for Disease Control and Prevention, over half of American households are wireless-only, meaning they have no 'land line' service. Additionally, mobile data traffic has increased 238% in the last two years alone (2016-2018), and that trend is expected to continue (Accenture). Like access to good roads and highways, there are direct and indirect economic benefits associated with dependable wireless connectivity. The next generation of wireless technology will be the basis for critical connectivity capabilities and innovative advances yet to be seen. From Smart City applications, to transportation and healthcare, next generation communications infrastructure is the launching pad that will enable it all. There are also public safety benefits of wireless coverage as well: 80% of 911 calls originate from a mobile device (NENA). Reliable and resilient communications connect police officers, firefighters, and other first responders by providing information they need wherever they are. The Chula Vista Police Department for example, is expanding their Drones as First Responder Program, which can dispatch a drone to an emergency and send HD video back to Headquarters in in mere minutes of receiving a call. San Diego County has adopted a mobile strategy for communicating to citizens during emergencies through services like the SD Emergencies App, CA Shakealert, and AltertSanDiego, which provide information on disasters, maps, and shelters directly to smart phones. This increased usage and innovation needs infrastructure to support it. We are trying to keep up with ballooning demand and provide the platform for flourishing innovative applications. We respectfully remind the City of Encinitas that the FCC order and federal law require that small wireless facilities deployments are held to the same processes/procedures as other users of the right-

ofway. “We conclude that aesthetics requirements are not preempted if they are (1) reasonable, (2) no more burdensome than those applied to other types of infrastructure deployments…” (FCC Order 18 133 §§ 86). Regulation also bars prohibition of service (including effective prohibitions). “Congress determined that state or local requirements that prohibit or have the effect of prohibiting the provision of service are unlawful and thus preempted.” (47 U.S.C. §§ 253(a), 332(c)(7)(B)(i)(II).

It is within this context that we have the following comments/recommendations on specifics of the proposed ordinance:

The draft references “other infrastructure deployments,” yet that term is not defined in section 3. If this ordinance is being applied to other users of the ROW and not only to wireless communications facilities, please specify so that other users can be made aware. Moreover, please confirm that the 500-Foot noticing at the time of application is also applied to other infrastructure deployments. Crown Castle still objects to this requirement as it is burdensome, not applied to other deployments, and may even be a nuisance to residents.

Application fee estimate of $850 – we would like to see the supporting cost analysis. Additionally, does batching of similar equipment/sites allow for a reduced rate as they are the same installation repeated on several different poles, which doesn’t require the same amount of review time as 5 individual design applications.

Decisions and Appeals (also in section 8.D) – interested persons will have the opportunity to appeal the DSD decision to the City Council. We interpret “any interested person” as any member of the public that wants to halt duly permitted deployments. This appeal structure, which should be an administrative permit process, will likely burden the city council, and add costs, delays, and uncertainty for infrastructure investments in Encinitas. It furthers our concerns about the noticing requirements, as they both give what should be an objective administrative process considerable delays and ambiguity. Again, are all other utility projects subjected to appeals directly to Council? We strongly recommend eliminating this provision.

Section 6(a)(3): Application and Review Procedures・The 500’ pole survey of all verticality with pole heights and why/why not selected is not agreeable and burdensome. We recommend this requirement mirror the 75-foot site survey, which is more in line with industry standard practice. ・3 photo simulations – we find this requirement excessive and costly. 1 photo simulation is our recommendation ・CDs – signed/stamped CDs should not be required at application submittal. This makes revisions expensive and time consuming. Being a requirement for permit issuance is reasonable.・Project narrative and justification – burdensome and not applied to other users of the ROW. Providers cannot be required to justify a site per new FCC Order. There is usage and demand in Residential areas, thus there will be small cell facilities in Residential areas. The City cannot require providers to justify why no other preferred location is available. We recommend removing the justification prohibition.・RF Compliance report – Crown Castle already and routinely submits report certifying the emissions from the equipment that will be used – NOT site specific.

・Property owner’s authorization –We have a master pole attachment agreement with SDG&E, with which they cannot deny a public utility company access to their pole as long as safety clearances are met. Make-ready pole attachment permits for fiber optic cable and SWF equipment runs concurrently with jurisdictional permitting, thus requiring site-specific approvals prior to issuing a ROW permit adds significant time delays. We recommend removal of this requirement unless showing proof of an overall master attachment agreement with the pole owner will suffice.・Acoustic Analysis 6. (a) (11) – providing an equipment specifications sheet listing any sound emissions should satisfy this requirement. Requiring an analysis by a certified engineer to demonstrate compliance is not reasonable, and unduly burdensome, especially if/when the equipment is passively cooled. ・Environmental Impact Assessment – Crown Castle and our SWFs deployed in the ROW have a categorical exemption from CEQA. We recommend removing this requirement, as it is unnecessary and redundant, and will delay permitting on both the city and the applicant sides. ・Submittal Appointments – Again, this requirement is not applied to others. Applications will be submitted with or without an appointment. Additionally, there should be no limit on the quantity of applications being submitted at one time. This is a pre-application requirement. City gets one review cycle of an application for completeness and issue a Notice of Incompleteness (NOI) within 10 days of submittal, allowing the applicant to cure ALL deficiencies. Upon

resubmittal, the shot clock review timeframes (60 – collocation, 90- new pole install) reset to 0. ・Consultant Review, applicant responsible for costs – This is not required of other users of the ROW, nor do most other cities require this. The City cannot subject small wireless facilities to additional/more burdensome requirements. Additionally, the City requiring an auxiliary review provided by a specific, when the same firm has recommended this requirement is a clear conflict of interest.

9.a.17: undergrounding all equipment except for the antenna and electric meter – Only power cables (not meter) and fiber cables can go underground. All other equipment, including radios, are installed above ground.

10.a.9 – recommend adding "of the same carrier," otherwise competition will be restricted. We also recommend removing the justifications called out by #8 and #10 from the list. City cannot prohibit services near residential areas, as this is where service is needed, and effective prohibitions of service are explicitly banned by the FCC order.

10.e.7 –15 feet from residential driveways will be an effective prohibition, especially is available poles are already within this distance. We recommend this item only apply to NEW pole installations.

11.h.3 – overall height – capped at 5 feet above support structure. This limit may work for current 4G installations but will be problematic for 4G/5Gcombinations. Recommend 7' if City wants to pursue a cap. Also, the antenna shrouding (h)(1) – the 2.5 times width of pole can be problematic, especially when dealing with 5G antennas that currently are not omni-directional and need multiple installed. Requiring a bottom taper of any antenna shroud is reasonable. Minimum shroud available in the market is 20". (h)(2) For a 3' antenna volume limit in residential areas – will work for 4G only.

11.i – accessory equipment capped at 9 cubic feet in residential areas and 12 cubic feet in nonresidential areas. These limits are reasonable for current deployments but may not work for 5G deployments which are expected next year.

11.j.1 – "where required" equipment other than meter and emergency disconnect switch must be placed underground when in an undergrounding district OR when the DSD director thinks equipment will incommode the public's use of the ROW. See above comment on undergrounding of equipment.

12. (d) – The preapproved/modified review process should include residential zones. Also, what are the pre-approved designs and when will they be made available? This proposed draft ordinance will make the process more time consuming for both staff and applicants alike. All SWF's fitting an objective design standard, dimensions, installed on existing/replacement structures in the ROW should have an expedited review process.

We are happy to answer any questions, and we look forward to continuing our great relationship with the City of Encinitas.

Thank you, Adrian Salas
Government Affairs Manager, San Diego
Crown Castle
10301 Meanley Dr. Ste. 200 San Diego, CA 92131
adrian.salas@crowncastle.com

References: Centers for Disease Control and Prevention - Wireless Substitution: Early Release of Estimates From the National Health Interview Survey, July–December 2016; 2017.
https://www.cdc.gov/nchs/data/nhis/earlyrelease/wireless201705.pdf
Accenture; How the Wireless Industry Powers the US Economy; 2018
https://api.ctia.org/wpcontent/uploads/2018/04/Accenture-Strategy-Wireless-Industry-Powers-USEconomy-2018-POV.pdf
NENA – National Emergency Number Association; https://www.nena.org/page/AboutNENA
Pew Research, Mobile Fact Sheet; 2019. https://www.pewinternet.org/fact-sheet/mobile/

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Crown Castle
10301 Meanly Dr.
Suite 200
San Diego, CA 92131

Adrian Salas
Government Affairs Manager, San Diego
Crown Castle

Wednesday, August 21, 2019

City of Encinitas City Council
Attn: City Manager
CC: City Clerk
505 S Vulcan Ave, Encinitas, CA 92024

Re: City Council Meeting 8/21/19 Item 10C - Regulation of Small Cell Wireless Communication Facilities; and, Consideration and Possible Adoption of an Urgency Ordinance and Resolution

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There are also public safety benefits of wireless coverage as well: 80% of 911 calls originate from a mobile device (NENA). Reliable and resilient communications connect police officers, firefighters, and other first responders by providing information they need wherever they are. The Chula Vista Police Department for example, is expanding their Drones as First Responder Program, which can dispatch a drone to an emergency and send HD video back to Headquarters in in mere minutes of receiving a call. San Diego County has adopted a mobile strategy for communicating to citizens during emergencies through services like the SD Emergencies App, CA Shakealert, and AltertSanDiego, which provide information on disasters, maps, and shelters directly to smart phones. This increased usage and innovation needs infrastructure to support it. We are trying to keep up with ballooning demand and provide the platform for flourishing innovative applications.

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133 §§ 86). Regulation also bars prohibition of service (including effective prohibitions). "Congress determined that state or local requirements that prohibit or have the effect of prohibiting the provision of service are unlawful and thus preempted." (47 U.S.C. §§ 253(a), 332(c)(7)(B)(i)(II).

It is within this context that we have the following comments/recommendations on specifics of the proposed ordinance:

The draft references "other infrastructure deployments," yet that term is not defined in section 3. If this ordinance is being applied to other users of the ROW and not only to wireless communications facilities, please specify so that other users can be made aware. Moreover, please confirm that the 500-Foot noticing at the time of application is also applied to other infrastructure deployments. Crown Castle still objects to this requirement as it is burdensome, not applied to other deployments, and may even be a nuisance to residents.

Application fee estimate of $850 – we would like to see the supporting cost analysis. Additionally, does batching of similar equipment/sites allow for a reduced rate as they are the same installation repeated on several different poles, which doesn't require the same amount of review time as 5 individual design applications.

Decisions and Appeals (also in section 8.D) – interested persons will have the opportunity to appeal the DSD decision to the City Council. We interpret "any interested person" as any member of the public that wants to halt duly permitted deployments. This appeal structure, which should be an administrative permit process, will likely burden the city council, and add costs, delays, and uncertainty for infrastructure investments in Encinitas. It furthers our concerns about the noticing requirements, as they both give what should be an objective administrative process considerable delays and ambiguity. Again, are all other utility projects subjected to appeals directly to Council? We strongly recommend eliminating this provision.

Section 6(a)(3): Application and Review Procedures

- The 500' pole survey of all verticality with pole heights and why/why not selected is not agreeable and burdensome. We recommend this requirement mirror the 75-foot site survey, which is more in line with industry standard practice.
- 3 photo simulations – we find this requirement excessive and costly. 1 photo simulation is our recommendation
- CDs – signed/stamped CDs should not be required at application submittal. This makes revisions expensive and time consuming. Being a requirement for permit issuance is reasonable.
- Project narrative and justification – burdensome and not applied to other users of the ROW. Providers cannot be required to justify a site per new FCC Order. There is usage and demand in Residential areas, thus there will be small cell facilities in Residential areas. The City cannot require providers to justify why no other preferred location is available. We recommend removing the justification prohibition.
- RF Compliance report – Crown Castle already and routinely submits report certifying the emissions from the equipment that will be used – NOT site specific.

- Property owner's authorization –We have a master pole attachment agreement with SDG&E, with which they cannot deny a public utility company access to their pole as long as safety clearances are met. Make-ready pole attachment permits for fiber optic cable and SWF equipment runs concurrently with jurisdictional permitting, thus requiring site-specific approvals prior to issuing a ROW permit adds significant time delays. We recommend removal of this requirement unless showing proof of an overall master attachment agreement with the pole owner will suffice.
- Acoustic Analysis 6. (a) (11) – providing an equipment specifications sheet listing any sound emissions should satisfy this requirement. Requiring an analysis by a certified engineer to demonstrate compliance is not reasonable, and unduly burdensome, especially if/when the equipment is passively cooled.
- Environmental Impact Assessment – Crown Castle and our SWFs deployed in the ROW have a categorical exemption from CEQA. We recommend removing this requirement, as it is unnecessary and redundant, and will delay permitting on both the city and the applicant sides.
- Submittal Appointments – Again, this requirement is not applied to others. Applications will be submitted with or without an appointment. Additionally, there should be no limit on the quantity of applications being submitted at one time. This is a pre-application requirement. City gets one review cycle of an application for completeness and issue a Notice of Incompleteness (NOI) within 10 days of submittal, allowing the applicant to cure ALL deficiencies. Upon resubmittal, the shot clock review timeframes (60 – collocation, 90- new pole install) reset to 0.
- Consultant Review, applicant responsible for costs – This is not required of other users of the ROW, nor do most other cities require this. The City cannot subject small wireless facilities to additional/more burdensome requirements. Additionally, the City requiring an auxiliary review provided by a specific, when the same firm has recommended this requirement is a clear conflict of interest.

9.a.17: undergrounding all equipment except for the antenna and electric meter – Only power cables (not meter) and fiber cables can go underground. All other equipment, including radios, are installed above ground.

10.a.9 – recommend adding "of the same carrier," otherwise competition will be restricted. We also recommend removing the justifications called out by #8 and #10 from the list. City cannot prohibit services near residential areas, as this is where service is needed, and effective prohibitions of service are explicitly banned by the FCC order.

10.e.7 –15 feet from residential driveways will be an effective prohibition, especially is available poles are already within this distance. We recommend this item only apply to NEW pole installations.

11.h.3 – overall height – capped at 5 feet above support structure. This limit may work for current 4G installations but will be problematic for 4G/5Gcombinations. Recommend 7' if City wants to pursue a cap. Also, the antenna shrouding (h)(1) – the 2.5 times width of pole can be problematic, especially when dealing with 5G antennas that currently are not omni-directional and need multiple installed. Requiring a bottom taper of any antenna shroud is reasonable. Minimum shroud available in the market is 20". (h)(2) For a 3' antenna volume limit in residential areas – will work for 4G only.

11.i – accessory equipment capped at 9 cubic feet in residential areas and 12 cubic feet in non-residential areas. These limits are reasonable for current deployments but may not work for 5G deployments which are expected next year.

11.j.1 – "where required" equipment other than meter and emergency disconnect switch must be placed underground when in an undergrounding district OR when the DSD director thinks equipment will incommode the public's use of the ROW. See above comment on undergrounding of equipment.

12. (d) – The preapproved/modified review process should include residential zones. Also, what are the pre-approved designs and when will they be made available? This proposed draft ordinance will make the process more time consuming for both staff and applicants alike. All SWF's fitting an objective design standard, dimensions, installed on existing/replacement structures in the ROW should have an expedited review process.

We are happy to answer any questions, and we look forward to continuing our great relationship with the City of Encinitas.

Thank you,
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References:
Centers for Disease Control and Prevention - Wireless Substitution: Early Release of Estimates From the National Health Interview Survey, July–December 2016; 2017.
https://www.cdc.gov/nchs/data/nhis/earlyrelease/wireless201705.pdf

Accenture; How the Wireless Industry Powers the US Economy; 2018
https://api.ctia.org/wpcontent/uploads/2018/04/Accenture-Strategy-Wireless-Industry-Powers-US-Economy-2018-POV.pdf

NENA – National Emergency Number Association; https://www.nena.org/page/AboutNENA

Pew Research, Mobile Fact Sheet; 2019. https://www.pewinternet.org/fact-sheet/mobile/

NATIONAL CENTER FOR HEALTH STATISTICS

National Health Interview Survey Early Release Program

Wireless Substitution: Early Release of Estimates From the National Health Interview Survey, July–December 2016

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Overview

The second 6 months of 2016 was the first time that a majority of American homes had only wireless telephones. Preliminary results from the July–December 2016 National Health Interview Survey (NHIS) indicate that 50.8% of American homes did not have a landline telephone but did have at least one wireless telephone (also known as cellular telephones, cell phones, or mobile phones)—an increase of 2.5 percentage points since the second 6 months of 2015. More than 70% of all adults aged 25-34 and of adults renting their homes were living in wireless-only households. This report presents the most up-to-date estimates available from the federal government concerning the size and characteristics of this population.

NHIS Early Release Program

This report is published as part of the NHIS Early Release Program. Twice each year, the National Center for Health Statistics (NCHS) releases selected estimates of telephone coverage for the civilian noninstitutionalized U.S. population based on data from NHIS, along with comparable estimates from NHIS for the previous 3 years. The estimates are based on in-person interviews that are conducted throughout the year to collect information on health status, health-related behaviors, and health care access and utilization. The survey also includes information about household telephones and whether anyone in the household has a wireless telephone.

To provide access to the most recent information from NHIS, estimates using the July–December 2016 data are being released prior to final data editing and final weighting. These estimates should be considered preliminary. Estimates produced using the final data files may differ slightly from those presented here.

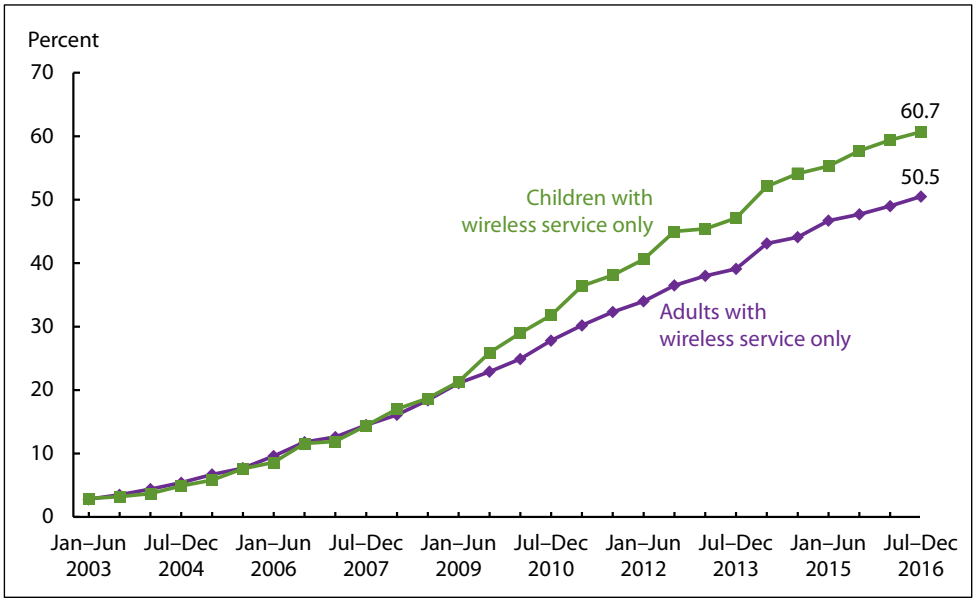
Methods

For many years, NHIS has asked respondents to provide residential telephone numbers, to permit the recontacting of survey participants. Starting in 2003, additional questions were asked to determine whether a family had a landline telephone. An NHIS family was considered to have landline telephone service if the survey respondent for the family reported that there was "at least one phone inside your home that is currently working and is not a cell phone." (To avoid possible confusion with cordless landline telephones, the word "wireless" was not used in the survey.)

An NHIS "family" is an individual or a group of two or more related persons living together in the same housing unit (a "household"). Thus, a family can consist of only one person, and more than one family can live in a household (including, for example, a household where there are multiple single-person families, as when unrelated roommates are living together).

The survey respondent for each family was also asked whether "anyone in your family has a working cellular telephone." Families are identified as "wireless families" if respondents reported that someone in the family had a working cell phone at the time of interview. This person (or persons) could be a civilian adult, a member of the military, or a child.

Figure. Percentages of adults and children living in households with only wireless telephone service: United States, 2003–2016



NOTE: Adults are aged 18 and over; children are under age 18.
DATA SOURCE: NCHS, National Health Interview Survey.

Households are identified as "wireless-only" if they include at least one wireless family and if there are no families with landline telephone service in the household. Persons are identified as wireless-only if they live in a wireless-only household. A similar approach is used to identify adults living in households with no telephone service (neither wireless nor landline). Household telephone status (rather than family telephone status) is used in this report because most telephone surveys do not attempt to distinguish among families when more than one family lives in the same household.

From July through December 2016, information on household telephone status was obtained for 19,956 households that included at least one civilian adult or child. These households included 36,828 civilian adults aged 18 and over, and 11,437 children under age 18. Analyses of telephone status are presented separately for households, adults, and children in **Table 1**.

Analyses of demographic characteristics are based on data from the NHIS Person and Household Files. Demographic data for all civilian adults living in interviewed households were used in these analyses. "Household income" is the sum of the family incomes in the household. Estimates stratified by household poverty status are based on reported income only because imputed income values are not available until a few months after the annual release of NHIS microdata. Household poverty status was unknown for 22.7% of adults in these analyses.

Analyses of selected health measures are based on data from the NHIS Sample Adult File. Health-related data for one randomly selected civilian adult in each family (the "sample adult") were used in these analyses. From July through December 2016, data on household telephone status and selected health measures were collected from 16,522 of these sample adults.

Because NHIS is conducted throughout the year and the sample is designed to yield a nationally representative sample each month, data can be analyzed quarterly. Weights are created for each calendar quarter of the NHIS sample. NHIS data weighting procedures are described in more detail in a previous NCHS report (Parsons et al., 2014).

Point estimates and 95% confidence intervals were calculated using SUDAAN software (RTI International, Research Triangle Park, NC) to account for the complex sample design of NHIS. Differences between percentages were evaluated using two-sided significance tests at the 0.05 level. Terms such as "more likely" and "less likely" indicate a statistically significant difference. Lack of comment regarding the difference between any two estimates does not necessarily mean that the difference was tested and found to be not significant. Because of small sample sizes, estimates based on less than 1 year of data may have large variances, and caution should be used in interpreting such estimates.

A new sample design was implemented with the 2016 NHIS. Sample areas were reselected to take account of changes in the distribution of the U.S. population since 2006, when the previous sample design was first implemented; commercial address lists were used as the main source of addresses, rather than field listing; and the oversampling procedures for black, Hispanic, and Asian persons that were a feature of the previous sample design were not implemented in 2016. Some differences between estimates for 2016 and estimates for earlier years may be attributable to the new sample design.

Telephone Status

In the second 6 months of 2016, more than one-half of all households (50.8%) did not have a landline telephone but did have at least one wireless telephone (**Table 1**). More than 123 million adults (50.5% of all adults) lived in households with only wireless telephones; over 44 million children (60.7% of all children) lived in households with only wireless telephones.

The percentage of households that are wireless-only and the percentages of adults and children living in wireless-only households have been steadily increasing. The observed 2.5-percentage-point increase in the percentage of households that are wireless-only from the second 6 months of 2015 through the second 6 months of 2016 was statistically significant. The 2.8-percentage-point increase for adults and the 3.0-percentage-point increase for children across the same 12-month time period were also significant (**Figure**). However, the increases from the first 6 months of 2016 to the second 6 months of 2016 were not statistically significant for adults (p = 0.11) or children (p = 0.36).

Approximately 3.2% of households had no telephone service (neither wireless nor landline) in the second 6 months of 2016. About 7.4 million adults (3.0%) and 2.3 million children (3.1%) lived in these households. The percentage of adults living without any telephone service has increased slightly but significantly over the past 3 years (**Table 1**). The corresponding percentage of children has not changed significantly (p = .16).

Demographic Differences

The percentage of U.S. civilian noninstitutionalized adults living in wireless-only households is shown, by selected demographic characteristics and survey time period, in **Table 2**. For July–December 2016:

- More than seven in ten adults aged 25–29 (72.7%) and aged 30-34 (71.0%) lived in households with only wireless telephones. These rates are greater than the rate for those 18–24 (61.7%). The percentage of adults living with only wireless telephones decreased as age increased beyond 35 years: 62.5% for those 35–44; 45.2% for those 45–64; and 23.5% for those 65 and over.
- More than four in five adults living only with unrelated adult roommates (83.7%) were in households with only wireless telephones. This rate is higher than the rates for adults living alone (54.7%), adults living only with spouses or other adult family members (42.7%), and adults living with children (58.1%).
- More than seven in ten adults living in rented homes (71.5%) had only wireless telephones. This rate is significantly higher than the rate for

adults living in homes owned by a household member (40.9%).

- Adults living in poverty (66.3%) and near poverty (59.0%) were more likely than higher income adults (48.5%) to be living in households with only wireless telephones. (Footnote 3 in **Table 2** gives definitions of these categories.)
- Hispanic adults (64.8%) were more likely than non-Hispanic white (46.6%), non-Hispanic black (52.1%), or non-Hispanic Asian (47.4%) adults to be living in households with only wireless telephones.

Geographic differences were also noted. Adults living in the Midwest (53.0%), South (55.5%), and West (53.4%) were more likely than those living in the Northeast (34.2%) to be living in households with only wireless telephones. Adults living in metropolitan areas (53.0%) were more likely than those living in nonmetropolitan areas (47.0%) to be living in wireless-only households.

Demographic Distributions

The demographic differences noted in the previous section are based on the distribution of household telephone status within each demographic group. When examining the population of wireless-only adults, some readers may instead wish to consider the distribution of various demographic characteristics within the wireless-only adult population.

Table 3 gives the percent distributions of selected demographic characteristics for adults living in households with only wireless telephones, by survey time period. The estimates in this table reveal that the distributions of selected demographic characteristics changed little over the 3-year period shown. The exceptions were related to age and home ownership status.

- The proportion of wireless-only adults who were aged 45 and over has increased steadily, from 34.2% in the second 6 months of 2013 to 39.7% in the second 6 months of 2016.
- The proportion of wireless-only adults living in homes owned by a household member increased from 48.5% in the second 6 months of 2013 to 54.4% in the second 6 months of 2016.

Selected Health Measures by Household Telephone Status

Many health surveys, political polls, and other types of research are conducted using random-digit-dial (RDD) telephone surveys. Despite operational challenges, most major survey research organizations include wireless telephone numbers when conducting RDD surveys. If they did not, the exclusion of households with only wireless telephones (along with the small proportion of households that have no telephone service) could bias results. This bias—known as coverage bias—could exist if there are differences between persons with and without landline telephones for the substantive variables of interest.

The NHIS Early Release Program updates and releases estimates for 15 key health indicators every 3 months. **Table 4** presents estimates by household telephone status (landline, wireless-only, or phoneless) for all but two of these measures. ("Pneumococcal vaccination" and "personal care needs" were not included because these indicators are limited to older adults aged 65 and over.) For July–December 2016:

- Regarding alcohol consumption, the percentage of adults who had at least one heavy drinking day in the past year was substantially higher among wireless-only adults (29.8%) than among adults living in landline households (18.8%). Wireless-only adults were also more likely to be current smokers.
- Compared with adults living in landline households, wireless-only adults were more likely to have their health status described as excellent or very good, more likely to have met the 2008 federal physical activity guidelines for aerobic activity (based on leisure-time activity), and less likely to have ever been diagnosed with diabetes.
- The percentage without health insurance coverage at the time of interview among wireless-only adults under age 65 (13.6%) was greater than the percentage among adults in that age group living in landline households (7.7%).
- Compared with adults living in landline households, wireless-only adults were more likely to have experienced financial barriers to obtaining needed health care, and they were less likely to have a usual place to go for medical care. Wireless-only adults were also less likely to have received an influenza vaccination during the previous year
- Wireless-only adults (46.1%) were more likely than adults living in landline households (36.9%) to have ever been tested for human immunodeficiency virus (HIV), the virus that causes AIDS.

The potential for bias due to undercoverage remains a real threat to health surveys that do not include sufficient representation of households with only wireless telephones.

Wireless-mostly Households

The potential for bias due to undercoverage is not the only threat to surveys conducted only on landline telephones. Researchers are also concerned that some people living in households with landlines cannot be reached on those landlines because they rely on wireless telephones for all or almost all of their calls.

In 2007, a question was added to NHIS for persons living in families with both landline and cellular telephones. The respondent for the family was asked to consider all of the telephone calls his or her family receives and to report whether "all or almost all calls are received on cell phones, some are received on cell phones and some on regular phones, or very few or none are received on cell phones." This question permits the identification of persons living in "wireless-mostly"

households—defined as households with both landline and cellular telephones in which all families receive all or almost all calls on cell phones.

Among households with both landline and wireless telephones, 38.0% received all or almost all calls on wireless telephones, based on data for July–December 2016. These wireless-mostly households make up 15.0% of all households. During the second 6 months of 2016, about 41 million adults (16.7%) lived in wireless-mostly households.

Table 5 gives the percentage of adults living in wireless-mostly households, by demographic characteristics and survey time period. For July–December 2016:

- Adults with college degrees (19.6%) were more likely to be living in wireless-mostly households than were high school graduates (14.8%) or adults with less education (12.2%).
- Adults living with children (19.4%) were more likely than adults living alone (9.9%) to be living in wireless-mostly households.
- Adults living in poverty (10.0%) and adults living near poverty (11.1%) were less likely than higher-income adults (18.9%) to be living in wireless-mostly households.
- Adults living in rented homes (10.5%) were less likely to be living in wireless-mostly households than were adults living in homes owned by a household member (19.7%).

NHIS data cannot be used to estimate the proportion of wireless-mostly adults who are unreachable or to estimate the potential for bias due to their exclusion from landline surveys.

State Estimates

The potential for bias may differ from one state to another because the prevalence of wireless-only households varies substantially across states. For more information about prevalence estimates at the state level, see

- NCHS. Modeled estimates (with standard errors) of the percent distribution of household telephone status for adults aged 18 and over, by state: United States, 2015. August 2016. Available from: http://www.cdc.gov/nchs/data/nhis/earlyrelease/wireless_state_201608.pdf.
- Blumberg SJ, Ganesh N, Luke JV, Gonzales G. Wireless substitution: State-level estimates from the National Health Interview Survey, 2012. National health statistics reports; no 70. Hyattsville, MD: National Center for Health Statistics. 2013. Available from: http://www.cdc.gov/nchs/data/nhsr/nhsr070.pdf.

Other NHIS Early Release Program Products

Two additional reports are published regularly as part of the NHIS Early Release Program. *Early Release of Selected Estimates Based on Data From the National Health Interview Survey* is published quarterly and provides estimates for 15 selected measures of health. *Health Insurance Coverage: Early Release of Estimates From the National Health Interview Survey* is also published quarterly and provides additional estimates regarding health insurance coverage. Other Early Release Program products are released as needed.

In addition to these reports, preliminary microdata files containing selected NHIS variables are produced as part of the ER Program. Beginning in May 2016, the telephone service use variables presented in this report have been included in those microdata files. These variables are made available twice each year, in November or December for data from the first 6 months of the calendar year and in May or June for data from the second 6 months of the calendar year. NHIS data users can analyze these files through the NCHS Research Data Centers (http://www.cdc.gov/rdc/) without having to wait for the final annual NHIS microdata files to be released.

For more information about NHIS and the NHIS Early Release Program, or to find other Early Release Program products, see

- NHIS home page at http://www.cdc.gov/nchs/nhis.htm.
- Early Release Program home page at http://www.cdc.gov/nchs/nhis/releases.htm.
- Parsons VL, Moriarity CL, Jonas K, et al. Design and estimation for the National Health Interview Survey: 2006–2015. National Center for Health Statistics. Vital Health Stat 2(165). 2014. Available from: http://www.cdc.gov/nchs/data/series/sr_02/sr02_165.pdf.

Suggested Citation

Blumberg SJ, Luke JV. Wireless substitution: Early release of estimates from the National Health Interview Survey, July–December 2016. National Center for Health Statistics. May 2017. Available from: http://www.cdc.gov/nchs/nhis.htm.

Table 1. Percent distribution of household telephone status for households, adults, and children, by date of interview: United States, July 2013–December 2016

Date of interview	Number of households (unweighted)	Landline with wireless	Landline without wireless	Landline with unknown wireless	Nonlandline with unknown wireless	Wireless-only	Phoneless	Total
Households								
July–December 2013	21,512	47.7	8.6	0.1	0.1	41.0	2.5	100.0
January–June 2014	22,438	44.7	8.5	0.1	0.0	44.0	2.6	100.0
July–December 2014	22,023	42.7	8.4	0.2	0.1	45.4	3.2	100.0
January–June 2015	21,517	41.6	7.6	0.1	0.0	47.4	3.4	100.0
July–December 2015	19,959	41.2	7.2	0.1	0.0	48.3	3.1	100.0
January–June 2016	20,206	40.2	7.2	0.1	0.0	49.3	3.1	100.0
July–December 2016	19,956	39.4	6.5	0.0	0.0	50.8	3.2	100.0
95% confidence interval[1]	…	38.44-40.34	6.09-7.03	0.02-0.08	0.02-0.09	49.76-51.76	2.92-3.56	…
Adults								
July–December 2013	40,173	51.5	7.0	0.1	0.1	39.1	2.2	100.0
January–June 2014	42,262	47.3	7.0	0.1	0.1	43.1	2.4	100.0
July–December 2014	41,160	45.8	7.1	0.1	0.1	44.1	2.9	100.0
January–June 2015	40,489	43.9	6.2	0.1	0.0	46.7	3.1	100.0
July–December 2015	37,332	43.7	5.8	0.1	0.0	47.7	2.7	100.0
January–June 2016	36,885	42.1	5.8	0.1	0.0	49.0	2.9	100.0
July–December 2016	36,828	41.0	5.4	0.0	0.0	50.5	3.0	100.0
95% confidence interval[1]	…	39.92-42.16	4.96-5.79	0.02-0.08	0.02-0.11	49.27-51.72	2.72-3.35	…
Children								
July–December 2013	13,714	46.4	3.8	0.1	0.0	47.1	2.5	100.0
January–June 2014	14,349	41.7	3.5	–	0.0	52.1	2.7	100.0
July–December 2014	13,754	39.1	3.3	0.1	0.0	54.1	3.4	100.0
January–June 2015	13,493	38.3	3.0	0.1	0.0	55.3	3.2	100.0
July–December 2015	12,197	36.2	2.8	0.1	0.0	57.7	3.1	100.0
January–June 2016	11,552	34.6	2.5	0.1	0.0	59.4	3.4	100.0
July–December 2016	11,437	33.5	2.6	0.0	0.1	60.7	3.1	100.0
95% confidence interval[1]	…	31.72-35.29	2.11-3.14	0.00-0.16	0.04-0.32	58.70-62.64	2.61-3.73	…

0.0 Quantity more than zero but less than 0.05.

… Category not applicable.

– Quantity zero.

[1]Refers to July–December 2016.

NOTE: Data are based on household interviews of a sample of the civilian noninstitutionalized population.

DATA SOURCE: NCHS, National Health Interview Survey, July 2013–December 2016.

Table 2. Percentage of adults living in wireless-only households, by selected demographic characteristics and calendar half-years: United States, July 2013–December 2016

Demographic characteristic	July–December 2013	January–June 2014	July–December 2014	January–June 2015	July–December 2015	January–June 2016	July–December 2016	95% confidence interval[1]
Race/ethnicity								
Hispanic or Latino, any race(s)	53.1	56.1	58.6	59.2	60.5	63.7	64.8	61.94–67.47
Non-Hispanic white, single race	35.1	39.6	40.3	43.2	44.0	45.0	46.6	45.32–47.89
Non-Hispanic black, single race	42.7	44.9	45.7	48.1	48.5	49.2	52.1	49.23–54.98
Non-Hispanic Asian, single race	38.1	41.3	42.3	47.9	48.4	51.4	47.4	42.18–52.61
Non-Hispanic other, single race	51.7	52.4	54.8	51.8	56.5	57.5	57.9	50.25–65.12
Non-Hispanic multiple race	45.7	52.5	53.3	53.6	60.2	53.9	62.2	56.97–67.24
Age (years)								
18–24	53.0	57.8	58.0	59.4	61.1	62.7	61.7	59.23–64.03
25–29	65.7	69.3	69.2	71.3	72.6	72.1	72.7	71.01–74.37
30–34	59.7	64.9	67.4	67.8	69.0	69.8	71.0	68.79–73.14
35–44	47.8	52.5	53.7	56.6	58.2	60.0	62.5	60.38–64.60
45–64	31.4	35.7	36.8	40.8	41.2	43.3	45.2	43.88–46.57
65 and over	13.6	15.7	17.1	19.3	20.5	21.1	23.5	22.19–24.86
Sex								
Male	40.4	44.3	45.7	48.2	49.3	50.3	51.6	50.30–52.93
Female	37.9	41.9	42.6	45.3	46.1	47.8	49.4	48.24–50.66
Education								
Some high school or less	41.8	46.6	46.5	49.0	51.1	52.1	55.2	52.86–57.54
High school graduate or GED[2]	38.8	43.3	44.2	46.7	47.2	48.4	50.2	48.60–51.89
Some post-high school, no degree	41.7	45.6	47.1	49.0	49.7	50.8	52.4	51.05–53.74
4-year college degree or higher	35.5	39.0	40.3	43.5	44.8	46.5	47.1	45.08–49.05
Employment status last week								
Working at a job or business	44.4	48.9	49.9	52.7	53.7	55.6	56.4	55.03–57.67
Keeping house	40.5	47.6	47.2	49.3	50.7	53.0	54.9	51.47–58.34
Going to school	46.3	49.7	53.8	49.6	53.2	53.4	58.9	54.95–62.75
Something else (incl. unemployed)	27.0	29.1	29.7	32.7	33.4	33.5	35.7	34.37–37.09
Household structure								
Adult living alone	46.6	48.3	49.5	51.1	52.1	53.3	54.7	53.47–55.88
Unrelated adults, no children	76.1	73.9	81.3	84.6	78.8	79.1	83.7	77.80–88.29
Related adults, no children	31.0	35.3	35.8	39.1	39.7	40.7	42.7	41.24–44.18
Adult(s) with children	44.8	49.8	50.8	53.3	55.2	57.0	58.1	55.99–60.11
Household poverty status[3]								
Poor	56.2	59.1	59.4	59.3	64.3	63.1	66.3	63.44–69.02
Near-poor	46.1	50.8	51.1	54.4	54.0	54.0	59.0	56.40–61.57
Not-poor	36.6	40.8	42.5	45.7	45.7	48.2	48.5	46.87–50.15

See footnotes at end of table.

Table 2. Percentage of adults living in wireless-only households, by selected demographic characteristics and calendar half-years: United States, July 2013–December 2016—*Continued*

Demographic characteristic	July–December 2013	January–June 2014	July–December 2014	January–June 2015	July–December 2015	January–June 2016	July–December 2016	95% confidence interval[1]
Geographic region[4]								
Northeast	24.9	27.8	29.5	31.6	31.4	32.4	34.2	31.15–37.33
Midwest	43.7	46.9	48.0	51.9	51.4	51.7	53.0	50.98–54.99
South	41.9	47.3	47.0	50.2	51.3	52.3	55.4	53.45–57.40
West	41.2	43.8	46.9	47.1	51.2	54.4	53.4	50.94–55.82
Metropolitan statistical area status								
Metropolitan	40.5	43.9	45.7	47.8	48.4	51.6	53.0	51.67–54.36
Not metropolitan	33.7	39.8	37.6	42.3	43.1	46.3	47.0	44.38–49.57
Home ownership status[5]								
Owned or being bought	28.5	32.9	33.1	37.2	37.3	39.0	40.9	39.54–42.21
Renting	61.7	64.6	66.2	67.0	68.8	69.7	71.5	70.02–72.87
Other arrangement	49.3	52.2	49.2	52.8	58.0	52.0	53.9	47.71–60.03
Number of wireless-only adults in survey sample (unweighted)	16,436	18,380	18,740	18,921	17,974	17,896	18,387	…

… Category not applicable.

[1]Refers to July–December 2016.

[2]GED is General Educational Development high school equivalency diploma.

[3]Based on household income and household size using the U.S. Census Bureau's poverty thresholds. "Poor" persons are defined as those below the poverty threshold. "Near-poor" persons have incomes of 100% to less than 200% of the poverty threshold. "Not-poor" persons have incomes of 200% of the poverty threshold or greater. Early Release estimates stratified by poverty status are based on reported income only and may differ from similar estimates produced later that are based on both reported and imputed income. NCHS imputes income when income is unknown, but the imputed income file is not available until a few months after the annual release of National Health Interview Survey microdata. For households with multiple families, household income and household size were calculated as the sum of the multiple measures of family income and family size.

[4]In the geographic classification of the U.S. population, states are grouped into the following four regions used by the U.S. Census Bureau: *Northeast* includes Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont; *Midwest* includes Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin; *South* includes Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia; and *West* includes Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

[5]For households with multiple families, home ownership status was determined by considering the reported home ownership status for each family. If any family reported owning the home, then the household-level variable was classified as "Owned or being bought" for all persons living in the household. If one family reported renting the home and another family reported "other arrangement," then the household-level variable was classified as "Other arrangement" for all persons living in the household.

NOTE: Data are based on household interviews of a sample of the civilian noninstitutionalized population.

DATA SOURCE: CDC/NCHS, National Health Interview Survey, July 2013–December 2016.

Table 3. Percent distributions of selected demographic characteristics for adults living in wireless-only households, by date of interview: United States, July 2013–December 2016

Demographic characteristic	July–December 2013	January–June 2014	July–December 2014	January–June 2015	July–December 2015	January–June 2016	July–December 2016	95% confidence interval[1]
Race/ethnicity								
Hispanic or Latino, any race(s)	20.5	19.8	20.3	19.6	19.9	20.5	20.3	18.32–22.48
Non-Hispanic white, single race	59.2	60.4	60.0	60.2	59.7	59.1	59.3	56.77–61.76
Non-Hispanic black, single race	12.6	12.1	12.1	12.1	12.0	11.7	12.2	10.96–13.57
Non-Hispanic Asian, single race	5.2	5.2	5.3	5.8	5.8	6.1	5.5	4.44–6.72
Non-Hispanic other, single race	1.0	0.9	0.7	0.8	1.0	0.9	0.9	0.73–1.11
Non-Hispanic multiple race	1.4	1.6	1.5	1.5	1.7	1.8	1.8	1.59–2.06
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	…
Age (years)								
18–24	17.4	17.1	16.6	16.0	16.0	15.8	14.9	14.20–15.59
25–29	14.8	14.1	13.9	13.6	13.6	13.3	13.0	12.40–13.53
30–34	13.3	13.1	13.2	12.6	12.6	12.4	12.3	11.73–12.90
35–44	20.4	20.3	20.1	19.9	20.0	19.9	20.2	19.39–21.03
45–64	27.8	28.6	28.8	30.0	29.6	30.2	30.5	29.62–31.39
65 and over	6.4	6.8	7.3	7.9	8.3	8.4	9.2	8.68–9.69
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	…
Sex								
Male	49.7	49.6	49.9	49.8	49.9	49.5	49.3	48.81–49.78
Female	50.3	50.4	50.1	50.2	50.1	50.5	50.7	50.22–51.19
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	…
Education								
Some high school or less	14.5	14.7	13.9	13.5	13.6	14.2	12.9	12.11–13.70
High school graduate or GED[2]	26.9	27.2	26.9	26.0	25.8	26.3	25.8	24.72–26.97
Some post-high school, no degree	32.4	32.2	31.9	32.0	31.7	30.9	32.3	31.29–33.26
4-year college degree or higher	26.2	25.9	27.3	28.5	28.9	28.7	29.0	27.87–30.20
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	…
Employment status last week								
Working at a job or business	70.1	69.3	70.1	69.7	69.7	70.3	69.9	69.01–70.80
Keeping house	5.7	6.4	6.0	6.0	5.9	5.8	5.7	5.23–6.29
Going to school	3.6	4.1	4.0	3.6	3.7	3.4	3.6	3.26–3.96
Something else (incl. unemployed)	19.8	19.5	19.1	19.8	20.0	19.7	20.1	19.36–20.84
Unknown, not reported	0.8	0.9	0.9	0.8	0.7	0.8	0.7	0.41–1.04
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	…
Household structure								
Adult living alone	18.6	17.0	17.5	16.4	17.4	17.0	16.2	15.58–16.88
Unrelated adults, no children	2.9	2.5	2.9	2.4	2.6	1.9	1.8	1.48–2.27
Related adults, no children	36.9	38.8	37.9	39.6	39.6	39.3	40.4	39.16–41.72
Adult(s) with children	41.6	41.8	41.6	41.6	40.4	41.8	41.5	40.16–42.88
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	…

Table 3. Percent distributions of selected demographic characteristics for adults living in wireless-only households, by date of interview: United States, July 2013–December 2016—*Continued*

Demographic characteristic	July–December 2013	January–June 2014	July–December 2014	January–June 2015	July–December 2015	January–June 2016	July–December 2016	95% confidence interval[1]
Household poverty status[3]								
Poor	14.1	13.0	13.6	10.9	12.1	10.9	10.8	9.97–11.71
Near-poor	16.6	16.7	15.9	15.5	15.6	14.9	15.4	14.48–16.39
Not-poor	47.8	49.4	49.3	53.1	50.8	53.8	53.7	52.35–55.13
Unknown, not reported	21.5	20.8	21.3	20.5	21.5	20.4	20.0	18.78–21.33
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	…
Geographic region[4]								
Northeast	11.3	11.1	12.0	11.5	12.1	12.1	12.5	11.00–14.15
Midwest	25.1	25.0	24.3	25.0	23.2	23.3	22.7	20.37–25.24
South	39.9	41.1	39.9	39.9	40.5	38.5	39.6	34.66–44.81
West	23.8	22.9	23.8	23.5	24.2	26.2	25.2	20.67–30.29
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	…
Metropolitan statistical area status								
Metropolitan	82.6	81.6	83.1	82.3	87.8	83.8	84.1	81.51–86.38
Not metropolitan	17.4	18.4	16.9	17.7	12.2	16.2	15.9	13.62–18.49
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	…
Home ownership status[5]								
Owned or being bought	48.5	51.1	49.5	53.8	51.6	52.9	54.4	53.03–55.83
Renting	49.1	46.4	48.4	44.2	45.8	45.1	43.4	41.88–44.84
Other arrangement	2.4	2.6	2.1	2.0	2.6	2.0	2.2	1.87–2.61
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	…
Number of wireless-only adults in survey sample (unweighted)	16,436	18,380	18,740	18,921	17,974	17,896	18,387	…

… Category not applicable.

[1]Refers to July–December 2016.

[2]GED is General Educational Development high school equivalency diploma.

[3]Based on household income and household size using the U.S. Census Bureau's poverty thresholds. "Poor" persons are defined as those below the poverty threshold. "Near-poor" persons have incomes of 100% to less than 200% of the poverty threshold. "Not-poor" persons have incomes of 200% of the poverty threshold or greater. Early Release estimates stratified by poverty status are based on reported income only and may differ from similar estimates produced later that are based on both reported and imputed income. NCHS imputes income when income is unknown, but the imputed income file is not available until a few months after the annual release of National Health Interview Survey microdata. For households with multiple families, household income and household size were calculated as the sum of the multiple measures of family income and family size.

[4]In the geographic classification of the U.S. population, states are grouped into the following four regions used by the U.S. Census Bureau: *Northeast* includes Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont; *Midwest* includes Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin; *South* includes Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia; and *West* includes Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

[5]For households with multiple families, home ownership status was determined by considering the reported home ownership status for each family. If any family reported owning the home, then the household-level variable was classified as "Owned or being bought" for all persons living in the household. If one family reported renting the home and another family reported "other arrangement," then the household-level variable was classified as "Other arrangement" for all persons living in the household.

NOTE: Data are based on household interviews of a sample of the civilian noninstitutionalized population.

DATA SOURCE: CDC/NCHS, National Health Interview Survey, July 2013–December 2016.

Table 4. Prevalence rates (and 95% confidence intervals) for selected measures of health-related behaviors, health status, health care service use, and health care access for adults aged 18 and over, by household telephone status: United States, July–December 2016

Measure	Landline[1]	Wireless-only	Phoneless
Health-related behaviors			
At least one heavy drinking day in past year[2]	18.8 (17.58-20.06)	29.8 (28.29-31.32)	24.5 (20.06-29.63)
Current smoker[3]	12.1 (11.08-13.16)	18.4 (17.09-19.79)	19.3 (15.05-24.52)
Met the 2008 federal physical activity guidelines for aerobic activity through leisure-time aerobic activity[4]	36.9 (35.52-38.35)	41.5 (39.99-43.01)	35.7 (31.04-40.66)
Health status			
Health status described as excellent or very good[5]	59.8 (58.54-60.99)	62.9 (61.37-64.42)	56.6 (50.66-62.43)
Experienced serious psychological distress in past 30 days[6]	2.4 (2.02-2.88)	4.6 (4.01-5.22)	3.2 (1.78-5.65)
Obese (adults aged 20 and over)[7]	30.7 (29.29-32.13)	30.1 (28.82-31.38)	25.6 (21.26-30.52)
Asthma episode in past year[8]	3.9 (3.36-4.49)	4.1 (3.53-4.70)	*2.6 (1.37-4.88)
Ever diagnosed with diabetes[9]	12.2 (11.28-13.15)	7.3 (6.64-8.06)	8.6 (5.60-12.93)
Health care service use			
Received influenza vaccine during past year[10]	49.7 (48.27-51.09)	35.2 (33.94-36.51)	37.4 (31.82-43.38)
Ever been tested for HIV[11]	36.9 (35.27-38.55)	46.1 (44.53-47.73)	38.7 (32.93-44.77)
Health care access			
Has a usual place to go for medical care[12]	92.2 (91.26-93.05)	81.1 (79.69-82.43)	81.4 (77.22-84.96)
Failed to obtain needed medical care in past year due to financial barriers[13]	3.9 (3.36-4.51)	7.8 (7.15-8.55)	10.0 (7.21-13.77)
Currently uninsured (adults aged 18–64)[14]	7.7 (6.58-8.89)	13.6 (12.30-15.08)	19.5 (14.32-26.00)
Number of adults in survey sample (unweighted)	7,422	8,607	493

* Estimate has a relative standard error greater than 30% and does not meet standards for reliability or precision.

[1]Includes households that also have wireless telephone service.

[2]The estimates presented here are for men aged 18 and over who had five or more drinks in 1 day at least once in the past year and women aged 18 and over who had four or more drinks in 1 day at least once in the past year. A year is defined as the 12 months prior to interview. The analyses excluded adults with unknown alcohol consumption (about 1%).

[3]A person who had smoked more than 100 cigarettes in his or her lifetime and now smokes every day or some days. The analyses excluded adults with unknown smoking status (about 2%).

[4]This measure reflects an estimate of regular leisure-time aerobic activity motivated by the 2008 federal *Physical Activity Guidelines for Americans* (http://www.health.gov/paguidelines/), which are being used in setting Healthy People 2020 objectives (http://www.healthypeople.gov). The 2008 guidelines refer to any kind of aerobic activity, but estimates in this table are limited to leisure-time physical activity only. These leisure-time aerobic activity estimates may therefore underestimate the percentage of adults who met the 2008 guidelines for aerobic activity. The 2008 federal guidelines recommend that for substantial health benefits, adults perform at least 150 minutes a week of moderate-intensity aerobic physical activity, or 75 minutes a week of vigorous-intensity aerobic physical activity, or an equivalent combination of moderate- and vigorous-intensity aerobic activity. The 2008 guidelines also state that aerobic activity should be performed in episodes of at least 10 minutes and preferably should be spread throughout the week. The analyses excluded adults with unknown physical activity participation (about 3%).

[5]Health status data were obtained by asking respondents to assess their own health and that of family members living in the same household as excellent, very good, good, fair, or poor. The analyses excluded persons with unknown health status (about 0.1%).

[6]Six psychological distress questions are included in the National Health Interview Survey. These questions ask how often during the past 30 days a respondent experienced certain symptoms of psychological distress (feeling so sad that nothing could cheer you up, nervous, restless or fidgety, hopeless, worthless, that everything was an effort). The response codes (0–4) of the six items for each person were weighted equally and summed. A value of 13 or more for this scale indicates that at least one symptom was experienced "most of the time" or "all of the time" and is used here to define serious psychological distress. The analyses excluded adults with unknown serious psychological distress status (about 4%).

[7]Obesity is defined as a body mass index (BMI) of 30 kg/m^2 or more. The measure is based on self-reported height and weight. The analyses excluded adults with unknown height or weight (about 6%). Estimates of obesity are presented for adults aged 20 and over because the Healthy People 2020 objectives (http://www.healthypeople.gov) for healthy weight among adults define adults as persons aged 20 and over.

[8]Information on an episode of asthma or an asthma attack during the past year is self-reported by adults aged 18 and over. A year is defined as the 12 months prior to interview. The analyses excluded persons with unknown asthma episode status (about 0.1%).

[9]Prevalence of diagnosed diabetes is based on self-report of ever having been diagnosed with diabetes by a doctor or other health professional. Persons reporting "borderline" diabetes status and women reporting diabetes only during pregnancy were not coded as having diabetes in the analyses. The analyses excluded adults with unknown diabetes status (about 0.1%).

Table 4. Prevalence rates (and 95% confidence intervals) for selected measures of health-related behaviors, health status, health care service use, and health care access for adults aged 18 and over, by household telephone status: United States, July–December 2016

Measure	Landline[1]	Wireless-only	Phoneless

[10]Receipt of flu shots and receipt of nasal spray flu vaccinations were included in the calculation of flu vaccination estimates. Responses to these two flu vaccination questions do not indicate when the subject received the flu vaccination during the 12 months preceding the interview. In addition, estimates are subject to recall error, which will vary depending on when the question is asked because the receipt of a flu vaccination is seasonal. The analyses excluded adults with unknown flu vaccination status (about 3%).

[11]Individuals who received human immunodeficiency virus (HIV) testing solely as a result of blood donation were considered not to have been tested for HIV. The analyses excluded adults with unknown HIV test status (about 5%).

[12]Does not include a hospital emergency room. The analyses excluded persons with an unknown usual place to go for medical care (about 1.5%).

[13]A year is defined as the 12 months prior to interview. The analyses excluded persons with unknown responses to the question on failure to obtain needed medical care due to cost (about 0.2%).

[14]A person was defined as uninsured if he or she did not have any private health insurance, Medicare, Medicaid, Children's Health Insurance Program, state-sponsored or other government-sponsored health plan, or military plan at the time of interview. A person was also defined as uninsured if he or she had only Indian Health Service coverage or had only a private plan that paid for one type of service such as accidents or dental care. The data on health insurance status were edited using an automated system based on logic checks and keyword searches. The analyses excluded adults with unknown health insurance status (about 1%).

NOTE: Data are based on household interviews of a sample of the civilian noninstitutionalized population.

DATA SOURCE: CDC/NCHS, National Health Interview Survey, July–December 2016.

Table 5. Percentage of adults living in wireless-mostly households, by selected demographic characteristics and calendar half-years: United States, July 2013–December 2016

Demographic characteristic	July–December 2013	January–June 2014	July–December 2014	January–June 2015	July–December 2015	January–June 2016	July–December 2016	95% confidence interval[1]
Total	18.3	16.6	16.9	16.3	16.1	16.6	16.7	15.95–17.54
Race/ethnicity								
Hispanic or Latino, any race(s)	16.6	14.6	14.2	15.4	15.0	14.5	15.6	13.63–17.75
Non-Hispanic white, single race	18.6	16.8	17.2	16.0	16.0	16.6	16.5	15.45–17.57
Non-Hispanic black, single race	18.2	16.9	17.5	17.3	17.1	18.4	17.5	15.81–19.36
Non-Hispanic Asian, single race	20.4	19.5	19.4	18.4	19.7	18.7	21.8	17.28–27.10
Non-Hispanic other, single race	14.1	11.0	*10.3	18.0	12.8	13.6	16.0	11.02–22.65
Non-Hispanic, multiple race	16.9	16.3	17.0	17.8	15.0	16.8	14.0	9.87–19.56
Age (years)								
18–24	20.0	18.1	17.7	17.1	17.2	16.5	17.2	15.43–19.14
25–29	14.5	11.8	13.5	11.1	11.1	12.6	11.7	10.06–13.65
30–44	20.0	17.6	17.2	16.9	16.2	16.5	15.9	14.79–16.99
45–64	21.6	20.0	20.6	19.2	19.9	20.1	20.7	19.62–21.86
65 and over	10.3	10.2	10.6	12.0	11.0	12.5	12.9	11.99–13.95
Sex								
Male	18.6	16.7	17.1	16.5	16.2	16.8	16.9	16.03–17.85
Female	18.0	16.5	16.7	16.1	16.1	16.4	16.6	15.79–17.35
Education								
Some high school or less	12.4	12.4	11.0	12.1	12.1	12.8	12.2	10.92–13.62
High school graduate or GED[2]	16.5	14.3	14.5	14.6	14.9	14.6	14.8	13.82–15.93
Some post-high school, no degree	18.9	17.3	17.7	16.4	15.8	16.9	17.4	16.25–18.51
4-year college degree or higher	22.3	20.1	20.8	19.5	19.5	19.7	19.6	18.38–20.89
Employment status last week								
Working at a job or business	21.4	18.9	19.5	18.2	18.3	18.0	18.4	17.47–19.35
Keeping house	16.9	15.9	16.8	13.9	15.5	15.7	16.9	14.83–19.30
Going to school	21.1	20.5	19.0	21.6	19.7	20.8	18.3	15.43–21.50
Something else (incl. unemployed)	11.4	11.2	10.9	11.9	11.4	13.2	13.0	12.17–13.87
Household structure								
Adult living alone	9.4	9.3	9.3	9.5	9.5	10.1	9.9	9.00–10.80
Unrelated adults, no children	11.2	9.2	5.5	7.4	*10.3	9.3	*6.0	3.09–11.27
Related adults, no children	18.1	15.9	17.3	16.4	16.3	16.3	17.1	16.07–18.24
Adult(s) with children	22.6	20.8	20.0	19.2	19.2	20.0	19.4	18.17–20.68
Household poverty status[3]								
Poor	9.1	9.1	8.4	10.0	8.7	9.7	10.0	8.45–11.82
Near-poor	12.0	10.6	12.0	12.5	10.7	12.8	11.1	9.43–12.91
Not-poor	22.1	20.0	19.4	18.4	18.7	18.6	18.9	17.85–19.96

See footnotes at end of table.

Table 5. Percentage of adults living in wireless-mostly households, by selected demographic characteristics and calendar half-years: United States, July 2013–December 2016—*Continued*

Demographic characteristic	July–December 2013	January–June 2014	July–December 2014	January–June 2015	July–December 2015	January–June 2016	July–December 2016	95% confidence interval[1]
Geographic region[4]								
Northeast	20.1	18.7	21.4	20.4	19.0	20.9	21.4	19.37–23.48
Midwest	16.2	14.5	14.6	13.1	14.9	13.9	15.0	13.34–16.91
South	18.0	16.0	16.2	16.3	15.6	16.0	15.8	14.61–16.99
West	19.3	18.1	16.5	16.2	15.9	16.7	16.2	14.50–17.94
Metropolitan statistical area status								
Metropolitan	18.7	16.9	17.0	16.8	16.3	16.6	17.2	16.22–18.25
Not metropolitan	16.7	15.5	16.2	14.2	15.0	12.9	12.9	11.65–14.22
Home ownership status[5]								
Owned or being bought	21.0	19.0	19.9	19.0	19.0	19.0	19.7	18.67–20.78
Renting	12.4	11.1	11.0	10.5	10.4	11.5	10.5	9.54–11.48
Other arrangement	14.8	12.8	12.1	14.1	11.7	16.3	14.9	10.94–20.06
Number of adults in survey sample who live in landline households with wireless telephones (unweighted)	22,879	19,608	18,040	17,527	15,780	15,487	15,173	…

* Estimate has a relative standard error greater than 30% and does not meet standards for reliability or precision.

… Category not applicable.

[1]Refers to July–December 2016.

[2]GED is General Educational Development high school equivalency diploma.

[3]Based on household income and household size using the U.S. Census Bureau's poverty thresholds. "Poor" persons are defined as those below the poverty threshold. "Near-poor" persons have incomes of 100% to less than 200% of the poverty threshold. "Not-poor" persons have incomes of 200% of the poverty threshold or greater. Early Release estimates stratified by poverty status are based on reported income only and may differ from similar estimates produced later that are based on both reported and imputed income. NCHS imputes income when income is unknown, but the imputed income file is not available until a few months after the annual release of National Health Interview Survey microdata. For households with multiple families, household income and household size were calculated as the sum of the multiple measures of family income and family size.

[4]In the geographic classification of the U.S. population, states are grouped into the following four regions used by the U.S. Census Bureau: *Northeast* includes Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont; *Midwest* includes Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin; *South* includes Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia; and *West* includes Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

[5]For households with multiple families, home ownership status was determined by considering the reported home ownership status for each family. If any family reported owning the home, then the household-level variable was classified as "Owned or being bought" for all persons living in the household. If one family reported renting the home and another family reported "other arrangement," then the household-level variable was classified as "Other arrangement" for all persons living in the household.

NOTE: Data are based on household interviews of a sample of the civilian noninstitutionalized population.

DATA SOURCE: CDC/NCHS, National Health Interview Survey, July 2013–December 2016.

About NENA

More in this Section...

As ***The Voice of 9-1-1™***, NENA is on the forefront of all emergency communications issues. The association serves its members and the greater public safety community as the only professional organization solely focused on 9-1-1 policy, technology, operations, and education issues. With more than 13,000 members in 48 chapters across the United States and around the globe, NENA promotes the implementation and awareness of 9-1-1, as well as international three-digit emergency communications systems.

NENA works with 9-1-1 professionals nationwide, public policy leaders, emergency services and telecommunications industry partners, like-minded public safety associations, and other stakeholder groups to develop and carry out critical programs and initiatives, to facilitate the creation of an IP-based Next Generation 9-1-1 system, and to establish industry leading standards, training, and certifications.

Through the association's efforts to provide effective and efficient public safety solutions, NENA strives to protect human life, preserve property, and maintain the security of our communities.

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Calendar

more (/events/event_list.asp)

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10/28/2019
Advanced Fire & EMS Dispatching - Wheaton, IL (/events/EventDetails.aspx?id=1223227)

10/30/2019
#Webinar Wednesday - Stress, PTSD, & Knowing the Difference Between Them (/events/EventDetails.aspx?id=1289580)

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FACT SHEET

JUNE 12, 2019

Mobile Fact Sheet

MORE FACT SHEETS: INTERNET/BROADBAND | SOCIAL MEDIA

Mobile phone ownership over time

Who owns cellphones and smartphones

Ownership of other devices

Smartphone dependency over time

Who is smartphone dependent

Find out more

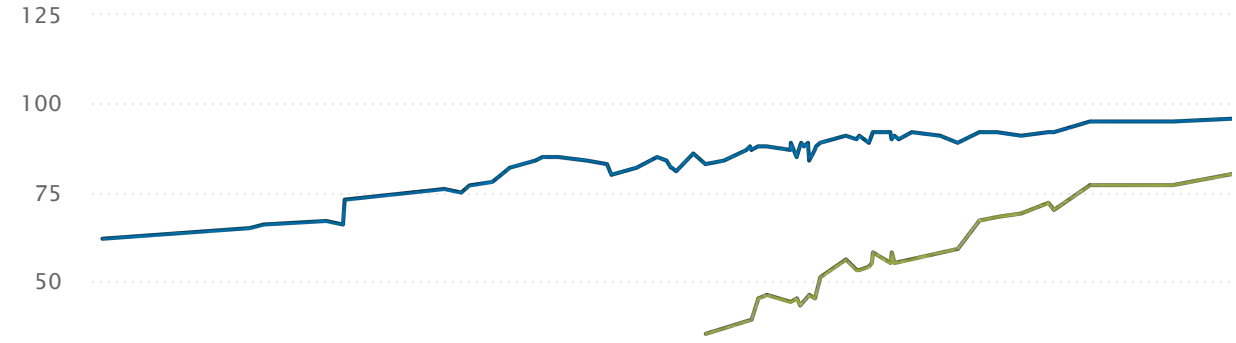
In contrast to the largely stationary internet of the early 2000s, Americans today are increasingly connected to the world of digital information while "on the go" via smartphones and other mobile devices. Explore the patterns and trends that have shaped the mobile revolution below.

Mobile phone ownership over time

The vast majority of Americans – 96% – now own a cellphone of some kind. The share of Americans that own smartphones is now 81%, up from just 35% in Pew Research Center's first survey of smartphone ownership conducted in 2011. Along with mobile phones, Americans own a range of other information devices. Nearly three-quarters of U.S. adults now own desktop or laptop computers, while roughly half now own tablet computers and roughly half own e-reader devices.

Chart Data Share Embed

% of U.S. adults who own the following devices



Source: Surveys conducted 2002-2019.

PEW RESEARCH CENTER

Who owns cellphones and smartphones

A substantial majority of Americans are cellphone owners across a wide range of demographic groups. By contrast, smartphone ownership exhibits greater variation based on age, household income and educational attainment.

% of U.S. adults who own the following devices

	Any cellphone	Smartphone	Cellphone, but not smartphone
Total	96%	81%	15%
Men	98%	84%	14%
Women	95%	79%	16%
Ages 18-29	99%	96%	4%
30-49	99%	92%	6%
50-64	95%	79%	17%
65+	91%	53%	39%
White	96%	82%	14%

	Any cellphone	Smartphone	Cellphone, but not smartphone
Black	98%	80%	17%
Hispanic	96%	79%	17%
Less than high school graduate	92%	66%	25%
High school graduate	96%	72%	24%
Some college	96%	85%	11%
College graduate	98%	91%	7%
Less than $30,000	95%	71%	23%
$30,000-$49,999	96%	78%	18%
$50,000-$74,999	98%	90%	8%
$75,000+	100%	95%	5%
Urban	97%	83%	13%
Suburban	96%	83%	13%
Rural	95%	71%	24%

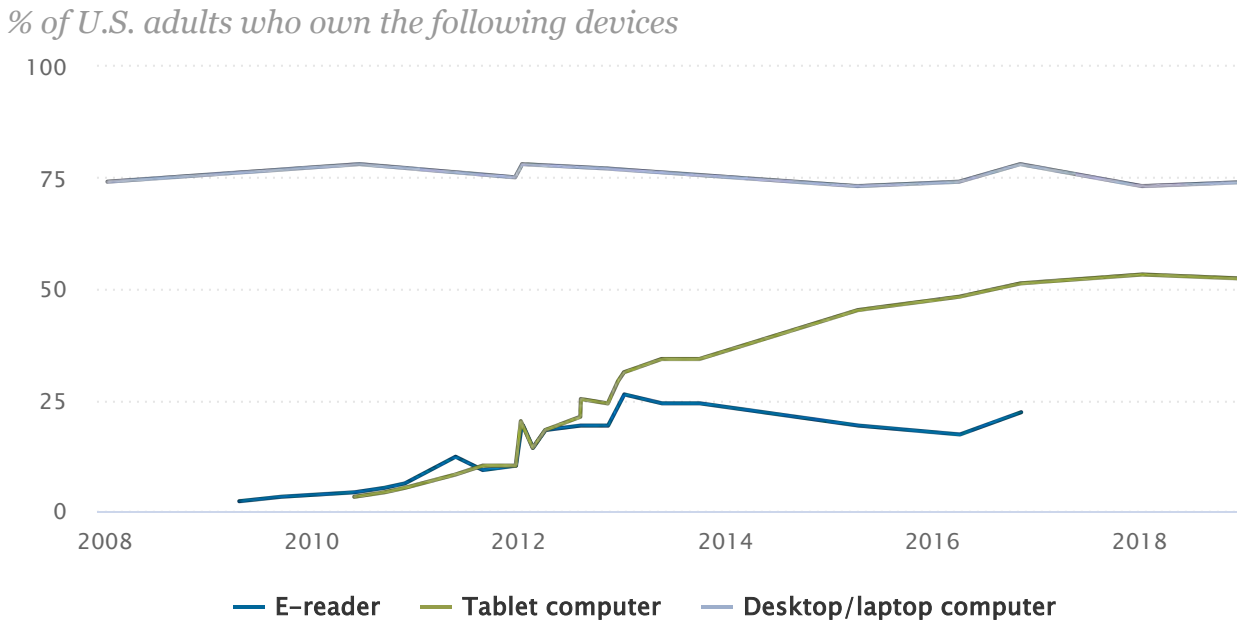
Source: Survey conducted Jan. 8 to Feb. 7, 2019.

PEW RESEARCH CENTER

Ownership of other devices

Along with mobile phones, Americans own a range of other information devices. Nearly three-quarters of U.S. adults now own desktop or laptop computers, while roughly half now own tablet computers and roughly half own e-reader devices.

Chart Data Share Embed



Source: Surveys conducted 2008-2019.

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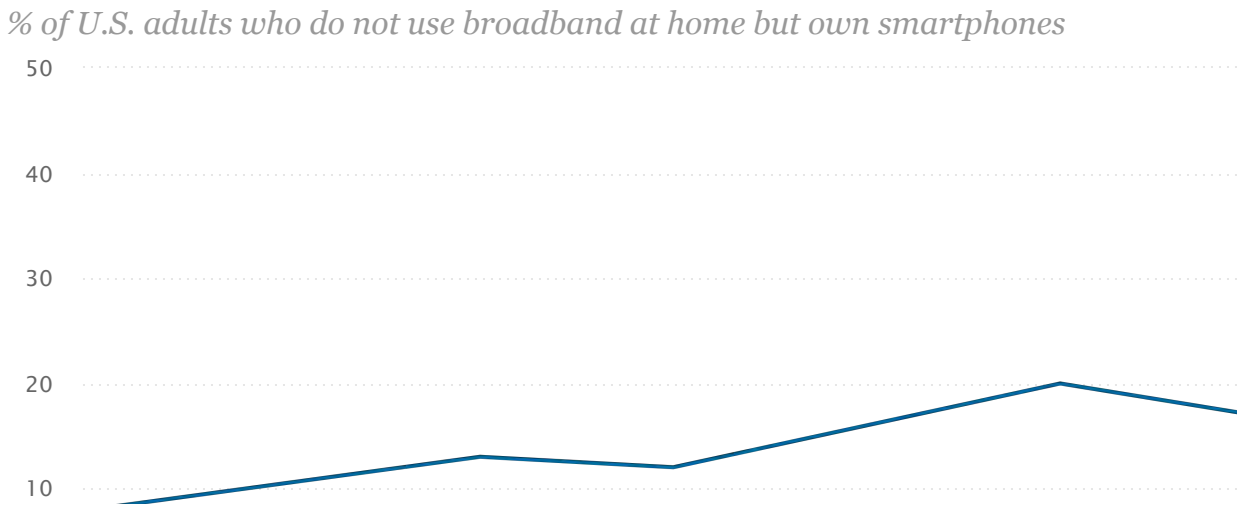
Smartphone dependency over time

A growing share of Americans now use smartphones as their primary means of online access at home. Today roughly one-in-five American adults are "smartphone-only" internet users – meaning they own a smartphone, but do not have traditional home broadband service.

Chart Data Share Embed



Source: Surveys conducted 2013-2019. Data for each year based on a pooled analysis of all surveys containing broadband and smartphone questions fielded during that year.

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Who is smartphone dependent

Reliance on smartphones for online access is especially common among younger adults, non-whites and lower-income Americans.

Age | Race | Gender | Income | Education | Community

Chart | Data | Share | Embed

% of U.S. adults who do not use broadband at home but own smartphones, by age

Source: Surveys conducted 2013-2019. Data for each year based on a pooled analysis of all surveys containing broadband and smartphone questions fielded during that year.

PEW RESEARCH CENTER

Find out more

Find more in-depth explorations of the impact of mobile adoption by following the links below.

Mobile Technology and Home Broadband 2019 June 13, 2019
Digital gap between rural and nonrural America persists May 31, 2019
Digital divide persists even as lower-income Americans make gains in tech adoption May 7, 2019
Millennials stand out for their technology use, but older generations also embrace digital life May 2, 2018
About a quarter of U.S. adults say they are 'almost constantly' online March 14, 2018
Nearly one-in-five Americans now listen to audiobooks March 8, 2018
A third of Americans live in a household with three or more smartphones May 25, 2017
Tech Adoption Climbs Among Older Adults May 17, 2017

All reports and blog posts related to mobile technology.

Kathy Noel

From: al chern <ar.mrarcmac@gmail.com>
Sent: Tuesday, September 10, 2019 2:37 PM
To: Roy Sapau
Subject: opposed to5G

Kathy Noel

From: Kathy Hollywood
Sent: Wednesday, August 28, 2019 11:20 AM
To: Roy Sapau
Subject: FW: Cell towers

Please add to mailing list for workshop info.

Kathy Hollywood, City Clerk
City of Encinitas
760-633-2601

From: Tony Kranz <tkranz@encinitasca.gov>
Sent: Wednesday, August 28, 2019 11:17 AM
To: Kathy Hollywood <khollywood@encinitasca.gov>
Subject: Fwd: Cell towers

Please let this person know how to receive meeting notifications.

Thanks,

Tony

Sent from my iPhone

Begin forwarded message:

> **From:** Alexandra Cassaniti <acassaniti@gmail.com>
> **Date:** August 28, 2019 at 11:07:13 AM PDT
> **To:** "council@encinitasca.gov" <council@encinitasca.gov>
> **Subject: Cell towers**
>
> Hello-
> Please keep me informed on any meetings that I can attend in regard to cell towers. Especially the new small 5G towers that are being placed on light posts and underground.
>
> As you are aware, 5G is an experiment that should be treated as such. I am happy to speak about the subject matter. I am currently finishing a pamphlet I have been working on for the last 3 years. I write about Electromagnetic Sensitivities, I live in Leucadia.
>
> Kind regards,
> Alexandra Cassaniti

Kathy Noel

From: Annemarie Clisby
Sent: Monday, September 23, 2019 10:56 AM
To: Roy Sapau
Subject: FW: 5G Workshop 9/23

From: alisonsurf <alisonsurf@yahoo.com>
Sent: Monday, September 23, 2019 7:11 AM
To: Council Members <council@encinitasca.gov>
Subject: 5G Workshop 9/23

Hello council members,

As a Leucadia resident, I am strongly opposed to having 5G cell towers in our neighborhood. The long term health effects are not known at this time and I don't think this will improve our quality of life in Encinitas.

Thanks for your consideration of this important issue,
Alison Young Haramis
1333 Hermes, Leucadia

Sent from my T-Mobile 4G LTE Device

Kathy Noel

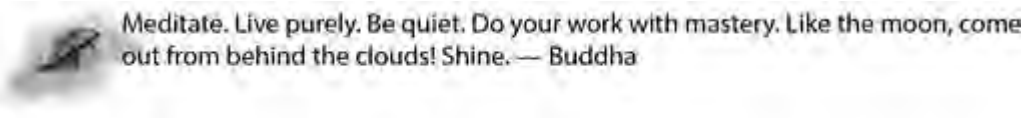
From: Annemarie Clisby
Sent: Monday, September 23, 2019 8:20 AM
To: Roy Sapau
Subject: FW: Stop5g in Encinitas

From: Amy Schick <aschick@bougainvilleacards.com>
Sent: Sunday, September 22, 2019 12:08 PM
To: Catherine Blakespear <cblakespear@encinitasca.gov>; Jody Hubbard <jhubbard@encinitasca.gov>; Tony Kranz <tkranz@encinitasca.gov>; Joe Mosca <jmosca@encinitasca.gov>; Kellie Shay Hinze <khinze@encinitasca.gov>; Annemarie Clisby <Aclisby@encinitasca.gov>
Subject: Stop5g in Encinitas

Dear Encinitas City Council,

I am writing as a resident of Encinitas at 381 N. Vulcan Ave. to let you know that I am ardently opposed to the installation of 5g small cell towers in Encinitas until there are conclusive studies that show there will be no harmful effects to the people who are living , working, or going to school near the places these cell towers are installed or to the surrounding environment. I strongly urge you to block the installation of 5g small cell towers in Encinitas.

Sincerely,
Amy Schick



Kathy Noel

From: Annemarie Clisby
Sent: Monday, August 26, 2019 9:51 AM
To: Roy Sapau
Subject: FW: TONIGHT's MEETING to vote on 5G...Please BANN IT!

From: Barbara Roberts <facereading1@aol.com>
Sent: Monday, August 26, 2019 9:38 AM
To: Catherine Blakespear <cblakespear@encinitasca.gov>; Jody Hubbard <jhubbard@encinitasca.gov>; Council Members <council@encinitasca.gov>; Tony Kranz <tkranz@encinitasca.gov>; Joe Mosca <jmosca@encinitasca.gov>; Kellie Shay Hinze <khinze@encinitasca.gov>
Subject: TONIGHT's MEETING to vote on 5G...Please BANN IT!

Dear City Council Members:

I am extremely concerned about 5G being rolled out into our communities and urge you to protect us from the dangers of this increase in wireless transmissions. There has not been any proper testing to determine the safety of 5 G on humans, animals or the environment. There have been numerous studies about the health hazards of 5G in Europe and the Netherlands is one country that has banned it. Cities in Northern CA have banned 5 G.

Please use your legislative and representative powers to refuse to permit small cell antennas in residential areas. I understand that in our

own country fire stations won't even allow 4G on their property because it impacts the health of the firemen and women. 5 G involves exponentially greater microwaves. These have been banned elsewhere. Please take a lead on protecting us, the residents.

Thank you for being proactive on this.
Sincerely,
Barbara Roberts
760-479-0008

Kathy Noel

From: Annemarie Clisby
Sent: Wednesday, August 28, 2019 10:19 AM
To: Roy Sapau
Subject: FW: Small cell towers in residential Encinitas neighborhoods

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From: BRANDT RICHARDS <btoddrichards@mac.com>
Sent: Tuesday, August 27, 2019 8:11 PM
To: Catherine Blakespear <cblakespear@encinitasca.gov>; ihubbard@encinitasca.gov; Council Members <council@encinitasca.gov>; Tony Kranz <tkranz@encinitasca.gov>; Joe Mosca <jmosca@encinitasca.gov>; Kellie Shay Hinze <khinze@encinitasca.gov>
Subject: Small cell towers in residential Encinitas neighborhoods

Brandt Richards
880 Cornish Dr
Encinitas, CA

City of Encinitas Council
Mayor Blakespear, Deputy Mayor Hubbard, and City Council Members Kellie Shay Hinze, Tony Kranz, and Joe Mosca

Re: Protective Small Cell Antenna Ordinance Needed Immediately

I am concerned about the timing of the urgency ordinance:

- scheduled for a City Council with three business days' notice;
- the last agenda item on an already full schedule;
- brought to the City Council many months after the FCC directive was issued and other local communities had implemented ordinances;
- the ordinance is not protective of sensitive and residential areas; and
- the ordinance provides a streamlined process for small cell antenna applications;

While I hope this is not true, I suspect that the urgency was a ploy to deflect and minimize the participation of citizens in Encinitas that are concerned about the environment in their community.

The urgency ordinance as it stands is not protective for sensitive areas and residential areas. There are no setbacks to sensitive areas which would be expected based on setbacks in the wireless ordinance for macro antennas. There is no protection of residential areas. And even though residential roads are one of the least preferred categories, the ordinance does not prevent Telecom installation of small cell antennas in front of our homes, which is most of Encinitas. (Note: there are 32 small cell antennas already installed on light poles in Encinitas residential areas via a business agreement that the City made with Crown Castle a few years ago. I suspect thatthis was organized without community participation.)

We want the ordinance to be more protective immediately, applied to all applications in process, before there is a flood of small cell antenna applications/installations in our neighborhoods. We can't wait for a small cell antenna community meeting.

I ask that the Encinitas small cell antenna ordinanceincorporate the best practices of protective small cell antennas

ordinances of the California Cities of Mill Valley and Los Altos; Calabasas; Fairfield, Petaluma and San Ramon; and Hercules.

- Mill Valley and Los Altos ordinances, prepared by Gail Karish – telecommunications attorney for Best Best & Krieger LLP, prohibit small cell antennas in residential areas.
- The Calabasas ordinance does not allow small cell antennas in residential areas.
- The Fairfield, Petaluma and San Ramon ordinances require substantial setbacks to sensitive area and residential areas and structures.
- The Hercules ordinance is the best administration for control of the application and shot clock process, requires ANSI 222 class III poles for all small cell installations, and prohibits new antenna support structures in residential areas.

For me and many of my friends and colleagues, there is a perception of harm associated with microwave antennas. We know this in our guts and this is validated by frequent news and science reports that show great biological harm from microwave radiation exposure. We are afraid for our property values.

Thank you for amending the Encinitas small cell antenna ordinance immediately for our collective safety.

Sincerely, Brandt Richards

Kathy Noel

From: Annemarie Clisby
Sent: Monday, September 23, 2019 10:43 AM
To: Roy Sapau
Subject: FW: 5G workshop 9/23 / AGAINST 5G in ENCINITAS

From: Bruce Egger <bruce.egger@gmail.com>
Sent: Sunday, September 22, 2019 7:12 PM
To: Council Members <council@encinitasca.gov>
Subject: 5G workshop 9/23 / AGAINST 5G in ENCINITAS

Dear City Council,

I am a homeowner and resident of Encinitas with two little girls. PLEASE act in the interests of your community! Thousands of independent studies show adverse health impacts to exposure to wireless radiation.

Keep Encinitas healthy and thriving and vote against 5G in Encinitas. Vote AGAINST 5G!

Thank you,
Bruce Egger

Kathy Noel

From: Annemarie Clisby
Sent: Monday, September 23, 2019 10:06 AM
To: Roy Sapau
Subject: FW: Encinitas 5G Work Shop Letter
Attachments: Encinitas 5G Work Shop Letter.pdf

From: Carolyn Mein (via Google Docs) <drmein@gmail.com>
Sent: Friday, September 20, 2019 8:43 PM
To: Council Members <council@encinitasca.gov>
Subject: Encinitas 5G Work Shop Letter

drmein@gmail.com has attached the following document:

Encinitas 5G Work Shop Letter

Google Docs: Create and edit documents online.
Google LLC, 1600 Amphitheatre Parkway, Mountain View, CA 94043, USA
You have received this email because someone shared a document with you from Google Docs.

September 23, 2019

Carolyn Mein, DC
PO Box 8112
Rancho Santa Fe, CA 92067

City of Encinitas, Council Members and Planner Roy Sapa'u

Subject: 5G Workshop 9/23/19

Please make the Encinitas small cell antenna ordinance as protective as possible for our residential and sensitive areas.

5G health issues are well documented by Martin Paul "5G Risk, The Scientific Perspective":
https://peaceinspace.blogs.com/files/5g-emf-hazards--dr-martin-l.-pall--eu-emf2018-6-11us3.pdf

The impacts of antennas on real estate values are documented at this link:
http://realtormag.realtor.org/daily-news/2014/07/25/cell-towers-antennas-problematic-for-buyers

Please protect our health and our property values. Incorporate into the Encinitas small cell antenna ordinance these concepts from other cities that have protective ordinances.

- Do not allow small cell antennas to be installed in residential areas (Calabasas, Los Altos, and Mill Valley.)

- Do not allow small cell antennas to be installed within 600 feet of sensitive areas. Sensitive areas include schools, preschools nurseries childcare centers hospitals fire stations, senior facilities, and any area deemed sensitive by the administrator of the small cell antenna ordinance. (Calabasas, Los Altos, Mill Valley and Hercules).)

- Do not allow new support structures to be installed in residential areas (Hercules).

- Require a 1000 foot setback to residential areas for new support structures (Hercules)

- Require all antenna installations at utility pole locations to be stealth and supporting equipment to the underground. (Hercules)

- Require that all antenna support structures meet the requirements of ANSI 222 class III, and that this is verified by an independent third-party engineer. (Hercules)

- Require third party testing for each antenna installation that verifies that RF emissions are not greater than the devices permitted for this location.

- Americans with Disabilities Act: add this statement to the boilerplate of the Encinitas ordinance: “all small cell antenna installations shall be ADA compliant in every respect”. (San Diego County ordinance)

- Require a master plan for all proposed antenna locations before applications can be submitted. (Calabasas)

- Make the small cell antenna application process as rigorous and protective to our city as possible. (The Calabasas and Hercules ordinances provide a very thorough administrative process that puts the city in control of the applications.)

- Require liability insurance for each antenna site (Hercules)

The FCC Third Report and Order (https://www.fcc.gov/document/cellular-reform-third-report-and-order) is a regulation that authorizes 5G infrastructure and installation of small cell antennas on lampposts and utility poles in the rights-of-way. This is a telecommunications initiative to further corporate goals and violates local land use control and the basic intent of the Federal communications Act. 5G is an assault on our right to health and our right to safety. Many cities have protective ordinances in place despite Telecom lawsuit threats. **We request that the City of Encinitas get legal counsel that is supportive of our requests to have a protective ordinance**… just like Calabasas, Mill Valley, and Los Altos.

Cities have the civic responsibility to protect their citizens, and we expect the City of Encinitas to protect all of us from the placement of 5G small cell antennas in our residential neighborhoods.

Sincerely

Carolyn Mein, DC

5G: Great risk for EU, U.S. and International Health! Compelling Evidence for Eight Distinct Types of Great Harm Caused by Electromagnetic Field (EMF) Exposures and the Mechanism that Causes Them

Written and Compiled by Martin L. Pall, PhD
Professor Emeritus of Biochemistry and Basic Medical Sciences
Washington State University
Address: 638 NE 41st Ave., Portland OR 97232 USA
martin_pall@wsu.edu 503-232-3883 May 17, 2018

Summary:

We know that there is a massive literature, providing a high level of scientific certainty, for each of eight pathophysiological effects caused by non-thermal microwave frequency EMF exposures. This is shown in from 12 to 35 reviews on each specific effect, with each review listed in Chapter 1, providing a substantial body of evidence on the existence of each effect. Such EMFs:

1. Attack our nervous systems including our brains leading to widespread neurological/neuropsychiatric effects and possibly many other effects. This nervous system attack is of great concern.
2. Attack our endocrine (that is hormonal) systems. In this context, the main things that make us functionally different from single celled creatures are our nervous system and our endocrine systems – even a simple planaria worm needs both of these. Thus the consequences of the disruption of these two regulatory systems is immense, such that it is a travesty to ignore these findings.
3. Produce oxidative stress and free radical damage, which have central roles in essentially all chronic diseases.
4. Attack the DNA of our cells, producing single strand and double strand breaks in cellular DNA and oxidized bases in our cellular DNA. These in turn produce cancer and also mutations in germ line cells which produce mutations in future generations.
5. Produce elevated levels of apoptosis (programmed cell death), events especially important in causing both neurodegenerative diseases and infertility.
6. Lower male and female fertility, lower sex hormones, lower libido and increased levels of spontaneous abortion and, as already stated, attack the DNA in sperm cells.
7. Produce excessive intracellular calcium [Ca2+]i and excessive calcium signaling.
8. Attack the cells of our bodies to cause cancer. Such attacks are thought to act via 15 different mechanisms during cancer causation.

There is also a substantial literature showing that EMFs also cause other effects including life threatening cardiac effects (Chapter 3). In addition substantial evidence suggests EMF causation of very early onset dementias, including Alzheimer's, digital and other types of dementias (Chapter 3); and there is evidence that EMF exposures in utero and shortly after birth can cause ADHD and autism (Chapter 5).

Each of these effects is produced via the main mechanism of action of microwave/lower frequency EMFs, activation of voltage-gated calcium channels (VGCCs) (Chapter 2). Each of them is produced via what are called downstream effects of VGCC activation. It follows from this that we have a good understanding not only that these effects occur, but also how they can occur. The extraordinary sensitivity of the VGCC voltage sensor to the forces of the EMFs tells us that the current safety guidelines allow us to be exposed to EMF levels that are something like

7.2 million times too high. That sensitivity is predicted by the physics. Therefore, the physics and the biology are each pointing to the same mechanism of action of non-thermal EMFs.

The different effects produced are obviously very deep concerns. They become much deeper and become existential threats when one considers that several of these effects are both cumulative and eventually irreversible. There is substantial evidence for the cumulative nature and eventual irreversibility of the neurological/neuropsychiatric effects, of the reproductive effects, the mutational DNA effects, the cardiac effects, of some but not other of the hormonal effects (Chapter 3); any causation of ADHD and autism may add additional concerns (here the cumulative nature is probably limited to the perinatal period). When we know that sperm counts have dropped by more than 50% throughout the technologically advanced countries on earth, it is difficult to avoid the conclusion that the vast majority of the population in those countries is already substantially impacted. The same conclusion can be made based on the widespread nature of the neuropsychiatric effects in those countries. Both of those effects will get much much worse even with no increase in current exposures, due to the cumulative nature and irreversibility of these effects. I expect we will see crash in human reproduction almost to zero as happened in the Magras and Xenos mouse study which I estimate to occur within about 5 years, without any increases in our exposures. Obviously 4G and 5G will make the situation much worse. Similarly I expect that the deterioration in brain function that we are already seeing will seal our fate if we fail to act rapidly and vigorously. Our collective brain function may become completely incapable of dealing with such a mega-crisis situation.

Now it can be argued that some of these may not develop as I expect, although those expectations are based on the best available evidence. One may even be able to argue this for all of those expectations. However, when we have substantial risk of multiple existential threats to every single technologically advanced country on earth, failure to act vigorously means there is a very high probability of complete destruction of these societies. And the chaos which would inevitably ensue, in a world that still has nuclear weapons, may well lead to extinction. In the face of these types or risk, the only reasonable course is to move with great vigor to stop new exposures and lower current exposures. One can still access the internet, using wired connections. And we can lower cell phone tower and cell phone radiation substantially. Smart meters, if needed, can work via wired connections.

Over 60% of this document (Chapters 5 & 6), is focused on the failures of statements from SCENIHR, the telecommunications industry, the U.S. FCC and the U.S. FDA to reflect the science. Their statements repeatedly omit much, often all of the most important science. Their statements are rife not only with omissions, but also with easily demonstrable falsehoods and with false logic. These have often occurred at times where we know that they knew better. These have occurred along with vigorous efforts by the telecommunications industry to corrupt the science by attacking individual scientists whose only fault is that they have obtained important findings that the industry does not like. These attacks have occurred along with vigorous efforts to corrupt two agencies that have important regulatory roles.

There are also possible concerns about individual industry-linked research studies. All wireless communication devices put out polarized EMFs that carry information via pulsations. Both the pulsations and the polarization make these EMFs much more biologically active. There are three other factors that also influence the production of effects. Several industry-linked studies may have used these factors, along with using very tiny numbers of individual animals in their studies, to produce studies which may have been designed to fail (Chapter 5). It is not clear at this point whether this type of concern is quite limited or whether it is very broad.

The European Commission has done nothing to protect European citizens from any of these very serious health hazards and the U.S. FDA, EPA and National Cancer Institute have done nothing to protect American citizens. The U.S. FCC has been much worse than that, acting vigorously with wanton disregard for our health.

Preface

The document that follows was, in its original form, sent to many of the authorities of the European Union, in conjunction with other documents sent to the same people by a group of European scientists. It was in response two documents that were, in turn, written by Mr. Ryan and Dr. Vinciūnas responding to a large group of European and other international scientists expressing great concern about the safety of 5G. I was asked by the leaders of the group of scientists to write my own response to those two documents. Mr. Ryan made the statement that "There is consistent evidence presented by national and international bodies (International Commission on Non Ionising Radiation Protection - ICNIRP, Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR) that exposure to electromagnetic fields does not represent a health risk, if it remains below the limits set by Council Recommendation 1999/519/EC1." In fact, that is not either the ICNIRP or SCENIHR position – their position, and similar positions have been taken by the U.S. FCC, FDA and the National Cancer Institute, is that the evidence is inconsistent or conflicting and therefore, in their view, no conclusions can be drawn. Some of these organization have also stated that there is no known mechanism by which effects can be produced. What is shown below is that there is a vast amount of evidence in the independent scientific literature that conflicts with both the conclusion about lack of demonstrated effects and the conclusion about lack of mechanism.

The European Commission, according to the Ryan and Vinciūnas documents and the U.S. National Cancer Institute, according to their web site, are each depending on the SCENIHR 2015 document to make judgments about EMF effects. Consequently, the reliability of SCENIHR 2015 is an essential element in determining the reliability of both of their assessments.

The document that is presented below, differs from the document that was emailed to EU authorities in three different ways: 1. The original document was sent as an email with multiple attachments. In this document attachments are simply provided as citations. The current document is a stand-alone document. 2. Some material is inserted to discuss positions taken by the U.S. FCC, FDA and National Cancer Institute, so as to be particularly relevant to the U.S. situation. 3. Substantial additional evidence is also provided.

The revised document contains seven chapters followed by a citation list for the entire document:

Chapter 1: Eight Extremely Well-Documented Effects of Non-Thermal EMF Exposures: Role of Pulsations, Other Factors that Influence EMF Effects, pp. 4-17

Chapter 2: How Each Such EMF Effect Is Directly Produced via Voltage-Gated Calcium Channel Activation: Role of the Voltage Sensor in Producing the Extraordinary Sensitivity to EMF Effects, pp. 17-23

Chapter 3. Strong Evidence for Cumulative and Irreversible EMF Effects pp. 23-27

Chapter 4. EMFs Including Wi-Fi May Be Particularly Damaging to Young People pp. 27,28

Chapter 5: The Importance of the SCENIHR 2015 Document and the Many Omissions, Flaws and Falsehoods in That Document pp. 28-58

Chapter 6: The U.S. Early Role in Recognizing Non-Thermal EMF Effects and How This Was Abandoned Starting in 1986: U.S. Failure to Research Health Impacts of Cell Phone Towers, Cell Phones, Wi-Fi, Smart Meters and Now 5G. What Is the Current Position of U.S. Government Agencies? pp. 58-78

Chapter 7: The Great Risks of 5G: What We Know and What We Don't Know pp. 78-82

Chapter 1. Eight Extremely Well-Documented Effects of Non-Thermal EMF Exposures: Role of Pulsations, Other Factors that Influence EMF Effects

Both the earlier Ryan document and the more recent Arūnas document each fail to pay any attention to the extensive scientific literature that has been accumulated on non-thermal electromagnetic field (EMF) effects. The scientific consensus of independent scientists based on information accumulated over the last 7 decades is just the opposite of what each of them states. I am copying into this document, at the end of Chapter 1, a series of 8 extremely well-documented effects of such EMF exposure, together with a list of review articles, most of them being peer reviewed articles published in well respected journals in the PubMed database, *that have each reviewed a body of evidence demonstrating the existence of each such effect*.

What are the effects produced by non-thermal exposures to microwave frequency EMFs, where we have an extensive scientific literature? Each of the following effects has been documented in from 12 to 34 reviews, listed at the end of Chapter 1.

1. Three types of cellular DNA attacks, producing single strand breaks in the cellular DNA, double strand breaks in cellular DNA and oxidized bases in cellular DNA. Each of these DNA changes have roles in cancer causation and in producing the most important mutational changes in humans and diverse animals. Double stranded DNA breaks produce chromosomal breaks, rearrangements, deletions and duplications and copy number mutations; they also produce gene amplification, an important mechanism in cancer causation. Single strand breaks in cellular DNA cause aberrant recombination events leading to copy number mutations. Oxidized bases cause point mutations. When these occur in somatic cells, they can each have roles in causing cancer. When these occur in germ line cells (and they have be shown to occur in sperm following EMF exposures), they cause the three most important types of mutations in future generations, chromosomal mutations, copy number mutations and point mutations. (21 different reviews documenting these types of cellular DNA damage)
2. A wide variety of changes leading to lowered male fertility, lowered female fertility, increased spontaneous abortion, lowered levels of estrogen, progesterone and testosterone, lowered libido (18 reviews). Human sperm count has dropped to below 50% of what used to be considered normal throughout the technologically advanced countries of the world [1]. Reproductive rates have fallen below replacement levels in every technologically advanced country of the world, with a single exception. These include every EU country, the U.S., Canada, Japan, South Korea, Taiwan, Singapore, Australia and New Zealand. Reproduction averages, in these countries, about 73% of replacement levels according to 2015 or 2016 data. A study on mouse reproduction [2] showed that radio/microwave frequency EMF exposure at doses well within our current safety guidelines produced substantial dose-dependent decreases in reproduction within

the first set of litters; further exposure produced dose-dependent complete or almost complete sterility that was found to be largely irreversible. When we have a technology that is universally present in these technologically advanced countries, that we know impacts reproduction, and reproduction has already dropped well below replacement levels, and we may be facing a catastrophic and irreversible decline in reproduction and there are more and more plans to expose us still further, don't you think that we should take note of the science? Mr. Ryan and Dr. Vinciūnas seem to be saying not at all. (Please note that the U.S. FCC and FDA also completely ignore this existential threat)

3. Neurological/neuropsychiatric effects (25 reviews). My own paper on this [3] and two earlier reviews cited in it found that there are whole series of repeatedly found EMF effects which have also become extremely widespread complaints in our technologically advanced societies, namely: sleep disturbance/insomnia; fatigue/tiredness; headache; depression/depressive symptoms; lack of concentration/attention/cognitive dysfunction; dizziness/vertigo; memory changes; restlessness/tension/anxiety/stress/agitation; irritability. These findings are not just based on epidemiological findings but are also based on profound impacts of EMFs, at levels well within our safety guidelines, on brain structure and function and also on the mechanism of non-thermal EMF action discussed below. When we have these neuropsychiatric effects becoming more and more common in technologically advanced societies all over the world, and *we know each of these is caused EMF exposures*, shouldn't we take note of this relationship?
4. Apoptosis/cell death (13 reviews). The two most important consequences of large increases in apoptosis (programmed cell death) are in causation of the neurodegenerative diseases and lowered reproduction although there are others.
5. Oxidative stress/free radical damage (19 reviews). Oxidative stress has roles in all or almost all chronic diseases. It is reported to have essential roles in producing the reproductive effects and the attacks on cellular DNA and may also have roles in producing the neurological effects and some of the cancer-causing effects shown to be produced here by EMF exposures.
6. Widespread endocrine (that is hormonal) effects (12 reviews). The steroid hormone levels drop with EMF exposure, whereas other hormone levels increase with initial exposure. The neuroendocrine hormones and insulin levels often drop with prolonged EMF exposure, possibly due to endocrine exhaustion.
7. Increases in intracellular calcium ([Ca2+]i) levels following EMF exposure (15 reviews). Calcium signaling also increases following EMF exposure.
8. Cancer causation (35 reviews). Brain cancer, salivary cancer, acoustic neuromas and two other types of cancer go up with cell phone use. People living near cell phone towers have increased cancer rates. Other types of EMFs are each implicated. Short wave radio, radio ham operators and people exposed to radar all are reported to have increased cancer incidence. Perhaps most telling, heavy-long term cell phone users have the highest incidence of brain cancer and have predominantly cancer increases on the ipsilateral side of the head (the side they use their cell phones), as opposed to the contralateral side. I have a paper [7], focused not on whether EMFs cause cancer but rather on ***how*** they can cause cancer. The paper shows that "downstream effects" of the main target of the EMFs in the cells of our bodies, can cause cancer in 15 different ways, including increases in cancer initiation, promotion and progression. Progression effects include both tissue invasion and metastasis. Each of these cancer causation effects are caused via mechanisms produced by downstream effects of the main non-thermal EMF mechanism, as discussed in Chapter 2.
9. Therapeutic effects of such EMFs. Such EMFs when focused on a specific region of the body where there is some dysfunction and when used at specific intensities, can have therapeutic effects. In my 2013 paper [4], I cited 12 different reviews where EMF

stimulation of bone growth was used therapeutically. There are something like 4000 papers on various therapeutic effects. Strangely, the telecommunications industry does not acknowledge these therapeutic effects, preferring rather to maintain the fiction that there are no non-thermal effects.

There is another set of reviews, 13 in this case, with each showing that pulsed EMFs are, in most cases, much more biologically active than are non-pulsed EMFs. This is particularly important because all wireless communication devices communicate via pulsations, making them potentially much more dangerous. It follows from this that if you wish to study the effects of Wi-Fi, cell phones, cordless phones, cell phone towers, smart meters or 5G, you had better study the real thing or at least something that pulses very much like the real thing. There are many studies that don't do this, but falsely claim to be genuine Wi-Fi, cell phone or cordless phone studies. Other factors that influence the occurrence of non-thermal EMF effects include the frequency being used, the polarization of the EMFs and the cell type being studied [4,5,8-11]. Furthermore there are intensity "windows" that produce maximum biological effects, such that both lower and higher intensities produce much less effect [5,8,9]. These window effect studies clearly show that dose-response curves are both non-linear and non-monotone, such that it is difficult or impossible to predict effects based on relative intensity even when all other factors are the same. The role of each of these factors is completely ignored by ICNIRP, SCENIHR, the U.S. FCC, FDA and National Cancer Institute as well as by many other industry-friendly groups. When each of these organizations concludes that "results are inconsistent" they are comparing studies based on superficial similarities but not on these demonstrated causal factors. What is being observed, therefore, is genuine biological heterogeneity, not inconsistency. It has been known since the beginning of modern science in the 16th century that how you do your studies is important in determining what results are obtained. How is it possible that ICNIRP, SCENIHR, the U.S. FCC, FDA and National Cancer Institute have forgotten this important fact?

The primary literature studies demonstrating roles of pulsation, frequency, polarization, cell type and intensity windows in determining biological effects are entirely dependent on having genuine effects to study. None of these studies could have been done without an effect to study. Consequently, the claims that there are no well-documented EMF effects are nonsense, based not only on the eight extremely well-documented effects summarized above, but also on the entire literature demonstrating the role of pulsation, frequency, polarization, cell type and intensity windows.

Now I haven't said anything about how these non-thermal EMF effects are produced. I am taking much of Chapter 2 from a recent paper [11].

Reviews each showing important health-related non-thermal effects of microwave frequency electromagnetic fields (EMFs).

These review lists were prepared by Dr. Martin L. Pall, Professor Emeritus of Biochemistry and Basic Medical Sciences, Washington State University. martin_pall@wsu.edu
BA degree in Physics, Phi Beta Kappa, with honors, Johns Hopkins University; PhD in Biochemistry & Genetics, Caltech.

Specific effects and reviews each reporting the effect in multiple primary literature studies:

Cellular DNA damage: Single strand and double strand breaks in cellular DNA and oxidized bases in cellular DNA, leading to chromosomal and other mutational changes:

1. Glaser ZR, PhD. 1971 Naval Medical Research Institute Research Report, June 1971. Bibliography of Reported Biological Phenomena ("Effects") and Clinical Manifestations Attributed to Microwave and Radio-Frequency Radiation. Report No. 2 Revised. https://scholar.google.com/scholar?q=Glaser+naval+medical+microwave+radio-frequency+1972&btnG=&hl=en&as_sdt=0%2C38 (Accessed Sept. 9, 2017)
2. Goldsmith JR. 1997 Epidemiologic evidence relevant to radar (microwave) effects. Environ Health Perspect 105(Suppl 6):1579-1587.
3. Yakymenko IL, Sidorik EP, Tsybulin AS. 1999 [Metabolic changes in cells under electromagnetic radiation of mobile communication systems]. Ukr Biokhim Zh (1999), 2011 Mar-Apr:20-28.
4. Aitken RJ, De Iuliis GN. 2007 Origins and consequences of DNA damage in male germ cells. Reprod Biomed Online 14:727-733.
5. Hardell, L., Sage, C. 2008. Biological effects from electromagnetic field exposure and public exposure standards. Biomed. Pharmacother. 62, 104-109.
6. Hazout A, Menezo Y, Madelenat P, Yazbeck C, Selva J, Cohen-Bacrie P. 2008 [Causes and clinical implications of sperm DNA damages]. Gynecol Obstet Fertil ;36:1109-1117.
7. Phillips JL, Singh NP, Lai H. 2009 Electromagnetic fields and DNA damage. Pathophysiology 16:79-88.
8. Ruediger HW. 2009 Genotoxic effects of radiofrequency electromagnetic fields. Pathophysiology. 16:89-102.
9. Makker K, Varghese A, Desai NR, Mouradi R, Agarwal A. 2009 Cell phones: modern man's nemesis? Reprod Biomed Online 18:148-157.
10. Yakymenko I, Sidorik E. 2010 Risks of carcinogenesis from electromagnetic radiation and mobile telephony devices. Exp Oncol 32:729-736.
11. Yakimenko IL, Sidorik EP, Tsybulin AS. 2011 [Metabolic changes in cells under electromagnetic radiation of mobile communication systems]. Ukr Biokhim Zh (1999). 2011 Mar-Apr;83(2):20-28.
12. Gye MC, Park CJ. 2012 Effect of electromagnetic field exposure on the reproductive system. Clin Exp Reprod Med 39:1-9. doi.org/10.5653/cerm.2012.39.1.1
13. Pall, ML. 2013. Electromagnetic fields act via activation of voltage-gated calcium channels to produce beneficial or adverse effects. J Cell Mol Med 17:958-965. doi: 10.1111/jcmm.12088.
14. Pall, M. L. 2015 Scientific evidence contradicts findings and assumptions of Canadian Safety Panel 6: microwaves act through voltage-gated calcium channel activation to induce biological impacts at non-thermal levels, supporting a paradigm shift for microwave/lower frequency electromagnetic field action. Rev. Environ. Health 3, 99-116. doi: 10.1515/reveh-2015-0001.
15. Hensinger P, Wilke E. 2016. Mobilfunk-Studienergebnisse bestätigen Risiken Studienrecherche 2016-4 veröffentlicht. Umwelt Medizin Gesellshaft 29:3/2016.
16. Houston BJ, Nixon B, King BV, De Iuliis GN, Aitken RJ. 2016 The effects of radiofrequency electromagnetic radiation on sperm function. Reproduction 152:R263-R276.
17. Batista Napotnik T, Reberšek M, Vernier PT, Mali B, Miklavčič D. 2016 Effects of high voltage nanosecond electric pulses on eukaryotic cells (in vitro): A systematic review. Bioelectrochemistry. 2016 Aug;110:1-12. doi: 10.1016/j.bioelechem.2016.02.011.
18. Asghari A, Khaki AA, Rajabzadeh A, Khaki A. 2016 A review on Electromagnetic fields (EMFs) and the reproductive system. Electron Physician. 2016 Jul 25;8(7):2655-2662. doi: 10.19082/2655.

19. Pall ML. 2018 How cancer can be caused by microwave frequency electromagnetic field (EMF) exposures: EMF activation of voltage-gated calcium channels (VGCCs) can cause cancer including tumor promotion, tissue invasion and metastasis via 15 mechanisms. Chapter 7 in Mobile Communications and Public Health, Marko Markov, Ed., CRC press, pp 163-184.
20. Pall ML. 2018 Wi-Fi is an important threat to human health. Environ Res 164:404-416.
21. Wilke I. 2018 Biological and pathological effects of 2.45 GHz on cells, fertility, brain and behavior. Umwelt Medizin Gesselshaft 2018 Feb 31 (1).

Lowered fertility, including tissue remodeling changes in the testis, lowered sperm count and sperm quality, lowered female fertility including ovarian remodeling, oocyte (follicle) loss, lowered estrogen, progesterone and testosterone levels (that is sex hormone levels), increased spontaneous abortion incidence, lowered libido:

1. Glaser ZR, PhD. 1971 Naval Medical Research Institute Research Report, June 1971. Bibliography of Reported Biological Phenomena ("Effects") and Clinical Manifestations Attributed to Microwave and Radio-Frequency Radiation. Report No. 2 Revised. https://scholar.google.com/scholar?q=Glaser+naval+medical+microwave+radio-frequency+1972&btnG=&hl=en&as_sdt=0%2C38 (Accessed Sept. 9, 2017)
2. Tolgskaya MS, Gordon ZV. 1973. Pathological Effects of Radio Waves, Translated from Russian by B Haigh. Consultants Bureau, New York/London, 146 pages.
3. Goldsmith JR. 1997 Epidemiological evidence relevant to radar (microwave) effects. Environ Health Perspect 105(Suppl 6):1579-1587.
4. Aitken RJ, De Iuliis GN. 2007 Origins and consequences of DNA damage in male germ cells. Reprod Biomed Online 14:727-733.
5. Hazout A, Menezo Y, Madelenat P, Yazbeck C, Selva J, Cohen-Bacrie P. 2008 [Causes and clinical implications of sperm DNA damages]. Gynecol Obstet Fertil ;36:1109-1117.
6. Makker K, Varghese A, Desai NR, Mouradi R, Agarwal A. 2009 Cell phones: modern man's nemesis? Reprod Biomed Online 18:148-157.
7. Kang N, Shang XJ, Huang YF. 2010 [Impact of cell phone radiation on male reproduction]. Zhonghua Nan Ke Xue 16:1027-1030.
8. Gye MC, Park CJ. 2012 Effect of electromagnetic field exposure on the reproductive system. Clin Exp Reprod Med 39:1-9. doi.org/10.5653/cerm.2012.39.1.1
9. La Vignera S, Condorelli RA, Vicari E, D'Agata R, Calogero AE. 2012 Effects of the exposure to mobile phones on male reproduction: a review of the literature. J Androl 33:350-356.
10. Carpenter DO. 2013 Human disease resulting from exposure to electromagnetic fields. Rev Environ Health 2013;28:159-172.
11. Nazıroğlu M, Yüksel M, Köse SA, Özkaya MO. 2013 Recent reports of Wi-Fi and mobile phone-induced radiation on oxidative stress and reproductive signaling pathways in females and males. J Membr Biol 246:869-875.
12. Adams JA, Galloway TS, Mondal D, Esteves SC, Mathews F. 2014 Effect of mobile telephones on sperm quality: a systematic review and meta-analysis. Environ Int 70:106-112.
13. Liu K, Li Y, Zhang G, Liu J, Cao J, Ao L, Zhang S. 2014 Association between mobile phone use and semen quality: a systematic review and meta-analysis. Andrology 2:491-501.

14. K Sri N. 2015 Mobile phone radiation: physiological & pathophysiological considerations. Indian J Physiol Pharmacol 59:125-135.
15. Hensinger P, Wilke E. 2016. Mobilfunk-Studienergebnisse bestätigen Risiken Studienrecherche 2016-4 veröffentlicht. Umwelt Medizin Gesellshaft 29:3/2016.
16. Houston BJ, Nixon B, King BV, De Iuliis GN, Aitken RJ. 2016 The effects of radiofrequency electromagnetic radiation on sperm function. Reproduction 152:R263-R276
17. Pall ML. 2018 Wi-Fi is an important threat to human health. Environ Res 164:404-416.
18. Wilke I. 2018 Biological and pathological effects of 2.45 GHz on cells, fertility, brain and behavior. Umwelt Medizin Gesselshaft 2018 Feb 31 (1).

Neurological/neuropsychiatric effects:

1. Marha K. 1966 Biological Effects of High-Frequency Electromagnetic Fields (Translation). ATD Report 66-92. July 13, 1966 (ATD Work Assignment No. 78, Task 11). http://www.dtic.mil/docs/citations/AD0642029 (accessed March 12, 2018)
2. Glaser ZR, PhD. 1971 Naval Medical Research Institute Research Report, June 1971. Bibliography of Reported Biological Phenomena ("Effects") and Clinical Manifestations Attributed to Microwave and Radio-Frequency Radiation. Report No. 2 Revised. https://scholar.google.com/scholar?q=Glaser+naval+medical+microwave+radio-frequency+1972&btnG=&hl=en&as_sdt=0%2C38 (Accessed Sept. 9, 2017)
3. Tolgskaya MS, Gordon ZV. 1973. Pathological Effects of Radio Waves, Translated from Russian by by Haigh. Consultants Bureau, New York/London, 146 pages.
4. Bise W. 1978 Low power radio-frequency and microwave effects on human electroencephalogram and behavior. Physiol Chem Phys 10:387-398.
5. Raines, J. K. 1981. Electromagnetic Field Interactions with the Human Body: Observed Effects and Theories. Greenbelt, Maryland: National Aeronautics and Space Administration 1981; 116 p.
6. Frey AH. 1993 Electromagnetic field interactions with biological systems. FASEB J 7:272-281.
7. Lai H. 1994 Neurological effects of radiofrequency electromagnetic radiation. In: Advances in Electromagnetic Fields in Living Systems, Vol. 1, J.C. Lin, Ed., Plenum Press, New York, pp. 27-88.
8. Grigor'ev IuG. 1996 [Role of modulation in biological effects of electromagnetic radiation]. Radiats Biol Radioecol 36:659-670.
9. Lai, H 1998 Neurological effects of radiofrequency electromagnetic radiation. http://www.mapcruzin.com/radiofrequency/henry_lai2.htm.
10. Aitken RJ, De Iuliis GN. 2007 Origins and consequences of DNA damage in male germ cells. Reprod Biomed Online 14:727-733.
11. Hardell, L., Sage, C. 2008. Biological effects from electromagnetic field exposure and public exposure standards. Biomed. Pharmacother. 62, 104-109.
12. Makker K, Varghese A, Desai NR, Mouradi R, Agarwal A. 2009 Cell phones: modern man's nemesis? Reprod Biomed Online 18:148-157.
13. Khurana VG, Hardell L, Everaert J, Bortkiewicz A, Carlberg M, Ahonen M. 2010 Epidemiological evidence for a health risk from mobile phone base stations. Int J Occup Environ Health 16:263-267.

14. Levitt, B. B., Lai, H. 2010. Biological effects from exposure to electromagnetic radiation emitted by cell tower base stations and other antenna arrays. Environ. Rev. 18, 369-395. doi.org/10.1139/A10-018
15. Carpenter DO. 2013 Human disease resulting from exposure to electromagnetic fields. Rev Environ Health 2013;28:159-172.
16. Politański P, Bortkiewicz A, Zmyślony M. 2016 [Effects of radio- and microwaves emitted by wireless communication devices on the functions of the nervous system selected elements]. Med Pr 67:411-421.
17. Hensinger P, Wilke E. 2016. Mobilfunk-Studienergebnisse bestätigen Risiken Studienrecherche 2016-4 veröffentlicht. Umwelt Medizin Gesellshaft 29:3/2016.
18. Pall ML. 2016 Microwave frequency electromagnetic fields (EMFs) produce widespread neuropsychiatric effects including depression. J Chem Neuroanat 75(Pt B):43-51. doi: 10.1016/j.jchemneu.2015.08.001.
19. Hecht, Karl. 2016 Health Implications of Long-Term Exposures to Electrosmog. Brochure 6 of A Brochure Series of the Competence Initiative for the Protection of Humanity, the Environment and Democracy. http://kompetenzinitiative.net/KIT/wp-content/uploads/2016/07/KI_Brochure-6_K_Hecht_web.pdf (accessed Feb. 11, 2018)
20. Sangün Ö, Dündar B, Çömlekçi S, Büyükgebiz A. 2016 The Effects of Electromagnetic Field on the Endocrine System in Children and Adolescents. Pediatr Endocrinol Rev 13:531-545.
21. Belyaev I, Dean A, Eger H, Hubmann G, Jandrisovits R, Kern M, Kundi M, Moshammer H, Lercher P, Müller K, Oberfeld G, Ohnsorge P, Pelzmann P, Scheingraber C, Thill R. 2016 EUROPAEM EMF Guideline 2016 for the prevention, diagnosis and treatment of EMF-related health problems and illnesses. Rev Environ Health DOI 10.1515/reveh-2016-0011.
22. Zhang J, Sumich A, Wang GY. 2017 Acute effects of radiofrequency electromagnetic field emitted by mobile phone on brain function. Bioelectromagnetics 38:329-338. doi: 10.1002/bem.22052.
23. Lai H. 2018. A Summary of Recent Literature (2007–2017) on Neurological Effects of Radio Frequency Radiation. Chapter 8 in Mobile Communications and Public Health, Marko Markov, Ed., CRC press, pp 185-220.
24. Pall ML. 2018 Wi-Fi is an important threat to human health. Environ Res 164:404-416.
25. Wilke I. 2018 Biological and pathological effects of 2.45 GHz on cells, fertility, brain and behavior. Umwelt Medizin Gesselshaft 2018 Feb 31 (1).

Apoptosis/cell death (an important process in production of neurodegenerative diseases that is also important in producing infertility responses):

1. Glaser ZR, PhD. 1971 Naval Medical Research Institute Research Report, June 1971. Bibliography of Reported Biological Phenomena ("Effects") and Clinical Manifestations Attributed to Microwave and Radio-Frequency Radiation. Report No. 2 Revised. https://scholar.google.com/scholar?q=Glaser+naval+medical+microwave+radio-frequency+1972&btnG=&hl=en&as_sdt=0%2C38 (Accessed Sept. 9, 2017)
2. Tolgskaya MS, Gordon ZV. 1973. Pathological Effects of Radio Waves, Translated from Russian by B Haigh. Consultants Bureau, New York/London, 146 pages.
3. Raines, J. K. 1981. Electromagnetic Field Interactions with the Human Body: Observed Effects and Theories. Greenbelt, Maryland: National Aeronautics and Space Administration 1981; 116 p.

4. Hardell L, Sage C. 2008. Biological effects from electromagnetic field exposure and public exposure standards. Biomed. Pharmacother. 62:104-109. doi: 10.1016/j.biopha.2007.12.004.
5. Makker K, Varghese A, Desai NR, Mouradi R, Agarwal A. 2009 Cell phones: modern man's nemesis? Reprod Biomed Online 18:148-157.
6. Levitt, B. B., Lai, H. 2010. Biological effects from exposure to electromagnetic radiation emitted by cell tower base stations and other antenna arrays. Environ. Rev. 18, 369-395. doi.org/10.1139/A10-018
7. Yakymenko I, Sidorik E. 2010 Risks of carcinogenesis from electromagnetic radiation and mobile telephony devices. Exp Oncol 32:729-736.
8. Yakimenko IL, Sidorik EP, Tsybulin AS. 2011 [Metabolic changes in cells under electromagnetic radiation of mobile communication systems]. Ukr Biokhim Zh (1999). 2011 Mar-Apr;83(2):20-28.
9. Pall, ML. 2013. Electromagnetic fields act via activation of voltage-gated calcium channels to produce beneficial or adverse effects. J Cell Mol Med 17:958-965. doi: 10.1111/jcmm.12088.
10. Pall ML. 2016 Microwave frequency electromagnetic fields (EMFs) produce widespread neuropsychiatric effects including depression. J Chem Neuroanat 75(Pt B):43-51. doi: 10.1016/j.jchemneu.2015.08.001.
11. Batista Napotnik T, Reberšek M, Vernier PT, Mali B, Miklavčič D. 2016 Effects of high voltage nanosecond electric pulses on eukaryotic cells (in vitro): A systematic review. Bioelectrochemistry. 2016 Aug;110:1-12. doi: 10.1016/j.bioelechem.2016.02.011.
12. Asghari A, Khaki AA, Rajabzadeh A, Khaki A. 2016 A review on Electromagnetic fields (EMFs) and the reproductive system. Electron Physician. 2016 Jul 25;8(7):2655-2662. doi: 10.19082/2655.
13. Pall ML. 2018 Wi-Fi is an important threat to human health. Environ Res 164:404-416.

Oxidative stress/free radical damage (important mechanisms involved in almost all chronic diseases; direct cause of cellular DNA damage):

1. Raines, J. K. 1981. Electromagnetic Field Interactions with the Human Body: Observed Effects and Theories. Greenbelt, Maryland: National Aeronautics and Space Administration 1981; 116 p.
2. Hardell, L., Sage, C. 2008. Biological effects from electromagnetic field exposure and public exposure standards. Biomed. Pharmacother. 62, 104-109.
3. Hazout A, Menezo Y, Madelenat P, Yazbeck C, Selva J, Cohen-Bacrie P. 2008 [Causes and clinical implications of sperm DNA damages]. Gynecol Obstet Fertil ;36:1109-1117
4. Makker K, Varghese A, Desai NR, Mouradi R, Agarwal A. 2009 Cell phones: modern man's nemesis? Reprod Biomed Online 18:148-157.
5. Desai NR, Kesari KK, Agarwal A. 2009 Pathophysiology of cell phone radiation: oxidative stress and carcinogenesis with focus on the male reproductive system. Reproduct Biol Endocrinol 7:114.
6. Yakymenko I, Sidorik E. 2010 Risks of carcinogenesis from electromagnetic radiation and mobile telephony devices. Exp Oncol 32:729-736.
7. Yakimenko IL, Sidorik EP, Tsybulin AS. 2011 [Metabolic changes in cells under electromagnetic radiation of mobile communication systems]. Ukr Biokhim Zh (1999). 2011 Mar-Apr;83(2):20-28.
8. Consales, C., Merla, C., Marino, C., et al. 2012. Electromagnetic fields, oxidative stress, and neurodegeneration. Int. J. Cell Biol. 2012: 683897.

9. LaVignera et al 2012 La Vignera S, Condorelli RA, Vicari E, D'Agata R, Calogero AE. 2012 Effects of the exposure to mobile phones on male reproduction: a review of the literature. J Androl 33:350-356.
10. Pall, ML. 2013. Electromagnetic fields act via activation of voltage-gated calcium channels to produce beneficial or adverse effects. J Cell Mol Med 17:958-965. doi: 10.1111/jcmm.12088.
11. Nazıroğlu M, Yüksel M, Köse SA, Özkaya MO. 2013 Recent reports of Wi-Fi and mobile phone-induced radiation on oxidative stress and reproductive signaling pathways in females and males. J Membr Biol 246:869-875.
12. Pall, M. L. 2015. Scientific evidence contradicts findings and assumptions of Canadian Safety Panel 6: microwaves act through voltage-gated calcium channel activation to induce biological impacts at non-thermal levels, supporting a paradigm shift for microwave/lower frequency electromagnetic field action. Rev. Environ. Health 3, 99-116.
13. Yakymenko I, Tsybulin O, Sidorik E, Henshel D, Kyrylenko O, Kysylenko S. 2015 Oxidative mechanisms of biological activity of low-intensity radiofrequency radiation. Electromagnetic Biol Med: Early Online 1-16. ISSN: 1536-8378.
14. Hensinger P, Wilke E. 2016. Mobilfunk-Studienergebnisse bestätigen Risiken Studienrecherche 2016-4 veröffentlicht. Umwelt Medizin Gesellshaft 29:3/2016.
15. Houston BJ, Nixon B, King BV, De Iuliis GN, Aitken RJ. 2016 The effects of radiofrequency electromagnetic radiation on sperm function. Reproduction 152:R263-R276.
16. Dasdag S, Akdag MZ. 2016 The link between radiofrequencies emitted from wireless technologies and oxidative stress. J Chem Neuroanat 75(Pt B):85-93.
17. Wang H, Zhang X. 2017 Magnetic fields and reactive oxygen species. Int J Mol Sci. 2017 Oct 18;18(10). pii: E2175. doi: 10.3390/ijms18102175.
18. Pall ML. 2018 Wi-Fi is an important threat to human health. Environ Res 164:404-416.
19. Wilke I. 2018 Biological and pathological effects of 2.45 GHz on cells, fertility, brain and behavior. Umwelt Medizin Gesselshaft 2018 Feb 31 (1).

Endocrine, that is hormonal effects:

1. Glaser ZR, PhD. 1971 Naval Medical Research Institute Research Report, June 1971. Bibliography of Reported Biological Phenomena ("Effects") and Clinical Manifestations Attributed to Microwave and Radio-Frequency Radiation. Report No. 2 Revised. https://scholar.google.com/scholar?q=Glaser+naval+medical+microwave+radio-frequency+1972&btnG=&hl=en&as_sdt=0%2C38 (Accessed Sept. 9, 2017)
2. Tolgskaya MS, Gordon ZV. 1973. Pathological Effects of Radio Waves, Translated from Russian by B Haigh. Consultants Bureau, New York/London, 146 pages.
3. Raines, J. K. 1981. Electromagnetic Field Interactions with the Human Body: Observed Effects and Theories. Greenbelt, Maryland: National Aeronautics and Space Administration 1981; 116 p.
4. Hardell, L., Sage, C. 2008. Biological effects from electromagnetic field exposure and public exposure standards. Biomed. Pharmacother. 62, 104-109.
5. Makker K, Varghese A, Desai NR, Mouradi R, Agarwal A. 2009 Cell phones: modern man's nemesis? Reprod Biomed Online 18:148-157.
6. Gye MC, Park CJ. 2012 Effect of electromagnetic field exposure on the reproductive system. Clin Exp Reprod Med 39:1-9. doi.org/10.5653/cerm.2012.39.1.1

7. Pall, M. L. 2015. Scientific evidence contradicts findings and assumptions of Canadian Safety Panel 6: microwaves act through voltage-gated calcium channel activation to induce biological impacts at non-thermal levels, supporting a paradigm shift for microwave/lower frequency electromagnetic field action. Rev. Environ. Health 3, 99-116.
8. Sangün Ö, Dündar B, Çömlekçi S, Büyükgebiz A. 2016 The Effects of Electromagnetic Field on the Endocrine System in Children and Adolescents. Pediatr Endocrinol Rev 13:531-545.
9. Hecht, Karl. 2016 Health Implications of Long-Term Exposures to Electrosmog. Brochure 6 of A Brochure Series of the Competence Initiative for the Protection of Humanity, the Environment and Democracy. http://kompetenzinitiative.net/KIT/wp-content/uploads/2016/07/KI_Brochure-6_K_Hecht_web.pdf (accessed Feb. 11, 2018)
10. Asghari A, Khaki AA, Rajabzadeh A, Khaki A. 2016 A review on Electromagnetic fields (EMFs) and the reproductive system. Electron Physician. 2016 Jul 25;8(7):2655-2662. doi: 10.19082/2655.
11. Pall ML. 2018 Wi-Fi is an important threat to human health. Environ Res 164:404-416.
12. Wilke I. 2018 Biological and pathological effects of 2.45 GHz on cells, fertility, brain and behavior. Umwelt Medizin Gesselshaft 2018 Feb 31 (1).

Increased intracellular calcium: intracellular calcium is maintained at very low levels (typically about 2 X 10-9 M) except for brief increases used to produce regulatory responses, such that sustained elevation of intracellular calcium levels produces many pathophysiological (that is disease-causing) responses).

1. Adey WR. 1988 Cell membranes: the electromagnetic environment and cancer promotion. Neurochem Res.13:671-677.
2. Walleczek, J. 1992. Electromagnetic field effects on cells of the immune system: the role of calcium signaling. FASEB J. 6, 3177-3185.
3. Adey, WR. 1993 Biological effects of electromagnetic fields. J Cell Biochem 51:410-416.
4. Frey AH. 1993 Electromagnetic field interactions with biological systems. FASEB J 7:272-281.
5. Funk RHW, Monsees T, Özkucur N. 2009 Electromagnetic effects—Form cell biology to medicine. Prog Histochem Cytochem 43:177-264.
6. Yakymenko IL, Sidorik EP, Tsybulin AS. 1999 [Metabolic changes in cells under electromagnetic radiation of mobile communication systems]. Ukr Biokhim Zh (1999), 2011 Mar-Apr:20-28.
7. Gye MC, Park CJ. 2012 Effect of electromagnetic field exposure on the reproductive system. Clin Exp Reprod Med 39:1-9. doi.org/10.5653/cerm.2012.39.1.1
8. Pall, ML. 2013. Electromagnetic fields act via activation of voltage-gated calcium channels to produce beneficial or adverse effects. J Cell Mol Med 17:958-965. doi: 10.1111/jcmm.12088.
9. Pall ML. 2014 Electromagnetic field activation of voltage-gated calcium channels: role in therapeutic effects. Electromagn Biol Med. 2014 Apr 8 doi: 10.3109/15368378.2014.906447.
10. Pall ML. 2015 How to approach the challenge of minimizing non-thermal health effects of microwave radiation from electrical devices. International Journal of Innovative Research in Engineering & Management (IJIREM) ISSN: 2350-0557, Volume-2, Issue -5, September 2015; 71-76.

11. Pall, M. L. 2015 Scientific evidence contradicts findings and assumptions of Canadian Safety Panel 6: microwaves act through voltage-gated calcium channel activation to induce biological impacts at non-thermal levels, supporting a paradigm shift for microwave/lower frequency electromagnetic field action. Rev. Environ. Health 3, 99-116. doi: 10.1515/reveh-2015-0001.
12. Pall ML. 2016 Electromagnetic fields act similarly in plants as in animals: Probable activation of calcium channels via their voltage sensor. Curr Chem Biol 10: 74-82.
13. Pall ML. 2016 Microwave frequency electromagnetic fields (EMFs) produce widespread neuropsychiatric effects including depression. J Chem Neuroanat 75(Pt B):43-51. doi: 10.1016/j.jchemneu.2015.08.001.
14. Batista Napotnik T, Reberšek M, Vernier PT, Mali B, Miklavčič D. 2016 Effects of high voltage nanosecond electric pulses on eukaryotic cells (in vitro): A systematic review. Bioelectrochemistry. 2016 Aug;110:1-12. doi: 10.1016/j.bioelechem.2016.02.011.
15. Asghari A, Khaki AA, Rajabzadeh A, Khaki A. 2016 A review on electromagnetic fields (EMFs) and the reproductive system. Electron Physician. 2016 Jul 25;8(7):2655-2662. doi: 10.19082/2655.

Pulsed EMFs are, in most cases much more biologically active than are non-pulsed EMFs. This is important because all wireless communication devices communicate via pulsations and because the "smarter" the devices are, the more they pulse because the pulsations convey the information. What should be obvious is that you cannot study such pulsation roles if there were no biological effects produced by such EMFs. *The pulsation studies alone tell us that there are many such EMF effects.*

1. Osipov YuA, 1965 [Labor hygiene and the effect of radiofrequency electromagnetic fields on workers]. Leningrad Meditsina Publishing House, 220 pp.
2. Pollack H, Healer J. 1967 Review of Information on Hazards to Personnel from High-Frequency Electromagnetic Radiation. Institute for Defense Analyses; Research and Engineering Support Division. IDA/HQ 67-6211, Series B, May 1967.
3. Frey AH. 1974 Differential biologic effects of pulsed and continuous electromagnetic fields and mechanisms of effect. Ann N Y Acad Sci 238: 273-279.
4. Creighton MO, Larsen LE, Stewart-DeHaan PJ, Jacobi JH, Sanwal M, Baskerville JC, Bassen HE, Brown DO, Trevithick JR. 1987 In vitro studies of microwave-induced cataract. II. Comparison of damage observed for continuous wave and pulsed microwaves. Exp Eye Res 45:357-373.
5. Grigor'ev IuG. 1996 [Role of modulation in biological effects of electromagnetic radiation]. Radiats Biol Radioecol 36:659-670.
6. Belyaev I. 2005 Non-thermal biological effects of microwaves. Microwave Rev 11:13-29.
7. Belyaev I. 2005 Non-thermal biological effects of microwaves: current knowledge, further perspective and urgent needs. Electromagn Biol Med 24(3):375-403.
8. Markov MS. 2007 Pulsed electromagnetic field therapy: History, state of the art and future. The Environmentalist 27:465-475.
9. Van Boxem K, Huntoon M, Van Zundert J, Patijn J, van Kleef M, Joosten EA. 2014 Pulsed radiofrequency: a review of the basic science as applied to the pathophysiology of radicular pain: a call for clinical translation. Reg Anesth Pain Med. 2014 Mar-Apr;39(2):149-59.
10. Belyaev, I. 2015. Biophysical mechanisms for nonthermal microwave effects. In: Electromagnetic Fields in Biology and Medicine, Marko S. Markov, ed, CRC Press, New York, pp 49-67.

11. Pall, M. L. 2015 Scientific evidence contradicts findings and assumptions of Canadian Safety Panel 6: microwaves act through voltage-gated calcium channel activation to induce biological impacts at non-thermal levels, supporting a paradigm shift for microwave/lower frequency electromagnetic field action. Rev. Environ. Health 3, 99-116. doi: 10.1515/reveh-2015-0001.
12. Panagopoulos DJ, Johansson O, Carlo GL. 2015 Real versus simulated mobile phone exposures in experimental studies. BioMed. Res. Int. 2015, article ID 607053, 8 pages. doi: 10.1155/2015/607053.
13. Batista Napotnik T, Reberšek M, Vernier PT, Mali B, Miklavčič D. 2016 Effects of high voltage nanosecond electric pulses on eukaryotic cells (in vitro): A systematic review. Bioelectrochemistry. 2016 Aug;110:1-12. doi: 10.1016/j.bioelechem.2016.02.011.

Cancer causation by EMF exposures:

1. Dwyer, M. J., Leeper, D. B. 1978 A Current Literature Report on the Carcinogenic Properties of Ionizing and Nonionizing Radiation. DHEW Publication (NIOSH) 78-134, March 1978.
2. Marino AA, Morris DH. 1985 Chronic electromagnetic stressors in the environment. A risk factor in human cancer. J environ sci health C3:189-219.
3. Adey WR. 1988 Cell membranes: the electromagnetic environment and cancer promotion. Neurochem Res.13:671-677.
4. Adey WR. 1990 Joint actions of environmental nonionizing electromagnetic fields and chemical pollution in cancer promotion. Environ Health Perspect 86:297-305.
5. Frey AH. 1993 Electromagnetic field interactions with biological systems. FASEB J 7:272-281.
6. Goldsmith JR. 1995 Epidemiological evidence of radiofrequency radiation (microwave) effects on health in military, broadcasting and occupational settings. Int J Occup Environ Health 1:47-57.
7. Goldsmith JR. 1997 Epidemiologic evidence relevant to radar (microwave) effects. Env Health Perspect 105(Suppl 6):1579-1587.
8. Kundi M, Mild K, Hardell L, Mattsson M. 2004 Mobile telephones and cancer – a review of the epidemiological evidence. J Toxicol Env Health, Part B 7:351-384.
9. Kundi M. 2004 Mobile phone use and cancer. Occup Env Med 61:560-570.
10. Behari J, Paulraj R. 2007 Biomarkers of induced electromagnetic field and cancer. Indian J Exp Biol 45:77-85.
11. Hardell L, Carlberg M, Soderqvist F, Hansson Mild K. 2008 Meta-analysis of long-term mobile phone use and the association with brain tumors. Int J Oncol 32:1097-1103.
12. Khurana VG, Teo C, Kundi M, Hardell L, Carlberg M. 2009 Cell phones and brain tumors: a review including the long-term epidemiologic data. Surg Neurol 72:205-214.
13. Desai NR, Kesari KK, Agarwal A. 2009 Pathophysiology of cell phone radiation: oxidative stress and carcinogenesis with focus on the male reproductive system. Reproduct Biol Endocrinol 7:114.
14. Davanipour Z, Sobel E. 2009 Long-term exposure to magnetic fields and the risks of Alzheimer's disease and breast cancer: Further biological research. Pathophysiology 16:149-156.
15. Yakymenko I, Sidorik E. 2010 Risks of carcinogenesis from electromagnetic radiation and mobile telephony devices. Exp Oncol 32:729-736.
16. Carpenter DO. 2010 Electromagnetic fields and cancer: the cost of doing nothing. Rev Environ Health 25:75-80.

17. Giuliani L, Soffriti M (Eds). 2010 NON-THERMAL EFFECTS AND MECHANISMS OF INTERACTION BETWEEN ELECTROMAGNETIC FIELDS AND LIVING MATTER, RAMAZZINI INSTITUTE EUR. J. ONCOL. LIBRARY Volume 5, National Institute for the Study and Control of Cancer and Environmental Diseases "Bernardino Ramazzini" Bologna, Italy 2010, 400 page monograph.
18. Khurana, V. G., Hardell, L., Everaert, J., Bortkiewicz, A., Carlberg, M., Ahonen, M. 2010 Epidemiological evidence for a health risk from mobile phone base stations. Int. J. Occup. Environ. Health 16, 263-267.
19. Yakymenko, I., Sidorik, E., Kyrylenko, S., Chekhun, V. 2011. Long-term exposure to microwave radiation provokes cancer growth: evidences from radars and mobile communication systems. Exp. Oncol. 33(2), 62-70.
20. Biointiative Working Group, David Carpenter and Cindy Sage (eds). 2012 Bioinitiative 2012: A rationale for biologically-based exposure standards for electromagnetic radiation. http://www.bioinitiative.org/participants/why-we-care/
21. Ledoigt G, Belpomme D. 2013 Cancer induction molecular pathways and HF-EMF irradiation. Adv Biol Chem 3:177-186.
22. Hardell L, Carlberg M. 2013 Using the Hill viewpoints from 1965 for evaluating strengths of evidence of the risk for brain tumors associated with use of mobile and cordless phones. Rev Environ Health 28:97-106. doi: 10.1515/reveh-2013-0006.
23. Hardell L, Carlberg M, Hansson Mild K. 2013 Use of mobile phones and cordless phones is associated with increased risk for glioma and acoustic neuroma. Pathophysiology 2013;20(2):85-110.
24. Carpenter DO. 2013 Human disease resulting from exposure to electromagnetic fields. Rev Environ Health 2013;28:159-172.gj
25. Davis DL, Kesari S, Soskolne CL, Miller AB, Stein Y. 2013 Swedish review strengthens grounds for concluding that radiation from cellular and cordless phones is a probable human carcinogen. Pathophysiology 20:123-129.
26. Morgan LL, Miller AB, Sasco A, Davis DL. 2015 Mobile phone radiation causes brain tumors and should be classified as a probable human carcinogen (2A). Int J Oncol 46(5): 1865-1871.
27. Mahdavi M, Yekta R, Tackallou SH. 2015 Positive correlation between ELF and RF electromagnetic fields on cancer risk. J Paramed Sci 6(3), ISSN 2008-4978.
28. Carlberg M, Hardell L. 2017 Evaluation of Mobile Phone and Cordless Phone Use and Glioma Risk Using the Bradford Hill Viewpoints from 1965 on Association or Causation. BioMed Res Int 2017, Article ID 9218486, https://doi.org/10.1155/2017/9218486
29. Bortkiewicz A, Gadzicka E, Szymczak W. 2017 Mobile phone use and risk for intracranial tumors and salivary gland tumors - A meta-analysis. Int J Occup Med Environ Health 30:27-43.
30. Bielsa-Fernández P, Rodríguez-Martín B. 2017 [Association between radiation from mobile phones and tumour risk in adults]. Gac Sanit. 2017 Apr 12. pii: S0213-9111(17)30083-3. doi: 10.1016/j.gaceta.2016.10.014. [Epub ahead of print]
31. Alegría-Loyola MA, Galnares-Olalde JA, Mercado M. 2017 [Tumors of the central nervous system]. Rev Med Inst Mex Seguro Soc 55:330-334.
32. Prasad M, Kathuria P, Nair P, Kumar A, Prasad K. 2017 Mobile phone use and risk of brain tumours: a systematic review of association between study quality, source of funding, and research outcomes. Neurol Sci. 2017 Feb 17. doi: 10.1007/s10072-017-2850-8. [Epub ahead of print].
33. Miller A. 2017 References on cell phone radiation and cancer. https://ehtrust.org/references-cell-phone-radio-frequency-radiation-cancer/ (Accessed Sept. 9, 2017)

34. Hardell L. 2017 World Health Organization, radiofrequency radiation and health – a hard nut to crack (Review). Int J Oncol 51:405-413.
35. Pall ML. 2018 How cancer can be caused by microwave frequency electromagnetic field (EMF) exposures: EMF activation of voltage-gated calcium channels (VGCCs) can cause cancer including tumor promotion, tissue invasion and metastasis via 15 mechanisms. Chapter 7 in: Mobile Communications and Public Health, Marko Markov, Ed., CRC Press, pp 163-184.

Each of these reviews, typically cite from 5 to over 100 primary literature citations, each showing that non-thermal EMF exposures produce the effect under which they are listed. It follows from this, that there are not only 11 or more reviews documenting each of these effects, but there is also a massive primary literature documenting these effects as well. It follows from this that the ICNIRP, FCC and International Safety Guidelines, which are entirely based only on thermal effects are inadequate and there have been petitions and other statements of international groups of scientists expressing great concern about this. *It follows that the ICNIRP, FCC and International safety guidelines are completely unscientific and cannot be relied upon to protect our safety.*

Chapter 2: How Each Such EMF Effect Is Produced via Voltage-Gated Calcium Channel Activation: Role of the Voltage Sensor in Producing the Extraordinary Sensitivity to EMF Effects

The Pall, 2013 [4] study showed that in 24 different studies (there are now a total of 26 [5]), effects of low-intensity EMFs, both microwave frequency and also lower frequency EMFs, could be blocked by calcium channel blockers, drugs that are specific for blocking voltage-gated calcium channels (VGCCs). There were 5 different types of calcium channel blockers used in these studies each thought to be highly specific, each structurally distinct and each binding to a different site on the VGCCs. *In studies where multiple effects were studied, all studied effects were blocked or greatly lowered by calcium channel blockers*. These studies show that EMFs produce diverse non-thermal effects via VGCC activation in many human and animal cells and even in plant cells where some similar calcium channels are involved [6]. Furthermore, many different effects shown to be produced in repeated studies by EMF exposures, including the effects discussed above, can each be produced by downstream effects of VGCC activation, via increased intracellular calcium [Ca2+]i, as discussed below.

Various EMFs act via VGCC activation, as shown by calcium channel blocker studies. These include microwave frequency EMFs, nanosecond pulse EMFs, intermediate frequency EMFs, extremely low frequency EMFs and even static electrical fields and static magnetic fields.

It is important to discuss why the VGCCs are so sensitive to activation by these low-intensity EMFs. Each of the VGCCs have a voltage sensor which is made up of 4 alpha helixes, each designated as an S4 helix, in the plasma membrane. Each of these S4 helixes has 5 positive charges on it, for a total of 20 positive charges making up the VGCC voltage sensor [5,8]. Each of these charges is within the lipid bilayer part of the plasma membrane. The electrical forces on the voltage sensor are extraordinarily high for three distinct reasons [5,8]. 1. The 20 charges on the voltage sensor make the forces on voltage sensor 20 times higher than the forces on a single charge. 2. Because these charges are within the lipid bilayer section of the membrane where the dielectric constant is about 1/120th of the dielectric constant of the aqueous parts of the cell, the law of physics called Coulomb's law, predicts that the forces will be approximately 120 times higher than the forces on charges in the aqueous parts of the cell. 3. Because the plasma membrane has a high electrical resistance whereas the aqueous parts of the cell are highly

conductive, the electrical gradient across the plasma membrane is estimated to be concentrated about 3000-fold. The combination of these factors means that comparing the forces on the voltage sensor with the forces on singly charged groups in the aqueous parts of the cell, the forces on the voltage sensor are approximately 20 X 120 X 3000 = 7.2 million times higher [5,8]. The physics predicts, therefore, extraordinarily strong forces activating the VGCCs via the voltage sensor. It follows that the biology tells us that the VGCCs are the main target of the EMFs and the physics tells us why they are the main target. *Thus the physics and biology are pointing in exactly the same direction*.

We have, then, very strong arguments that the EMFs act directly on the voltage-sensor to activate the VGCCs. There are several other types of evidence, each providing important evidence supporting this view:

1. In a study published by Pilla [12], it was found that pulsed EMFs produced an "instantaneous" increase in calcium/calmodulin-dependent nitric oxide synthesis in cells in culture. What this study [12] showed was that following EMF exposure, the cells in culture, must have produced a large increase in [Ca2+]i, this in turn produced a large increase in nitric oxide synthesis, the nitric oxide diffused out of the cells and out of the aqueous medium above the cells into the gas phase, where the nitric oxide was detected by a nitric oxide electrode. This entire sequence occurred in less than 5 seconds. This eliminates almost any conceivable indirect effect, except possibly via plasma membrane depolarization. Therefore, it is likely that the pulsed EMFs are acting directly on the voltage sensors of the VGCCs and possibly the voltage-gated sodium channels, to produce the [Ca2+]i increase.

2. There are also additional findings pointing to the voltage sensor as the direct target of the EMFs. In addition to the VGCCs, there are also voltage-gated sodium, potassium and chloride channels, with each of these having a voltage sensor similar to those found in the VGCCs. Lu et al [13] reported that voltage gated sodium channels, in addition to the VGCCs were activated by EMFs. Tabor et al [14] found that Mauthner cells, specialized neurons with special roles in triggering rapid escape mechanisms in fish, were almost instantaneously activated by electrical pulses, which acted via voltage-gated sodium channel activation to subsequently produce large [Ca2+]i increases. Zhang et al [15] reported that in addition to the VGCCs, potassium and chloride channels were each activated by EMFs, although these other voltage-gated ion channels had relatively modest roles, compared with the VGCCs, in producing biological effects. Each of these three studies [13-15] used specific blockers for these other voltage-gated ion channels to determine their roles. The Tabor et al [14] study also used genetic probing to determine the role of the voltage-gated sodium channels. Lu et al [13] also used whole cell patch clamp measurements to measure the rapid influx of both sodium and calcium into the cell via the voltage-gated channels following EMF exposure. Sodium influx, particularly in electrically active cells, acts in the normal physiology to depolarize the plasma membrane, leading to VGCC activation such that the voltage-gated sodium channels may act primarily via indirect activation of the VGCCs. In summary then, we have evidence that in animal including human cells, seven distinct classes of voltage-gated ion channels are each activated by EMF exposures: From Ref. [4], four classes of voltage-gated ion channels were shown from calcium channel blocker studies, to be activated by EMFs, L-type, T-type, N-type and P/Q –type VGCCs. In this paragraph we have evidence that three other channels are also activated, voltage-gated sodium channels, voltage-gated potassium channels and voltage-gated chloride channels. Furthermore the plant studies strongly suggest that the so called TPC channels, which contain a similar voltage sensor, are activated in plants allowing calcium influx into plants to produce similar EMF-induced responses [6]. In summary, then we have evidence for eight different ion channels being activated by EMF exposure, four classes of VGCCs, one class each of voltage-gated sodium,

potassium and chloride channels and also one class of plant channel, with each of these channels having a similar voltage-sensor regulating its opening. One can put those observations together with the powerful findings from the physics, that the electrical forces on the voltage-sensor are stunningly strong, something like 7.2 million times stronger than the forces on the singly charged groups in the aqueous phases of the cell. Now you have a stunningly powerful argument that the voltage sensor is the predominant direct target of the EMFs.

3. The most important study on this subject, was published by Tekieh et al [16]. It showed that microwave frequency EMFs directly activate the VGCCs in isolated membranes. A variety of microwave frequencies were used in these studies and each such frequency produced VGCC activation in a completely cell-free system. This study clearly shows that the EMF activation of the VGCCs is direct and not due to some indirect regulatory effect.

How then does the estimated sensitivity of the voltage-sensor, about 7.2 million times greater forces than the forces on singly charged groups, compare with previous estimates of levels of EMF exposure needed to produce biological effects? The ICNIRP 2009 [17] safety guidelines allowed for 2 to 10 W/m^2 exposure, depending upon frequency. In contrast, the Bioinitiative Working Group 2007 [18] proposed a precautionary target level of 3 to 6 $\mu W/m^2$ or about a million-fold lower, using a safety factor of 10. If one uses a more commonly used safety factor of 50 to 100, then the 7.2 million-fold sensitivity of the voltage-sensor, predicted by the physics, falls right in the middle of the Bioinitiative Working Group 2007 calculations. So again, it can be argued that the physics and the biology are pointing in the same direction, in this case pointing to the same approximate range of sensitivity.

You may be wondering why I am spending so much time and space going through each of these studies. The answer is that a well over a trillion dollar (or trillion euro) set of industries, the telecommunications industry, has been putting out propaganda for over two decades, arguing that there cannot be a mechanism of action of these non-thermal EMFs to produce biological effects; and that these EMFs are too weak to do anything and that only thermal effects are documented. It is essential to dot every **i** and cross every **t** with regard to the main mechanism of action of non-thermal effects. That is exactly what has been done here.

<u>How Can the Diverse Effects of Such EMF Exposures Be Produced by VGCC Activation?</u>

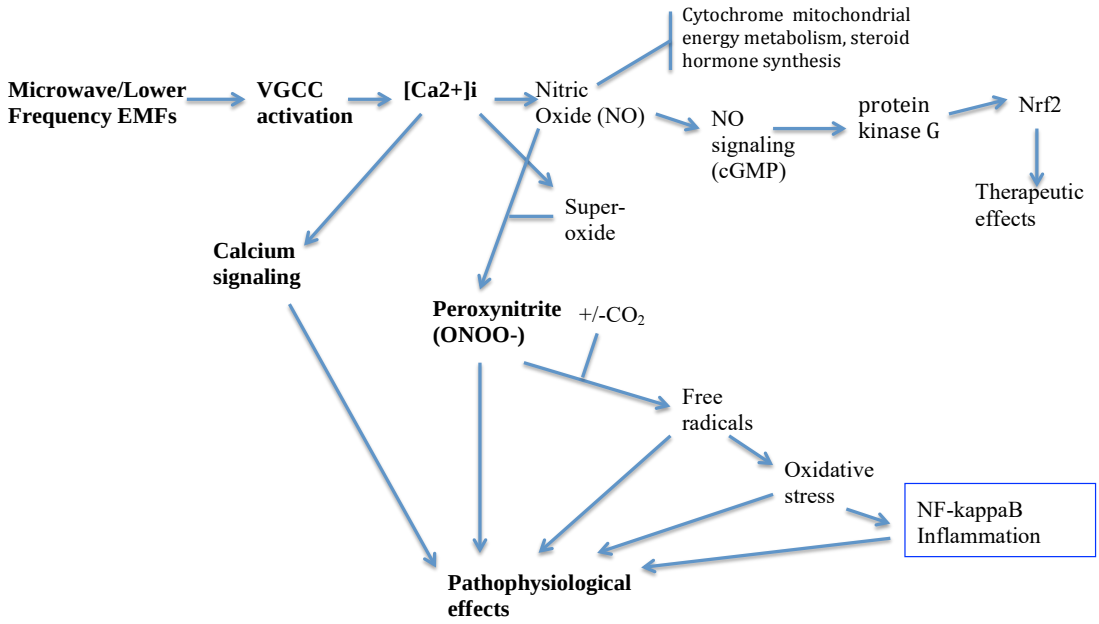

Fig. 1 How EMFs Act via VGCC Activation to Produce Various Effects

The mechanisms by which various effects can be generated by VGCC activation are outlined in Fig. 1. Going across the top of Fig. 1, it can be seen that increased intracellular calcium [Ca2+]i can increase nitric oxide (NO) synthesis, stimulating the NO signaling pathway (going to the right from top, center), to produce therapeutic effects. NO (very top) can also bind to cytochromes and inhibit their activity. NO binding to the terminal oxidase in the mitochondria inhibits energy metabolism and lowers, therefore, ATP. NO binding to cytochrome P450s, lowers synthesis of steroid hormones, including estrogen, progesterone and testosterone. The P450 lowering also lowers detoxification and vitamin D activity. Most of the pathophysiological effects are produced by the peroxynitrite/free radical/oxidative stress pathway center to lower right (Fig. 1) and also by excessive calcium signaling pathway (slightly left of center, Fig. 1). Some of the ways these are thought to produce various well-established EMF effects are outlined in Table 1.

Table 1. How Eight Established Effects of EMFs Can Be Produced by VGCC Activation

EMF effect	Probable mechanism(s)
Oxidative stress	Produced by elevated levels of peroxynitrite and the free radical breakdown products of peroxynitrite and its CO_2 adduct. Four studies of EMF exposure, cited in [4] showed that oxidative stress following exposure was associated with major elevation of 3-nitrotyrosine, a marker of peroxynitrite, thus confirming this interpretation. Two other studies each found 3-nitrotyrosine elevation, both following 35 GHz exposures [19,20].
Lowered male/female fertility, elevated spontaneous abortion, lowered libido	Both the lowered male fertility and lowered female fertility are associated with and presumably caused by the oxidative stress in the male and female reproductive organs. Spontaneous abortion is often caused by chromosomal mutations, so the germ line mutations may have a causal role. Lowered libido may be caused by lowered estrogen, progesterone and testosterone levels. It seems likely that

	these explanations may be oversimplified. One additional mechanism that may be important in producing lowered fertility is that VGCC activation and consequent high [Ca2+]i levels is known to have a key role in avoiding polyspermy. Consequently, if this response is triggered before any fertilization of an egg has occurred, it may prevent any sperm from fertilizing and egg.
Neurological/ neuropsychiatric effects	Of all cells in the body, the neurons have the highest densities of VGCCs, due in part to the VGCC role and [Ca2+]i role in the release of every neurotransmitter in the nervous system. Calcium signaling regulates synaptic structure and function in 5 different ways, each likely to be involved here. Oxidative stress and apoptosis are both thought to have important roles. Lowered sleep and increased fatigue are likely to involve lowered nocturnal melatonin and increased nocturnal norepinephrine.
Apoptosis	Apoptosis can be produced by excessive Ca2+ levels in the mitochondria and by double strand breaks in cellular DNA; it seems likely that both of these mechanisms are involved following EMF exposure. A third mechanism for triggering apopotosis, endoplasmic reticulum stress (see bottom row in this Table), may also be involved.
Cellular DNA damage	Cellular DNA damage is produced by the free radical breakdown products of peroxynitrite directly attacking the DNA [7].
Changes in non-steroid hormone levels	The release of non-steroid hormones is produced by VGCC activation and [Ca2+]i elevation. The immediate effects of EMF exposures is to increase hormone release and to raise, therefore, hormone levels. However many hormone systems become "exhausted" as a consequence of chronic EMF exposures. The mechanism of exhaustion is still uncertain, but it may involve oxidative stress and inflammation.
Lowered steroid hormone	Steroid hormones are synthesized through the action of cytochrome P450 enzymes; activity of these hormones is inhibited by binding of high levels of nitric oxide (NO) leading to lowered hormone synthesis.
Calcium overload	Produced by excessive activity of the VGCCs; secondary calcium overload is produced by oxidative stress activation of TRPV1, TRPM2 and possibly some other TRP receptors, opening the calcium channel of these receptors.
Heat shock protein induction	There is a large literature showing that excessive [Ca2+]i induces very large increases in heat shock proteins. This is thought to be produced by complex calcium signaling changes involving the endoplasmic reticulum, mitochondria and the cytosol and also involving excessive [Ca2+]i producing increasing protein misfolding [21-23]. It should be noted that some calcium is essential for proper protein folding in the endoplasmic reticulum such that only excessive calcium leads to misfolding and consequent endoplasmic reticulum stress.

Each of the seven established EMF effects, discussed above, can be generated through the mechanisms outlined in Fig. 1, as shown by Table 1. An eighth, heat shock protein induction can also be so explained (Table 1). Several other such effects, including EMF causation of

cataracts, breakdown of the blood-brain barrier, lowered nocturnal melatonin are also so explained, as discussed earlier [5]. The primary mechanism for therapeutic effects was discussed in [4,24,25] and was also shown to be generated via such VGCC downstream effects. Fifteen mechanisms for EMF cancer causation are described in ref [7]; these are far too complex to describe in this document so the reader is referred to ref [7].

It can be seen, in summary, that we are far beyond the issue whether there are non-thermal EMF effects. Rather many researchers have identified many established effects of EMF exposure. The main direct targets of non-thermal EMF exposure, the VGCCs have also been identified and how these get activated by EMF exposure acting on the VGCC voltage-sensor has also been determined. And finally we have identified how a wide variety of these effects can be generated via downstream effects produced by such VGCC activation.

Our current safety guidelines are based only on heating (thermal) effects. Heating is produced predominantly by forces on singly charged groups in the aqueous phases of the cell but the forces on the voltage sensor are approximately 7.2 million times higher. Therefore, our current safety guidelines are allowing us to be exposed to EMFs that are approximately 7.2 million times too strong. That 7.2 million figure is somewhat similar to the estimate given by the Bioinitiative Report and by the Building Biologists, based on completely different considerations.

It should be obvious, that non-thermal EMFs:

1. Attack our nervous systems including our brains leading to widespread neuropsychiatric effects and possibly many other effects. This nervous system attack is of great concern.
2. Attack our endocrine (that is hormonal) systems. In this context, the main things that make us functionally different from single celled creatures are our nervous system and our endocrine systems – even a simple planaria worm needs both of these. Thus the consequences of the disruption of these two regulatory systems is immense, such that it is a travesty to ignore these findings.
3. Produce oxidative stress and free radical damage, which have central roles in all common chronic diseases.
4. Attack the DNA of our cells, producing single strand and double strand breaks in cellular DNA and oxidized bases in our cellular DNA. These in turn produce both cancer and mutations in germ line cells with germ line mutations producing mutations impacting future generations.
5. Produce elevated levels of apoptosis (programmed cell death), events especially important in causing both neurodegenerative diseases and infertility.
6. Lower male and female fertility, lowered sex hormones, lowered libido, increased levels of spontaneous abortion and, as already stated, attacks on the DNA in sperm cells.
7. Produce excessive intracellular calcium [Ca2+]i and increased calcium signaling.
8. Act in the cells of our bodies via 15 different mechanisms to cause cancer.

By attacking all of these important systems in the body, EMFs attack everything we care about including our health (in many ways), our reproductive systems, the integrity of our genomes and our ability to produce healthy offspring.

There are 79 different reviews listed at the end of Chapter 1, with each documenting the existence of one or more of these various non-thermal EMF effects. What, then, do the two organization reports that the EU authorities and U.S. authorities rely upon, ICNIRP and SCENIHR 2015, have to say about these independent reviews. The answer is absolutely nothing! Neither one of them

uses any of these independent reviews to assess EMF effects. This whole area is discussed in much more detail in Chapter 5, below.

Chapter 3. Strong Evidence for Cumulative and Irreversible EMF Effects

Two questions that must be raised about the effects of these low-intensity EMFs producing biological effects is are they cumulative and are they reversible? I am aware of several different types of evidence for cumulative effects and also for irreversible effects.

Three of the human occupational exposure studies from the 1970's reviewed in the Raines, National Aeronautics and Space Administration (NASA) study [26], showed that effects increased substantially with increasing time of exposure to a particular type and intensity of EMF. While these three studies each show cumulative effects but they provide no data on possible irreversibility of these neurological/neuropsychiatric effects. However the largest review of such occupational exposures (Hecht [28]) does provide substantial evidence on the cumulative nature and irreversibility of these neurological/neuropsychiatric effects.

Hecht [28] reviewed 60 different studies of occupational exposures that were done between 1960 and 1990 in the Soviet Union and East Germany. These were occupational exposure studies of over 3500 people, who were exposed to microwave frequency EMFs at intensities of less than 1/1000th of our safety guidelines. These studies [28] found that these EMFs produced neuropsychiatric effects similar to those found in my much more recent study [3], listed in Chapter 1 as well as on cardiac effects. Neither the neuropsychiatric findings nor the cardiac findings were unique however. Similar neuropsychiatric effects have been found to be caused by low intensity EMF exposures [27,29-34]. Cardiac effects have also been found in humans [26,29,30,32,34,35] similar to those found by Hecht [28].

Hecht [28] reports that exposures at those very low intensities for up to 3 years produced increased sympathetic nervous system activity, apparently in response to the EMF stress, following the classic stress sequence described by Hans Selye in 1953. No other effects were apparent during this circa 3 year period. However longer exposure produced observable neurological/neuropsychiatric and cardiac effects as well as other effects which were initially modest. Exposures of 3 to 5 years typically produced effects that could be largely reversed after 2 to 3 years in a no-EMF exposure environment. Hecht states that "if detected early, effective therapy is possible." However longer than 4 to 5 years exposures produced more severe effects which did not reverse when the persons were subsequently put into a no-EMF exposure environment. These and other effects continued to worsen with 10 years of exposure or longer. This cumulative nature of such EMF exposures was noted in two earlier reviews cited by Hecht et al [36,37]. These studies, then, provide very large amounts of evidence both for the cumulative nature of these neuropsychiatric effects, as well as the apparent irreversibility of these effects as they become more severe. Hecht also notes that "decline in health status increasingly amplifies EMF effects." This a pattern of increasing apparent sensitivity produced by previous exposure is similar to that described in the Western literature on electromagnetic hypersensitivity (EHS), something that Hecht recognizes [28]. EHS something that is discussed very briefly below in this section.

There are strong similarities between the Hecht [28] findings on microwave frequency EMFs in humans and the impacts of such EMFs on cellular and organ histology in rodents, as were reviewed in Tolgskaya and Gordon [38] and discussed in Pall [3]. In rodents, initially non-thermal exposures over periods of 1 to 2 months produced modest changes in structure of the brain and of the neurons. When such exposures ceased, most of the structural changes

disappeared – that is the changes were largely reversed when the animals were placed back into a no-EMF environment. However more months of exposure produced much more severe impacts on brain and neuronal structure and these were irreversible [38, 3]. More recent, Western country and other country studies cited in [3], provide much further support for brain impacts similar to those found in Soviet and also other country brain studies reviewed by Tolgskaya and Gordon[38]. Tolgskaya and Gordon [38,3] also reported findings that in histological studies, the nervous system was the most sensitive organ in the body, followed closely by effects on the heart and the testis, although many other organs were also impacted. Thus, the Tolgskaya and Gordon review [38,3] provides very important support for the findings of neurological/neuropsychiatric effects, the cardiac effects, discussed immediately above and below, and the reproductive effects discussed in Chapter 1. By comparing the animal studies with the human studies, one can see the striking similarities, with the major difference being that the effects in rodents are much more rapid than the effects on humans. Given the much higher metabolic rates in rodents and much lower life spans in rodents, the timing difference is not surprising. With regard to the issues of cumulative nature and irreversibility, both rodent and human studies provide strong support for both neurological and neuropsychiatric effects showing both cumulative nature and irreversibility and show a similar pattern of cumulative effects with the cardiac effects.

What are the cardiac effects discussed briefly above, that are produced by non-thermal microwave frequency EMF exposures? The effects include tachycardia (rapid heartbeat) where some people with apparent EHS, on blinded exposure to cordless phone radiation have instantaneous tachycardia, an effect that is also essentially instantaneously reversible on cessation of exposure [28,35,36]. So tachycardia can be an almost instantaneous response to EMFs and it is sometimes also found with arrhythmia. Prolonged exposures produce both arrhythmias and bradycardia (slow heart beat) [26-30,32]. Similar EMF cardiac effects were seen in animal studies, with the earliest of these going back to the late 1960s.

Some of the early studies on long-term EMF cardiac effects are listed in Table 2, below. They show that such chronic exposures produce bradycardia and sometimes arrhythmia. The early Soviet studies (labeled USSR) reported similar findings to those found in the western studies (Table 2).

Table 2. Chronic Exposure, Non-Thermal EMF Cardiac Effects from NASA Review [26]

Study	**Effects Reported**
Schwan 1977	Cardiology changes
Dwyer 1978	Bradycardia, hypotension
Sadicikova (USSR)	Bradycardia, hypo & hypertension, cardiac pain, systolic murmur
Kalyada (USSR)	“cardiovascular changes”
Sadichikova (USSR)	Changes in cardiovascular system
Pressman 1970	QRS interval in ECG increased (bradycardia), also arrhythmia
Domanski (USSR)	Bradycardia, hypotension, ECG changes (shows both bradycardia and arrhythmia)
Lerner (1980)	Bradycardia
Stuchley (1978)	Bradycardia (measured in 2 ways), hyper & hypotension, cardiac pain, systolic murmur.

Arrhythmias, especially when they are accompanied by bradycardia, are often associated with sudden cardiac death. We are having an epidemic of young, apparently healthy athletes dying in

the middle of an athletic competition of apparent sudden cardiac death, which may, therefore be possibly caused by EMF exposures [39]. Some of these individuals have been saved from death [39] and subsequently found to be suffering from bradycardia and arrhythmias. Another type of cardiac effect is that when apparent EHS people are exposed to Wi-Fi, cell phone, cell phone tower or smart meter radiation, they are reported to suffer from heart palpitations. Each of these four types of cardiac effects, tachycardia, arrhythmias, bradycardia and heart palpitations involve aberrations in the electrical control of the heartbeat. How can these be produced?

The heartbeat is controlled by pacemaker cells in what is called the sino-atrial node of the heart. Those pacemaker cells have been shown to have very high densities of the T-type VGCCs which may make these cells particularly susceptible to direct effects of the EMFs (recall that EMFs act via VGCC activation). The T-type and the L-type VGCCs have essential roles in controlling the heartbeat. It follows that EMF exposures, acting directly on the pacemaker cells of the heart, can produce tachycardia responses. Furthermore, gene mutations in a VGCC gene that produce increased VGCC activity can produce both tachycardia and arrhythmia in young babies carrying those mutations; these young children die of sudden cardiac death at a very young age. How then do we get bradycardia? Bradycardia is produced when EMFs chronically impact the sino-atrial node, such that the dysfunction involved in heart failure, which is very complex, produces dysfunction of the pacemaker cells of the heart, producing bradycardia [40].

It follows from this that EMF-produced bradycardia and chronic arrhythmias are likely to be caused by heart-failure-like changes that particularly impact the sino-atrial node of the heart, including the tissue remodeling found in heart failure. This model has been confirmed by the findings of Liu et al [41], who found that pulsed microwave frequency EMF produced tissue remodeling that specifically impacted the sino-atrial node of the heart with remodeling changes similar to those found in heart failure [40]. Heart failure develops in a cumulative fashion and, based on current medicine at least, is an irreversible process involving tissue remodeling and a large number of other biochemical and physiological changes [41]. It seems likely, therefore, that the EMF effects on the heart are both cumulative and irreversible.

You will recall, from the discussion at the beginning of Chapter 1, that there are 18 reviews documenting that EMF produces lowered fertility. These act via diverse mechanisms. These include tissue remodeling changes in the testis, lowered sperm count and sperm quality, lowered female fertility including ovary remodeling and oocyte apoptosis, lowered estrogen, progesterone and testosterone levels (that is sex hormone levels), increased spontaneous abortion incidence, and lowered libido. We already have sperm count drops to below 50% of normal in every technologically advanced country on earth [1]. We also have fertility drops to well below replacement levels in every technologically advanced country on earth, with one exception. Clinical observations argue that while there are sometimes technical fixes that allow some reproduction, infertility appears to be inherently irreversible. The Magras and Xenos [2] in mice, also discussed in Chapter 1 shows that radiofrequency radiation exposures well below our safety guidelines, produce immediate drops in mouse reproduction in the first litter. Further exposures to the same EMF levels produced a crash in reproduction essentially to zero, a crash that appeared to be essentially irreversible.

We don’t know that humans will behave very similarly to mice. We do know that the EMFs produce the diverse effects on human reproduction listed in the previous paragraph. My prediction is that even if exposures level off where they are now, we will start seeing crashes in reproduction within about 5 years. If we go ahead with 5G, that crash may be almost instantaneous.

Mutation accumulation produced by cellular DNA damage is likely to be both cumulative and irreversible, as well, because later mutations are highly unlikely to reverse previously occurring mutations. It has been estimated that all we need to have is an increase in germ line mutation of 2 ½ to 3-fold, to become over time, extinct from the very high levels of mutations in each newborn. From the high levels of DNA damage produced in human sperm from common EMF exposures, we may be already well above that level.

It follows from this that we already face four existential threats produced by microwave frequency EMF exposures to the survival of every technologically advanced society on earth:

1. Cumulative and irreversible neurological/neuropsychiatric effects.
2. Cumulative and irreversible reproductive effects.
3. Cumulative and irreversible cardiac effects, leading to sudden cardiac death.
4. DNA effects in germ line, including sperm cells, leading to major impacts on our gene pool and high mutation frequencies.

Any one of these can destroy us on its own and with the ever increasing exposures and especially the vast increases in exposure that the 5G rollout will inevitably produce, that destruction is likely to be imminent. These don't even take into consideration the cancer effects, the hormonal effects or other effects produced by increased oxidative stress or increased apoptotic cell death. There is extraordinary evidence for each of these effects of EMF exposure, which have been repeatedly documented in the reviews listed in Chapter 1.

The following information is derived from an abstract that I used for a talk at the Neuroscience 2016 meeting in Los Angeles, a meeting that was focused on Alzheimer's disease and similar dementias. The discussion here raises the question of whether Alzheimer's and other dementias may be still another set of irreversible diseases where cumulative effects of microwave frequency EMFs may have important causal roles. Dementias and other types of neurological deaths have had unexplained rapid recent increases [42-44]. The parallel between these increases and the increases in cell phone and other EMF exposures suggested that such exposures may cause dementia increases [45]. Reports show people circa age 30 developing Alzheimer's or other very early onset dementias and even younger people are reported to develop digital dementias, dementias caused by heavy use of digital devices [46-48]. One of the questions being raised here, is whether digital dementias are caused, at least in part, by the EMF exposures produced by these digital devices and the Wi-Fi fields involved in their usage, rather than solely by such things as screen time, as is often assumed. As you have seen in chapter 2, microwave and lower frequency EMFs act via activation of the VGCCs, leading to increases in intracellular calcium ([Ca2+]i) and downstream effects including increased Ca2+ signaling, NO, superoxide, peroxynitrite, free radicals, oxidative stress, NF-kappaB and mitochondrial dysfunction.

Each of these downstream effects have been shown to have important roles in causing Alzheimer's disease and other neurodegenerative diseases [49-51]. These all suggest plausible mechanisms for action for EMFs causing Alzheimer's disease. Furthermore the amyloid-beta protein (Aβ) which has an specific role in causing Alzheimer's disease, is produced in increasing amounts by elevated [Ca2+]i, and small Aβ aggregates form Ca2+ channels in the plasma membrane and aggregates also raise [Ca2+]i via increased VGCC and RYRr activity, suggesting a vicious cycle between Aβ and [Ca2+]i in Alzheimer's disease. This argues that increased intracellular calcium levels, produced by the EMFs increases Aβ and increased Aβ increases intracellular calcium, in what may be the central mechanism in causing Alzheimer's disease.

Four rodent studies support an EMF role in Alzheimer's disease. A series of short pulses of EMFs in young rats, produced the following in the equivalent of middle aged rats: elevated brain Aβ and oxidative stress; lowered cognition and memory [52,53]. 900 MHz exposures produces oxidative stress, increased Aβ and lowered miR-107, all found in Alzheimer's disease brains [52-55]. There are many animal studies showing roles for [Ca2+]i through both VGCCs and RYRs in causing Alzheimer's disease in rodent models; these include studies with calcium channel blockers and studies of transgenic mice with varying VGCC and RYR expression. Very low EMF exposures can produce, however, protective responses [56,57]; this is not surprising because EMF therapy is thought to act via NO signaling and protein kinase G (see Fig.1, Chapter 2) and this pathway is reported to protect from Alzheimer's disease. Epidemiological studies have shown that exposure of humans of 50/60 Hz EMFs, which also act via VGCC activation, can cause elevated Alzheimer's disease incidence [58,59]. Interestingly, a 1997 article in Microwave News, discussing two such epidemiological findings on EMFs and Alzheimer's disease in humans, found that occupational exposures to EMFs produced as much as a four-fold increase in Alzheimer's disease [59A]. That same article [59A] suggested a similar mechanism to the mechanism suggested here, namely that increased [Ca2+]i following EMF exposure produces increases in Aβ. In conclusion, a wide range of studies support the view that low intensity microwave frequency exposures acting via VGCC activation and [Ca2+]i, can produce increases in Aβ and other causal factors of Alzheimer's disease in humans and in animals and EMFs have been shown to produce Alzheimer's effects in rats.

These various findings on EMFs and Alzheimer's disease, the increasingly early onset of dementias and the occurrence of digital dementias, all suggest we may have another very high level threat caused by EMF exposures, possibly involving cumulative EMF effects and leading to severe, irreversible brain damage.

Chapter 4 EMFs Including Wi-Fi May Be Particularly Damaging to Young People

Most arguments that have been made that microwave frequency EMFs may be much more damaging to young children have centered on the much smaller skulls and skull thickness in young children, increasing the exposure of their brains to EMFs [60, 61]. However there are other arguments to be made. EMFs have been shown to be particularly active in producing effects on embryonic stem cells [62-71]. Because such stem cells occur at much higher cell densities in children, with stem cell densities the highest in the fetus and decreasing with increasing age [62, 63], impacts on young children are likely to be much higher than in adults. The decreased DNA repair and increased DNA damage following EMF exposure, in conjunction with the increased cell division in young children, strongly suggest that young children may be increasingly susceptible to cancer following such exposures [62-64, 71]. Two reviews discussed in the next chapter provide further evidence on higher cancer susceptibility of children. EMF action on stem cells may also cause young children to be particularly susceptible to disruption of brain development [66,71], something that may be relevant to autism causation.

It is my belief that the role of [Ca2+]i in synapse development is also relevant to the possible EMF causation of autism. The Hecht review of Soviet occupational exposure studies [28] reports that "younger persons show a greater sensitivity to electromagnetic fields than adults." These are all very problematic issues and we cannot rule out the possibility that there are other problematic issues as well. Redmayne and Johansson [72] reviewed the literature showing that there are age-related effects, such that young people are more sensitive to EMF effects. It follows from these various findings that the placement of Wi-Fi into schools around the country and the not uncommon placing of cell phone towers on schools may well both be a high level threats to the health of our children as well being a threat to teachers and any very sensitive fetuses teachers

may be carrying, as well. Mr. Barrie Trower, a retired military intelligence expert from the U.K. has been going around the world, at his expense, speaking against Wi-Fi in schools. His knowledge on this is based in part on classified information which he is unable to discuss, but has given him great concern.

Chapter 5: The Importance of the SCENIHR 2015 Document and the Many Omissions, Flaws and Falsehoods in That Document

One thing that I think we can all agree upon, is that the SCENIHR 2015 [73] document is an important document. The reason for its importance is that previous industry-friendly documents, and there have been many of them, have only reviewed very limited amounts of the literature on EMF effects. Consequently all of these other documents are open to the criticism that they have cherry picked what little data they have chosen to discuss. SCENIHR 2015 [73] has a reference list of almost 48 pages in length, going from page 233 to 280. So it appears that SCENIHR 2015 may have done a much more thorough and defensible review of the literature. Our assessement of SCENIHR 2015 [73] is important because of the confidence expressed in this document both by Mr. Ryan and Dr. Vinciūnas and also by the U.S. National Cancer Institute. The question that is being raised here is whether SCENIHR 2015 is thorough and defensible or not.

The Speit/Schwarz Controversy: How SCENIHR Has Put Out Seven Falsehoods in Support of the Industry Progaganda Position

I am going to start by discussing a single particularly important issue from [73]. At the end of Table 5 in [73]. there is a claim that a 2013 study by Speit et al [74] was unable to replicate the findings of a 2008 study published by Schwarz et al [75]. In Table 5 they state further that Speit el al found "No effect on DNA integrity (MN) and DNA migration (comet); Repetition study of Schwarz et al, 2008." What is called loss of DNA integrity here, measured by formation of micronuclei (MN), is caused by the formation of double strand breaks in cellular DNA. The comet assay measures single strand breaks in cellular DNA. Schwarz et al [75] found strong evidence that there were large increases in both single strand and double strand breaks in cellular DNA following very low intensity exposures to a cell phone-like pulsed radiation, but SCENIHR claims that Speit et al [74] were unable to repeat the earlier study. Elsewhere (p.89, bottom) SCENIHR states that "By using the same exposure system and the same experimental protocols as the authors of the original study, they failed to confirm the results. They did not find any explanation for these conflicting results (Speit et al, 2013)."

A careful examination of both [74] and [75] finds the following: 1. Speit et al [74] used a lymphocytic cell line, HL-60; Schwarz et al [75] studied human fibroblasts. This is a big difference because, as we have already said, different cell types behave differently. 2. Speit et al [74] used 1800 MHz radiation; Schwarz et al [75] used 1950 MHz radiation (the frequency of UMTS, also called 3G). Again we have a potentially important difference because effects are influenced by the frequency used. 3. Speit et al [74] used a continuous wave EMF; Schwarz et al [75] used a highly pulsed EMF, with high levels of both KHz and MHz pulsations to mimic the pulsation pattern of 3G cell phones. This is expected to produce very large differences between the two studies. 4. Speit et al [74] used a reverberation exposure chamber; Schwarz et al [75] did not use any exposure chamber. This could be another very large difference between the two studies, a difference that will be discussed toward the end of this chapter. 5. So where did the claim come from that Speit was trying to repeat the Schwarz study? Speit et al [74] says in their paper that they were trying to repeat another study (not Schwarz) that was described in a report but was never published. 6. Speit et al [74] do not even cite the Schwarz et al [75] paper, so obviously they did not intend to repeat Schwarz. We have then SCENIHR 2015 stating three

multifaceted falsehoods that Speit et al [74] tried to repeat the earlier studies of Schwarz et al [75], that they were unable to repeat those Schwarz et al [75] studies and that they used identical methodology to that used by Schwarz et al [75]. In addition to those three are four underlying falsehoods – namely that the two studies used very different methodologies, notably differing in the cell type studied, differing in the frequency used, differing widely in the in pulsations used and differing in the use of an exposure chamber. *Each of these falsehoods are SCENIHR's not Speit et al [74]'s, each of them can be easily seen to be false by even a superficial reading of these two papers*.

As you might guess, there is a major story behind all of this. The very low intensity exposure used in the Schwarz et al [75] study produced large numbers of DNA breaks, larger than that produced by 1600 chest X-rays. This conclusion can be made by comparing the results of Schwarz et al [75] with the earlier study of Lutz and Adlkofer [76]. From this comparison, it seems clear that non-ionizing radiation similar to 3G radiation can be much more dangerous to the DNA of our cells than is a similar energy of ionizing radiation. When this was found, the industry went into attack mode, attacking the two Professors who collaborated in [75], Prof. Franz Adlkofer in Germany and Prof. Hugo Rüdinger in Austria. The first couple of years of these attacks have been described in some detail on pp 117-131 in Dr. Devra Davis' book Disconnect [77]. Before the SCENIHR 2015 document was drafted, it was clear that the publishers who had published Adlkofer's and Rüdinger's work, not just the Schwarz et al [75] study but other papers by the same research group, had long since rejected the industry propaganda claims. In addition. Adlkofer had won a lawsuit in the German courts against his main accuser. He has subsequently since won a second such lawsuit. The last paragraph on p.89 in SCENIHR 2015 is word for word industry propaganda. What is clear is that SCENIHR is wittingly or unwittingly serving as a propagandist for the industry in and that process, SCENIHR has no difficulty in putting forth seven obvious, individually important falsehoods.

One question that needs to be raised is how is it possible for microwave frequency EMFs to produce much more cellular DNA damage than a comparable energy level of ionizing radiation? Both ionizing radiation and microwave/lower frequency EMFs act via free radicals to attack the DNA. If you examine Fig. 1, Chapter 2, you will see how low intensity microwave frequency EMFs can act (p. 20). The free radicals that attack the DNA are breakdown products peroxynitrite.. The sequence of events leading to those free radicals starts, of course with the extraordinarily high sensitivity of the VGCC voltage sensor to the electrical forces of the EMFs that open the VGCC calcium channels. Following that there are three steps in the process leading to peroxynitrite elevation *each of which have high levels of amplification*. The first of these is that when the VGCC channels are open, they allow the influx of about a million calcium ion per second into the cell. The second amplification is that elevated intracellular calcium [Ca2+]i activates the synthesis of both nitric oxide (NO) and superoxide. The third amplification is that the formation of peroxynitrite is proportional to the product of nitric oxide concentration *times* the superoxide concentration. When you have three sequential amplification mechanisms, you can get a very large response, in this case free radical attack on cellular DNA, from a very small initial signal. That is where much of the existential crises are coming are from, with EMFs threatening the survival of every technologically advanced country on earth.

Going back to falsehoods perpetrated by SCENIHR regarding Speit/Schwarz, here are two possible interpretations for those seven falsehoods. One is that SCENIHR is simply an industry propaganda organ. The second is that we have a group of scientists (SCENIHR) who are largely incompetent and that it is just coincidence that these seven falsehoods serve the industry propaganda case. Either of these interpretations completely destroy the claims of confidence in

SCENIHR that Mr. Ryan and Dr. Vinciūnas made in the documents they wrote that were referred to in the Preface of this document.

I have written here another 27 pages critiquing the SCENIHR 2015 [73] document. If you are already convinced that the SCENIHR claims that there are no established non-thermal EMF effects are false and that we have eight extremely well documented effects (Chapter 1) and that we have detailed mechanisms of how these effects are produced (Chapter 2), then I suggest you skip to the summary of Chapter 5 starting on p. 57 and then go on to the consider the U.S. situation in Chapter 6 and 5G in Chapter 7. If, however, you are not so convinced, you need to read the intervening 27 pages.

22 Reviews on EMF Effects, 20 of Which Are Ignored by SCENIHR, Two of Which Are Discussed in [73] but Essentially Dismissed

Now let's go on to consider how SCENIHR 2015 [73] considers the many independent reviews, listed in Chapter 1, which disagree with them and also fall into the 2009 through 2013 period that SCENIHR claims to have thoroughly considered. See Table 3.

Table 3: 2009 to 2013 Reviews that Should Have Been Cited and Discussed in SCENIHR 2015

Citation	**Brief Summary**	**What does SCENIHR 2015 say about it?**
[78] Khurana VG, Teo C, Kundi M, Hardell L, Carlberg M. 2009 Cell phones and brain tumors: a review including the long-term epidemiologic data. Surg Neurol 72:205-214.	Meta-analysis study of cell phone usage and brain cancer. The results indicate that using a cell phone for > or = 10 years approximately doubles the risk of being diagnosed with a brain tumor on the same ("ipsilateral") side of the head preferred for cell phone use. The data achieve statistical significance for glioma and acoustic neuroma but not for meningioma. CONCLUSION: The authors conclude that there is adequate epidemiologic evidence to suggest a link between prolonged cell phone usage and the development of an ipsilateral brain tumor.	Nothing. Review is not cited and not discussed.
[79] Desai NR, Kesari KK, Agarwal A. 2009 Pathophysiology of cell phone radiation: oxidative stress and carcinogenesis with focus on the male reproductive system. Reproduct Biol Endocrinol 7:114.	This review identifies the plasma membrane as a target of RF-EMW. In addition, the effects of RF-EMW on plasma membrane structures (i.e. NADH oxidase, phosphatidylserine, ornithine decarboxylase) and voltage-gated calcium channels are discussed. We explore the disturbance in reactive oxygen species (ROS) metabolism caused by RF-EMW and delineate NADH oxidase mediated ROS formation as playing a central role in oxidative stress (OS) due to cell phone radiation (with a focus on the male reproductive system). This review also addresses: 1) the controversial effects of RF-EMW on mammalian cells and sperm DNA as well as its effect on apoptosis, 2) epidemiological, in vivo animal and in vitro studies on	Nothing. Review is not cited and not discussed.

	the effect of RF-EMW on male reproductive system.	
[80] Makker K, Varghese A, Desai NR, Mouradi R, Agarwal A. 2009 Cell phones: modern man's nemesis? Reprod Biomed Online 18:148-157.	Effects of cell phone exposure on the cardiovascular system, sleep and cognitive function, as well as localized and general adverse effects, genotoxicity potential, neurohormonal secretion and tumour induction. The proposed mechanisms by which cell phones adversely affect various aspects of human health, and male fertility in particular, are explained, and the emerging molecular techniques and approaches for elucidating the effects of mobile phone radiation on cellular physiology using high-throughput screening techniques, such as metabolomics and microarrays, are discussed. A novel study is described, which is looking at changes in semen parameters, oxidative stress markers and sperm DNA damage in semen samples exposed in vitro to cell phone radiation.	Nothing. Review is not cited and not discussed.
[81] Ruediger HW. 2009 Genotoxic effects of radiofrequency electromagnetic fields. Pathophysiology. 16:89-102.	101 publications are exploited which have studied genotoxicity of radiofrequency electromagnetic fields (RF-EMF) in vivo and in vitro. Of these 49 report a genotoxic effect and 42 do not. In addition, 8 studies failed to detect an influence on the genetic material, but showed that RF-EMF enhanced the genotoxic action of other chemical or physical agents. Variation in results may in part be explained by the different cellular systems and from the variety of analytical methods being used. Taking altogether there is ample evidence that RF-EMF can alter the genetic material of exposed cells in vivo and in vitro and in more than one way. This genotoxic action may be mediated by microthermal effects in cellular structures, formation of free radicals, or an interaction with DNA-repair mechanisms.	Nothing. Review is not cited and not discussed.
[82] Phillips JL, Singh NP, Lai H. 2009 Electromagnetic fields and DNA damage. Pathophysiology 16:79-88.	A major concern of the adverse effects of exposure to non-ionizing electromagnetic field (EMF) is cancer induction. Since the majority of cancers are initiated by damage to a cell's genome, studies have been carried out to investigate the effects of electromagnetic fields on DNA and chromosomal structure. Additionally, DNA damage can lead to changes in cellular functions and cell death. Single cell gel electrophoresis, also known as the 'comet assay', has been widely used in EMF research to determine DNA damage, reflected as single-strand breaks, double-strand breaks, and crosslinks. Studies have also been carried out to investigate chromosomal conformational changes and micronucleus formation in cells after exposure to EMF. This review describes the comet assay and its utility to qualitatively and quantitatively assess DNA damage, reviews studies that have	Nothing. Review is not cited and not discussed.

	investigated DNA strand breaks and other changes in DNA structure, and then discusses important lessons learned from our work in this area.	
[83] Davanipour Z, Sobel E. 2009 Long-term exposure to magnetic fields and the risks of Alzheimer's disease and breast cancer: Further biological research. Pathophysiology 16:149-156.	Extremely low frequency (ELF) and radio frequency (RF) magnetic fields (MFs) pervade our environment. Whether or not these magnetic fields are associated with increased risk of serious diseases, e.g., cancers and Alzheimer's disease, is thus important when developing a rational public policy. Our objective was to provide an unbiased review of the current knowledge and to provide our general and specific conclusions. RESULTS: The evidence indicates that long-term significant occupational exposure to ELF MF may certainly increase the risk of both Alzheimer's disease and breast cancer. There is now evidence that two relevant biological processes (increased production of amyloid beta and decreased production of melatonin) are influenced by high long-term ELF MF exposure that may lead to Alzheimer's disease. There is further evidence that one of these biological processes (decreased melatonin production) may also lead to breast cancer. Finally, there is evidence that exposures to RF MF and ELF MF have similar biological consequences. CONCLUSION: It is important to mitigate ELF and RF MF exposures through equipment design changes and environmental placement of electrical equipment.	Nothing. Review is not cited and not discussed.
[84] Yakymenko I, Sidorik E. 2010 Risks of carcinogenesis from electromagnetic radiation and mobile telephony devices. Exp Oncol 32:729-736.	Latest epidemiological data reveal a significant increase in risk of development of some types of tumors in chronic (over 10 years) users of mobile phone. It was detected a significant increase in incidence of brain tumors (glioma, acoustic neuroma, meningioma), parotid gland tumor, seminoma in long-term users of mobile phone, especially in cases of ipsilateral use (case-control odds ratios from 1.3 up to 6.1). Two epidemiological studies have indicated a significant increase of cancer incidence in people living close to the mobile telephony base station as compared with the population from distant area. These data raise a question of adequacy of modern safety limits of electromagnetic radiation (EMR) exposure for humans. For today the limits were based solely on the conception of thermal mechanism of biological effects of RF/MW radiation. Meantime the latest experimental data indicate the significant metabolic changes in living cell under the low-intensive (non-thermal) EMR exposure. Among reproducible biological effects of low-intensive MWs are reactive oxygen species overproduction, heat shock proteins	Nothing. Review is not cited and not discussed.

	expression, DNA damages, apoptosis. Practical steps must be done for reasonable limitation of excessive EMR exposure, along with the implementation of new safety limits of mobile telephony devices radiation, and new technological decisions, which would take out the source of radiation from human brain.	
[85] Carpenter DO. 2010 Electromagnetic fields and cancer: the cost of doing nothing. Rev Environ Health 25:75-80.	Concern of health hazards from EMFs has increased as the use of cell phones and other wireless devices has grown in all segments of society, especially among children. While there has been strong evidence for an association between leukemia and residential or occupational exposure to ELF EMFs for many years, the standards in existence are not sufficiently stringent to protect from an increased risk of cancer. For RF EMFs, standards are set at levels designed to avoid tissue heating, in spite of convincing evidence of adverse biological effects at intensities too low to cause significant heating. Recent studies demonstrate elevations in rates of brain cancer and acoustic neuroma only on the side of the head where individuals used their cell phone. Individuals who begin exposure at younger ages are more vulnerable. These data indicate that the existing standards for radiofrequency exposure are not adequate. While there are many unanswered questions, the cost of doing nothing will result in an increasing number of people, many of them young, developing cancer.	Nothing. Review is not cited and not discussed.
[86] Giuliani L, Soffritti M (Eds). 2010 NON-THERMAL EFFECTS AND MECHANISMS OF INTERACTION BETWEEN ELECTROMAGNETIC FIELDS AND LIVING MATTER, RAMAZZINI INSTITUTE EUR. J. ONCOL. LIBRARY Volume 5, National Institute for the Study and Control of Cancer and Environmental Diseases "Bernardino Ramazzini" Bologna, Italy 2010, 400 page monograph.	Contains entire articles on: 1. Influence of mobile phone radiation on cognitive function. 2. Impact of DECT cordless phone radiation on heart rate variability and on the autonomic nervous system. 3 & 4. Two articles on the impact of radiofrequency radiation on the blood-brain barrier. 5 & 6. Two articles on microwave/radiofrequency radiation and cancer causation. 7. Epidemiological studies of EMF impact on human reproduction.	Nothing. Review is not cited and not discussed.
[87] Khurana, V. G., Hardell, L., Everaert,	We identified a total of 10 epidemiological studies that assessed for putative health effects of mobile phone	Nothing. Review is not

J., Bortkiewicz, A., Carlberg, M., Ahonen, M. 2010 Epidemiological evidence for a health risk from mobile phone base stations. Int. J. Occup. Environ. Health 16, 263-267.	base stations (cell phone antennae). Seven of these studies explored the association between base station proximity and neurobehavioral effects and three investigated cancer. We found that eight of the 10 studies reported increased prevalence of adverse neurobehavioral symptoms or cancer in populations living at distances < 500 meters from base stations. None of the studies reported exposure above accepted international guidelines, suggesting that current guidelines may be inadequate in protecting the health of human populations. We believe that comprehensive epidemiological studies of long-term mobile phone base station exposure are urgently required to more definitively understand its health impact.	cited and not discussed.
[88] Levitt, B. B., Lai, H. 2010. Biological effects from exposure to electromagnetic radiation emitted by cell tower base stations and other antenna arrays. Environ. Rev. 18, 369-395. doi.org/10.1139/A10-018	Both anecdotal reports and some epidemiology studies, reviewed in this study, have found headaches, skin rashes, sleep disturbances, depression, decreased libido, increased rates of suicide, concentration problems, dizziness, memory changes, increased risk of cancer, tremors, and other neurophysiological effects in populations near base stations. Cardiac effects were also reported. Symptoms reported may be classic microwave sickness, first described in 1978. Nonionizing electromagnetic fields are among the fastest growing forms of environmental pollution. Some extrapolations can be made from research other than epidemiology regarding biological effects from exposures at levels far below current exposure guidelines.	Nothing. Review is not cited and not discussed.
[89] Kang N, Shang XJ, Huang YF. 2010 [Impact of cell phone radiation on male reproduction]. Zhonghua Nan Ke Xue 16:1027-1030.	With the popularized use cell phones, more and more concern has been aroused over the effects of their radiation on human health, particularly on male reproduction. Cell phone radiation may cause structural and functional injuries of the testis, alteration of semen parameters, reduction of epididymal sperm concentration and decline of male fertility. This article presents an overview on the impact of cell phone radiation on male reproduction.	Nothing. Review is not cited and not discussed.
[90] Yakymenko, I., Sidorik, E., Kyrylenko, S., Chekhun, V. 2011. Long-term exposure to microwave radiation provokes cancer growth: evidences from radars and mobile communication systems. Exp. Oncol. 33(2), 62-70.	The carcinogenic effect of MW irradiation is typically manifested after long term (up to 10 years and more) exposure. Nevertheless, even a year of operation of a powerful base transmitting station for mobile communication reportedly resulted in a dramatic increase of cancer incidence among population living nearby. In addition, model studies in rodents unveiled a significant increase in carcinogenesis after 17-24 months of MW exposure both in tumor-prone and intact animals. To that, such metabolic changes, as overproduction of reactive oxygen species, 8-hydroxi-2-deoxyguanosine formation, or ornithine	Nothing. Review is not cited and not discussed.

	decarboxylase activation under exposure to low intensity MW confirm a stress impact of this factor on living cells. We also address the issue of standards for assessment of biological effects of irradiation. It is now becoming increasingly evident that assessment of biological effects of non-ionizing radiation based on physical (thermal) approach used in recommendations of current regulatory bodies, including the International Commission on Non-Ionizing Radiation Protection (ICNIRP) Guidelines, requires urgent reevaluation. We conclude that recent data strongly point to the need for re-elaboration of the current safety limits for non-ionizing radiation using recently obtained knowledge. We also emphasize that the everyday exposure of both occupational and general public to MW radiation should be regulated based on a precautionary principles which imply maximum restriction of excessive exposure.	
[91] Yakimenko IL, Sidorik EP, Tsybulin AS. 2011 [Metabolic changes in cells under electromagnetic radiation of mobile communication systems]. Ukr Biokhim Zh (1999). 2011 Mar-Apr;83(2):20-28.	Review is devoted to the analysis of biological effects of microwaves. The results of last years' researches indicated the potential risks of long-term low-level microwaves exposure for human health. The analysis of metabolic changes in living cells under the exposure of microwaves from mobile communication systems indicates that this factor is stressful for cells. Among the reproducible effects of low-level microwave radiation are overexpression of heat shock proteins, an increase of reactive oxygen species level, an increase of intracellular Ca2+, damage of DNA, inhibition of DNA reparation, and induction of apoptosis. Extracellular-signal-regulated kinases ERK and stress-related kinases p38MAPK are involved in metabolic changes. Analysis of current data suggests that the concept of exceptionally thermal mechanism of biological effects of microwaves is not correct. In turn, this raises the question of the need to revaluation of modern electromagnetic standards based on thermal effects of non-ionizing radiation on biological systems.	Nothing. Review is not cited and not discussed.
[92] Gye MC, Park CJ. 2012 Effect of electromagnetic field exposure on the reproductive system. Clin Exp Reprod Med 39:1-9. doi.org/10.5653/cerm. 2012.39.1.1 . Clin Exp Reprod Med 39:1-9. doi.org/10.5653/cerm.	The safety of human exposure to an ever-increasing number and diversity of electromagnetic field (EMF) sources both at work and at home has become a public health issue. To date, many *in vivo* and *in vitro* studies have revealed that EMF exposure can alter cellular homeostasis, endocrine function, reproductive function, and fetal development in animal systems. Reproductive parameters reported to be altered by EMF exposure include male germ cell death, the estrous cycle, reproductive endocrine hormones, reproductive organ weights, sperm motility, early embryonic development, and pregnancy success. At	Nothing. Review is not cited and not discussed.

2012.39.1.1	the cellular level, an increase in free radicals and [Ca(2+)]i may mediate the effect of EMFs and lead to cell growth inhibition, protein misfolding, and DNA breaks. The effect of EMF exposure on reproductive function differs according to frequency and wave, strength (energy), and duration of exposure. In the present review, the effects of EMFs on reproductive function are summarized according to the types of EMF, wave type, strength, and duration of exposure at cellular and organism levels.	
[93] La Vignera S, Condorelli RA, Vicari E, D'Agata R, Calogero AE. 2012 Effects of the exposure to mobile phones on male reproduction: a review of the literature. J Androl 33:350-356.	The use of mobile phones is now widespread. A great debate exists about the possible damage that the radiofrequency electromagnetic radiation (RF-EMR) emitted by mobile phones exerts on different organs and apparatuses. The aim of this article was to review the existing literature exploring the effects of RF-EMR on the male reproductive function in experimental animals and humans. Studies have been conducted in rats, mice, and rabbits using a similar design based upon mobile phone RF exposure for variable lengths of time. Together, the results of these studies have shown that RF-EMR decreases sperm count and motility and increases oxidative stress. In humans, 2 different experimental approaches have been followed: one has explored the effects of RF-EMR directly on spermatozoa and the other has evaluated the sperm parameters in men using or not using mobile phones. The results showed that human spermatozoa exposed to RF-EMR have decreased motility, morphometric abnormalities, and increased oxidative stress, whereas men using mobile phones have decreased sperm concentration, decreased motility (particularly rapid progressive motility), normal morphology, and decreased viability. These abnormalities seem to be directly related to the duration of mobile phone use.	Nothing. Review is not cited and not discussed.
[94] Biointiative Working Group, David Carpenter and Cindy Sage (eds). 2012 Bioinitiative 2012: A rationale for biologically-based exposure standards for electromagnetic radiation. http://www.bioinitiative.org/participants/why-we-care/	Sections on EMF effects: SECTION 4: EVIDENCE FOR INADEQUACY OF THE STANDARDS SECTION 5: EVIDENCE FOR EFFECTS ON GENE AND PROTEIN EXPRESSION SECTION 6: EVIDENCE FOR GENOTOXIC EFFECTS – RFR AND ELF DNA DAMAGE SECTION 7: EVIDENCE FOR STRESS RESPONSE (STRESS PROTEINS) SECTION 8: EVIDENCE FOR EFFECTS ON IMMUNE FUNCTION SECTION 9: EVIDENCE FOR EFFECTS ON NEUROLOGY AND BEHAVIOR SECTION 10: EFFECTS OF EMF FROM WIRELESS COMMUNICATION UPON THE	Nothing. Review is not cited and not discussed.

	BLOOD-BRAIN BARRIER SECTION 11: EVIDENCE FOR BRAIN TUMORS AND ACOUSTIC NEUROMAS SECTION 12: EVIDENCE FOR CHILDHOOD CANCERS (LEUKEMIA) SECTION 13: EVIDENCE FOR EFFECTS ON MELATONIN: ALZHEIMER'S DISEASE AND BREAST CANCER SECTION 14: EVIDENCE FOR BREAST CANCER PROMOTION SECTION 15: EVIDENCE FOR DISRUPTION BY THE MODULATING SIGNAL SECTION 16: PLAUSIBLE GENETIC AND METABOLIC MECHANISMS FOR BIOEFFECTS OF VERY WEAK ELF MAGNETIC FIELDS ON LIVING TISSUE SECTION 17 EVIDENCE BASED ON EMF MEDICAL THERAPEUTICS SECTION 18: FERTILITY AND REPRODUCTION EFFECTS OF EMF SECTION 19: FETAL AND NEONATAL EFFECTS OF EMF SECTION 20: FINDINGS IN AUTISM CONSISTENT WITH EMF AND RFR	
[4] Pall, ML. 2013. Electromagnetic fields act via activation of voltage-gated calcium channels to produce beneficial or adverse effects. J Cell Mol Med 17:958-965. doi: 10.1111/jcmm.12088.	The direct targets of extremely low and microwave frequency range electromagnetic fields (EMFs) in producing non-thermal effects have not been clearly established. However, studies in the literature, reviewed here, provide substantial support for such direct targets. Twenty-three studies have shown that voltage-gated calcium channels (VGCCs) produce these and other EMF effects, such that the L-type or other VGCC blockers block or greatly lower diverse EMF effects. Furthermore, the voltage-gated properties of these channels may provide biophysically plausible mechanisms for EMF biological effects. Downstream responses of such EMF exposures may be mediated through Ca(2+) /calmodulin stimulation of nitric oxide synthesis. Potentially, physiological/therapeutic responses may be largely as a result of nitric oxide-cGMP-protein kinase G pathway stimulation. A well-studied example of such an apparent therapeutic response, EMF stimulation of bone growth, appears to work along this pathway. However, pathophysiological responses to EMFs may be as a result of nitric oxide-peroxynitrite-oxidative stress pathway of action. A single such well-documented example, EMF induction of DNA single-strand breaks in cells, as measured by alkaline comet assays, is reviewed here. Such single-strand breaks are	This was cited. Sole statement is: "(see Pall, 2013 for a review of studies suggesting effects through voltage-gated calcium channels)." None of the important implications listed on the left are used in any way in the rest of the SCENIHR 2015 document See text for further discussion..

	known to be produced through the action of this pathway. Data on the mechanism of EMF induction of such breaks are limited; what data are available support this proposed mechanism. Other Ca(2+) -mediated regulatory changes, independent of nitric oxide, may also have roles. This article reviews, then, a substantially supported set of targets, VGCCs, whose stimulation produces non-thermal EMF responses by humans/higher animals with downstream effects involving Ca(2+) /calmodulin-dependent nitric oxide increases, which may explain therapeutic and pathophysiological effects.	
[95] Nazıroğlu M, Yüksel M, Köse SA, Özkaya MO. 2013 Recent reports of Wi-Fi and mobile phone-induced radiation on oxidative stress and reproductive signaling pathways in females and males. J Membr Biol 246:869-875.	The aim of the study was to discuss the mechanisms and risk factors of EMR changes on reproductive functions and membrane oxidative biology in females and males. It was reported that even chronic exposure to EMR did not increase the risk of reproductive functions such as increased levels of neoantigens abort. However, the results of some studies indicate that EMR induced endometriosis and inflammation and decreased the number of follicles in the ovarium or uterus of rats. In studies with male rats, exposure caused degeneration in the seminiferous tubules, reduction in the number of Leydig cells and testosterone production as well as increases in luteinizing hormone levels and apoptotic cells. In some cases of male and female infertility, increased levels of oxidative stress and lipid peroxidation and decreased values of antioxidants such as melatonin, vitamin E and glutathione peroxidase were reported in animals exposed to EMR. In conclusion, the results of current studies indicate that oxidative stress from exposure to Wi-Fi and mobile phone-induced EMR is a significant mechanism affecting female and male reproductive systems.	This was listed on p.285 under ***Literature identified but not cited.*** SCENIHR chose not to cite or discuss this paper, although they had identified it.
[96] Ledoigt G, Belpomme D. 2013 Cancer induction molecular pathways and HF-EMF irradiation. Adv Biol Chem 3:177-186.	The response of cells to different types of electromagnetic fields can be induced by low-level (athermal) high frequency (HF) electromagnetic fields (EMFs) exposure associated with mobile phone technologies. There are many examples of biological effects involving the epigenome. EMFs could trigger protein activation mediated by ligands, such as Ca2+, that alter the conformation of binding proteins, especially the NADPH plasmic membrane oxidase, so inducing increased formation of reactive oxygen species (ROS) that may alter proteomic functions. Classical anti-apoptotic and procarcinogenic signaling pathways that are commonly found activated in human malignancies and in inflammation mainly involve the tran-	Nothing. Review is not cited and not discussed.

	scription factor NF-κB. The microenvironment that exists during chronic inflammation can contribute to cancer progression. The data support the proposition that long term HF-EMF exposure associated with improper use of cell phones can potentially cause cancer.	
[97] Hardell L, Carlberg M. 2013 Using the Hill viewpoints from 1965 for evaluating strengths of evidence of the risk for brain tumors associated with use of mobile and cordless phones. Rev Environ Health 28:97-106. doi: 10.1515/reveh-2013-0006.	BACKGROUND: Wireless phones, i.e., mobile phones and cordless phones, emit radiofrequency electromagnetic fields (RF-EMF) when used. An increased risk of brain tumors is a major concern. The International Agency for Research on Cancer (IARC) at the World Health Organization (WHO) evaluated the carcinogenic effect to humans from RF-EMF in May 2011. It was concluded that RF-EMF is a group 2B, i.e., a "possible", human carcinogen. Bradford Hill gave a presidential address at the British Royal Society of Medicine in 1965 on the association or causation that provides a helpful framework for evaluation of the brain tumor risk from RF-EMF. METHODS:All nine issues on causation according to Hill were evaluated. Regarding wireless phones, only studies with long-term use were included. In addition, laboratory studies and data on the incidence of brain tumors were considered. RESULTS: The criteria on strength, consistency, specificity, temporality, and biologic gradient for evidence of increased risk for glioma and acoustic neuroma were fulfilled. Additional evidence came from plausibility and analogy based on laboratory studies. Regarding coherence, several studies show increasing incidence of brain tumors, especially in the most exposed area. Support for the experiment came from antioxidants that can alleviate the generation of reactive oxygen species involved in biologic effects, although a direct mechanism for brain tumor carcinogenesis has not been shown. In addition, the finding of no increased risk for brain tumors in subjects using the mobile phone only in a car with an external antenna is supportive evidence. Hill did not consider all the needed nine viewpoints to be essential requirements. CONCLUSION:Based on the Hill criteria, glioma and acoustic neuroma should be considered to be caused by RF-EMF emissions from wireless phones and regarded as carcinogenic to humans, classifying it as group 1 according to the IARC classification. Current guidelines for exposure need to be urgently revised.	Nothing. Review is not cited and not discussed. The Hill criteria are THE well-accepted way of analyzing biological plausiblility of epidemiologic al evidence. It is unacceptable for SCENIHR not to consider this review when attempting to analyze epidemiologic al evidence of EMF cancer causation.
[98] Hardell L, Carlberg M, Hansson Mild K. 2013 Use of	The International Agency for Research on Cancer (IARC) at WHO evaluation of the carcinogenic effect of RF-EMF on humans took place during a 24-31 May	This paper is cited and discussed

mobile phones and cordless phones is associated with increased risk for glioma and acoustic neuroma. Pathophysiology 2013;20(2):85-110.	2011 meeting at Lyon in France. The Working Group consisted of 30 scientists and categorised the radiofrequency electromagnetic fields from mobile phones, and from other devices that emit similar non-ionising electromagnetic fields (RF-EMF), as Group 2B, i.e., a 'possible', human carcinogen. The decision on mobile phones was based mainly on the Hardell group of studies from Sweden and the IARC Interphone study. We give an overview of current epidemiological evidence for an increased risk for brain tumours including a meta-analysis of the Hardell group and Interphone results for mobile phone use. Results for cordless phones are lacking in Interphone. The meta-analysis gave for glioma in the most exposed part of the brain, the temporal lobe, odds ratio (OR)=1.71, 95% confidence interval (CI)=1.04-2.81 in the ≥10 years (>10 years in the Hardell group) latency group. Ipsilateral mobile phone use ≥1640h in total gave OR=2.29, 95% CI=1.56-3.37. The results for meningioma were OR=1.25, 95% CI=0.31-4.98 and OR=1.35, 95% CI=0.81-2.23, respectively. Regarding acoustic neuroma ipsilateral mobile phone use in the latency group ≥10 years gave OR=1.81, 95% CI=0.73-4.45. For ipsilateral cumulative use ≥1640h OR=2.55, 95% CI=1.50-4.40 was obtained. Also use of cordless phones increased the risk for glioma and acoustic neuroma in the Hardell group studies. Survival of patients with glioma was analysed in the Hardell group studies yielding in the >10 years latency period hazard ratio (HR)=1.2, 95% CI=1.002-1.5 for use of wireless phones. This increased HR was based on results for astrocytoma WHO grade IV (glioblastoma multiforme). Decreased HR was found for low-grade astrocytoma, WHO grades I-II, which might be caused by RF-EMF exposure leading to tumour-associated symptoms and earlier detection and surgery with better prognosis. Some studies show increasing incidence of brain tumours whereas other studies do not. It is concluded that one should be careful using incidence data to dismiss results in analytical epidemiology. The IARC carcinogenic classification does not seem to have had any significant impact on governments' perceptions of their responsibilities to protect public health from this widespread source of radiation.	very briefly. See text for discussion.
[99] Davis DL, Kesari S, Soskolne CL, Miller AB, Stein Y. 2013 Swedish review strengthens grounds for concluding that	Mobile phones are two-way microwave radios that also emit low levels of electromagnetic radiation. Inconsistent results have been published on potential risks of brain tumors tied with mobile phone use as a result of important methodological differences in study design and statistical power. Some studies have	Nothing. Review is not cited and not discussed.

radiation from cellular and cordless phones is a probable human carcinogen. Pathophysiology 20:123-129.	examined mobile phone users for periods of time that are too short to detect an increased risk of brain cancer, while others have misclassified exposures by placing those with exposures to microwave radiation from cordless phones in the control group, or failing to attribute such exposures in the cases. In 2011, the World Health Organization, International Agency for Research on Cancer (IARC) advised that electromagnetic radiation from mobile phone and other wireless devices constitutes a "possible human carcinogen," 2B. Recent analyses not considered in the IARC review that take into account these methodological shortcomings from a number of authors find that brain tumor risk is significantly elevated for those who have used mobile phones for at least a decade. Studies carried out in Sweden indicate that those who begin using either cordless or mobile phones regularly before age 20 have greater than a fourfold increased risk of ipsilateral glioma. Given that treatment for a single case of brain cancer can cost between $100,000 for radiation therapy alone and up to $1 million depending on drug costs, resources to address this illness are already in short supply and not universally available in either developing or developed countries. Significant additional shortages in oncology services are expected at the current growth of cancer. No other environmental carcinogen has produced evidence of an increased risk in just one decade. Empirical data have shown a difference in the dielectric properties of tissues as a function of age, mostly due to the higher water content in children's tissues. High resolution computerized models based on human imaging data suggest that children are indeed more susceptible to the effects of EMF exposure at microwave frequencies. If the increased brain cancer risk found in young users in these recent studies does apply at the global level, the gap between supply and demand for oncology services will continue to widen. Many nations, phone manufacturers, and expert groups, advise prevention in light of these concerns by taking the simple precaution of "distance" to minimize exposures to the brain and body. We note that brain cancer is the proverbial "tip of the iceberg"; the rest of the body is also showing effects other than cancers.	

Of these 22 reviews, 19 are found in the PubMed database, the most widely used medical database in the world, so there is no excuse for not discussing these 19, but only two of them were discussed (see below). With regard to the eight different types of effects that I consider established non-thermal EMF effects, each of them were reviewed in multiple studies described in Table 3 as follows: Cancer 12 reviews [78,82,83-87,90,94,96-98]; Oxidative stress/free

radicals 8 reviews [79,80,84,90,92,-96]; Cellular DNA damage 10 review [4,79,80-82,84,90-92,94]; Apoptosis/cell death 3 reviews [79,82,91]; Lowered fertility 7 reviews [80,86,89,92-95]; Neurological/neuropsychiatric effects 4 reviews [80,87,88,94]; Calcium overload 4 reviews [4,91,92,96]; Endocrine effects 2 reviews [92,95]. It is not clear why so many important reviews on effects are not found in SCENIHR 2015 [73]. What is perhaps surprising, is that these reviews also document many other effects, none of which are clearly acknowledged by SCENIHR. These include stress responses; breakdown of the blood-brain barrier; fetal and neonatal effects; therapeutic effects; Alzheimer's disease; increased nitric oxide; endometriosis; changes in protein levels (proteomics) and changes in gene expression; NF-kappaB elevation; increased suicide; changes in protein kinase activity including ERK and p32MAPK; mechanisms associated with oxidative stress including elevated NADPH/NADH oxidase increased lipid peroxidation and decreased enzymatic antioxidant activity, increased ornithine decarboxylase; and autism. It can be seen from this that the SCENIHR 2015 document seems to be systematically avoiding considering substantial bodies of evidence regarding a very large range of repeatedly reported EMF effects, each of which challenges the SCENIHR position that no effects are established.

Three specific issues regarding apparent cancer causation by EMFs need to be discussed here. Five of these reviews each review a body of evidence showing that cancer rates are higher on the side of the head where people use their cell phones and cordless phones, the ipsilateral side, as opposed to the opposite side of the head, called the contralateral side [78,84,85,98,99]. These are very important studies because they are not likely to be affccted by how complete the reporting data are, or whether there are affects produced by chemicals, ionizing radiation or other EMFs; each of these factors should not be specific for the side of the head impacted. The contralateral side of the head serves as a control that can be compared with the ipsilateral side of the head. What is strange about the SCENIHR 2015 document, is that it avoids discussing all of these data presented in these five reviews. That is even true for [98] which is discussed very briefly in SCENIHR 2015. Only one body of evidence from [98] is discussed in SCENIHR 2015 but several others are not discussed, including the two bodies of evidence which each find statistically significant rises in ipsilateral cancer as compared with contralateral cancer. The ipsilateral findings produce very strong arguments that cell phones and/or cordless phones do cause brain cancer in humans. The best evidence suggests that both cell phones and cordless phones do cause cancer. What does SCENIHR 2015 [73] say about ipsilateral cancer? [73] states, on p. 74 that "ORs for glioma were higher in subjects who reported phone use mostly on the same side of the head (ipsilateral) as their tumour than for use on the opposite side (contralateral). For meningioma, ORs for temporal lobe tumours were slightly lower than for other locations, while a similar pattern as for glioma of higher ipsilateral ORs compared to contralateral ORs was seen." On p. 76, SCENIHR states that "Afterwards, in an attempt to quantify the relationship, Interphone and the Hardell studies were analysed in a meta-analytical approach (Hardell et al., 2013a), an OR of 1.71 (CI: 1.04-2.81) was found for temporal glioma among ipsilateral mobile phone users of 10+ years of use…." On p. 77, regarding a study designed to assess the reliability of self-reported cell phone usage in young brain cancer patients, a study **not** designed to assess ipsilateral effects in patients whose cancer cases may likely have been caused by cell phone usage, the SCENIHR 2015 document states "No clear patterns were seen when comparing ipsilateral and contralateral use." That is not surprising. It can be seen from this that 2 out of 3 studies that SCENIHR discussed argue that there is increased ipsilateral cancer and argue therefore that cell phones or cordless phones do cause cancer. Furthermore, they ignore large amounts of data, cited in [78,84,85,98,99] that provide further support for this view. When SCENIHR wishes to take the opposite position from that taken in these reviews, it is incumbent on SCENIHR to cite them, to discuss the data and opinion presented in those reviews and then and only then can they argue for their position. Having failed to do those things, SCENIHR loses credibility in any argument that they are doing what they can to protect our

health. The same is true for all of the other effects where they similarly fail to cite large numbers of obviously relevant reviews, each arguing for various health effects produced by EMF exposures.

Two other findings from these reviews are important in assessing EMF cancer causation. Refs. [85 and 99] each provide evidence that younger people are more susceptible to cancer causation by EMFs than are adults. SCENIHR takes the opposite view but cannot argue credibly without considering those who differ. The other finding found in [97] is that the epidemiological evidence on cancer causation by microwave frequency EMFs satisfies most of the Hill criteria. The Hill criteria are THE well-accepted criteria that allow one to distinguish chance associations from causal roles in epidemiology. Because epidemiology is the main basis for the arguments that SCENIHR makes against the conclusion that EMFs cause cancer, it is essential that SCENIHR carefully examine the Hill criteria. They fail to do so. They also ignored this study where these criteria were examined and where it was concluded that the majority of the Hill criteria argue that EMFs do cause cancer. This again, undercuts any claim that SCENIHR has carefully considered critically important findings with regard to EMF health effects.

There are several places in the SCENIHR 2015 document, where they state that no mechanisms have been identified by which claimed effects of EMFs can be produced. These can be found by searching the SCENIHR 2015 document using "mechanism" as the search term. However [4] clearly states that the VGCC activation mechanism triggered by EMF exposure can produce, via this mechanism, cellular DNA damaging effects, can produce therapeutic effects and can produce oxidative stress effects. It can be seen, therefore that SCENIHR has no problem making repeated claims that have been falsified by information that they presumably have examined. It also can be seen from this, that even in the cases where SCENIHR cites and very briefly discusses a review that disagrees with them, one can have no assurance that the information is used by SCENIHR in its assessment of health impacts. The causation of cellular DNA damage by EMFs acting via VGCC activation also has important implications with regard to cancer causation. Because almost all cases of cancer start with mutagenic DNA damage in the cell destined to become a cancer cell, this shows how EMFs can initiate the process of carcinogenesis.

It is clear that the SCENIHR 2015 document neither cited nor discussed 20 out of 22 reviews that have documented non-thermal effects of EMFs. In addition, the most important findings of the two that were cited in the document were ignored in the document as well. Therefore SCENIHR has systematically avoided discussing the most important implications of reviews that fell into the time frame they purport to have studied and disagreed with SCENIHR on the existence of important effects. The question can be raised, however, as to whether the SCENIHR has done a better job in its consideration of primary literature citations. To answer that question, I am using a database of important primary literature, regarding effects of cell phone EMFs that we are commonly exposed to.

<u>23 Genuine Cell Phone Studies, Each of Which Should Be Discussed in SCENIHR 2015, 20 of Which Are Not.</u>

Panagopoulos et al [100] showed that whereas 46 out of 48 studies on genuine cell phone radiation showed health-related effects, the majority of studies on simulated cell phones reported no statistically significant effects. They [100] interpreted the difference of results as having been caused by the lowered pulsation rate of the "simulated" cell phone exposures. While I am sure that is part of the explanation, there may be other possible differences that are discussed later in this chapter.

Of those 48 genuine cell phone studies, 23 fell into the time frame (Jan. 2009 through Dec. 2013) reviewed in SCENIHR, 2015. Because of the importance of cell phones and therefore cell phone radiation in our lives, I am using these 23 as a database of primary literature studies that should all be covered in the SCENIHR 2015 [73] document. How many of these 23 were reviewed and cited in SCENIHR 2015? The answer is four (17%) and I will discuss how each of them were discussed below. I have inserted 17 of these into Table 4 below, but six were left out, because they are easy to summarize. These six are all Drosophila studies, none of which were discussed in SCENIHR 2015 [73] but are easy to summarize. All six Drosophila studies were focused on lowered fertility following EMF exposure, with the majority of these focused on lowered female fertility. Four of the six found increased apoptosis following cell phone EMF exposaure and four of the six also found cellular DNA damage following exposure. These are important because of the similarities of each of these effects to effects found in mammals. They are also important because they found DNA damage in Drosophila eggs, whereas mammalian eggs no similar studies have been done because of the difficulty in doing so. Two of these six Drosophila studies, also identified a low intensity exposure window which produced much larger effects than did lower or higher intensities. These exposure windows make it difficult or impossible to predict EMF effects based on EMF intensities. However, the industry and industry friendly groups such as SCENIHR repeatedly make such false predictions.

In mammals there are many studies showing DNA damage in sperm following EMF exposure. This DNA damage in germ line cells is particularly importance because of the importance of mutations passed onto progeny. Table 4 summarizes the other 17 genuine cell phone radiation findings that that SCENIHR 2015 [73] should be discussing, 15 of which were not discussed or cited in SCENIHR 2015.

Table 4: Genuine Cell Phone Studies that Fell into the 2009 through 2013 SCENIHR 2015 period

Citation studied	Cell Phone Effects Reported	SCENIHR comments
1. Mailankot M, Kunnath AP, Jayalekshmi H, Koduru B, Valsalan R. 2009 Radio frequency electromagnetic radiation (RF-EMR) from GSM (0.9/1.8GHz) mobile phones induces oxidative stress and reduces sperm motility in rats. Clinics (Sao Paulo) 64:561-565.	The present study was designed to evaluate the effects of RF-EMR from mobile phones on free radical metabolism and sperm quality. MATERIALS AND METHODS: Male albino Wistar rats (10-12 weeks old) were exposed to RF-EMR from an active GSM (0.9/1.8 GHz) mobile phone for 1 hour continuously per day for 28 days. Controls were exposed to a mobile phone without a battery for the same period. The phone was kept in a cage with a wooden bottom in order to address concerns that the effects of exposure to the phone could be due to heat emitted by the phone rather than to RF-EMR alone. Animals were sacrificed 24 hours after the last exposure and tissues of interest were harvested. RESULTS: One hour of exposure to the phone did not significantly change facial temperature in either group of rats. No significant difference was observed in total sperm count between controls and RF-EMR exposed groups. However, rats exposed to RF-EMR exhibited a significantly reduced percentage of motile sperm. Moreover, RF-EMR exposure resulted in a significant increase in lipid peroxidation and low GSH content in the testis and epididymis.	Listed under literature identified but not cited. SCENIHR knew about this paper but decided not to discuss it.

	CONCLUSION: Given the results of the present study, we speculate that RF-EMR from mobile phones negatively affects semen quality and may impair male fertility.	
2. Gul A, Celebi H, Uğraş S. 2009 The effects of microwave emitted by cellular phones on ovarian follicles in rats. Arch Gynecol Obstet 280:729-733. doi: 10.1007/s00404-009-0972-9.	The aim of this study was to investigate whether there were any toxic effects of microwaves of cellular phones on ovaries in rats. METHODS: In this study, 82 female pups of rats, aged 21 days (43 in the study group and 39 in the control group) were used. Pregnant rats in the study group were exposed to mobile phones that were placed beneath the polypropylene cages during the whole period of pregnancy. The cage was free from all kinds of materials, which could affect electromagnetic fields. A mobile phone in a standby position for 11 h and 45 min was turned on to speech position for 15 min every 12 h and the battery was charged continuously. On the 21st day after the delivery, the female rat pups were killed and the right ovaries were removed. The volumes of the ovaries were measured and the number of follicles in every tenth section was counted. RESULTS: The analysis revealed that in the study group, the number of follicles was lower than that in the control group. The decreased number of follicles in pups exposed to mobile phone microwaves suggest that intrauterine exposure has toxic effects on ovaries. CONCLUSION: We suggest that the microwaves of mobile phones might decrease the number of follicles in rats by several known and, no doubt, countless unknown mechanisms.	Not cited and not discussed by SCENIHR.
3. Imge EB, Kiliçoğlu B, Devrim E, Cetin R, Durak I. 2010 Effects of mobile phone use on brain tissue from the rat and a possible protective role of vitamin C - a preliminary study. Int J Radiat Biol 86:1044-1049. doi: 10.3109/09553002.2010.501838.	To evaluate effects of mobile phone use on brain tissue and a possible protective role of vitamin C. MATERIALS AND METHODS: Forty female rats were divided into four groups randomly (Control, mobile phone, mobile phone plus vitamin C and, vitamin C alone). The mobile phone group was exposed to a mobile phone signal (900 MHz), the mobile phone plus vitamin C group was exposed to a mobile phone signal (900 MHz) and treated with vitamin C administered orally (per os). The vitamin C group was also treated with vitamin C per os for four weeks. Then, the animals were sacrificed and brain tissues were dissected to be used in the analyses of malondialdehyde (MDA), antioxidant potential (AOP), superoxide dismutase, catalase (CAT), glutathione peroxidase (GSH-Px), xanthine oxidase, adenosine deaminase (ADA) and 5'nucleotidase (5'-NT). RESULTS: Mobile phone use caused an inhibition in 5'-NT and CAT activities as compared to the control group. GSH-Px activity and the MDA level were also found to be reduced in the mobile phone group but not significantly. Vitamin C caused a significant increase in the activity of GSH-Px and non-significant increase in the activities of 5'-NT,	Not cited and not discussed by SCENIHR.

	ADA and CAT enzymes. CONCLUSION: Our results suggest that vitamin C may play a protective role against detrimental effects of mobile phone radiation in brain tissue.	
4. Sharma VP, Kumar NR. 2010 Changes in honeybee behavior under the influence of cell phone radiation. Curr Science 98: 1376-1378.	Honeybee behaviour and biology has been affected by electrosmog since these insects have magnetite in their bodies which helps them in navigation. There are reports of sudden disappearance of bee populations from honeybee colonies. The reason is still not clear. We have compared the performance of honeybees in cellphone radiation exposed and unexposed colonies. A significant ($p < 0.05$) decline in colony strength and in the egg laying rate of the queen was observed. The behaviour of exposed foragers was negatively influenced by the exposure, there was neither honey nor pollen in the colony at the end of the experiment.	Not cited and not discussed by SCENIHR.
5. Vecchio F, Babiloni C, Ferreri F, Buffo P, Cibelli G, Curcio G, van Dijkman S, Melgari JM, Giambattistelli F, Rossini PM. 2010 Mobile phone emission modulates inter-hemispheric functional coupling of EEG alpha rhythms in elderly compared to young subjects. Clin Neurophysiol 121:163-171. doi: 10.1016/j.clinph.2009.11.002.	It has been reported that GSM electromagnetic fields (GSM-EMFs) of mobile phones modulate--after a prolonged exposure--inter-hemispheric synchronization of temporal and frontal resting electroencephalographic (EEG) rhythms in normal young subjects [Vecchio et al., 2007]. Here we tested the hypothesis that this effect can vary on physiological aging as a sign of changes in the functional organization of cortical neural synchronization. METHODS: Eyes-closed resting EEG data were recorded in 16 healthy elderly subjects and 5 young subjects in the two conditions of the previous reference study. The GSM device was turned on (45 min) in one condition and was turned off (45 min) in the other condition. Spectral coherence evaluated the inter-hemispheric synchronization of EEG rhythms at the following bands: delta (about 2-4 Hz), theta (about 4-6 Hz), alpha 1 (about 6-8 Hz), alpha 2 (about 8-10 Hz), and alpha 3 (about 10-12 Hz). The aging effects were investigated comparing the inter-hemispheric EEG coherence in the elderly subjects vs. a young group formed by 15 young subjects (10 young subjects of the reference study; Vecchio et al., 2007). RESULTS: Compared with the young subjects, the elderly subjects showed a statistically significant ($p<0.001$) increment of the inter-hemispheric coherence of frontal and temporal alpha rhythms (about 8-12 Hz) during the GSM condition. CONCLUSIONS: These results suggest that GSM-EMFs of a mobile phone affect inter-hemispheric synchronization of the dominant (alpha) EEG rhythms as a function of the physiological aging. SIGNIFICANCE: This study provides further evidence that physiological aging is related to changes in the functional organization of cortical neural synchronization.	Was cited and discussed – see text.
6. Kumar NR,	The present study was carried out to find the effect of cell	Not cited

Sangwan S, Badotra P. 2011 Exposure to cell phone radiations produces biochemical changes in worker honey bees. Toxicol Int. 2011 Jan;18(1):70-2. doi: 10.4103/0971-6580.75869.	phone radiations on various biomolecules in the adult workers of Apis mellifera L. The results of the treated adults were analyzed and compared with the control. Radiation from the cell phone influences honey bees' behavior and physiology. There was reduced motor activity of the worker bees on the comb initially, followed by en masse migration and movement toward "talk mode" cell phone. The initial quiet period was characterized by rise in concentration of biomolecules including proteins, carbohydrates and lipids, perhaps due to stimulation of body mechanism to fight the stressful condition created by the radiations. At later stages of exposure, there was a slight decline in the concentration of biomolecules probably because the body had adapted to the stimulus.	and not discussed by SCENIHR.
7. Favre D. 2011 Mobile phone-induced honeybee worker piping. Apidologie 42:270-279.	Electromagnetic waves originating from mobile phones were tested for potential effects on honeybee behavior. Mobile phone handsets were placed in the close vicinity of honeybees. The sound made by the bees was recorded and analyzed. The audiograms and spectrograms revealed that active mobile phone handsets have a dramatic impact on the behavior of the bees, namely by inducing the worker piping signal. In natural conditions, worker piping either announces the swarming process of the bee colony or is a signal of a disturbed bee colony.	Not cited and not discussed by SCENIHR.
8. Cammaerts MC, Debeir O, Cammaerts R. 2011. Changes in Paramecium caudatum (protozoa) near a switched-on GSM telephone. Electromagn Biol Med. 2011 Mar;30(1):57-66. doi: 10.3109/15368378.2011.566778.	The protozoan Paramecium caudatum was examined under normal conditions versus aside a switched-on GSM telephone (900 MHz; 2 Watts). Exposed individuals moved more slowly and more sinuously than usual. Their physiology was affected: they became broader, their cytopharynx appeared broader, their pulse vesicles had difficult in expelling their content outside the cell, their cilia less efficiently moved, and trichocysts became more visible. All these effects might result from some bad functioning or damage of the cellular membrane. The first target of communication electromagnetic waves might thus be the cellular membrane.	Listed under literature identified but not cited. SCENIHR knew about this paper but decided not to discuss it.
9. Çam ST, Seyhan N. 2012 Single-strand DNA breaks in human hair root cells exposed to mobile phone radiation. Int J Radiat Biol 88:420-424. doi: 10.3109/09553002.2012.666005.	To analyze the short-term effects of radiofrequency radiation (RFR) exposure on genomic deoxyribonucleic acid (DNA) of human hair root cells. SUBJECTS AND METHODS: Hair samples were collected from eight healthy human subjects immediately before and after using a 900-MHz GSM (Global System for Mobile Communications) mobile phone for 15 and 30 min. Single-strand DNA breaks of hair root cells from the samples were determined using the 'comet assay'. RESULTS: The data showed that talking on a mobile phone for 15 or 30 min significantly increased ($p < 0.05$) single-strand DNA breaks in cells of hair roots close to the phone. Comparing the 15-min and 30-min data using the paired t-	Not cited and not discussed by SCENIHR.

	test also showed that significantly more damages resulted after 30 min than after 15 min of phone use. CONCLUSIONS: A short-term exposure (15 and 30 min) to RFR (900-MHz) from a mobile phone caused a significant increase in DNA single-strand breaks in human hair root cells located around the ear which is used for the phone calls.	
10. Vecchio F, Tombini M, Buffo P, Assenza G, Pellegrino G, Benvenga A, Babiloni C, Rossini PM. 2012 Mobile phone emission increases inter-hemispheric functional coupling of electroencephalographic α rhythms in epileptic patients. Int J Psychophysiol 84:164-171. doi: 10.1016/j.ijpsycho.2012.02.002.	It has been reported that GSM electromagnetic fields (GSM-EMFs) of mobile phones modulate - after a prolonged exposure - inter-hemispheric synchronization of temporal and frontal resting electroencephalographic (EEG) rhythms in normal young and elderly subjects (Vecchio et al., 2007, 2010). Here we tested the hypothesis that this can be even more evident in epileptic patients, who typically suffer from abnormal mechanisms governing synchronization of rhythmic firing of cortical neurons. Eyes-closed resting EEG data were recorded in ten patients affected by focal epilepsy in real and sham exposure conditions. These data were compared with those obtained from 15 age-matched normal subjects of the previous reference studies. The GSM device was turned on (45 min) in the "GSM" condition and was turned off (45 min) in the other condition ("sham"). The mobile phone was always positioned on the left side in both patients and control subjects. Spectral coherence evaluated the inter-hemispheric synchronization of EEG rhythms at the following frequency bands: delta (about 2-4 Hz), theta (about 4-6 Hz), alpha1 (about 6-8 Hz), alpha2 (about 8-10 Hz), and alpha3 (about 10-12 Hz). The effects on the patients were investigated comparing the inter-hemispheric EEG coherence in the epileptic patients with the control group of subjects evaluated in the previous reference studies. Compared with the control subjects, epileptic patients showed a statistically significant higher inter-hemispheric coherence of temporal and frontal alpha rhythms (about 8-12 Hz) in the GSM than "Sham" condition. These results suggest that GSM-EMFs of mobile phone may affect inter-hemispheric synchronization of the dominant (alpha) EEG rhythms in epileptic patients. If confirmed by future studies on a larger group of epilepsy patients, the modulation of the inter-hemispheric alpha coherence due to the GSM-EMFs could have clinical implications and be related to changes in cognitive-motor function.	Was cited and discussed – see text.
11. Al-Damegh MA. 2012 Rat testicular impairment induced by electromagnetic radiation from a conventional cellular	OBJECTIVE: The aim of this study was to investigate the possible effects of electromagnetic radiation from conventional cellular phone use on the oxidant and antioxidant status in rat blood and testicular tissue and determine the possible protective role of vitamins C and E in preventing the detrimental effects of electromagnetic	Listed under literature identified but not cited.

telephone and the protective effects of the antioxidants vitamins C and E. Clinics 67:785-792	radiation on the testes. MATERIALS AND METHODS: The treatment groups were exposed to an electromagnetic field, electromagnetic field plus vitamin C (40 mg/kg/day) or electromagnetic field plus vitamin E (2.7 mg/kg/day). All groups were exposed to the same electromagnetic frequency for 15, 30, and 60 min daily for two weeks. RESULTS: There was a significant increase in the diameter of the seminiferous tubules with a disorganized seminiferous tubule sperm cycle interruption in the electromagnetism-exposed group. The serum and testicular tissue conjugated diene, lipid hydroperoxide, and catalase activities increased 3-fold, whereas the total serum and testicular tissue glutathione and glutathione peroxidase levels decreased 3-5 fold in the electromagnetism-exposed animals. CONCLUSION: Our results indicate that the adverse effect of the generated electromagnetic frequency had a negative impact on testicular architecture and enzymatic activity. This finding also indicated the possible role of vitamins C and E in mitigating the oxidative stress imposed on the testes and restoring normality to the testes.	SCENIHR knew about this paper but decided not to discuss it.
12. Aldad TS, Gan G, Gao X-B, Taylor HS. 2012 Fetal radiofrequency radiation from 800-1900 MH-rated cellular telephone affects neurodevelopment and behavior in mice. Scientific Rep 2, article 312.	Neurobehavioral disorders are increasingly prevalent in children, however their etiology is not well understood. An association between prenatal cellular telephone use and hyperactivity in children has been postulated, yet the direct effects of radiofrequency radiation exposure on neurodevelopment remain unknown. Here we used a mouse model to demonstrate that in-utero radiofrequency exposure from cellular telephones does affect adult behavior. Mice exposed in-utero were hyperactive and had impaired memory as determined using the object recognition, light/dark box and step-down assays. Whole cell patch clamp recordings of miniature excitatory postsynaptic currents (mEPSCs) revealed that these behavioral changes were due to altered neuronal developmental programming. Exposed mice had dose-responsive impaired glutamatergic synaptic transmission onto layer V pyramidal neurons of the prefrontal cortex. We present the first experimental evidence of neuropathology due to in-utero cellular telephone radiation. Further experiments are needed in humans or non-human primates to determine the risk of exposure during pregnancy.	Was cited and discussed, see text.
13. Liu C, Gao P, Xu SC, Wang Y, Chen CH, He MD, Yu ZP, Zhang L, Zhou Z. 2013 Mobile phone radiation induces mode-dependent	A mouse spermatocyte-derived GC-2 cell line was exposed to a commercial mobile phone handset once every 20 min in standby, listen, dialed or dialing modes for 24 h. DNA damage was determined using an alkaline comet assay. RESULTS: The levels of DNA damage were significantly increased following exposure to MPR in the listen, dialed and dialing modes. Moreover, there	Not cited and not discussed by SCENIHR.

DNA damage in a mouse spermatocyte-derived cell line: a protective role of melatonin. Int J Radiat Biol. 2013. 89: 993-1001. doi: 10.3109/09553002.2013.811309.	were significantly higher increases in the dialed and dialing modes than in the listen mode. Interestingly, these results were consistent with the radiation intensities of these modes. However, the DNA damage effects of MPR in the dialing mode were efficiently attenuated by melatonin pretreatment. CONCLUSIONS: These results regarding mode-dependent DNA damage have important implications for the safety of inappropriate mobile phone use by males of reproductive age and also suggest a simple preventive measure: Keeping mobile phones as far away from our body as possible, not only during conversations but during 'dialed' and 'dialing' operation modes. Since the 'dialed' mode is actually part of the standby mode, mobile phones should be kept at a safe distance from our body even during standby operation. Furthermore, the protective role of melatonin suggests that it may be a promising pharmacological candidate for preventing mobile phone use-related reproductive impairments.	
14. Koca O, Gökçe AM, Öztürk MI, Ercan F, Yurdakul N, Karaman MI. 2013 Effects of intensive cell phone (Philips Genic 900) use on the rat kidney tissue. Urol J. 2013 Spring;10:886-891.	To investigate effects of electromagnetic radiation (EMR) emitted by cell phones on the rat kidney tissue. MATERIALS AND METHODS: Twenty-one male Albino rats were divided into 3 groups, each comprising 7 rats. Group 1 was exposed to a cell phone in speech mode for 8 hours/day for 20 days and their kidneys were removed. Group 2 was exposed to EMR for 20 days and then their kidneys were removed after an interval of 20 days. Cell phone used in the present study was Philips Genie 900, which has the highest specific absorption rate on the market. RESULTS: Light microscopic examination of the kidney tissues obtained from the first group of rats revealed glomerular damage, dilatation of Bowman's capsule, formation of large spaces between the tubules, tubular damage, perivascular edema, and inflammatory cell infiltration. The mean severity score was 4.64 ± 1.7 in group 1, 4.50 ± 0.8 in group 2, and 0 in group 3. While there was no significant difference between group 1 and group 2 ($P > .05$), the mean severity scores of groups 1 and 2 were significantly higher than that of the control group ($P = .001$ for each). CONCLUSION: Considering the damage in rat kidney tissue caused by EMR-emitting cell phones, high-risk individuals should take protective measures.	Not cited and not discussed by SCENIHR.
15. Meo SA, Al Rubeaan K. 2013 Effects of exposure to electromagnetic field radiation (EMFR) generated by activated mobile	Extensive use of mobile phones has been accompanied by a common public debate about possible adverse effects on human health. No study has been published so far to establish any association between the fastest growing innovation of mobile phone and fasting blood glucose. The aim was to determine the effects of exposure to electromagnetic field radiation generated by mobile	Not cited and not discussed by SCENIHR.

phones on fasting blood glucose. Int J Occup Med Environ Health 26:235-241. doi: 10.2478/s13382-013-0107-1.	phones on fasting blood glucose in Wistar Albino rats. MATERIALS AND METHODS: 40 Male Albino rats (Wistar Strain) were divided into 5 equally numerous groups. Group A served as the control one, group B received mobile phone radiation for less than 15 min/day, group C: 15-30 min/day, group D: 31-45 min/day, and group E: 46-60 min/day for a total period of 3 months. Fasting blood glucose was determined by using Spectrophotometer and serum insulin by Enzyme-linked Immunosorbent Assay (ELISA). The Homeostatic Model (HOMA-B) was applied for the assessment of β-cell function and (HOMA-IR) for resistance to insulin. RESULTS: Wister Albino rats exposed to mobile phone radiation for longer than 15 min a day for a total period of 3 months had significantly higher fasting blood glucose ($p < 0.015$) and serum insulin ($p < 0.01$) compared to the control group. HOMA-IR for insulin resistance was significantly increased ($p < 0.003$) in the groups that were exposed for 15-30 and 46-60 min/day compared to the control rats. CONCLUSION:The results of the present study show an association between long-term exposure to activated mobile phones and increase in fasting blood glucose and serum insulin in Albino rats.	
16. Tsybulin O, Sidorik E, Brieieva O, Buchynska L, Kyrylenko S, Henshel D, Yakymenko I. 2013 GSM 900 MHz cellular phone radiation can either stimulate or depress early embryogenesis in Japanese quails depending on the duration of exposure. Int J Radiat Biol 89:756-763. doi: 10.3109/09553002.2013.791408.	Our study was designed to assess the effects of low intensity radiation of a GSM (Global System for Mobile communication) 900 MHz cellular phone on early embryogenesis in dependence on the duration of exposure. MATERIALS AND METHODS: Embryos of Japanese Quails were exposed in ovo to GSM 900 MHz cellular phone radiation during initial 38 h of brooding or alternatively during 158 h (120 h before brooding plus initial 38 h of brooding) discontinuously with 48 sec ON (average power density 0.25 μW/cm(2), specific absorption rate 3 μW/kg) followed by 12 sec OFF intervals. A number of differentiated somites were assessed microscopically. Possible DNA damage evoked by irradiation was assessed by an alkaline comet assay. RESULTS: Exposure to radiation from a GSM 900 MHz cellular phone led to a significantly altered number of differentiated somites. In embryos irradiated during 38 h the number of differentiated somites increased ($p < 0.001$), while in embryos irradiated during 158 h this number decreased ($p < 0.05$). The lower duration of exposure led to a significant ($p < 0.001$) decrease in a level of DNA strand breaks in cells of 38-h embryos, while the higher duration of exposure resulted in a significant ($p < 0.001$) increase in DNA damage as compared to the control. CONCLUSION: Effects of GSM 900 MHz cellular phone radiation on early embryogenesis can be either stimulating or deleterious depending on the duration of exposure.	Listed under literature identified but not cited. SCENIHR knew about this paper but decided not to discuss it.

17. Luo Q, Jiang Y, Jin M, Xu J, Huang HF. 2013 Proteomic analysis on the alteration of protein expression in the early-stage placental villous tissue of electromagnetic fields associated with cell phone exposure. Reprod Sci 20:1055-1061. doi: 10.1177/1933719112473660.	To explore the possible adverse effects and search for cell phone electromagnetic field (EMF)-responsive proteins in human early reproduction, a proteomics approach was employed to investigate the changes in protein expression profile induced by cell phone EMF in human chorionic tissues of early pregnancy in vivo. METHODS: Volunteer women about 50 days pregnant were exposed to EMF at the average absorption rate of 1.6 to 8.8 W/kg for 1 hour with the irradiation device placed 10 cm away from the umbilicus at the midline of the abdomen. The changes in protein profile were examined using 2-dimensional electrophoresis (2-DE). RESULTS: Up to 15 spots have yielded significant change at least 2- to 2.5-folds up or down compared to sham-exposed group. Twelve proteins were identified-procollagen-proline, eukaryotic translation elongation factor 1 delta, chain D crystal structure of human vitamin D-binding protein, thioredoxin-like 3, capping protein, isocitrate dehydrogenase 3 alpha, calumenin, Catechol-O-methyltransferase protein, proteinase inhibitor 6 (PI-6; SerpinB6) protein, 3,2-trans-enoyl-CoA isomerase protein, chain B human erythrocyte 2,3-bisphosphoglycerate mutase, and nucleoprotein. CONCLUSION: Cell phone EMF might alter the protein profile of chorionic tissue of early pregnancy, during the most sensitive stage of the embryos. The exposure to EMF may cause adverse effects on cell proliferation and development of nervous system in early embryos. Furthermore, 2-DE coupled with mass spectrometry is a promising approach to elucidate the effects and search for new biomarkers for environmental toxic effects.	Listed under literature identified but not cited. SCENIHR knew about this paper but decided not to discuss it.

If you look through the studies described in Table 4, you will see multiple studies in oxidative stress/free radical damage, on changes in tissue structure (sometimes called remodeling), on cellular DNA damage, on male fertility (and also one on female fertility), on behavioral changes and on neurological changes. There is also one study on insulin/type 2 diabetes (hormonal effect). It follows from this that five of the effects that were extensively documented in large numbers of reviews (Chapter 1) are further demonstrated, as being caused be cell phone radiation, in these studies. In addition the tissue remodeling and proteomic changes discussed in Chapter 3 are also further demonstrated here. One question that needs to be raised with regard to SCENIHR is why so many clearly important primary literature studies of cell phone radiation (perhaps the most important source of human microwave irradiation) are not discussed in SCENIHR 2015. I will discuss certain particular articles that I think are particularly important for *particular reasons*. Subsequently, I will discuss the three articles that SCENIHR does discuss.

One of the more interesting studies not discussed by SCENIHR, is #11 in Table 4. This was published by a woman scientist in Saudi Arabia. What it shows is that 15, 30 or 60 minutes per day of cell phone radiation disrupts the structure of the rat testis and also produces high levels of oxidative stress as shown by measuring 5 different markers of oxidative stress. Such studies have been done for several decades, with oxidative stress having been shown in many different organs

following EMF exposures. What is particularly important in this study is that high levels of two different antioxidants, vitamin C and vitamin E, were each shown to produce substantial protection of the testis structure from the EMF effects while partially normalizing the oxidative stress elevation. What this clearly shows is that the oxidative stress causes the testis tissue disruption. So we don't just have evidence for two effects, testis disruption and oxidative stress but we have strong evidence that one causes the other. It is exactly these connections that are essential for the progression of the science!

13 is another study not discussed by SCENIHR which is particularly important. It looks at cell phone radiation DNA damage produced in a mouse spermatocyte-derived cell line. What it finds is that DNA damage is particularly high when the cell phone is in the dialed or dialing mode, as opposed to a listen mode. They also state that the radiation levels in the three modes correspond, at least roughly, to the DNA damage effects seen. They also show that pretreatment with melatonin (which is known to have antioxidant effects) greatly lowers the DNA damage produced by the cell phone EMF exposures. This is similar to the study discussed immediately above because it again shows that one effect, DNA damage is produced by another effect, namely oxidative stress/free radical elevation. You will recall that as discussed in Chapter 2, cellular DNA damage following EMF exposure is produced by the attacks by on the DNA by peroxynitrite derived free radicals. This study provides confirmation for that mechanism.

#14 is another study not discussed by SCENIHR which is also particularly important. It looks at the impact of cell phone radiation on kidney structure of rats, using six different measures of kidney structure. There were two groups of rats that were exposed to cell phone radiation which were both compared with each other and with normal unexposed control rats. The two exposed groups differed from each other in one group the kidney structure was assessed immediately following the 20 day exposure period. The second exposure group was also exposed for 20 days but was given 20 days subsequently with no exposure to see if the kidney structure spontaneously recovered. There was no recovery seen in the second group, showing that the kidney damage was effectively irreversible. In Chapter 3, several tissue remodeling type effects produced by EMF exposure appeared to be irreversible. Study #14 may add an additional such effect to that list.

#15 is another study not discussed by SCENIHR which is also particularly important. In this study control (unexposed) rats were compared with rats exposed to cell phone radiation for: less than 15 minutes per day, 15 to 30 minutes per day, 31 to 45 minutes per day or 45 to 60 minutes per day. Rats exposed to over 15 minutes per day of cell phone radiation showed type 2 diabetes onset-like effects, with higher fasting glucose levels and higher serum insulin levels. This appears to be, therefore a study showing important hormone dysfunction. It should be noted that the same research group has found similar changes in people living near cell phone towers [101]. Consequently, this is still another situation where findings in experimental animal studies appear to be directly applicable to humans.

Of the papers that were discussed, it is my opinion that the Aldad et al paper (#12, Table 4) is perhaps the most important. The paper starts out discussing the very large increase in ADHD that we have had in recent years, an increase which suggests that one or more environmental changes must be involved. This paper is from a distinguished laboratory, Hugh Taylor's laboratory at Yale, and was published in one of the highly respected Nature journals and the paper, at this writing has been cited 89 times, showing a high level of scientific interest in it. The paper showed that prenatal exposure of pregnant mice to cell phone radiation produced three highly statistically significant changes in the adult mice. These were a decrease in measured memory function, increase in hyperactivity and increase in anxiety. They also showed that there was a dose dependent decrease in an important neurological parameter, the frequency of miniature

excitatory postsynaptic currents, allowing the authors to conclude "that these behavioral changes were due to altered neuronal developmental programming." SCENIHR states the following about this study: "Neurodevelopment from a functional point of view was studied by Aldad et al. (2012) who exposed mice in utero and investigated them as adults for certain behavioural traits and electrophysiological characteristics. Exposure is poorly described but is reported to be to a muted telephone (900-1800 MHz) during the entire gestation period. After blinded investigations, the authors concluded that exposed animals displayed hyperactivity, memory deficiencies, decreased anxiety, and impaired glutamatergic transmission. Although the study employs relevant biological end-points, it cannot be used for any conclusions regarding pre-natal mobile phone exposure and functional development of the brain." SCENIHR fails to tell us why they claim the exposures were poorly described nor do they provide any reasoning on why "it cannot be used for any conclusions regarding pre-natal mobile phone exposure and development of the brain." It is hard to see how such results could be found unless there are substantial effects of pre-natal exposure. Because the study used genuine cell phone radiation, the effects seen are disturbing. It would be reasonable for SCENIHR to call for more studies of this type to see if they can be replicated. Having said that there have been five subsequent studies that I found where pre-natal mouse exposure to non-thermal EMFs produced substantial and somewhat similar adult neurological effects and or behavioral effects [102-106]. These five included exposures to Wi-Fi and to DECT (cordless phone) EMFs. These studies provide, then, strong evidence that prenatal exposures to EMFs can in animals, produce ADHD-like effects even into adulthood. They also show that during the late prenatal period, the developing brain is particularly sensitive to the effects of microwave frequency EMFs and raise the issue of how long after birth such sensitivity is also seen. It is common for SCENIHR and other industry friendly organizations to treat experimental studies as if they had the weaknesses of epidemiological studies. They don't because they can and do in these cases, directly demonstrate causation. In epidemiology, causation can be inferred but not directly demonstrated. What about epidemiological evidence with regard to EMF causation of ADHD? There are two such studies that each provide evidence for an association between prenatal cell phone exposures and development of ADHD [107,108]. SCENIHR knew about both of these, since it discusses one of them which is, in turn, based on the earlier one. Why then did SCENIHR not make the connection of those two studies with at Aldad study (#12 in Table 4)? That is of course an important failure, given that the Aldad study greatly strengthens the argument for EMF causation of ADHD.

Given the current situation where there are a total of 6 studies showing that pre-natal EMF exposures, including cell phone, Wi-Fi and cordless phone EMFs can cause ADHD-like effects in mice and two human epidemiological studies suggesting a similar mechanism in humans and the parallel between the huge increase in ADHD in humans and the huge increase in microwave frequency EMF exposures, is there any other type of evidence that supports a causal role for EMFs? It turns out there is. EMFs act primarily via VGCC activation (Chapter 20. Genetic polymorphism studies show that elevated VGCC activity has a role in causing ADHD [109], acting to a substantial extent prenatally. This is the way real science works. It is not the way that SCENIHR works.

The Vecchio et al 2010 paper (#5, Table 4) was discussed in SCENIHR 2015 as follows: "A study by Vecchio et al. (2010) analysed age-dependent EMF effects on alpha activity in waking EEGs in 16 older (47-84 years) and 15 younger subjects (20-37 years). Participants were exposed to a GSM signal (902.40 MHz, modulation frequencies: 8.33 and 217 Hz) for 45 min with a maximum SAR of 0.5 W/kg emitted by a commercially available mobile phone which was set using a test card in a double-blind cross-over paradigm. EEG was recorded for 5 min prior to and following exposure at 19 electrodes. The authors found an increased inter-hemispheric coherence of frontal alpha EEG activity after GSM exposure which was statistically significant for the

elderly subjects but not for the young ones. This might point to a GSM-EMF related inter-hemispheric synchronization of alpha rhythms as a function of physiological aging." Another related study (#by the same research group was also cited and discussed SCENIHR 2015 [73] as follows: "Vecchio et al. (2012a) used the same study design to investigate an exposure effect in patients with epilepsy. Data from 10 patients were compared to results from 15 age- matched controls from previous studies. Patients showed a statistically significant higher inter-hemispheric coherence of temporal and frontal alpha-rhythms under exposure as compared to control subjects. According to the authors, these results might indicate a GSM exposure effect on inter-hemispheric synchronization of the dominant (alpha) EEG rhythms in epileptic patients."

What do I have to say about the two Vecchio studies? They are both based on an earlier 2007 study which showed that increased EEG coherence between the two hemispheres of the brain was produced by genuine cell phone EMF exposure. What the 2010 study (#5 in Table 4) shows is that the EMF-induced increased coherence is much higher in older adults than it is in younger adults. What the 2012 study (#10 in Table 4) shows is that the EMF-induced coherence seen in people with epilepsy is also much higher than in people without epilepsy. These three studies then provide large amounts of evidence for a neurological effect of cell phone radiation that is influenced by two variables, age and epilepsy. These findings should be looked at the context of the 23 reviews, listed in Chapter 1, each showing that EMFs produce both neurological and/or neuropsychiatric impacts on the brain. Here we have still another neurological effect, one that is influenced by age and epileptic condition. There are, then three important findings in these studies. One is that while we have had quite lot of evidence showing that children are more sensitive to EMF effects than adults, this is the first clear finding, to my knowledge, that suggests that older people may be more sensitive to a neurological effect. The linkage to epilepsy should not be surprising as some EHS people are reported to have seizures triggered by very low intensity EMF exposures. Finally, the communication between the two hemispheres of the brain has been known for over half a century to be through what is called the corpus callosum, a structure deeply buried in the middle of the brain, linking the two hemispheres. These effects increasing the coherence between the two hemispheres are probably produced, therefore, through the impact of the EMFs on the corpus callosum. That implies, in turn, that the EMFs act much more deeply in the brain than the industry claims is possible.

The problem with SCENIHR is that it lives in a totally fictional universe where none of those EMF effect reviews exist or at least none of them have any relevance to the SCENIHR world. Neither of the two Vecchio et al studies, discussed in the previous two paragraphs, are used by SCENIHR [73] to make any conclusions about EMF effects or lack thereof – they are only cited in the quote that I gave you. We know that because because the citations are by author's last name and are, therefore easily searchable. Similarly, the Aldad et al (#12) study discussed two paragraphs further up, was also never cited except in the quotation given. So none of these three papers are used to assess any effects of EMFs or lack of effects. The same thing is true of the two reviews from Table 3 that were cited and discussed in [73]. They also were only cited in the quoted section and are never used to assess EMF effects or the mechanism of EMF action. As previously noted, there are several statements in SCENIHR 2015 [73] regarding lack of any available mechanism to explain claimed EMF effects, something that is directly contradicted by one of those cited and discussed reviews [4]. The consequence of all of that is that we have two very large and very consequential bodies of literature, the reviews on EMF effects and the literature on genuine cell phone radiation effects, which are entirely missing from any SCENIHR 2015 [73] conclusion.

<u>Is There Another Systematic Effort by Industry to Corrupt the Literature that Has Been Followed to Some Extent by SCENIHR?</u>

The important roles of pulsation, window effects, frequency, cell type and polarization in determining biological activity of EMFs were discussed in Chapter 1, where it was noted that SCENIHR fails to pay attention to any of these roles. That failure shows up in many places in the document. In Tables 5, 6, 7, 8, 9, 10, 11, 12, 13 and 14 of SCENIHR 2015 [73], the discussion of each table centers on how many studies found apparent effects and how many did not. But these numbers are irrelevant to the issue of whether there are effects or not. In fact one can argue that the industry, knowing about the roles of each of these factors, could fund any number of studies designed to give apparent negative results just by manipulating these factors to minimize responses and by only studying tiny numbers of individuals to produce low statistical power. This approach closely describes the approach used in seven studies of what were claimed to be genuine Wi-Fi studies that were described by Foster and Moulder [110] in Table 4 of their paper. Those seven studies were shown [11] to all have used an EMF that was not genuine Wi-Fi, despite claims to the contrary. They each used one of two types of reverberation exposure chamber for their rodent exposures, with each type of chamber greatly lowering the polarization of the EMFs [11] and also generating some level of destructive interference from variable path lengths produced by the reverberations. Each of these changes from genuine Wi- Fi is predicted to lower effects. Foster and Moulder [110] concluded that there was no effect in any of these studies. However tiny numbers of rodents were studied, between 3 and 15 in each class, such that these studies have very low statistical power to conclude anything substantive.

It is not possible to conclude no effect even with large studies. At most one can claim that there is no statistically significant evidence of an effect. With tiny numbers, a claim of no effect is complete nonsense. This problem with "no effect" claims is documented in a section of Rothman et al., Modern Epidemiology, 3rd Edition, a highly respected source of information, cited over 19,000 times according to the Google Scholar database. It states (p. 151, bottom) that: "A common misinterpretation of significance tests is that there no difference between two observed groups because the null test is not statistically significant, in that P is greater that the cutoff for declaring statistical significance (again, usually 0.05). This interpretation confuses a descriptive issue (whether two observed groups differ) with an inference about the superpopulation. The significance test refers only to the superpopulation, not the observed groups. To say that the difference is not statistically significant means only that one cannot reject the null hypothesis that the superpopulation groups are the same; it does not imply that the two groups are the same." All such claims of "no effect" are, therefore flawed. When they are made regarding very small studies with very low statistical power, they are particularly deeply flawed.

Were these seven studies designed to fail? I don't think we can say for certain but they certainly *look* as if they may have been. They also raise the serious question about whether the industry may be corrupting the science, by using their knowledge of the roles of pulsation, window effects, frequency, cell type and polarization.

The SCENIHR 2015 document has 127 places in the 221 pages of text where the term "no effect" was found (these can be easily found by searching the document using "no effect" for the search terms (that also picks up "no effects" statements. The first two of these 127 places are used properly, to describe the null hypothesis. *Each of the other 125 should not be there*, with each of those 125 overstating the case and therefore, improperly supporting the industry propaganda case.

In any case, the only way to show that there are inconsistencies or conflicts in the EMF literature is to carefully repeat studies finding such effects, not to flood the literature with studies done under other conditions. The logic used throughout SCENIHR 2015 [73] of just counting numbers of studies is deeply flawed.

Summary of Flaws in SCENIHR 2015

The first set of flaws, is that SCENIHR is perfectly willing to make statements which they know or should have known are false. The most egregious example of this is the Speit/Schwarz controversy described at the beginning of this chapter where there are seven clear falsehoods *created by SCENIHR*, each of which greatly strengthens the telecommunications industry propaganda positions. There are many others, described in this chapter that are substantive, but less egregious than the Speit/Schwarz falsehoods.

There is a vast literature, both in the review literature and in the primary literature studies, that disagrees strongly with the SCENIHR positions and is completely ignored by SCENIHR. In a few cases, such studies are cited and very briefly discussed by SCENIHR but then they have no impact on the assessments that SCENIHR makes in the SCENIHR 2015 document [73]. In most cases, they are neither cited nor discussed. The situation here is similar to an organization that has two sets of books, the fake books that are used in public and then a genuine set of books that includes all of the data that are too inconvenient to be included in the fake set of books.

The finally, we have three additional considerations which interact with each other to produce the completely bogus logic used by SCENIHR and by other organizations that have taken positions similar those taken by SCENIHR. One of those considerations comes from our knowledge that pulsation pattern, cell type, polarization and frequency can all influence biological effects and that there are exposure windows that produce much larger effects than are seen with either lower or higher intensities. Our knowledge of these factors mean that it is possible for the telecommunications industry to foster any number of studies where it is unlikely that statistically significant evidence of effects will be seen. I have presented examples where this may have been done. One of the most bizarre things about the SCENIHR 2015 document [73] is that there is a sentence on p. 101 where they state "In some of these cases, the effect seemed to be dependent on the cell type investigated and by the electromagnetic parameters applied (frequency, modulation)." Modulation and pulsation are the same thing. They know about these three factors and therefore, they know that these factors may explain differences in results obtained by different studies. But they still falsely assume that such differences imply inconsistencies in results and falsely assume that it makes sense to simply count apparent positive and apparent negative studies as a way of assessing whether there are effects or not.

SCENIHR has often falsely stated that these studies show no effects as opposed to lack of statistical significance of any effects. SCENIHR 2015 document has 125 places where such bogus claims of "no effect" are found. They repeatedly claim the literature is inconsistent but studies done under different conditions are *not* inconsistent because they are more likely to be due to genuine biological heterogeneity of responses. The false logic described here is used, in turn, to support another highly pervasive false logic. I've documented where SCENIHR has simply counted numbers of studies showing so many findings of effects and some other number of findings of "no effect." But these numbers are meaningless, when the studies are done under different conditions and where the "no effect" numbers can easily be inflated by studies designed to produce such results. They are also, of course, meaningless, when large numbers of studies that show effects are eliminated by SCENIHR by the simple process of pretending they don't exist. You can see from this, that the entire logical framework behind the SCENIHR 2015 [73] document is completely bogus.

Lastly, before going on to the situation in the U.S. and with 5G, there is one other thing I want to state here. In 2005, Dr. Jared Diamond published a book [111] entitled "Collapse: How

Societies Choose to Fail or Succeed." In it he documents how each society that "chose to fail," chose paths that had some short term gains but also had much more severe longer-term consequences. This is exactly what we have been doing with the EMFs, except that the consequences are much more severe than the collapse of one society – here all of the advanced technology societies on earth are at great risk.

Chapter 6: The U.S. Early Role in Recognizing Non-Thermal EMF Effects and How This Was Abandoned Starting in 1986: U.S. Failure to Research Health Impacts of Cell Phone Towers, Cell Phones, Wi-Fi, Smart Meters and Now 5G. What Is the Current Position of U.S. Government Agencies?

We in the U.S. often take great pride in our scientific research. That is, of course, especially true of U.S. scientists, of which I am one. We have far more Nobel laureates than any other country so we think of ourselves as being the #1 science country in the world. But we have had, over the past 20 years, almost no scientific primary literature studies, either laboratory studies or epidemiological studies, on non-thermal microwave frequency EMF effects. We had much more such research in this area 35 years ago,

In terms of non-thermal effects of microwave frequency (sometimes called radiofrequency) EMFs, the U.S. government published documents acknowledging the existence of large numbers of such non-thermal effects. This included the 1971 U.S. Office of Naval Medical Research Institute Report [30] and the 1981 report from the National Aeronautics and Space Administration (NASA) [26]. The most recent such report acknowledging widespread non-thermal EMF effects was the NCRP report [112] published in 1986. It follows that for the past 32 years, the U.S.government has been in denial on what *had been* repeatedly recognized by our government and is of great importance to protecting our health. 1986 turns out to be a key year because in that year, the U.S. Environmental Protection Agency (EPA) shut down its in house research program studying non-thermal EMF effects. In 1986, the U.S. Office of Naval Research, which had been funding grants in this area, stopped funding any new grants – the already funded grants were funded to the end of the grant period but no new grants were funded past 1986. A few years later, I think it was in late 1994, a similar shutdown of grants went into effect at the NIEHS, the part of the National Institutes of Health (NIH) which supports environmental health research. In 1999, the last U.S. agency that had been funding some research in this area, The Department of Energy also shut down what little research it had been funding.

The consequences of those shutdowns is that of the 17 studies on people living near cell phone towers, not a single study has been done in the U.S. Of the 23 studies of effects of genuine Wi-Fi EMFs, each of them showing effects [11], not a single study was done in the U.S. Of the over 50 studies on genuine cell phone radiation effects, only single one was done in the U.S, the NTP cell phone cancer study required by the Congress. So we have a situation where the U.S. government is encouraging EMF exposures and, in many cases, making it impossible to avoid EMF exposures while doing nothing or almost nothing to ensure our safety. There are a tiny number of studies that somehow sneak through, such as the Aldad et al study (#12 in Table 4) discussed in the preceding chapter, which was funded through the Child and Human Development Institute of the NIH, but these are few and far between.

How did these shutdowns happen? I don't know about 1986 but have some useful information from 1994/1995.

Attacks by the Telecommunications Industry on Two U.S. Scientists

Dr. Henry Lai from the University of Washington and a collaborator, NP Singh were using the alkaline comet assay, discussed earlier in this document to measure single stranded breaks in cellular DNA. They found a substantial elevation of the levels following low level EMF exposure in late1994. Before that finding had even been published, they found that they were targets of a severe attack from the telecommunications industry. A key document providing evidence of this was what was called the "War-Gaming" memo [113], where an executive named Norm Sandler, head of the Corporate Communications Department of Motorola (at that time the largest cell phone company) sent the memo to Michael Kehs of a public relations campaign in Washington DC (dated Dec. 13, 1994), describing their planned response to these at that time, unpublished findings. The memo stated that "While this work raises some interesting questions about possible biological effects, it is our understanding that there are too many uncertainties—related to the methodology employed, the findings that have been reported and the science that underlies them—to draw any conclusions about its significance at this time. Without additional work in this field, there is absolutely no basis to determine whether the researchers found what they report finding—or that the results have anything at all to do with DNA damage or health risks, especially at the frequencies and power levels of power levels of wireless communication devices.

In discussing the frequency differentiation issue, we should be able to say that Lai-Singh and Sarkar were not conducted at cellular (that is cell phone) frequencies."

(My comments are as follows: It is true that Lai/Singh used a different frequency from that used by cell phones. So the industry was correct about that. But the findings also show that the industry claims that there cannot be any non-thermal effects are wrong, and that may be more important. Singh had a reputation of being a genuine international expert on comet assays, so I doubt that methodology was a problem. If this had nothing to do with DNA damage or health risks, Motorola would not be worrying about these findings. There were at that time (1994) previously published studies of EMF effects on cellular DNA including the concurrent Sarkar findings and including findings of chromosome breaks and rearrangements reported in [30]).

Further down, the memo: "I think we have sufficiently war-gamed the Lai-Singh issue, assuming that SAG (Scientific Advisory Group, a group linked to the telecom industry) and the CTIA (the umbrella telecom lobbying, publicity and legal organization) have done their homework. We want to run this by George Carlo and fill him in on contacts we have made."

Under Excerpts from Confidential Working Draft #3. Question and Response:

Q. How can Motorola downplay the significance of the Lai study when one of your own expert consultants is on record telling Microwave News that the results—if replicated—could throw previous notions of RF safety into question?
R. It is not a question of downplaying the significance of the Lai study. In his comments to Microwave News, Dr. Sheppard raised the key question: Can it be replicated and interpreted? We will wait and see."
(My comments: Replication needed to be done, so that was a valid point. The interpretation was and is clear – it is that EMF exposures produce large increases in the numbers of single strand breaks in the cellular DNA.)

"Action Planned: In addition to response materials prepared by SAG (see attached copies) we will work with SAG to identify appropriate experts to comment in general on the science of DNA research, in addition to any experts SAG may be able to recommend to publicly comment on one or both of these particular studies.

Then they talk about Media Strategy where Motorola stays in the background with SAG and CTIA in front."

Three important things happened to Dr. Henry Lai at about this time [114,115]. In November 1994, before the War-Gaming memo had been written, a representative of the industry called the NIH claiming that money had been misspent from the Henry Lai grant for the DNA studies. Dr. Lai faxed the NIH an explanation which was accepted. However, the cutoff of new NIEHS funding appears to have occurred at this time, such that the industry pressure is likely to have been important. Furthermore [114] "The industry made a full-court press to discredit the DNA break study. A consistent and coordinated message was put out to marginalize Lai and Singh. For instance, in November 1994 (note: this was also before the War-Gaming memo was written), Q. Balzano, then a senior Motorola executive, wrote to us (Microwave News) that "Even if it is validated, the effects it purports to show may be inconsequential." (My comment is that DNA breaks produced at intensity levels well below safety guidelines are *not* inconsequential. If they were, the industry would not be worrying so much about them). Ron Nessen, the CTIA's top spokesman told a Florida newspaper that "It's not very relevant." He also tried to cast doubt on the comet assay pioneered by Singh to measure DNA breaks. It "may not be scientifically valid." Quite a number of months later, the head of the WTR (successor organization to SAG) wrote a 6 page letter to the President of the University of Washington to try to get him to fire both Lai and Singh [114, 115]. Neither was fired, but this is what you face when you get results that the telecommunications industry does not like.

(My comments: The basic findings of the Lai and Singh studies have been replicated more than two dozen times, at this writing. There have also been many replicates of the findings of increased micronucleus formation and oxidized bases in the DNA following non-thermal EMF exposures. All of that replication and the 21 reviews that were listed in Chapter 1 each showing non-thermal cellular DNA damage have still not gotten the telecommunications industry to admit that these DNA effects are occurring. The industry apparently does not care about the replication but cares, rather, about having talking points. Furthermore, when the industry was trying to get Dr. Lai's research funding cut off or later was trying to get both Lai and Singh fired, they were trying to *prevent* replication rather than encouraging it).

So Dr. Henry Lai was the first major scientist who came under vicious attack from the telecommunications industry and their allies, but he was certainly not the last. There are many such scientists including Prof. Adlkofer in Germany and Prof. Rüdinger in Austria. I know of nine others who have been attacked in the U.S. or in Europe. But here is a situation where the U.S. instead of leading world science in the right direction has been leading it into corruption. There are others.

I want to talk about another especially important case of such an attack on a U.S. scientist, that of Professor Om Gandhi. Gandhi is a professor at the University of Utah who, for many years was doing modeling of cell phone EMF exposures on the brains of humans. He was modeling such exposures for a substantial period of time of time based on the head of what was called standard anthropomorphic man (SAM). SAM was modeled from a 6 foot 2 inch, 200 pound man, a man in the upper 10% of men for head size and estimated skull thickness. He was doing such cell phone modeling for the telecommunications industry and received an important honor for this research. Because the safety guidelines are based only on thermal effects, the modeling was aimed at determining heating of the human brain by cell phone radiation.

Prof. Gandhi became concerned about the fact that both the head size and skull thickness of SAM was greater than that of most men and essentially all women and children and consequently began modeling a typical woman and typical 10 year old child, When he did that he found that the cell phone EMF exposures to the brain were much too high, even based on their own standards, standards that were and are only based on heating. The timing of these events was from 1975 through 1996. I will be quoting on what occurred subsequently. I have received permission from Dr. Devra Davis to make these quotes from pages 81 through 88 of her book Disconnect [77]. I will use a different font for those quotes so that you can see them easily.

Based on the new work he had produced, Gandhi called for a revision of the safety standards that regulated cell phones. The industry was stunned. For years, Gandhi had been one of those on whom they had counted. If Gandhi's work went uncontested, it would mean that children, women and men with smaller heads could not safely use some electronic devices or that these devices would have to be redesigned to emit less radio frequency radiation. The industry's first response was to cut off all of Gandhi's funding.

Going to p. 86 from [77]:

Gandhi explained that something has gone very wrong with standard setting in the United States in the past few years.

"Starting in the late 1980s, I chaired the committee to set standards for radio-frequency exposures before all cell phones ever existed. About a decade ago, C.K. Chou, then at the City of Hope Hospital, replaced me. Within two years, Chou had moved. He became a senior executive with Motorola—a clear conflict of interest. The committee that advises as to cell phone standards is supposed to be independent and had never before been led by someone from the very industry it advises. Under Chou's leadership, the committee relaxed standards for cell phones as of 2005. Having spent my entire life developing models of the brain, I know how things work. I also know that what we have done here is to ratchet up exposures, without actually telling people we have done so. Today's standards for cell phones have more than doubled the amount of radio-frequency radiation allowed into the brain."

The next quote starts at 2002, before the more than doubling of those radiation standards (pp. 87-88 from [77]).

By 2002 the gloves were off and the industry made it clear to Gandhi that they would take him on directly. Gandhi remembers being told by an industry colleague who was once a student and friend, "If you insist on publishing these papers saying that children get more exposed than adults and saying our test procedure is not valid, you can expect that we will not fund you."

Gandhi replied, "I am a university professor. I don't need your money."

Next industry tried to place an article by Chou critiquing Gandhi's models in the journal of which Gandhi had been editor and chief and in which he had published dozens of articles, and asked that either his (that is Gandhi's) article criticizing the grounds for setting standards be removed, or that they be allowed to publish Chou's rejoinder.

Gandhi reports that four different peer reviews of Chou's critique of my work indicated that Chou's critique of my work was 'scientific junk.' Only when the editor of the journal balked did the industry finally relent. Despite this success in beating back one attempt to discredit Gandhi's work, the effort to increase allowable amounts of radio frequency radiation was won on a major front. As the new chief of the standard-setting committee, Chou masterminded changes in the standards, and the committee, which now included a large majority of industry experts, issued new recommendations, ignoring Gandhi's analysis showing that these would effectively double exposures.

(I want to comment on this. I've published three papers on the physics of EMF action [4,5,11]. In each of them, I have taken the industry arguments about the physics seriously. Even though it was clear that the industry arguments were wrong, because of the clear existence of so many effects that occur at non-thermal levels of exposure, the industry arguments claiming that there could only be thermal effects were substantive and therefore, had to be considered. What I find, in the previous six paragraph, is that the industry itself is ready to throw out its own arguments, when they conflict with their ability to make massive profits. The issues here are very simple. Anyone with the most elementary understanding of the geometry of the head and a high school knowledge or physics, will know that a person with a smaller head and thinner skull will be exposed to higher brain levels of radiation from cell phones.)

What is obvious about this is that the industry does not care about health impacts, as long as they can maintain some deniability. What is also obvious is that the telecommunications industry can act to systematically corrupt an organization that, in effect, regulates the telecommunications industry. That in turn means that other organizations that, in effect, regulate the industry must be scrutinized for possible corruption. Those include ICNIRP, SCENIHR, WHO, the FCC and the FDA.

When Have Somewhat Similar Things Happened in Other Situations in the U.S.?

Is this approach to obfuscating the science unusual? Not really, but it appears to be much more extreme than usual, with the telecommunications industry and EMF effects. I suggest looking at the book on "Doubt Is Their Product: How Industry's Assault on Science Threatens Your Health" by Dr. David Michaels. I've cited a book review of that book here [116]. The review starts out with the statement that "Creating doubt – at least enough to derail government regulation – is an art form long practiced and highly perfected by some sectors of private industry. In the book, Professor David Michaels vividly demonstrates how each such industry channels some of its profit to 'product defense firms' and 'self interested scientists' who conduct research designed to cast doubt on the science that supports regulation." (I will add that it also casts doubt on the science that may support lawsuits, as well.) "As a result of the doubt created, regulation is long-delayed and thousands of people (or perhaps millions) suffer and die unnecessarily." The industries that are covered in the book include tobacco, lead, asbestos, Merck (the maker of Vioxx), global warming, chromium, beryllium, artificial butter flavoring (diacetyl, the cause of often fatal popcorn lung). I think you will see parallels with what went on with SCENIHR (Chapter 5) and with the telecommunications industry actions (this chapter). Part of the problem with these precedents, is that nobody went to prison, despite the many deaths and injuries that were perpetrated and in most of these cases, the industries involved ended up making more money than they lost in the subsequent lawsuits. The precedent has been set that you can get away with almost anything if you are big enough and powerful enough and rich enough. That

may have been sufficient to encourage the telecommunications industry to follow a similar, although, in my opinion, much more aggressive pathway.

One question that can be asked is whether there are any major international political figures who appear to have a good understanding of the EMF/health issue? When I was asked that question, I was able to come up with only one person. That person is President Vladimir Putin of Russia. This inference comes from an interview of Dr. Dietrich Klinghardt, who practices in Seattle, by Dr. Joseph Mercola, that occurred in December 2017, an interview that was entirely focused on EMF health effects [117]. In that context Dr. Klinghardt states that a lecture that Putin gave to the Russian assembly said, "We do not need to go to war with America. America is committing collective suicide by the way they are using electricity. We just have to wait until they are all in the psychiatric hospital." When I saw that, I asked myself whether it is plausible that Vladimir Putin has a deep understanding of the neuropsychiatric effects of the EMFs? And then I thought, of course, Vladimir Putin was the head of the KGB when the latter studies reviewed by Dr. Karl Hecht [28] were being done in the Soviet Union. The most important effects that were shown to be produced by the EMFs, in those studies, were the neuropsychiatric effects. Furthermore, the Putin statement apparently shows not only a substantial understanding of those effects but also the fact that they are cumulative and become irreversible, as shown in those studies [28] and in other studies discussed in Chapter 4. One thing that I would add is that President Putin apparently practices what he preaches. He avoids smart phones [118].

It is my opinion, that the CIA and other international intelligence agencies should examine these issues very carefully to assess whether they see the kinds of threats that I see. Those agencies are very good at obtaining information from various sources and determining probable threats to national and international security. It should not be difficult to come to an assessment, especially because some of us have done much of the work that needs to be done. The threat here is self-inflicted, it is not caused by any foreign power or set of powers. But it is the most serious national or international security threat that we have faced, in my opinion, with the exception of nuclear annihilation.

Propaganda:

In the initial days of the controversy regarding cell phones, in 1993, the industry developed a huge public relations effort in the face of lawsuits and adverse press reports impacting the industry. Paul Staiano, President of Motorola General Systems stated in a 1993 ABC 20/20 interview [119] that, “Forty years of research and more than ten thousand studies have proved that cellular phones are safe.” So I asked how many studies of cell phone safety or lack there of had been published by the end of 1993. The way I did that was to search in the PubMed database under (cell phones or cellular phones or mobile phones). I found about 11,000 hits, roughly 99% of them having nothing to do with health safety, and then looked at the few studies that had been published before the end of 1993. The only study I found that had any connection with health or safety, was one on driving safety while using a cellular phone, giving equivocal results with regard to driving safety. So there, were apparently no studies done on cell phone safety at that time. Furthermore, even if there had been any studies, they could not possibly show that “cellular phones are safe.” At most they might show that there was no statistically significant evidence of an effect but that only shows that you have not proven an effect, not that you have proven the opposite. It can be seen, therefore, that this propaganda statement is complete nonsense. Furthermore, we know that the Panagopoulos et al [100] review, showed that 46 out of 48 genuine cell phone studies that they reviewed showed effects. So the facts are exactly opposite of the industry propaganda on this. If this was the beginning of propaganda in the U.S. let’s look at something much more recent.

Berezow and Bloom Op-Ed Document: Recommendation to Limit Maryland School Wi-Fi Is Based on "Junk Science"

Berezow and Bloom, [120] start their 2017 op-ed with the claim that "The CEHPAC, an agency within Maryland's Department of Health and Mental Hygeine, has recommended that schools reduce or eliminate students' exposure to Wi-Fi because it believes wireless signals might cause cancer. *This is pure, unadulterated junk science. At least three separate, major areas of scientific knowledge can unambiguously confirm that wireless radiation is completely safe* (italics added)."

They continue with the physics [120], stating that "CEHPAC fails to realize that all radiation is not created equal. The energy of nuclear radiation, X-rays and UV light is high enough to damage our bodies and cause cancer. But other forms of radiation are energetically weak by comparison. They cannot cause cancer." This argument has validity with regard to individual photons, as I stated in my first paper on the activation of VGCCs by EMFs [4], but it is completely bogus with regard to EMFs as a whole. It has been known for 70 years that a person walking in front of a high powered radar machine will rapidly die, but Berezow and Bloom claim that cannot happen because the fields are "energetically weak." Furthermore, as discussed in Chapter 2 and elsewhere [5,11], the voltage sensor that controls the opening of the VGCCs is extraordinarily sensitive to electrical forces of EMFs, with the forces on the voltage sensor being approximately 7.2 million times greater than the forces on singly charged groups in the aqueous parts of our cells and tissues. It can be seen, therefore, that Berezow and Bloom [120] while claiming to be experts, are profoundly ignorant of the relevant physics.

Berezow and Bloom [120] state that "According to the NIH's National Cancer Institute [121], well performed studies that included over one million people showed no connection between cell phone use and cancer." There is no such statement in the NCI 2016 [121] document – I suggest the reader look it up – it differs substantially from the op-ed characterization of it. The NCI 2016 [121] document, states that "there is currently no consistent evidence that non-ionizing radiation increases cancer risk" (sole supporting citation in NCI 2016 [121] was SCENIHR 2015 [73]). It has been shown above in Chapter 5, that SCENIHR 2015 is not a credible source of information on this and as shown, in Chapter 1, there are 35 different reviews that each provide strong evidence that EMFs do cause cancer. So claiming, that EMF causation of cancer is, in Berezow & Bloom's words, "pure, unadulterated junk science" is nonsense. What is amazing here is that the U.S. NTP study, published by Wyde et al [122], clearly shows that cell phones do cause cancer but it was completely left out of the Berezow & Bloom statement.

Let's go to their third "major area of scientific knowledge" – Berezow and Bloom [120] state that "the only known health effects from Wi-Fi are due to psychosomatics." That is, "people who believe that something will make them sick will report feeling ill, even if nothing is happening externally." Some of the Wi-Fi studies (Table 1 in [11]) are cell culture studies, some are animal model studies where EMF exposures are compared with sham exposures. While there may be a very weak argument regarding some but not other human studies when they are not done blinded, there is no argument that effects in any of the other studies are caused by "psychosomatics." Berezow and Bloom do not look at any of the 23 studies of Wi-Fi reviewed in [11], each of which showed effects and it is clear that most of them cannot possibly be due to psychosomatics. What is surprising here, is that the trillion dollar set of telecommunication industries, having been working on their propaganda for over a quarter of a century, is unable to produce a more convincing argument.

Have There Been Individual Research Studies Designed to Fail and Therefore Corrupt the Scientific Literature?

The first example, that I am aware of, where false science has been produced to supposedly show that an important EMF observation was unrepeatable also came from the U.S. It was described in Dr. Davis' book [77]. Dr. Allen H. Frey (pronounced Fry) published a paper in 1975 in Annals of the New York Academy of Science showing that low intensity pulsed EMF exposures produced a breakdown of the blood-brain barrier, the barrier in the blood vessels in the brain and the brain tissue that protects the brain from toxic chemicals and also infectious agents. The methodology that he used was to inject the fluorescent dye fluorescein into the blood (IV) and then use its fluorescence to detect whether and to what extent it penetrates into the brain tissue from the blood. A subsequent paper was published in 1978 [123], using similar methodology *except* that the fluorescein instead of being injected into the blood, was injected by intraperitoneal (IP) injection. When a compound is injected IP, it enters the blood only slowly over a substantial period of time, so that when one does a short term experiment looking at penetration through the blood-brain barrier, essentially nothing is seen. This was a transparent attempt to claim that the studies of Dr. Frey had been repeated with negative results, but the Frey studies had not be replicated.

I am aware of many papers that were flawed like the seven studies of simulated Wi-Fi, discussed near the end of Chapter 5 that were each touted by Foster and Moulder [110]. Let me remind you of what the flaws were in those seven studies. Firstly, each of them used EMFs that were the correct frequency for Wi-Fi but differed in pulsation from genuine Wi-Fi. Each of these studies used a reverberation exposure chamber which is predicted to decrease effects by both decreasing the polarization of the EMFs and increasing the destructive interference of the EMFs. They also used tiny numbers of animals for each study group, such that any statistics would have very low power. Finally, Foster and Moulder claimed each of them showed "no effect" when one can only at best claim there was no statistically significant evidence of an effect. Given the tiny numbers, the lack of statistical significance is of very little importance. I find that this pattern has been followed in a substantial number of additional studies.

What I want to discuss here is a paper that had each of those four properties but had several additional flaws, as well. I am aware of three legal proceedings in the U.S., where the industry side of that case touted the paper to be discussed, as being a particularly strong one. This paper by Ziemann et al [124] is entitled "Absence of genotoxic potential of 902 MHz (GSM) and 1747 MHz (DCS) wireless communication signals: In vivo two-year bioassay in B6C3F1 mice. In other words, the title claims that the 902 MHz frequency, studied and the 1747 MHz frequency also studied in the paper cannot cause DNA damage or other types of genotoxicity."

On p. 456 of Ziemann et al [124], the authors make clear that they are studying the effects of simulated cell phone radiation, not actual cell phone radiation. You will recall that Panagopoulos et al [110] found that almost all studies of genuine cell phone radiation found effects whereas less than half of simulated cell phone studies showed effects. This raises an important question about why Ziemann et al [124] opted to study simulated cell phone radiation. Much of the funding of the Ziemann et al paper (see pp. 462-463) came from industry sources. Funding source is not a flaw but it is a reason to look at the paper particularly closely. 2. The Ziemann et al [124] study used a stainless steel exposure chamber similar to the reverberation chambers discussed in Chapter 5 of this document. The chamber is predicted, to produce lower effects because of lowered polarization and increased destructive interference 3. The study is described as being a two year study of radiation effects. However the cells examined for micronuclei (their marker for genotoxicity (cellular DNA damage)), were mouse erythrocytes (red blood cells), and such

erythrocytes have a lifespan of only about 30 days; because of the inherent instability of micronuclei in replicating cells, such micronuclei in erythrocytes may possibly be generated over at most a 30 day period. It is misleading to describe this as a two year study when only the last 30 days are relevant to generating the marker being studied. 4. In rats and humans, erythrocytes containing micronuclei are selectively removed from circulation very quickly (see p. 459 of Ziemann et al [124]). While Ziemann et al claim that mice do not have a similar mechanism for selective rapid removal, the only citation that they provide is a study published by Chaubey et al (1993) showing that this was apparently true with Swiss mice; Ziemann et al [124] chose to use B6C3F1/CrlBR mice, a different inbred mouse strain which may well behave quite differently from Swiss mice. It follows from this that we have no idea whether the strain studied is similar to Swiss mice with regard to selective removal of erythrocytes containing micronuclei.

5. Ziemann et al [124] show that male and female mice behave quite differently with regard to levels of micronuclei (Tables I and III in [124]); however in their experimental study (Figure 2), males and females were combined in doing the statistics. What that inevitably does is to produce greater variations in micronuclei levels within different animal groups, making it substantially more difficult to detect any statistical significance among different animal groups in the study. It also means that it is important to use similar ratios of males and females in the experimental groups and we have no idea whether this was done or not. 6. In section A of Figure 2, there were only 8 animals in each group studied. In section B of Figure 2, there are only 5 to 9 animals in each animal group studied. These tiny numbers mean that there is only extremely low statistical power to detect any effects of EMF exposure and therefore these tiny studies make it almost impossible to say anything at all about the results. 7. The Ziemann et al study [124] provide none of their raw data; consequently we are in a situation where we have no way of judging whether their statistical analysis was done properly. We also have no way to use any such data as part of a meta-analysis of multiple studies, which may have much more power than do any single study (particularly such a tiny one). Consequently, the lack of statistical significance they report, cannot be properly assessed by the reader. 8. When one does a study looking at the possible effects of some variables, in this case a couple of simulated cell phone radiation studies, the most you can say about an apparent negative result is that "we did not see any statistically significant effects." When you have tiny studies such a described under 7 above, then the lack of statistical significance tells you almost nothing. But even with a very large study such as with thousands of mice including hundreds in each experimental group, all you can say is that "we did not see any statistically significant effects." 9. What do Ziemann et al conclude? They state in their title that there is an "Absence of genotoxic potential of 902 MHz (GSM) and 1747 (DCS) wireless communication signals." Did they study these EMFs in all organisms and all cell types? No of course not. Did they study all possible pulsation patterns of these two frequency EMFs? No of course not. Did they study all types of genotoxicity found following low-intensity EMF exposures? No, just one, micronuclei in erythrocytes in an inbred strain of mice. This title alone should tell any competent scientist that the paper is deeply flawed, completely apart from the preceding 8 flaws, with each of the 8 adding substantially to the flaws in this paper.

<u>George Carlo Letter</u>

Dr. George Carlo is an interesting and controversial figure who has both a law degree (JD) and a PhD in, I believe, epidemiology. He had worked in the telecommunications industry for years as head of the SAG and then WTR research arms. Dr. Carlo wrote an important letter to the heads of the telecommunications companies on October 7, 1999. The letter he sent to the head of AT&T is available on the internet [125]. In his book [126] Carlo lists all of the people sent the letter and also provides the text of the letter.

Carlo was, at that time the soon to be retiring head of the WTR, which was the CTIA/telecommunications industry research arm. In the letters to the heads of the telecommunications industry companies, Carlo discusses the types of evidence arguing that cell phones do apparently cause cancer and that they do cause DNA damage to our cellular DNA. The DNA damage, suggested that the apparent cancer causation was real. Carlo continues the letter as follows [125]:

"Today, I sit here extremely frustrated and concerned that appropriate steps have not been taken by the wireless industry to protect consumers during this time of uncertainty about safety." Continuing further down, Carlo adds:

"Alarmingly, indications are that some segments of the industry have ignored the scientific findings suggesting potential health effects, have repeatedly and falsely claimed that wireless phones are safe for all consumers including children, and have created an illusion of responsible follow up by calling for and supporting more research. The most important measures of consumer protection are missing: complete and honest factual information to allow informed judgment by consumers about assumption of risk; the direct tracking and monitoring of what happens to consumers who use wireless phones; and, the monitoring of changes in the technology that could impact health.

I am especially concerned about what appear to be actions by a segment of the industry to conscript the FCC, the FDA and WHO with them in following a non-effectual course that will likely result in a regulatory and consumer backlash."

This is an important letter for several reasons. After October 7, 1999 the heads of the telecommunications companies or, for that matter anyone else at those companies, could no longer legitimately claim that they did not know there were serious health concerns with cell phones, with targeting cell phones to young children, or with increasing allowable cell phone exposure radiation. The last of these was done a few years later, as you have already seen.

The concerns Carlo expresses about the FCC (Federal Communications Commission) and the FDA (U.S. Food and Drug Adminstration) are particularly important in the U.S., because both the FCC and the FDA had already been given important regulatory roles when the Carlo letter was written. The FCC had been given the power of regulating the location of cell phone towers by the 1996 telecommunications act, which also *prohibited, as I understand it, any state or local government from protecting their people's health by regulating cell phone tower positioning*. In other words, the 1996 telecommunications act *de facto* stated that the U.S. Federal government valued telecommunication industry profits over every single health impact of microwave frequency radiation, *no matter how serious* it is, to the American people. There have been several subsequent pieces of legislation that have made the situation still worse. The FDA had been given the power to regulate radiation emissions from cell phones and other devices that emit microwave/radiofrequency radiation, with cell phone regulation apparently being shared with the FCC.

<u>What Can We Say About the FCC?</u>

There was a very informative document about the FCC published by the Safra Institute for Ethics at Harvard University [127] entititled "Captured Agency: How the Federal Communications Commission Is Dominated by the Industries It Presumably Regulates." One of the sections in that document shows why both the FCC role and the telecommunications industry role were so important with regard to the 1996 telecommunications act:

Section 332(c)(7)(B)(iv) of the Act remarkably, and that adverb seems inescapably best here, wrests zoning authority from local governments. Specifically, they cannot cite health concerns about the effects of tower radiation to deny tower licenses so long as the towers comply with FCC regulations.

Congress Silences Public

Section 322(c)(7)(B0(iv) of the Communications Act Provides:
No State or local government or instrumentality thereof may regulate the placement, construction of personal wireless service facilities on the basis of environmental effects of radio frequency emissions to the extent that such facilities comply with the Commission's regulations concerning such emissions.

In preempting local zoning authority – along with the public's right to guard its own safety and health, Congress unleashed an orgy of infrastructure build-out. Emboldened by the government green light and the vast consumer appetite for wireless technology, industry has had a free hand in installing more than 300,000 sites. Church steeples, schoolyards, school rooftops, even trees can house these facilities.

What, then are the consequences of all of this? The 17 studies that have been done on people living near cell phone towers show that many people within 300 meters (about 1000 feet) of a cell phone tower are afflicted by six of the health effects found in those many reviews listed in Chapter 1. Two of those effects have not been looked at. According to this literature, people living within 300 meters of cell phone towers suffer from widespread neuropsychiatric effects, cellular DNA damage, cancer, oxidative stress, elevated apoptosis (cell death), and hormonal effects. They also suffer from cardiac effects like those discussed in Chapter 3 and from hypertension and also anemia. The two extremely well documented EMF health effects that have not been looked at are the reproductive effects and the high levels of intracellular calcium. That does not tell us these are not also caused in people living near cell phone towers, just that no one has looked. Roughly 30% of the people in this country live within 300 meters of a cell phone tower so the impact on health is major. But few know about this and the media and our government, including especially the FCC and FDA are keeping it all a deep dark secret. Not a single one of these 17 studies have been done in the U.S. Consequently, when the U.S. has ensured that we are irradiated by well over 300,000 of these cell phone towers, it has done absolutely nothing to determine what the consequences of exposure are. Of course we are impacted not only by cell phone towers near where we live but also near where we work or go to school and to some extent, when we are driving around town. These high levels of exposure are not necessary. Switzerland has safety guidelines that are 100 times more stringent than ours, Russia has safety guidelines that are 1000 times more stringent than ours. The health effects we see now will no doubt rise much further in the future without any increasing exposure, because many of these effects are cumulative, eventually becoming irreversible.

I would encourage you to look at the whole FCC as a captured agency document [127] – it can be downloaded at no cost from the internet [127]. It is very interesting and adds considerably to my short comments here regarding corruption.

So what does the FCC have to say about EMF effects on its web site [128]? I have copied some relevant sections as follows:

At relatively low levels of exposure to RF radiation, i.e., levels lower than those that would produce significant heating, the evidence for production of harmful biological effects is ambiguous and unproven. Such effects, if they exist, have been referred to as "non-thermal" effects. A number of reports have appeared in the scientific literature describing the observation of a range of biological effects resulting from exposure to low levels of RF energy. However, in most cases, further experimental research has been unable to reproduce these effects. Furthermore, since much of the research is not done on whole bodies (in vivo), there has been no determination that such effects constitute a human health hazard. It is generally agreed that further research is needed to determine the generality of such effects and their possible relevance, if any, to human health. In the meantime, standards-setting organizations and government agencies continue to monitor the latest experimental findings to confirm their validity and determine whether changes in safety limits are needed to protect human health. (Back to Index)

CAN PEOPLE BE EXPOSED TO LEVELS OF RADIOFREQUENCY RADIATION THAT COULD BE HARMFUL?

Studies have shown that environmental levels of RF energy routinely encountered by the general public are typically far below levels necessary to produce significant heating and increased body temperature. However, there may be situations, particularly in workplace environments near high-powered RF sources, where the recommended limits for safe exposure of human beings to RF energy could be exceeded. In such cases, restrictive measures or mitigation actions may be necessary to ensure the safe use of RF energy. (Back to Index)

CAN RADIOFREQUENCY RADIATION CAUSE CANCER?

Some studies have also examined the possibility of a link between RF exposure and cancer. Results to date have been inconclusive. While some experimental data have suggested a possible link between exposure and tumor formation in animals exposed under certain specific conditions, the results have not been independently replicated. Many other studies have failed to find evidence for a link to cancer or any related condition. The Food and Drug Administration has further information on this topic with respect to RF exposure from mobile phones at the following Web site: FDA Radiation-Emitting Products Page . (Back to Index)

Let's look at the first paragraph. In the third and fourth sentence, they state that there have been non-thermal effects reported but then say that "in most cases they have not been reproduced." Is that true? No. The 79 reviews listed in Chapter 1 have each found repeated studies documenting one or more of the EMF effects. You can't get a review published without multiple studies. And the fact that so many of these effects have been repeatedly reviewed, over many years shows that similar patterns of evidence have been found over long periods of time. *The FCC provides not one iota of evidence on its claims, despite the fact that such a claim of inability to reproduce findings absolutely requires extensive documentation to be scientifically valid. This difference in documentation, means that any one of those 79 reviews listed in Chapter 1 is vastly more scientific in showing the falsity of the FCC statement than is the FCC statement itself, which is completely undocumented.*

Let's go on to the cancer claim at the bottom of the copied section. The FCC states that "A number of reports have appeared in the scientific literature describing the observation of a range of biological effects resulting from exposure to low levels of RF energy. However, in most cases, further experimental research has been unable to reproduce these effects. Furthermore, since much of the research is not done on whole bodies (in vivo), there has been no determination that such effects constitute a human health hazard." You will note here that there are no specifics, nor were there any specifics on the section discussed in the previous paragraph. What we have here are completely undocumented FCC claims, with no specifics whatsoever and claims that are clearly contradicted by each of the 35 reviews on cancer causation by EMF exposure. They are also clearly contradicted by the 21 reviews on cellular DNA damage following EMF exposures, something that the FCC says nothing about. It has been known for decades, that the process of carcinogenesis (cancer causation) usually starts with one or more mutations in the cellular DNA, mutations that can be caused by each of the three types of cellular DNA damage known to be caused by EMF exposure.

The sort of pattern seen here, where we have gross generalizations followed by no or completely inadequate documentation goes on with the industry propaganda [119,120] as discussed earlier, as well as in the Speit/Schwarz discussion from early in Chapter 5. What you see in each of those cases is everything falls apart when you look carefully at the facts. The situation with the FCC statements is very similar. There can be little doubt that the FCC is acting as a propaganda organization here, as strongly suggested by the George Carlo letter [125,126] and the FCC as a captured agency [127] document.

Three questions: Does the FCC know that these statements that it has made are not factual? Does it know how non-thermal EMF effects actually are produced? Does it know that its safety guidelines do not protect our health? That answer to all three of these questions is yes. How do I know? I know because I did a PowerPoint presentation to the FCC in September 2016 which presented findings in each of these important areas. My account of that presentation, written two days after it occurred, follows:

Professor Emeritus Martin L. Pall presented Powerpoint presentation on the main mechanism of action of non-thermal microwave frequency EMFs to the FCC

I met with Julius Knapp, Chief of OET, Martin Doczkat, Branch Chief, OET/Technical Analysis Branch, and Ed Mantiply Engineer OET/Associate Chief at the Federal Communications Commission on September 21, 2016 to present a Powerpoint presentation and answer questions. The presentation showed that non-thermal microwave and lower frequency EMFs act via voltage-gated calcium channel (VGCC) activation. The most important findings demonstrating this mechanism are that various effects produced by such non-thermal exposures can be blocked or greatly lowered by calcium channel blockers, drugs that are highly specific for blocking VGCCs. The reason why such low intensity non-thermal exposures activate the VGCCs is because the voltage sensor of the VGCCs is exquisitely sensitive to the electrical forces produced by these EMFs. The forces on the voltage sensor are calculated to be about 7.2 million times higher than are the forces on singly charged chemical groups in the aqueous phases of the cell. This very high level sensitivity also predicts that the safety guidelines allow us to be exposed to EMF intensities that are approximately 7.2 million times too high.

The actions produced by such VGCC activation go mainly through the excessive intracellular calcium levels produced by such activation. Excessive calcium acts via three main pathways to produce effects in the body. Therapeutic effects are produced through the nitric oxide signaling pathway whereas many pathophysiological effects are produced by the peroxynitrite/oxidative stress pathway. Excessive calcium signaling also produces pathophysiological effects. Numerous effects produced following non-thermal EMF exposures can be produced by these pathways including oxidative stress, cellular DNA damage, cancer, widespread neuropsychiatric effects, breakdown of the blood brain barrier, lowered male and female fertility and various endocrine (that is hormonal) changes.

It has long been known that pulsed EMFs are usually much more biologically active than are non-pulsed (or continuous wave) EMFs and this difference appears to be consistent with the VGCC mechanism. Because all wireless communication devices communicate via pulsations, such devices may be of special concern.

Three concerns were expressed with regard to 5G: 1. The stronger absorption of the very high frequencies involved require the setting up of vast numbers of antennae, making it essentially impossible to avoid damaging exposures. 2. The stronger absorption suggests that these EMFs may be particularly active in activating the VGCC voltage sensor. 3. The very high level and complexity of pulsations also may make for much more biological damage via VGCC activation.

There was substantial discussion of the need for biological safety testing. That discussion focused on the using cells in culture that have high densities and different types of VGCCs. Responses can be monitored by either monitoring intracellular calcium levels or by measuring nitric oxide production using a nitric oxide electrode.

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We had what would be considered in diplomatic circles a good and productive meeting, but since that time the FCC has doubled down on their positions, pushed much further on 5G, leading us to the mega-crisis situation which we are faced with now. Instead of actually testing 5G radiation biologically for safety, using the methods that were discussed in that meeting, the FCC has instead opted to put out tens of millions of 5G antennae without any biological safety testing of genuine 5G radiation. That is the insanity that we are in.

What About the FDA?

The Food and Drug Administration (FDA) was given the power to regulate devices that emit microwave frequency EMFs. This was not an unreasonable decision, given that the FDA was already regulating the safety of medical devices, where one can argue that there are similar challenges involved. The FDA was given this responsibility without any additional funding. So obviously, it was and is distinctly limited in what it can do.

What the FDA did was to issue a Letter of Intent for Proposed Collaboration in Mobile Phone Research between the Food and Drug Administration and the Cellular Telecommunications

Industry Association (CTIA), [129] Dated October 20, 1999. This would involve a Cooperative Research and Development Agreement (CRADA). Later in their Letter of Intent, it states under Initial Research Under the CRADA [129]: "The first study to be conducted would follow up on the findings of studies previously conducted by WTR but not yet published using the micronucleus assay, a test which detects structural effects on genetic material. Research data in the literature from RF exposure studies using the micronucleus assay are conflicting, and warrant follow-up study." You will see here that the FDA is accepting the industry claim that these studies are conflicting even though, having been done under different circumstances, they are not.

The basic approach of the CRADA was that the industry would fund any research to be done and decide what research should be done by whom and how and what information would be published subsequently.

You may recall that Dr. George Carlo wrote a very important letter to the heads of the telecommunications companies, described earlier. That letter was dated two weeks before the date of the letter or intent. Carlo's letter stated: "I am especially concerned about what appear to be actions by a segment of the industry to conscript the FCC, the FDA and WHO… ." Carlo who had been up to that point, an industry insider, and apparently had reason to think that the FDA had been corrupted, or what he called conscripted by parts of the telecommunications industry two weeks before the letter of intent was written. I don't think this is definitive evidence that the FDA has been corrupted, and it can even be argued that it is not evidence at all. But it does suggest, however, that we need to look further into this issue.

Let's go on to the results of this CRADA [130]. The FDA reports the following findings from the CRADA: "FDA's cooperative research and development agreement (CRADA) with the Cellular Communication & Internet Association (CTIA) has resulted in research projects focused on two topics - mechanistic studies related to genotoxicity and exposure assessment studies. All studies funded through the CRADA have been completed, and no association was found between exposure to radiofrequency (RF) radiation from cell phones and adverse health effects." I have been unable to get copies of these studies and therefore cannot comment on them.

The CRADA also lead to a National Academy of Sciences (NAS) workshop on EMFs that lead, in turn, to a 2008 NAS report. That 2008 NAS report can be accessed from [130]. It is a useful report, in my view, albeit one that leaves out much of what was already known in 2008. It does ***not*** say that there are no clear non-thermal effects and specifically calls for study of the neurological effects, suggesting that "that neural networks are a sensitive biological target." It also calls for much research on biophysical or biochemical molecular mechanism(s) that may lead to the non-thermal effects. It also calls for much more study on cancer. There has been a large amount of progress in each of these three areas since 2008, including of course the identification of VGCC activation as the most important but not necessarily the only biophysical mechanism. The problem with regard to the FDA is that as far as one can tell, the FDA has paid no attention to either the 2008 report or to the subsequent progress we have had in these several areas.

Let's shift our attention to what the FDA currently says about the impacts of these EMFs? On their web site [131], the FDA states the following:

Is there a connection between certain health problems and exposure to radiofrequency fields via cell phone use?

The results of most studies conducted to date indicate that there is not. In addition, attempts to replicate and confirm the few studies that did show a connection have failed.

According to current data, the FDA believes that the weight of scientific evidence does not show an association between exposure to radiofrequency from cell phones and adverse health outcomes. Still, there is a consensus that additional research is warranted to address gaps in knowledge, such as the effects of cell phone use over the long-term and on pediatric populations.

There was a similar statement made by the FCC, in previous section, and also similar statement was made by Samsung, one of world's largest producers of cell phones which reads a follows [132]:

Over the past 15 years, scientists have conducted hundreds of studies looking at the biological effects of radio frequency energy emitted by cell phones. While some researchers have reported biological changes associated with RF energy, these studies have failed to be replicated. The majority of studies published have failed to show an association between between exposure to radio frequency from a cell phone and health problems.

Neither the FDA statement nor the Samsung statement give us any idea what possible effects are being considered here, what literature was used for such a consideration. These statements are completely undocumented and therefore must be viewed as being unscientific. In Chapter 1, 79 reviews were given that each showed the existence of one or more effects. Eignt different of effects were each documented in from 12 to 35 reviews. Such reviews must be extensively documented or one cannot get them published. Any one of those reviews provides, therefore, a much stronger argument for presence of one or more effects than do the FDA, FCC and Samsung statements put together arguing for the opposite. One thing that is strange about the FDA statement is that they are talking specifically about cell phones even though they are tasked with regulating safety on all such microwave/radiofrequency devices. What I have done below is to put together the 16 reviews which are completely or largely focused on cell phone radiation effects so that we can see what specific effects have been found to be caused by cell phone radiation. I will summarize those effects below.

Table 5: Reviews on Cell Phone Effects and the Effects Found in Each

Review on Cell Phone Effects	Effects Found
La Vignera S, Condorelli RA, Vicari E, D'Agata R, Calogero AE. 2012 Effects of the exposure to mobile phones on male reproduction: a review of the literature. J Androl 33:350-356.	Multiple effects on male reproduction
Makker K, Varghese A, Desai NR, Mouradi R, Agarwal A. 2009 Cell phones: modern man's nemesis? Reprod Biomed Online 18:148-157.	Cellular DNA damage, neurological/neuropsychiatric effects, apoptosis
Yakymenko IL, Sidorik EP, Tsybulin AS. 1999 [Metabolic changes in cells under electromagnetic radiation of mobile communication systems]. Ukr Biokhim Zh (1999), 2011 Mar-Apr:20-28.	Apoptosis, increased oxidative stress, increased intracellular calcium
K Sri N. 2015 Mobile phone radiation: physiological & pathophysiological considerations. Indian J Physiol Pharmacol 59:125-135.	Male infertility, cellular DNA damage, lowered melatonin, increased stress protein expression
Nazıroğlu M, Yüksel M, Köse SA, Özkaya MO. 2013 Recent reports of Wi-Fi and mobile phone-induced	Oxidative stress, male and female reproductive signaling dysfunction

radiation on oxidative stress and reproductive signaling pathways in females and males. J Membr Biol 246:869-875.	
Yakymenko I, Sidorik E. 2010 Risks of carcinogenesis from electromagnetic radiation and mobile telephony devices. Exp Oncol 32:729-736.	Cancer, cellular DNA damage, apoptosis; higher cancer incidence on ipsilateral side of the head, not contralateral
Zhang J, Sumich A, Wang GY. 2017 Acute effects of radiofrequency electromagnetic field emitted by mobile phone on brain function. Bioelectromagnetics 38:329-338. doi: 10.1002/bem.22052.	Neurological dysfunction
Kundi M, Mild K, Hardell L, Mattsson M. 2004 Mobile telephones and cancer – a review of the epidemiological evidence. J Toxicol Env Health, Part B 7:351-384.	Cancer – epidemiological review
Hardell L, Carlberg M, Soderqvist F, Hansson Mild K. 2008 Meta-analysis of long-term mobile phone use and the association with brain tumors. Int J Oncol 32:1097-1103.	Cancer – meta-analysis on long-term cell phone use and brain tumors
Hardell L, Carlberg M. 2013 Using the Hill viewpoints from 1965 for evaluating strengths of evidence of the risk for brain tumors associated with use of mobile and cordless phones. Rev Environ Health 28:97-106. doi: 10.1515/reveh-2013-0006.	Mobile and cordless phone radiation caused brain cancer based on the Hill criteria for causation (most important criteria for causation in epidemiology)
Hardell L, Carlberg M, Hansson Mild K. 2013 Use of mobile phones and cordless phones is associated with increased risk for glioma and acoustic neuroma. Pathophysiology 2013;20(2):85-110.	Mobile and cordless phone exposures associated with increased risk of glioma and acoustic neuroma; higher cancer increase on ipsilateral side of the head
Davis DL, Kesari S, Soskolne CL, Miller AB, Stein Y. 2013 Swedish review strengthens grounds for concluding that radiation from cellular and cordless phones is a probable human carcinogen. Pathophysiology 20:123-129.	Cell phone and cordless phone radiation are a probable carcinogens; cancer increase on ipsilateral side of the head, not contralateral side
Morgan LL, Miller AB, Sasco A, Davis DL. 2015 Mobile phone radiation causes brain tumors and should be classified as a probable human carcinogen (2A). Int J Oncol 46(5): 1865-1871.	Mobile phone radiation causes brain tumors and should be classified as a probable human carcinogen
Bielsa-Fernández P, Rodríguez-Martín B. 2017 [Association between radiation from mobile phones and tumour risk in adults]. Gac Sanit. 2017 Apr 12. pii: S0213-9111(17)30083-3. doi: 10.1016/j.gaceta.2016.10.014.	Association between mobile phone risk and tumor risk
Prasad M, Kathuria P, Nair P, Kumar A, Prasad K. 2017 Mobile phone use and risk of brain tumours: a systematic review of association between study quality, source of funding, and research outcomes. Neurol Sci. 2017 Feb 17. doi: 10.1007/s10072-017-2850-8.	The association between mobile phone use and brain cancer is higher in independently funded studies than in industry funded studies
Miller A. 2017 References on cell phone radiation and cancer. https://ehtrust.org/references-cell-phone-radio-	This is a bibliography of studies on cell phone radiation and cancer – most

frequency-radiation-cancer/ (Accessed Sept. 9, 2017)	support the view that cell phones do cause cancer

The effects of specifically cell phone radiation that have been found in these reviews (Table 5) include: lowered male reproductive function, lowered female reproductive function, increased cellular DNA damage, neurological/neuropsychiatric effects, increased stress protein synthesis, increased intracellular calcium, apoptosis, lowered melatonin, oxidative stress, cancer (10 reviews) and specifically increased ipsilateral cancer (3 reviews). So there are 11 different cell phone effects where there is substantial enough evidence to warrant publication in one or more review articles. Each of these effects has been shown to occur in response to other microwave frequency EMFs and therefore should be considered to be caused by EMFs more broadly.

The summary of Table 4, Chapter 5, the genuine cell phone primary literature studies that fell into the 2009-2013 time frame, started as follows: "If you look through the studies described in Table 4, you will see multiple studies in oxidative stress/free radical damage, on changes in tissue structure (sometimes called remodeling), on cellular DNA damage, on male fertility (and also one on female fertility), on behavioral changes and on neurological changes. There is also one study on insulin/type 2 diabetes (hormonal effect). It follows from this that five of the effects that were extensively documented in large numbers of reviews (Chapter 1) are further demonstrated to be produced by cell phone radiation in these studies. In addition the tissue remodeling and proteomic changes discussed in Chapter 3 are also further demonstrated here."

It can be seen from Tables 4 & 5 and the preceding two paragraphs, that there is a vast amount of literature on repeatedly found effects of cell phone radiation, effects which make a mockery of the *completely undocumented and non-specific* FDA claims to the contrary.

Let's look at another part of the FDA statement which also shows similarities to statements made elsewhere [131]:

The biological effects of radiofrequency energy should not be confused with the effects from other types of electromagnetic energy.

Very high levels of electromagnetic energy, such as is found in X-rays and gamma rays can ionize biological tissues. Ionization is a process where electrons are stripped away from their normal locations in atoms and molecules. It can permanently damage biological tissues including DNA, the genetic material.

The energy levels associated with radiofrequency energy, including both radio waves and microwaves, are not great enough to cause the ionization of atoms and molecules. Therefore, RF energy is a type of non-ionizing radiation. Other types of non-ionizing radiation include visible light, infrared radiation (heat) and other forms of electromagnetic radiation with relatively low frequencies.

This is almost identical to another Samsung statement and also to an FCC statement that I have not copied. Here is the Samsung statement [133]:

The biological effects of RF energy should not be confused with the effects from other types of electromagnetic energy.

Very high levels of electromagnetic energy, such as is found in X-rays and gamma rays, can ionize biological tissues. Ionization is a process where electrons are stripped away from their normal locations in atoms and molecules. It can permanently damage biological tissues including DNA, the genetic material.

The energy levels associated with radio frequency energy, including both radio waves and microwaves, are not great enough to cause ionization of atoms and molecules. Therefore, RF energy is a type of non-ionizing radiation. Other types of non-ionizing radiation include visible light, infrared radiation (heat), and other forms of electromagnetic radiation with relatively low frequencies.

While RF energy does not ionize particles, large amounts can increase body temperatures and cause tissue damage. Two areas of the body, the eyes and the testes, are particularly vulnerable to RF heating because there is relatively little blood flow in them to carry away excess heat.

The three paragraphs from the FDA statement are word for word identical to the first three paragraphs of the Samsung statement. The last paragraph in the Samsung statement was deleted from the FDA statement. It is clear from this that either the FDA statement is derived from the earlier industry statement rather than the other way around or both are derived from a previous statement similar to the Samsung statement.

These types of statements have given rise to shorter statements that are all something like the following:

Non-ionizing radiation consists of photons that do not have enough energy to break chemical bonds including the chemical bonds of DNA.

All of these statements are technically correct. They are also highly misleading. They are often falsely interpreted as meaning that there cannot be any effects of non-ionizing, non-thermal EMF exposures ***including indirect effects***. There are many possible indirect effects that may occur, given the complexity of biology. But our situation goes way beyond that, because we know that most of the effects are produced via VGCC activation which produces, as downstream effects, the free radical breakdown products of peroxynitrite (Fig. 1, Chapter 2). Those free radical breakdown products attack DNA, proteins and other biological constituents in ways that are very similar to the ways in which ionizing radiation attack these same molecules. Ionizing radiation was shown by Arthur Compton, who won the Nobel prize in physics in 1927, for showing that ionizing radiation produces large numbers of free radicals through what has become known as Compton scattering, with those free radicals being responsible for most of the biological effects of ionizing radiation. So the often repeated industry claim that ionizing radiation is dangerous but non-ionizing radiation is not, <u>is wrong</u> – both of them produce similar effects mediated through free radical generation. However the dangers of non-ionizing radiation may eclipse the dangers of ionizing radiation under some conditions because of something that is discussed early in Chapter 5, at the end of the Speit/Schwarz discussion. There are three processes which occur in the sequence by which EMF activation leads to peroxynitrite breakdown product radicals, each of which have high levels of amplification (each discussed on p. 29 in Chapter 5). Thus potentially and I believe actually microwave frequency EMFs can produce under suitable conditions, much more efficient free radical production than occurs from a similar energy level of ionizing radiation.

The FDA may have had a long history of playing fast and loose with the truth. For example, Microwave News article published in 2003, provides this account of what occurred at the FDA in 1993 [134]:

1993 FDA Memo Data "Strongly Suggest" Microwaves Can Promote Cancer.

In the spring of 1993 at the height of the public concern over cell phone brain tumor risks, the Food and Drug Adminstration (FDA) biologists concluded [134] that the available data "strongly suggest" that microwaves can "accelerate the development of cancer." This assessment is from an internal agency memo recently obtained by Microwave News under the Freedom of Information Act.

"Of approximately eight chronic animal experiments known to us, five resulted in increased numbers of malignancies, accelerated progression of tumors, or both" wrote Drs. Mays Swicord and Larry Cress of FDA's Center for Devices and Radiological Health (CDRH) in Rockville, MD. They also pointed to other evidence from laboratory (in vitro) studies which supported cancer risk.

Yet in its public statements at that time, the agency played down these findings [134]. For instance in a Talk Paper issued in early February, the FDA stated that there was "limited evidence that suggests that lower levels (of microwaves) might cause adverse effects."

"A few studies suggest that (microwave) levels (from cellular phones) can accelerate the development of cancer in laboratory animals," the FDA added [134], "but there is much uncertainty among scientists about whether these results apply to the use of cellular phones."

I have three comments. Firstly, if you look at the 35 citations in the list on cancer causation in Chapter 1, you will see that there are 8 citations (#s 2-7 & 15 & 19) which provide similar evidence of stimulation of tumor promotion, four of which (#s 3-6) were published around 1993, the time of the FDA memo and public statement described above. Therefore, there was a substantial literature including peer-reviewed primary literature and review articles which produced similar conclusions to those of the FDA internal memo. The importance of the memo is that the FDA knew about these findings and opted to cover them up.

Secondly if you compare the rhetoric in the 1993 memo with the first quote from the current FDA web site quoted in this section, you will see some striking similarities. They both first refer to "a few studies" which are not identified, followed by raising uncertainties and then finally raising doubt as to whether these findings apply to cell phone radiation. The pattern of the FDA rhetoric has not changed much in 25 years.

If one includes the middle statement also quoted from the FDA web site, we have three FDA statements each of which downplays any biological effects and each of which are strongly rebutted by extensive peer-reviewed independent scientific literature. I'm not sure we can say the FDA has been corrupted by the industry, but what we can say is that it has been functioning as if it has been corrupted for 25 years.

In mid-2009 Margaret A. Hamburg, the new commissioner of the FDA, and Joshua M. Sharfstein, her principal deputy commissioner, published a commentary article in the New England Journal of Medicine [135] which included the following:

"One of the greatest challenges facing any public health agency is that of risk communication. … The FDA's job is to minimize risks through education, regulation, and enforcement. To be credible in all these tasks, the agency must communicate frequently and clearly about risks and benefits—and about what organizations and individuals can do to minimize risk. When, like the FDA, Americans must make choices about medication, devices, foods, or nutrition in the absence of perfect information, the FDA cannot delay in providing reasonable guidance —guidance that informs rather than causes unnecessary anxiety. For these communications to have credibility, the public must trust the agency to base its decisions on science."

These were and are laudable goals. As far as I can tell, with regard to EMF effects, the FDA has failed to base either its communications or its decisions on science.

Summary of Chapter 6

In the areas discussed in Chapter 6 what used to be the primacy of U.S. science has completely disintegrated. It has disintegrated because of the cessation of U.S. government funding for either experimental studies or epidemiological studies. It has disintegrated due to attacks on U.S. and International scientists, attacks that started in the U.S. with the attacks on Dr. Henry Lai. It has disintegrated because of aggressive industry propaganda, propaganda that has no connection with the real science. It has disintegrated because of the outright corruption of the committee to set standards for radio-frequency exposures and the FCC and the possible and *de facto* corruption of the FDA. The telecommunications industry has been aware of much of the problems with their approach since the 1999 letter to them from George Carlo. The FCC has been aware of much more of the science since my presentation to them in September 2016. The FDA has been aware of contrary findings since 1993. Each of them has, if anything, doubled down on their fictions since those respective times.

Many of these things are going on internationally; however the U.S. has often been leading the world in these processes. All of the actions we have seen to corrupt the science and public understanding of the science have the effect of making it vastly more difficult for individuals impacted by the EMFs to protect themselves from further harm. We have many effects that are cumulative and become irreversible as they become more severe, effects that impact at a minimum, tens of millions of Americans and hundreds of millions of people elsewhere in the world. *Industrial and regulatory organizations make it difficult or impossible for people to have scientifically valid information also make it difficult or impossible for people to protect themselves from the accumulation of these effects, leading to severe irreversible effects. Each of the organizations involved, both U.S. and international that collaborate in this process, have important responsibility for the consequences.* I think damage goes way beyond tens and hundreds of millions of people, because I think we are looking at cumulative severe impact on our brain function, on our reproductive function and on our DNA, and that these, in turn will lead to the crash of every single technologically advanced country on earth, barring a major change in course. That will happen fairly quickly, in my opinion, even without 5G but 5G will greatly speed up the process and perhaps even add new egregious effects

Chapter 7: The Great Risks of 5G: What We Know and What We Don't Know

We have already discussed two issues that are essential to understanding 5G. One is that pulsed EMFs are, in most cases, much more biologically active than are non-pulsed (often called

continuous wave) EMFs. A second is that the EMFs act by putting forces on the voltage sensor of the VGCCs, opening these calcium channels and allowing excessive calcium ions to flow into the cell. The voltage sensor is extraordinarily sensitive to those electrical forces, such that the safety guidelines are allowing us to be exposed to EMFs that are something like 7.2 million times too high.

The reason that the industry has decided to go to the extremely high frequencies of 5G is that with such extremely high frequencies, it is possible to carry much more information via much more pulsation than it is possible to carry with lower frequencies even in the microwave range. We can be assured, therefore, that 5G will involve vastly more pulsation than do EMFs that we are currently exposed to. It follows from that, that any biological safety test of 5G must use the very rapid pulsations including whatever very short term spikes may be present, that are to be present in genuine 5G. There is an additional process that is planned to be used in 5G: phased arrays (https://en.wikipedia.org/wiki/Phased_array). Here multiple antenna elements act together to produce highly pulsed fields which are designed for 5G, to produce increased penetration. 5G will entail particularly powerful pulsations to be used, which may, therefore, be particularly hazardous.

The only data we have, to my knowledge, on millimeter wave frequencies of 5G used *non-pulsed EMFs in the millimeter frequency range of 5G, not genuine 5G*. Such millimeter waves have been shown to produce a number of downstream effects of VGCC activation. One millimeter wave study showed that it activated both the VGCCs and also the voltage-gated potassium channels, suggesting that it worked via the voltage sensor, as do other EMFs [136]. Any such data tells us almost nothing about how biologically active genuine very highly pulsed 5G will be. I take it that from their statements, that both Mr. Ryan and Dr. Vinciūnas are ready to put out 10s of millions of 5G antennae to afflict every single person in the EU with 5G radiation without even a single biological test of safety of genuine 5G. In the U.S., the FCC has taken a much worse position. The FCC is not only willing to allow such completely untested exposures but has also been has been aggressively pushing to promote installation of 5G antennae, such that antennae are already being installed in parts of the U.S. In a world where shocking behavior has become less and less shocking, I consider EU and U.S. views and actions to be shocking. The U.S. situation is mass insanity. I would have hoped that the Europeans, who think of themselves as being much more thoughtful than Americans, would have been genuinely more thoughtful.

Why does 5G need such high numbers of antennae? It is because the 5G radiation is much more absorbed as it enters various materials. The approach is to use many more antennae with one found every few houses, such that 5G can sufficiently penetrate local walls. Such absorption usually involves the interaction with electrically charged groups, such that such high absorption is likely to involve placing forces on electrically charged groups. Because such forces are the way in which EMFs activate the VGCCs, it seems highly likely, therefore, that 5G radiation will be particularly active in VGCC activation.

In summary, then, 5G is predicted to be particularly dangerous for each of four different reasons: 1. The extraordinarily high numbers of antennae that are planned. 2. The very high energy outputs which will be used to ensure penetration. 3. The extraordinarily high pulsation levels. 4. The apparent high level interactions of the 5G frequency on charged groups presumably including the voltage sensor charged groups.

Now what the telecommunications industry argues is that 5G radiation will be mostly absorbed in the outer 1 or 2 mm of the body, such that they claim that we don't have to worry about the effects. There is some truth to that, but there are also some caveats that make any conclusions

made from that, much more suspect. In any case, these surface effects of 5G will have especially strong impact on organisms with much higher surface to volume ratios. Consequently, I predict that many organisms will be much more impacted than we will. This includes insects and other arthropods, birds and small mammals and amphibia. It includes plants including even large trees, because trees have leaves and reproductive organs that are highly exposed. I predict there will be major ecological disasters as a consequence of 5G. This will include vast conflagrations because EMF exposures make plants much more flammable.

But let's get back to humans. The industry has also made claims that more conventional microwave frequency EMFs are limited in effect to the outer 1 cm of the body. We know that is not true, however because of the effects deep in the human brain, on the heart and on hormone systems. Perhaps the most important two studies demonstrating effects deep within the body are the studies of Professor Hässig and his colleagues in Switzerland on cataract formation in newborn calves [137,138]. These two studies clearly show that when pregnant cows are grazing near mobile phone base stations (also called cell phone towers), the calves are born with very greatly increased incidences of cataracts. It follows from these findings that even though the developing fetuses are very deep in the body of the mother and should be highly protected from the EMF exposures, they are not so protected. And because the EMF safety guidelines in Switzerland are 100 times more stringent than are the safety guidelines in most of the rest of Europe, in the U.S., Canada and most of the rest of the world, the more general safety guidelines allow greatly excessive exposures and penetration of effects. The claims of industry that microwave frequency EMFs only act in the outer centimeter of the body are clearly false.

How then can both conventional microwave frequency EMFs and 5G radiation act deeply within the body? You may correctly observe that the electrical effects of the EMFs activate the voltage sensor and that the direct electrical forces are rapidly attenuated in the body. So how can we get deep effects? I think the answer is that the magnetic parts of the EMFs have been known for decades to penetrate much more deeply than do the electrical parts. The magnetic fields put forces on mobile electrically charged groups dissolved in the aqueous phases of the body and small individual movements of the charged groups can regenerate electric fields that are essentially identical to the electric fields of the original EMFs, carrying the same frequency and same pulsation pattern, although with lower intensity. An example of this is given in the Lu and Ueno [139] study. Because the voltage sensor is so stunningly sensitive to electrical forces and part of the reason for that is the very high level of amplification of the electrical field across the plasma membrane, we have an almost perfect way in which to produce EMF effects deeply within our bodies.

I am very concerned that 5G may produce effects like those we already see produced from lower frequency EMFs but are much more severe. I am also concerned that we will also see responses that are qualitatively different. Let me give you three possible examples of the latter type and one quantitative example. Each of the four types of blindness, have downstream effects of VGCC activation as causal factors: cataracts, detached retinas, glaucoma and macular degeneration. The aqueous and vitreous humors in the eye may be an ideal environment for the regeneration of the electrical fields within the eye. We may, therefore have a gigantic epidemic of each of the four types of blindness. Another concern focuses on kidney dysfunction, which was shown in Chapter 5 to be impacted by EMFs. The kidneys have much fluid, both blood and also what will become urine, which may allow efficient the regeneration of electrical fields. Such regeneration may be expected to impact both the glomerular filtration and also the reabsorption, both essential to kidney function. Does this mean that 5G will produce very large increases in kidney failure? The only way to find out is to do biological safety testing of genuine 5G radiation. Let me give you a third example. Fetuses and very young babies have much more water in their bodies than do

adults. Therefore, they may be a special risk for impacts of 5G, because of great increases in the regeneration of the electrical fields. Here one can think of all kinds of possibilities. Let me suggest two. We may have a gigantic (sorry about using that word again) epidemic of spontaneous abortion due the teratogenic effects. Another possibility is that instead of autism being one birth in 38, however horrendous that is, it could be one out of two, or even a majority of births. I don't know that these will happen, but these are the kinds of risks we are taking and there are many others one can think of. Putting in tens of millions of 5G antennae without a single biological test of safety has got to be about the stupidest idea anyone has had in the history of the world.

This brings us back to the earlier point. The only way to do 5G safety testing is to do genuine 5G biological safety testing. I have published on how this can be done relatively easily at relatively low cost and have, as you saw in the Chapter 6, told the FCC how this can be done. Those tests must be done by organizations completely independent of industry and that leaves out both ICNIRP and SCENIHR and a lot of other organizations.

Now we will get into the precautionary principle which is specially relevant to the EU but may have lessons for all of us.

Dr. Vinciūnas' last full paragraph reads as follows: "The recourse to the EU's precautionary principle to stop distribution of 5G products appears too drastic a measure. We need first to see how this technology will be applied and how the scientific evidence will evolve. Please be assured that the Commission will keep abreast of the scientific evidence in view of safeguarding the health of European citizens at the highest level possible and in line with its mandate."

Article 191 defines the **Precautionary Principle** as follows:

"According to the European Commission the precautionary principle may be invoked when **a phenomenon, product or process may have a dangerous effect**, identified by a **scientific and objective evaluation**, **if this evaluation does not allow the risk to be determined with sufficient certainty**.

Recourse to the principle belongs in the general framework of **risk analysis** (which, besides risk evaluation, includes risk management and risk communication), and more particularly in the context of **risk management** which corresponds to the decision-making phase.

The Commission stresses that the precautionary principle may only be invoked in the event of a potential risk and that it can never justify arbitrary decisions.
The precautionary principle may only be invoked when the **three preliminary conditions** are met:

identification of potentially adverse effects;
evaluation of the scientific data available;
the extent of scientific uncertainty."

The question now is what about 5G? We have with 5G strong suspicions of similar or much more severe risk of effects documented elsewhere in this document. We have no biological safety testing of genuine 5G radiation. Therefore, we have no risk analysis or risk management because we have no risk assessment whatsoever on 5G. So here we have Dr. Vinciūnas arguing that the request for precautionary principle application is premature. But it is not the request for

the use of the precautionary principle that is premature, it is the Commission's claim that it has done the required risk analysis and risk assessment. This is the bizarre world that we live in.

The European Commission has done nothing to protect European citizens from the very serious health hazards and the U.S. FDA, EPA and National Cancer Institute have done nothing to protect U.S. citizens. The U.S. FCC has been worse than that, acting in wanton disregard for our health.

Let me close, as follows. There have been certain points in our history where people have stood up to strong destructive forces against what often appeared to be insurmountable odds. Those people are THE most honored people in our history. The people who failed to do so are among the most despised people in our history. I am not at all sure we will have historians to record us 100 years from now or even 30 years from now, given the direction in which we are heading. But if we do, rest assured that these are the standards by which we will all be judged.

Citations used in the text:

[1] Levine H, Jorgensen N, Martino-Andrade A, Mendiola J, Weksler-Derri D, Mindlis I, Pinotti R, Swan SH. 2017 Temporal trends in sperm count: a systematic review and meta-analysis. Human Reproduction Update, https://doi.org/10.1093/humupd/dmx022
[2] Magras IN, Xenos TD. 1997 RF radiation-induced changes in the prenatal development of mice. Bioelectromagnetics 18:455-461.
[3] Pall ML. 2016 Microwave frequency electromagnetic fields (EMFs) produce widespread neuropsychiatric effects including depression. J Chem Neuroanat 75(Pt B):43-51. doi: 10.1016/j.jchemneu.2015.08.001.
[4] Pall, ML. 2013. Electromagnetic fields act via activation of voltage-gated calcium channels to produce beneficial or adverse effects. J Cell Mol Med 17:958-965. doi: 10.1111/jcmm.12088.
[5] Pall, M. L. 2015 Scientific evidence contradicts findings and assumptions of Canadian Safety Panel 6: microwaves act through voltage-gated calcium channel activation to induce biological impacts at non-thermal levels, supporting a paradigm shift for microwave/lower frequency electromagnetic field action. Rev. Environ. Health 3, 99-116. doi: 10.1515/reveh-2015-0001.
[6] Pall ML. 2016 Electromagnetic fields act similarly in plants as in animals: Probable activation of calcium channels via their voltage sensor. Curr Chem Biol 10: 74-82.
[7] Pall, M. L., 2018. How cancer can be caused by microwave frequency electromagnetic field (EMF) exposures: EMF activation of voltage-gated calcium channels (VGCCs) can cause cancer including tumor promotion, tissue invasion and metastasis via 15 mechanisms. Chapter 7 in Markov, M. S., (Ed.), Mobile Communications and Public Health, CRC Press, Boca Raton, FL, in press.
[8] Belyaev, I., 2005. Non-thermal biological effects of microwaves. Microwave Rev. 11, 13-29.
[9] Belyaev, I., 2015. Biophysical mechanisms for nonthermal microwave effects. In: Markov M.S. (Ed), Electromagnetic Fields in Biology and Medicine, CRC Press, New York, pp 49-67.
[10] Panagopoulos, D. J., Johansson, O., Carlo, G. L., 2015. Polarization: a key difference between man-made and natural electromagnetic fields, in regard to biological activity. Sci. Rep. 2015 Oct 12;5:14914. doi: 10.1038/srep14914.
[11] Pall ML. 2018 Wi-Fi is an important threat to human health. Environ Res 164:405-416. doi: 10.1016/j.envres.2018.01.035.
[12] Pilla, A. A., 2012. Electromagnetic fields instantaneously modulate nitric oxide signaling in challenged biological systems. Biochem. Biophys. Res. Commun. 28, 426:330-333. doi: 10.1016/j.bbrc.2012.08.078.
[13] Lu, X. W., Du, L., Kou, L., Song, N., Zhang, Y. J., Wu, M. K., Shen, J. F., 2015. Effects of

moderate static magnetic fields on the voltage-gated sodium and calcium channels currents in trigeminal ganglion neurons. Electromagn. Biol. Med. 34, 285-292. doi: 10.3109/15368378.2014.906448.
[14] Tabor, K. M., Bergeron, S. A., Horstick, E. J., Jordan, D. C., Aho, V., Porkka-Heiskanen, T., Haspel, G, Burgess, H. A., 2014. Direct activation of the Mauthner cell by electric field pulses drives ultrarapid escape responses. J Neurophysiol 112:834-844. doi: 10.1152/jn.00228.2014.
[15] Zhang, J., Li, M., Kang, E. T., Neoh, K. G., 2016. Electrical stimulation of adipose-derived mesenchymal stem cells in conductive scaffolds and the roles of voltage-gated ion channels. Acta Biomater. 32, 46-56. doi: 10.1016/j.actbio.2015.12.024.
[16] Tekieh T, Sasanpour P, Rafii-Tabar H. 2016 Effects of electromagnetic field exposure on conduction and concentration of voltage gated calcium channels: A Brownian dynamics study. Brain Res 1646:560-569.
[17] ICNIRP 2009 International Commission on Non-ionizing Radiation Protection. ICNIRP statement on the "Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (up to 300 GHz). Health Phys 97:257-258.
[18] Bioinitiative Working Group. 2007 BioInitiative Report: A rationale for biologically-based public exposure standard for electromagnetic fields (ELF and RF). Sage C and Carpenter DO (Eds.), Available online: http://www.bioinitiative.org/table-of-contents/ (accessed March 19, 2018)
[19] Sypniewska, R. K., Millenbaugh, N. J., Kiel, J. L., Blystone, R. V., Ringham, H. N., Mason, P. A., Witzmann, F. A., 2010. Protein changes in macrophages induced by plasma from rats exposed to 35 GHz millimeter waves. Bioelectromagnetics 3, 656-663. doi: 0.1002/bem.20598.
[20] Kalns, J., Ryan, K. L., Mason, P. A., Bruno, J. G., Gooden, R., Kiel, J. L., 2000. Oxidative stress precedes circulatory failure induced by 35-GHz microwave heating. Shock 13, 52-59.
[21] Garbuz, D. G., 2017. Regulation of heat shock gene expression in response to stress. Mol. Biol. 51, 352-367. doi: 10.1134/S0026893317020108.
[22] Park, H. K., Lee, J. E., Lim, J. F., Kang, B. H., 2014. Mitochondrial Hsp90s suppress calcium-mediated stress signals propagating from the mitochondria to the ER in cancer cells. Mol. Cancer 13 Article Number: 148 doi: 10.1186/1476-4598-13-148.
[23] Krebs, J., Groenendyk, J., Michalek, M., 2011. Ca2+-signaling, alternative splicing and endoplasmic reticulum stress responses. Neurochem. Res. 36, 1198-1211. doi: 10.1007/s11064-011-0431-4.
[24] Pilla, A. A., 2013. Nonthermal electromagnetic fields: from first messenger to therapeutic applications. Electromagn Biol Med 32, 123-136. doi: 10.3109/15368378.2013.776335.
[25] Pall, M. L., 2014. Electromagnetic field activation of voltage-gated calcium channels: role in therapeutic effects. Electromagn. Biol. Med. 2014 Apr 8 doi: 10.3109/15368378.2014.906447.
[26] Raines JK. 1981. Electromagnetic Field Interactions with the Human Body: Observed Effects and Theories. Greenbelt, Maryland: National Aeronautics and Space Administration 1981; 116 p.
[27] Goldsmith JR. 1997 Epidemiologic evidence relevant to radar (microwave) effects. Env Health Perspect 105(Suppl 6):1579-1587.
[28] Hecht Karl. 2016 Health Implications of Long-Term Exposures to Electrosmog. Brochure 6 of A Brochure Series of the Competence Initiative for the Protection of Humanity, the Environment and Democracy. http://kompetenzinitiative.net/KIT/wp-content/uploads/2016/07/KI_Brochure-6_K_Hecht_web.pdf (accessed Feb. 11, 2018)
[29] Marha K. 1966 Biological Effects of High-Frequency Electromagnetic Fields (Translation). ATD Report 66-92. July 13, 1966 (ATD Work Assignment No. 78, Task 11).
[30] Glaser ZR, PhD. 1971 Naval Medical Research Institute Research Report, June 1971. Bibliography of Reported Biological Phenomena ("Effects") and Clinical Manifestations Attributed to Microwave and Radio-Frequency Radiation. Report No. 2 Revised.

https://scholar.google.com/scholar?q=Glaser+naval+medical+microwave+radio-frequency+1972&btnG=&hl=en&as_sdt=0%2C38 (Accessed Sept. 9, 2017)
[31] Bise W. 1978 Low power radio-frequency and microwave effects on human electroencephalogram and behavior. Physiol Chem Phys 10:387-398.
[32] Belyaev I, Dean A, Eger H, Hubmann G, Jandrisovits R, Kern M, Kundi M, Moshammer H, Lercher P, Müller K, Oberfeld G, Ohnsorge P, Pelzmann P, Scheingraber C, Thill R. 2016 EUROPAEM EMF Guideline 2016 for the prevention, diagnosis and treatment of EMF-related health problems and illnesses. Rev Environ Health DOI 10.1515/reveh-2016-0011.j
[33] Hedendahl L, Carlberg M, Hardell L. 2015 Electromagnetic hypersensitivity--an increasing challenge to the medical profession. Rev Environ Health 30:209-215. doi: 10.1515/reveh-2015-0012.
[34] Carpenter DO. 2015 The microwave syndrome or electro-hypersensitivity: historical background. Rev Environ Health 30:217-222. doi: 10.1515/reveh-2015-0016
[34] Havas M. 2013 Radiation from wireless technology affects the blood, the heart and the autonomic nervous system. Rev Environ Health 82:75-84.https://doi.org/10.1515/reveh-2013-0004
[35] Havas M, Marrongelle J, Pollmer, Kelley E, Rees C, Tully S. 2010 Provocation study using heart rate variability shows microwave radiation from 2.4 GHz cordless phone affects autonomic nervous system. Eur J Oncol 5:273-300.
[36] Gordon, ZV. 1966 [Problems of industrial hygiene and biological effects of super high frequency electromagne c fields.] Medizina, Moscow (in Russian)
[37] Presman, AS. Electromagnetic fields and life. New York: Plenum Press, 1970.
[38] Tolgskaya MS, Gordon ZV. 1973. Pathological Effects of Radio Waves, Translated from Russian by B Haigh. Consultants Bureau, New York/London, 146 pages.
[39] Siebert DM, Drezner JA. 2018 Sudden cardiac arrest on the field of play: turning tragedy into a survivable event. Neth Heart J 26:115-119. doi: 10.1007/s12471-018-1084-6.
[40] Pall ML. 2013 The NO/ONOO- cycle as the central cause of heart failure. Int J Mol Sci 14:22274-22330. doi: 10.3390/ijms141122274.
[41] Liu YQ, Gao YB, Dong J, Yao BW, Zhao L, Peng RY. 2015 Pathological changes in the sinoatrial node tissues of rats caused by pulsed microwave exposure. Biomed Environ Sci 28:72-75. doi: 10.3967/bes2015.007.
[42] Pritchard C, Mayers A, Baldwin D. 2013 Changing patterns of neurological mortality in the 10 major developed countries--1979-2010. Public Health 127:357-368. doi: 10.1016/j.puhe.2012.12.018.
[43] Pritchard C, Rosenorn-Lanng E. 2015 Neurological deaths of American adults (55-74) and the over 75's by sex compared with 20 Western countries 1989-2010: Cause for concern. Surg Neurol Int 2015 Jul 23;6:123. doi: 10.4103/2152-7806.161420.
[44] Vieira RT, Caixeta L, Machado S, Silva AC, Nardi AE, Arias-Carrión O, Carta MG. 2013 Epidemiology of early-onset dementia: a review of the literature. Clin Pract Epidemiol Ment Health 9:88-95. doi: 10.2174/1745017901309010088.
[45] Hallberg O, Johansson O. 2005 Alzheimer mortality—why does it increase so rapidly in sparsely populated areas? Eur Biol Bioelectromag 1;1-8
[46] [Dossey L. 2014 FOMO, digital dementia, and our dangerous experiment. Explore (NY) 2014 Mar-Apr;10(:69-73. doi: 10.1016/j.explore.2013.12.008.
[47] Moledina S, Khoja A. 2018 Letter to the Editor: Digital Dementia-Is Smart Technology Making Us Dumb? Ochsner J. 2018 Spring;18(1):12.
[48] Spitzer, Manfred. Digitale Demenz. Wie wir uns und unsere Kinder um den Verstand bringen. Droemer Verlag, Munich 2012.
[49] Mattson MP. 2007 Calcium and neurodegeneration. Aging Cell 6:337-350. doi: 10.1111/j.1474-9726.2007.00275.x

[50] Celsi F, Pizzo P, Brini M, Leo S, Fotino C, Pinton P, Rizzuto R. 2009 Mitochondria, calcium and cell death: a deadly triad in neurodegeneration. Biochim Biophys Acta 1787:335-344. doi: 10.1016/j.bbabio.2009.02.021.
[51] Carreiras MC, Mendes E, Perry MJ, Francisco AP, Marco-Contelles J. 2013 The multifactorial nature of Alzheimer's disease for developing potential therapeutics. Curr Top Med Chem 13:1745-1770.
[52] Jiang DP, Li J, Zhang J, Xu SL, Kuang F, Lang HY, Wang YF, An GZ, Li JH, Guo GZ. 2013 Electromagnetic pulse exposure induces overexpression of beta amyloid protein in rats. Arch Med Res 44:178-184. doi: 10.1016/j.arcmed.2013.03.005.
[53] Jiang DP, Li JH, Zhang J, Xu SL, Kuang F, Lang HY, Wang YF, An GZ, Li J, Guo GZ. 2016 Long-term electromagnetic pulse exposure induces Abeta deposition and cognitive dysfunction through oxidative stress and overexpression of APP and BACE1. Brain Res. 2016 Jul 1;1642:10-19. doi: 10.1016/j.brainres.2016.02.053.
[54] Dasdag S, Akdag MZ, Kizil G, Kizil M, Cakir DU, Yokus B. 2012 Effect of 900 MHz radio frequency radiation on beta amyloid protein, protein carbonyl, and malondialdehyde in the brain. Electromagn Biol Med. 2012 Mar;31(1):67-74. doi: 10.3109/15368378.2011.624654.
[55] Dasdag S, Akdag MZ, Erdal ME, Erdal N, Ay OI, Ay ME, Yilmaz SG, Tasdelen B, Yegin K. 2015 Long term and excessive use of 900 MHz radiofrequency radiation alter microRNA expression in brain. Int J Radiat Biol 91:306-311. doi: 10.3109/09553002.2015.997896.
[56] Arendash GW, Mori T, Dorsey M, Gonzalez R, Tajiri N, Borlongan C. 2012 Electromagnetic treatment to old Alzheimer's mice reverses β-amyloid deposition, modifies cerebral blood flow, and provides selected cognitive benefit. PLoS One. 2012;7(4):e35751. doi: 10.1371/journal.pone.0035751.
[57] Arendash GW. 2016 Review of the Evidence that Transcranial Electromagnetic Treatment will be a Safe and Effective Therapeutic Against Alzheimer's Disease. J Alzheimers Dis 53:753-771.
[58] García AM, Sisternas A, Hoyos SP. 2008 Occupational exposure to extremely low frequency electric and magnetic fields and Alzheimer disease: a meta-analysis. Int J Epidemiol 37:329-340. doi: 10.1093/ije/dym295.
[59] Hug K1, Röösli M, Rapp R. 2006 Magnetic field exposure and neurodegenerative diseases--recent epidemiological studies. Soz Praventivmed 51:210-220.
[59A] No author listed. 1997 Stronger evidence for an Alzheimer’s EMF connection. Microwave News XVII, Jan/Feb 1997, 1,6,7.
[60] Gandhi OP, Kang G. 2001 Calculation of induced current densities for humans by magnetic fields from electronic article surveillance devices. Phys Med Biol 46:2759-2771.
[61] Gandhi OP, Morgan LL, de Salles AA, Han YY, Herberman RB, Davis DL. 2012 Exposure Limits: The underestimation of absorbed cell phone radiation, especially in children. Electromagn Biol Med 31:34-51. doi: 10.3109/15368378.2011.622827.
[62] Belyaev IY, Markovà E, Hillert L, Malmgren LO, Persson BR. 2009 Microwaves from UMTS/GSM mobile phones induce long-lasting inhibition of 53BP1/gamma-H2AX DNA repair foci in human lymphocytes. Bioelectromagnetics 30:129-141. doi: 10.1002/bem.20445.
[63] Markovà E, Malmgren LO, Belyaev IY. 2010 Microwaves from Mobile Phones Inhibit 53BP1 Focus Formation in Human Stem Cells More Strongly Than in Differentiated Cells: Possible Mechanistic Link to Cancer Risk. Environ Health Perspect 118:394-399. doi: 10.1289/ehp.0900781
[64] Lee SS, Kim HR, Kim MS, Park SH, Kim DW. 2014 Influence of smart phone Wi-Fi signals on adipose-derived stem cells. Ja J Cranofac Surg 25:1902-1907. doi: 10.1097/SCS.0000000000000939.
[65] Czyz J, Guan K, Zeng Q, Nikolova T, Meister A, Schönborn F, Schuderer J, Kuster N, Wobus AM. 2004 High frequency electromagnetic fields (GSM signals) affect gene expression

levels in tumor suppressor p53-deficient embryonic stem cells. Bioelectromagnetic 25:296-307. doi:10.1002/bem.10199
[66] Xu F, Bai Q, Zhou K, Ma L, Duan J, Zhuang F, Xie C, Li W, Zou P, Zhu C. 2016 Age-dependent acute interference with stem and progenitor cell proliferation in the hippocampus after exposure to 1800 MHz electromagnetic radiation. Electromagn Biol Med 3:1-9. doi: 10.1080/15368378.2016.
[67] Odaci E, Bas O, Kaplan S. 2008 Effects of prenatal exposure to a 900 MHz electromagnetic field on the dentate gyrus of rats: a stereological and histopathological study. Brain Res 1238:224-229. doi: 10.1016/j.brainres.2008.08.013.
[68] Uchugonova A, Isemann A, Gorjup E, Tempea G, Bückle R, Watanabe W, König K. 2008 Optical knock out of stem cells with extremely ultrashort femtosecond laser pulses. J Biophotonics 1(6):463-469. doi: 10.1002/jbio.200810047.
[69] Wang C, Wang X, Zhou H, Dong G, Guan X, Wang L, Xu X, Wang S, Chen P, Peng R, Hu X. 2015 Effects of pulsed 2.856 GHz microwave exposure on BM-MSCs isolated from C57BL/6 mice. PLoS One. 2015 Feb 6;10(2):e0117550. doi: 10.1371/journal.pone.0117550.
[70] Teven CM, Greives M, Natale RB, Su Y, Luo Q, He BC, Shenaq D, He TC, Reid RR. 2012 Differentiation of osteoprogenitor cells is induced by high-frequency pulsed electromagnetic fields. J Craniofac Surg 23:586-593. doi: 10.1097/SCS.0b013e31824cd6de.
[71] Bhargav H, Srinivasan TM, Varambally S, Gangadhar BN, Koka P. 2015 Effect of Mobile Phone-Induced Electromagnetic Field on Brain Hemodynamics and Human Stem Cell Functioning: Possible Mechanistic Link to Cancer Risk and Early Diagnostic Value of Electronphotonic Imaging. J Stem Cells 10 (4): 287-294.
[72] Redmayne M, Johansson O. 2015 Radiofrequency exposure in young and old: different sensitivities in the light of age-relevant natural differences. Rev Environ Health 30: 323-335. doi: 10.1515/reveh-2015-0030.
[73] SCENIHR, 2015. Health effects of EMF – 2015 Scientific Committee on Emerging and Newly Identified Health Risks SCENIHR: opinion on potential health effects of exposure to electromagnetic fields (EMF).
https://ec.europa.eu/health/scientific_committees/emerging/docs/scenihr_o_041.pdf (accessed Sept. 7, 2017)
[74] Speit G, Gminski R, Tauber R. 2013 Genotoxic effects of exposure to radiofrequency electromagnetic fields (RF-EMF) in HL-60 cells are not reproducible. Mutat Res Genet Toxicol Environ Mutagen 755: 163-166.
{75] Schwarz C, Kratochvil E, Pilger A, Kuster N, Adlkofer F, Rüdiger HW. 2008 Radiofrequency electromagnetic fields (UMTS, 1,950 MHz) induce genotoxic effects in vitro in human fibroblasts but not in lymphocytes. Int Arch Occup Environ Health 81: 755-767.
[76] J. Lutz and F. Adlkofer, 2007 Objections against current limits for microwave radiation. Proceedings or the WFMN07, Chemnitz, Germany, pp. 119-123. http://www.mobilfunk-debatte.de/pdf/studien/Lutz_Adlkofer_WFMN07_III_A1.pdf (accessed March 36, 2018).
[77] Davis D. 2010 Disconnect: The Truth about Cell Phone Radiation, What the Industry Is Doing to Hide It, and How to Protect Your Family. Penguin Group, New York.
[78] Khurana VG, Teo C, Kundi M, Hardell L, Carlberg M. 2009 Cell phones and brain tumors: a review including the long-term epidemiologic data. Surg Neurol 72:205-214.
[79] Desai NR, Kesari KK, Agarwal A. 2009 Pathophysiology of cell phone radiation: oxidative stress and carcinogenesis with focus on the male reproductive system. Reproduct Biol Endocrinol 7:114.
[80] Makker K, Varghese A, Desai NR, Mouradi R, Agarwal A. 2009 Cell phones: modern man's nemesis? Reprod Biomed Online 18:148-157.
[81] Ruediger HW. 2009 Genotoxic effects of radiofrequency electromagnetic fields. Pathophysiology. 16:89-102.

[82] Phillips JL, Singh NP, Lai H. 2009 Electromagnetic fields and DNA damage. Pathophysiology 16:79-88.
[83] Davanipour Z, Sobel E. 2009 Long-term exposure to magnetic fields and the risks of Alzheimer's disease and breast cancer: Further biological research. Pathophysiology 16:149-156.
[84] Yakymenko I, Sidorik E. 2010 Risks of carcinogenesis from electromagnetic radiation and mobile telephony devices. Exp Oncol 32:729-736.
[85] Carpenter DO. 2010 Electromagnetic fields and cancer: the cost of doing nothing. Rev Environ Health 25:75-80.
[86] Giuliani L, Soffriti M (Eds). 2010 NON-THERMAL EFFECTS AND MECHANISMS OF INTERACTION BETWEEN ELECTROMAGNETIC FIELDS AND LIVING MATTER, RAMAZZINI INSTITUTE EUR. J. ONCOL. LIBRARY Volume 5, National Institute for the Study and Control of Cancer and Environmental Diseases "Bernardino Ramazzini" Bologna, Italy 2010, 400 page monograph.
[87] Khurana, V. G., Hardell, L., Everaert, J., Bortkiewicz, A., Carlberg, M., Ahonen, M. 2010 Epidemiological evidence for a health risk from mobile phone base stations. Int. J. Occup. Environ. Health 16, 263-267.
[88] Levitt, B. B., Lai, H. 2010. Biological effects from exposure to electromagnetic radiation emitted by cell tower base stations and other antenna arrays. Environ. Rev. 18, 369-395. doi.org/10.1139/A10-018
[89] Kang N, Shang XJ, Huang YF. 2010 [Impact of cell phone radiation on male reproduction]. Zhonghua Nan Ke Xue 16:1027-1030.
[90] Yakymenko, I., Sidorik, E., Kyrylenko, S., Chekhun, V. 2011. Long-term exposure to microwave radiation provokes cancer growth: evidences from radars and mobile communication systems. Exp. Oncol. 33(2), 62-70.
[91] Yakimenko IL, Sidorik EP, Tsybulin AS. 2011 [Metabolic changes in cells under electromagnetic radiation of mobile communication systems]. Ukr Biokhim Zh (1999). 2011 Mar-Apr;83(2):20-28.
[92] Gye MC, Park CJ. 2012 Effect of electromagnetic field exposure on the reproductive system. Clin Exp Reprod Med 39:1-9. doi.org/10.5653/cerm.2012.39.1.1
[93] La Vignera S, Condorelli RA, Vicari E, D'Agata R, Calogero AE. 2012 Effects of the exposure to mobile phones on male reproduction: a review of the literature. J Androl 33:350-356.
[94] Biointiative Working Group, David Carpenter and Cindy Sage (eds). 2012 Bioinitiative 2012: A rationale for biologically-based exposure standards for electromagnetic radiation. http://www.bioinitiative.org/participants/why-we-care/
[95} Nazıroğlu M, Yüksel M, Köse SA, Özkaya MO. 2013 Recent reports of Wi-Fi and mobile phone-induced radiation on oxidative stress and reproductive signaling pathways in females and males. J Membr Biol 246:869-875.
[96] Ledoigt G, Belpomme D. 2013 Cancer induction molecular pathways and HF-EMF irradiation. Adv Biol Chem 3:177-186.
[97] Hardell L, Carlberg M. 2013 Using the Hill viewpoints from 1965 for evaluating strengths of evidence of the risk for brain tumors associated with use of mobile and cordless phones. Rev Environ Health 28:97-106. doi: 10.1515/reveh-2013-0006.
[98] Hardell L, Carlberg M, Hansson Mild K. 2013 Use of mobile phones and cordless phones is associated with increased risk for glioma and acoustic neuroma. Pathophysiology 2013;20(2):85-110.
[99} Davis DL, Kesari S, Soskolne CL, Miller AB, Stein Y. 2013 Swedish review strengthens grounds for concluding that radiation from cellular and cordless phones is a probable human carcinogen. Pathophysiology 20:123-129.
[100] Panagopoulos DJ, Johansson O, Carlo GL. 2015. Real versus simulated mobile phone exposures in experimental studies. BioMed Res Int 2015, article ID 607053, 8 pages. doi: 10.1155/2015/607053.

[101] Meo SA, Alsubaie Y, Almubarak Z, Almutawa H, AlQasem Y, Hasanato RM. 2015 Association of Exposure to Radio-Frequency Electromagnetic Field Radiation (RF-EMFR) Generated by Mobile Phone Base Stations with Glycated Hemoglobin (HbA1c) and Risk of Type 2 Diabetes Mellitus. Int J Environ Res Public Health 13;12:14519-14528. doi: 10.3390/ijerph121114519.
[102] Othman, H., Ammari, M., Rtibi, K., Bensaid, N., Sakly, M., Abdelmelek, H. 2017. Postnatal development and behavior effects of in-utero exposure of rats to radiofrequency waves emitted from conventional WiFi devices. Environ. Toxicol. Pharmacol. 52:239-247. doi: 10.1016/j.etap.2017.04.016.
[103] Bas O, Sönmez OF, Aslan A, Ikinci A, Hanci H, Yildirim M, Kaya H, Akca M, Odaci E. 2013 Pyramidal Cell Loss in the Cornu Ammonis of 32-day-old Female Rats Following Exposure to a 900 Megahertz Electromagnetic Field During Prenatal Days 13-21. Neuroquantology 11: 591-599.
[104] Kumari K, Koivisto H, Myles C, Jonne N, Matti V, Heikki T, Jukka J. 2017 Behavioural phenotypes in mice after prenatal and early postnatal exposure to intermediate frequency magnetic fields. Environ Res 162: 27-34
[105] Othman H, Ammari M, Sakly M, Abdelmelek H. 2017 Effects of prenatal exposure to WIFI signal (2.45GHz) on postnatal development and behavior in rat: Influence of maternal restraint. Behav Brain Res 326: 291-302.
[106] Stasinopoulou M, Fragopoulou AF, Stamatakis A, Mantziaras G, Skouroliakou K, Papassideri IS, Stylianopoulou F, Lai H, Kostomitsopoulos N, Margaritis LH. 2016 Effects of pre- and postnatal exposure to 1880-1900 MHz DECT base radiation on development in the rat. Reprod Toxicol 2016; 65: 248-262.
[107] Divan HA, Kheifets L, Obel C, Olsen J. 2008 Prenatal and postnatal exposure to cell phone use and behavioral problems in children. Epidemiology 19:523-529. doi: 10.1097/EDE.0b013e318175dd47.
[108] Divan HA, Kheifets L, Obel C, Olsen J. 2012 Cell phone use and behavioural problems in young children. J Epidemiol Community Health. 2012 Jun;66(6):524-9. doi: 10.1136/jech.2010.115402.
[109] Kabir ZD, Martínez-Rivera A, Rajadhyaksha AM. 2017 From Gene to Behavior: L-Type Calcium Channel Mechanisms Underlying Neuropsychiatric Symptoms. Neurotherapeutics. 2017 Jul;14(3):588-613. doi: 10.1007/s13311-017-0532-0.
[110] Foster KR, Moulder JE. 2013 Wi-Fi and health: review of current status of research. Health Phys 105:561-565. doi: 10.1097/HP.0b013e31829b49bb.
[111] Diamond Jared. 2005 Collapse: How Societies Choose to Fail or Succeed. Viking Group, New York.
[112] NCRP Report No. 86. 1986 Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields. Recommendations of the National Council on Radiation Protection and Measurements. 400 pp. Bethesda MD 20814
[113] Motorala, Microwaves and DNA Breaks: "War-Gaming"the Lai-Singh Experiments. Dec. 13, 1994. Reprinted in Microwave News January/February 1997 https://www.rfsafe.com/wp-content/uploads/2014/06/cell-phone-radiation-war-gaming-memo.pdf (Accessed April 4, 2018).
[114] WTR and betrayal of the public trust. Microwave News, March 2005. http://microwavenews.com/docs/MWN.March-05.pdf (accessed April 4, 2018)
[115] Wakeup Call Cover Story. Rob Harrill University of Washington Alumni News, March 2005. http://www.washington.edu/alumni/columns/march05/wakeupcall01.html (Accessed April 4, 2018)
[116] Schneider, Scott. 2008 Book Review of "Doubt is Their Product: How Industry's Assault on Science Threatens Your Health." By David Michaels.

https://www.lhsfna.org/index.cfm/lifelines/june-2008/book-review-doubt-is-their-product/ (accessed April 4, 2018).
[117] Interview of Dr. Dietrich Klinghardt by Dr. Joe Mercola, December 28, 2017. https://idocslide.com/the-philosophy-of-money.html?utm_source=interview-klinghardt-emf (Accessed April 6, 2018). Please note: There is also youtube video of this interview.
[118] http://www.newsweek.com/why-does-vladimir-putin-avoid-smartphones-801406 (Accessed April 9, 2018).
[119] Goldberg RB. 1993 The cellular phone controversy: real or contrived? EMF Health Report 1(1): 1993. EPI1793
[120] Berezow A, Bloom A. 2017 Recommendation to limit Md. School Wi-Fi based on 'junk science'. Baltimore Sun op-ed piece, March 12. http://www.baltimoresun.com/news/opinion/oped/bs-ed-wifi-school-20170312-story.html (Accessed June 17, 2017).
[121] NCI, 2016 National Cancer Institute Statement on Electromagnetic Fields and Cancer May 2016. https://www.cancer.gov/about-cancer/causes-prevention/risk/radiation/electromagnetic-fields-fact-sheet (accessed Sept. 7, 2017)
[122] Wyde M, Cesta M, Blystone C, et al. 2016 Report of Partial findings from the National Toxicology Program Carcinogenesis Studies of Cell Phone Radiofrequency Radiation in Hsd: Sprague Dawley® SD rats (Whole Body Exposure). bioRXiv doi.org/10.1101/055699
[123] Merritt, JH, Chamness AF, Allen SJ. 1978 Studies on blood-brain barrier permeability after microwave-radiation. Rad Environ Biophys 15:367-377.
[124] Ziemann C, Brockmeyer H, Reddy SB, Vijayalaxmi, Prihoda TJ, Kuster N, Tillmann T, Dasenbrock C. 2009 Absence of genotoxic potential of 902 MHz (GSM) and 1747 MHz (DCS) wireless communication signals: In vivo two-year bioassay in B6C3F1 mice. Int J Radiat Biol 85:454-464. doi: 10.1080/09553000902818907.
[125] Dr. George L. Carlo Letter To AT&T Chairman on Cell Phone Radiation, October 7, 1999. https://www.rfsafe.com/dr-george-l-carlo-letter-to-att-chairman-on-cell-phone-radiation/ (Accessed April 8, 2018).
[126] Carlo, George and Schram, Martin. 2001 Cell Phones: Invisible Hazards in the Wireless Age: An Insider's Alarming Discoveries about Cancer and Genetic Damage. Carroll and Graf, New York.
[127] Alster, Norm. 2015 Captured Agency: How the Communications Commission Is Dominated by the Industry It Presumably Regulates. Edmund J. Safra Institute for Ethics, Harvard University, Cambridge, MA, USA
[128] FCC Federal Communication RF Safety FAQ. No date given https://www.fcc.gov/engineering-technology/electromagnetic-compatibility-division/radio-frequency-safety/faq/rf-safety#top
[129] FDA Letter of Intent for Collaboration with the CTIA. October 18, 1999. https://www.rfsafe.com/fda-letter-intent-collaboration-ctia/ (Accessed April 14, 2018).
[130] Cooperative Research and Development Agreement (CRADA). Updated on Dec. 4, 2017 https://www.fda.gov/Radiation-EmittingProducts/RadiationEmittingProductsandProcedures/HomeBusinessandEntertainment/CellPhones/ucm116340.htm
[131] fda.gov site Cell Phones > Current Research Results. No Date given. https://www.fda.gov/Radiation-EmittingProducts/RadiationEmittingProductsandProcedures/HomeBusinessandEntertainment/CellPhones/ucm116335.htm
[132] Samsung Health and Safety and Warrantee Guide. 2015 https://www.samsung.com/us/Legal/PHONE-HS_GUIDE_English.pdf (Accessed April 15, 2018)

[133] Samsung Gear S Black (AT&T) last updated July 17, 1017. https://www.samsung.com/us/support/service/warranty/SM-R750AZKAATT (Accessed April 15, 2018).
[134] 1993 FDA Memo: Data "Strongly Suggest" Microwaves Can Promote Cancer. Jan/Feb 1993, p. 1, 5. https://pdfs.semanticscholar.org/776f/b8ea63bd5c3c32699e90301af123eea6c6c7.pdf (Accessed Apr 15, 2018)
[135] Hamburg MA, Sharfstein JM. 2009 The FDA as a public health agency. N Engl J Med 360:2493-2495. doi: 10.1056/NEJMp0903764
[136] Alekseev SI, Ziskin MC. 1999 Effects of millimeter waves on ionic currents of Lymnaea neurons. Bioelectromagnetics 20:24-33.
[137] Hässig M, Jud F, Naegeli H, Kupper J, Spiess BM. 2009 Prevalence of nuclear cataract in Swiss veal calves and its possible association with mobile telephone antenna base stations. Schweiz Arch Tierheilkd 151:471-478.
[138] Hässig M, Jud F, Spiess B. 2012 [Increased occurrence of nuclear cataract in the calf after erection of a mobile phone base station]. Schweiz Arch Tierheilkd 154:82-86.
[139] Lu M, Ueno S. 2013 Calculating the induced electromagnetic fields in real human heads by deep transcranial magnetic stimulation. 35th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Book Series. Osaka Japan, pp. 795-798.

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Thursday, October 24, 2019

Cell Towers, Antennas Problematic for Buyers

July 25, 2014

An overwhelming 94 percent of home buyers and renters surveyed by the National Institute for Science, Law & Public Policy (NISLAPP) say they are less interested and would pay less for a property located near a cell tower or antenna.

What's more, of the 1,000 survey respondents, 79 percent said that under no circumstances would they ever purchase or rent a property within a few blocks of a cell tower or antennas, and almost 90 percent said they were concerned about the increasing number of cell towers and antennas in their residential neighborhood.

The survey, “Neighborhood Cell Towers & Antennas—Do They Impact a Property’s Desirability?” also found that properties where a cell tower or group of antennas are placed on top of or attached to a building (condominium high-rise, for instance) is problematic for buyers.

Trouble Spots for Buyers:

- Home Owners Object to Cell Tower Installations
- Field Guide to Cell Phone Towers
- 6 Ways a Home May Turn Off Buyers
- 6 Ways to Turn Off Buyers at Open Houses

“A study of real estate sales prices would be beneficial at this time in the Unites States to determine what discounts home buyers are currently placing on properties near cell towers and antennas,” says Jim Turner, chair of NISLAPP.

The NISLAPP survey echoes the findings of a study by Sandy Bond of the New Zealand Property Institute and past president of the Pacific Rim Real Estate Society (PRRES). "The Impact of Cell Phone Towers on House Prices in Residential Neighborhoods," which was published in The Appraisal Journal in 2006, found that buyers would pay as much as 20 percent less for a property near a cell tower or antenna.

Source: “Neighborhood Cell Towers & Antennas—Do They Impact a Property’s Desirability?” National Institute for Science, Law & Public Policy (June 2014)

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Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	
Amendment of Parts 1 and 22 of the Commission's Rules with Regard to the Cellular Service, Including Changes in Licensing of Unserved Area	)	WT Docket No. 12-40 (*terminated*)
	)	RM No. 11510 (*terminated*)
	)	
Amendment of the Commission's Rules with Regard to Relocation of Part 24 to Part 27	)	
	)	
Interim Restrictions and Procedures for Cellular Service Applications	)	
	)	
Amendment of Parts 0, 1, and 22 of the Commission's Rules with Regard to Frequency Coordination for the Cellular Service	)	
	)	
Amendment of Part 22 of the Commission's Rules Regarding Certain Administrative and Filing Requirements	)	
	)	
Amendment of the Commission's Rules Governing Radiated Power Limits for the Cellular Service	)	RM No. 11660 (*terminated*)
	)	
Amendment of Parts 1, 22, 24, 27, 74, 80, 90, 95, and 101 to Establish Uniform License Renewal, Discontinuance of Operation, and Geographic Partitioning and Spectrum Disaggregation Rules and Policies for Certain Wireless Radio Services	)	WT Docket No. 10-112
	)	
2016 Biennial Review of Telecommunications Regulations	)	WT Docket No. 16-138

THIRD REPORT AND ORDER

Adopted: July 12, 2018 **Released: July 13, 2018**

By the Commission: Chairman Pai issuing a statement.

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I. INTRODUCTION

1. In this Third Report and Order, we take additional steps to reduce unnecessary regulatory burdens for licensees in the 800 MHz Cellular Radiotelephone (Cellular) Service as well as other Part 22 licensees, thereby freeing up more resources for investment in new technologies and greater spectrum efficiency to meet increasing consumer demand for advanced wireless services. Specifically, we modernize our rules by eliminating several Part 22 recordkeeping and reporting obligations that were adopted more than two decades ago—obligations for which there is no longer a benefit to outweigh the compliance costs and burdens imposed on licensees. We also eliminate certain Cellular Service-specific rules that are no longer necessary. Our revisions today will provide Cellular and other Part 22 licensees with enhanced flexibility and advance our goal of ensuring more consistency in licensing across commercial wireless services, while taking into account unique features of each service. With this Third Report and Order we conclude an important chapter in the Commission's extensive regulatory reform agenda and terminate the proceeding in WT Docket No. 12-40, including RM Nos. 11510 and 11660.

II. BACKGROUND

2. In 1981, the Commission adopted its initial Cellular Service rules; these provided the foundation of the commercial wireless industry and made mobile services broadly available to the American public nationwide.[1] In 2012, the Commission released a Cellular Reform *Notice of Proposed Rulemaking,* which was intended to modernize the legacy site-based Cellular licensing scheme and transition it to a geographically based licensing model.[2] In 2014, the Commission adopted a *Report and Order* (*R&*O)*,* which modernized Cellular Service licensing in several respects.[3] The centerpiece of the *R&O* was the adoption of a geographically-based licensing regime, with licenses based on Cellular Geographic Service Area (CGSA) boundaries; this added significant new flexibility for licensees to

[1] *See generally An Inquiry Into the Use of the Bands 825-845 MHz and 870-890 MHz for Cellular Communications Systems; and Amendment of Parts 2 and 22 of the Commission's Rules Relative to Cellular Communications Systems,* CC Docket No. 79-318, Report and Order*,* 86 F.C.C.2d 469 (1981).

[2] *Amendment of Parts 1 and 22 of the Commission's Rules with Regard to the Cellular Service, Including Changes in Licensing of Unserved Area*; *Amendment of the Commission's Rules with Regard to Relocation of Part 24 to Part 27*; *Interim Restrictions and Procedures for Cellular Service Applications*, WT Docket No. 12-40, RM No. 11510, Notice of Proposed Rulemaking and Order, 27 FCC Rcd 1745, 1747 n.3, 1750-52, 1758 (2012) (*NPRM*). Under the legacy site-based model, applications with comprehensive technical data and prior FCC approval had been required for new Cellular systems and for modifications of an existing system that would expand the licensee's authorized Cellular Geographic Service Area (CGSA), no matter how slight the expansion. Based on Commission data when it released the *NPRM*, approximately 80 percent of the 1,468 Cellular Market Area (CMA) channel blocks were almost completely licensed already, with only limited unlicensed area remaining, primarily in Alaska and other rural areas in the western United States. *See NPRM*, 27 FCC Rcd at 1747, 1750-55, 1768-1769.

[3] *Amendment of Parts 1 and 22 of the Commission's Rules with Regard to the Cellular Service, Including Changes in Licensing of Unserved Area, et al.,* WT Docket No. 12-40, RM Nos. 11510 and 11660, Report and Order and Further Notice of Proposed Rulemaking, 29 FCC Rcd 14100 (2014) (*R&O* and *Further Notice,* respectively).

improve their systems within those boundaries.[4] The *R&O* also added significant opportunities for licensees to expand their service coverage without prior authorization, resulting in a substantial reduction in administrative burdens for both licensees and FCC staff.[5] In the *Further Notice*, the Commission proposed additional Cellular licensing reforms and overdue reforms of the Cellular radiated power and related technical rules that could facilitate the ability of Cellular licensees to deploy advanced broadband services.[6]

3. In the 2017 *Second Report and Order*, the Commission modernized numerous Cellular technical rules, including the outdated radiated power and related rules, to permit power measurement using power spectral density.[7] These changes facilitate the use of Cellular spectrum to provide advanced mobile broadband services, such as 4G long term evolution (LTE), while protecting public safety communications from increased potential for unacceptable interference.[8] The *Second R&O* also revised rules to further eliminate unnecessary filings and other regulatory burdens for Cellular licensees.[9] The Commission's reforms resulted in Cellular Service rules more akin to the flexible licensing schemes found in other similar mobile services, such as the Broadband Personal Communications Service (PCS),[10] the commercial service in the 700 MHz band (700 MHz Service),[11] the 600 MHz Service,[12] and the Advanced Wireless Services (AWS),[13] to help ensure that carriers are treated similarly regardless of technology choice.

4. In the *Second Further Notice*, to build on reforms adopted in the *R&O* and *Second R&O* and to respond to certain submissions by commenters in the Commission's 2016 Biennial Review proceeding,[14] the Commission proposed and sought comment on additional reforms of its Part 22 rules

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[4] See the *R&O* for the full discussion of the revised rules adopted (29 FCC Rcd at 14102-26 (Section II) and 14156-63 (Appendix A (Final Rules)).

[5] *See id*., 29 FCC Rcd at 14115-18. The *R&O* also established a field strength limit rule tailored to reflect the continued ability to expand Cellular service area coverage. *See id*. at 14109-10.

[6] *Further Notice*, 29 FCC Rcd at 14126-52.

[7] *See Amendment of Parts 1 and 22 of the Commission's Rules with Regard to the Cellular Service, Including Changes in Licensing of Unserved Area*, *Amendment of the Commission's Rules with Regard to Relocation of Part 24 to Part 27; Interim Restrictions and Procedures for Cellular Service Applications*; *Amendment of Parts 0, 1, and 22 of the Commission's Rules with Regard to Frequency Coordination for the Cellular Service*; *Amendment of the Commission's Rules Governing Radiated Power Limits for the Cellular Service*; *Amendment of Parts 1, 22, 24, 27, 74, 80, 90, 95, and 101 to Establish Uniform License Renewal, Discontinuance of Operation, and Geographic Partitioning and Spectrum Disaggregation Rules and Policies for Certain Wireless Radio Services; 2016 Biennial Review of Telecommunications Regulations*, WT Docket Nos. 12-40, 10-112, and 16-138, RM Nos. 11510 and 11660, Second Report and Order, Report and Order, and Second Further Notice of Proposed Rulemaking, 32 FCC Rcd 2518 (2017). Herein, we reference the Second Report and Order and the Report and Order collectively as "*Second R&O*"; we reference the Second Further Notice of Proposed Rulemaking as "*Second Further Notice*."

[8] *Second R&O*, 32 FCC Rcd at 2535-56; *see also id*. at 2562-64.

[9] *Id*., 32 FCC Rcd at 2557-61, 2567-70 (adopting a more flexible rule concerning permanent discontinuance of operations, eliminating certain filing requirements for minor system changes, and deleting the Part 22 rules pertaining to Cellular Service license renewals).

[10] *See generally* 47 CFR §§ 24.1 *et seq*.

[11] *See generally* 47 CFR Part 27.

[12] *See generally Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, GN Docket No. 12-268, Report and Order, 29 FCC Rcd 6567 (2014) (*BIA Report and Order*) (subsequent history omitted); 47 CFR § 27.5(l).

[13] *See generally* 47 CFR Part 27.

[14] *Second Further Notice*, 32 FCC Rcd at 2570-75. The Commission had solicited comments in a public notice in its 2016 Biennial Review of Telecommunications Regulations proceeding. *Commission Seeks Public Comment in 2016 Biennial Review of Telecommunications Regulations*, WT Docket No. 16-138 (other docket numbers omitted),

governing not only the Cellular Service but other Part 22 Public Mobile Services (PMS) as well.[15] The Commission also invited comment on whether other measures could be taken to allow Part 22 licensees to benefit from the same level of flexibility available to other commercial wireless licensees.[16] In that context, the Commission raised the possibility of relocating—to Part 27 of the Commission's rules—certain Part 22 rules, as well as the Part 24 PCS rules and other rules governing geographically licensed wireless services.[17]

5. In response to the *Second Further Notice*, five parties filed comments and one party filed reply comments; three parties subsequently filed *ex parte* letters.[18] Commenters generally support the Commission's proposed deletion of the Part 22 rules addressed in the *Second Further Notice*. Only two commenters address the issue of possible relocation of rules to Part 27 and possible reorganization of that rule part—one favoring the idea and the other opposing it. In addition, some commenters propose deleting other rules that had not been previously considered by the Commission in this proceeding. The record and our decisions are set forth below under specific headings pertaining to these various rules and issues.

III. ELIMINATION OF UNNECESSARY RULES

6. In the sections below, we delete the following administrative and recordkeeping rules for Part 22 licensees: Sections 22.301 and 22.303, concerning station inspections and the retention of hard copies of station authorizations and other station records; and Section 22.325, concerning station control points and personnel on duty at those control points.[19] Removing these provisions will eliminate needless burdens that are inconsistent with the Commission's practices and the now-predominant use of electronic records storage and access, and it will also eliminate asymmetry across competing commercial mobile radio services (CMRS), as the Commission's rules for newer wireless services such as PCS, certain AWS, and the 700 MHz Service do not include such provisions. We also delete Section 22.321, concerning equal employment opportunities, as duplicative, as well as Sections 22.3 and 22.927, which set forth service provider obligations concerning their authorizations and subscribers' Cellular mobile stations.[20] These rules are no longer necessary, as explained below.

A. Sections 22.301, 22.303—Station Inspection, Retention of Station Authorizations

7. In the *Second Further Notice*, the Commission proposed and sought comment on deletion of Sections 22.301 and 22.303 of the Commission's rules, which collectively require that hard copies of license authorizations and other records be maintained by all Part 22 licensees for each station and that such records and the station itself be made available for inspection upon request.[21] The Commission

(Continued from previous page)
Public Notice, 31 FCC Rcd 12166, 12174-75 (2016) (*Biennial Review PN*). Although the Commission has considered in this Cellular Reform proceeding certain issues that were initially raised by commenters in response to the *Biennial Review PN* in WT Docket No. 16-138 (WT Biennial Review proceeding), such consideration does not otherwise impact review of other comments and issues raised in response to that *PN*.

[15] The other services governed by Part 22 of our rules are Paging, Air-Ground, Rural, and Offshore Radiotelephone.

[16] *Second Further Notice*, 32 FCC Rcd at 2571, 2574.

[17] *Id*., 32 FCC Rcd at 2574-75.

[18] *See* Appendix C for a list of parties that submitted comments, reply comments, and *ex parte* letters.

[19] 47 CFR §§ 22.301, 22.303, 22.325.

[20] 47 CFR §§ 22.321, 22.3, 22.927.

[21] *Second Further Notice*, 32 FCC Rcd at 2571-72 (citing comments submitted by CTIA and Verizon in response to the *Further Notice*, and by CTIA and T-Mobile USA, Inc. in response to the *Biennial Review PN*). Section 22.301 specifically requires that, "[u]pon reasonable request, the licensee of any station authorized in the Public Mobile Services must make the station and station records available for inspection by authorized representatives of the Commission at any reasonable hour." 47 CFR § 22.301. Noting the rule's requirement that the *station itself*, not just the station's records, be available for inspection by the Commission, the Commission emphasized that,

questioned whether the benefits of maintaining hard copies outweigh the costs and burdens to Part 22 licensees in the age of electronic licensing and recordkeeping, particularly as license authorizations are maintained in the Commission's Universal Licensing System (ULS).[22] The Commission also sought comment on a suggestion that, even if we eliminate Sections 22.301 and 22.303, we should nonetheless affirmatively require Part 22 licensees "to have electronic copies [of licenses] easily accessible to personnel and FCC inspectors."[23]

8. Commenters addressing this issue unanimously endorse the Commission's proposal to delete Sections 22.301 and 22.303; they assert that these administrative requirements are burdensome and inconsistent with today's licensing practices.[24] AT&T and Verizon point out that, since 2014, the Commission has deemed the electronic version of an authorization—stored in ULS—to be the official Commission record, and it no longer sends printed copies of authorizations through the U.S. Postal Service unless so requested by the licensee.[25] The Enterprise Wireless Alliance (EWA) adds that a "physical copy of a license can never be more and could be less up-to-date than ULS data."[26] The commenters further argue that, with the movement to geographic-based licensing (which provides licensees with the flexibility to make certain changes to their systems without Commission filings), individual authorizations are no longer relevant and may not include all operating parameters.[27] This fact of current-day operations, the Critical Messaging Association (CMA) claims, can create problems when state and local officials, unfamiliar with the Commission's geographic licensing model, do not find paper

(Continued from previous page)
regardless of whether we retain a rule in Part 22 explicitly requiring licensees to make their stations available for inspection, we retain our general station inspection authority under Section 303(n) of the Communications Act, 47 U.S.C. § 303(n). *See Second Further Notice,* 32 FCC Rcd at 2572. Section 22.303 more broadly requires Part 22 licensees to retain, among other documentation, the authorization for each station as a permanent part of station records.

[22] *Second Further Notice*, 32 FCC Rcd at 2572.

[23] *Id*., 32 FCC Rcd at 2572 (citing comments submitted by Public Knowledge in the WT Biennial Review proceeding). Public Knowledge did not submit comments or reply comments following release of the *Second Further Notice*.

[24] AT&T Comments at 2-3 (May 15, 2017); CMA Comments at 2-3 (May 15, 2017); CTIA Comments at 2-4 (May 15, 2017); EWA *Ex Parte* Letter at 2-3 (June 15, 2017); Verizon Comments at 2-3 (May 15, 2017). EWA's submission (styled as "Reply Comments") was filed outside the pleading cycle (*see Federal Register*, 82 Fed. Reg. 17959 (April 14, 2017) (summarizing the *Second Further Notice* and establishing the pleading cycle)). We consider EWA's submission as an *ex parte* letter in the interest of having a complete record, ensuring full and fair participation in this proceeding.

[25] AT&T Comments at 2 (citing *Wireless Telecommunications Bureau Implements Enhancements to the Commission's Universal Licensing System and Antenna Structure Registration System and Adopts Final Procedures for Providing Access to Official Electronic Authorizations*, WT Docket No. 14-161, Public Notice, 29 FCC Rcd 15252 (WTB 2014) (*Official Electronic Authorizations PN*); Verizon Comments at 2 (citing same). *See also* EWA *Ex Parte* Letter at 3.

[26] EWA *Ex Parte* Letter at 3.

[27] E.g., AT&T Comments at 2-3 (noting, at 3, that internal base stations whose Service Area Boundaries (SABs) "do not comprise the outer edge" of the CGSA are no longer issued site-specific authorizations, and that even a Cellular Service station that defines the SAB might today have a license that no longer includes all operating parameters," because Cellular licensees can now operate much like Part 24 and Part 27 licensees without having to report every modification to a system).

records at stations to reflect all sites as operated, leading in some cases to erroneous accusations by such authorities of unauthorized operations.[28]

9. *Discussion*. We find that Sections 22.301 and 22.303 have outlived the usefulness they may have had in the past and now impose administrative burdens without any corresponding public benefit. Because the Commission no longer routinely mails printed authorizations, licensees cannot comply with the rule's hard-copy requirement unless they themselves print, or request that the Bureau print and mail, an authorization every time an application is granted. Such a requirement does not serve the public interest. ULS is available electronically at all times: licensees have access to their official authorizations, while members of the public have access to reference copies reflecting the most up-to-date information concerning all authorizations.[29] And as AT&T observes, the movement away from site-specific filings renders on-site comparison of paper records and operating parameters unnecessary and largely infeasible.[30] Moreover, the Commission has not imposed the recordkeeping and station inspection requirements of Sections 22.301 and 22.303 on licensees in competing wireless services governed by Parts 24 and 27 of our rules. For all these reasons, we delete both of these rules.[31]

B. Section 22.325—Control Points

10. Section 22.325 of the Commission's rules requires that "[e]ach station in the Public Mobile Services [ ] have at least one control point and a person on duty who is responsible for station operation."[32] The Commission proposed and sought comment on eliminating Section 22.325 in the *Second Further Notice*.[33] It queried whether today automatic and remote monitoring render this rule unnecessary from a technological standpoint.[34]

11. Commenters addressing this issue agree with the proposal to delete this rule on grounds that it does not reflect licensees' existing automatic and remote monitoring facilities and is unnecessary.[35] AT&T adds that Cellular licensees have "developed extensive expertise in working with their counterparts" to comply with Commission rules governing coordination with adjacent channel and adjacent market licensees, interference avoidance, especially with respect to Part 90 public safety

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[28] CMA Comments at 2. According to CMA, while deleting the two rules might not "100% solve that problem," it would at least remove the "ostensible . . . requirement that all such sites be reflected" in hard copy records retained at every station. *Id*. at 2-3.

[29] *Official Electronic Authorizations PN*, 29 FCC Rcd at 15252-53.

[30] AT&T Comments at 2-3.

[31] *See* Final Rules (Appendix A). As was also noted in the *Second Further Notice*, the Commission retains station inspection authority under 47 U.S.C. § 303(n). With respect to Public Knowledge's request, given that electronic copies of authorizations are easily accessible to the public and FCC inspectors via ULS, we see no need to require Part 22 licensees "to have electronic copies [of licenses] easily accessible to personnel and FCC inspectors." *See supra* note 23.

[32] 47 CFR § 22.325. While the rule does not require that the person on duty be at the control point or continuously monitor all transmissions of the station, the control point must have facilities that enable the person on duty to turn off the transmitters in the event of a malfunction.

[33] *Second Further Notice*, 32 FCC Rcd at 2573.

[34] *Id*., 32 FCC Rcd at 2573.

[35] *See* AT&T Comments at 3 (stating that Cellular licensees "remotely monitor their network usage and operation and by necessity retain the ability to deactivate the radios as needed in the event of interference"); CMA Comments at 3 (stating that automatic and remote monitoring facilities are "routinely used by CMA members"); CTIA Comments at 3-4 (asserting that the rule is unique to Part 22 and is "another example of unnecessary and asymmetrical regulation," and that most licensees have centralized operations); EWA *Ex Parte* Letter at 4; Verizon Comments at 3 (stating that it maintains "Network Operations Centers that monitor all of its Commission-licensed operations and have the ability to power down transmitters due to malfunction . . . or any other reason," and claiming that this network architecture "is commonplace among wireless carriers.").

licensees operating in the 800 MHz band, and international agreements.[36] EWA contends that "licensees have every incentive to ensure that their facilities are operating properly and in compliance with FCC requirements," and the Commission "no longer needs to prescribe how licensees must accomplish that task."[37]

12. *Discussion*. Based on the record before us, we find that Section 22.325 is now technologically obsolete, as licensees today routinely monitor their network operations by automatic and remote mechanisms. And one commenter claims that the rule inhibits efficiencies in licensees' operations.[38] We therefore conclude that Section 22.325 no longer serves the public interest. As with Sections 22.301 and 22.303, discussed above, there is no similar provision in Part 24 or Part 27 of the Commission's rules related to station control points or the requirement to have a person on duty who is responsible for station operation. Part 22 licensees should have the same flexibility as Part 24 and Part 27 commercial wireless licensees to determine how to manage their networks to ensure compliance with the Commission's rules, including how best to avoid interference. Accordingly, we delete Section 22.325.[39]

C. Section 22.321(c)—Equal Employment Opportunities

13. Section 22.321(c) requires all Part 22 licensees (i.e., PMS licensees), regardless of their size, to submit an annual report to the Commission indicating whether any EEO complaints have been filed at the federal, state, or local level against the licensee.[40] For any such complaint, the report must state the parties involved, date of filing, court or agencies reviewing the complaint, appropriate file number, and disposition of the complaint.[41] All common carriers (i.e., not only Part 22 licensees) with at least 16 full-time employees are subject to the same requirement under Section 1.815 of the Commission's rules, which specifies that an annual employment report is to be submitted on FCC Form 395.[42] Pursuant to comments on the record in the WT Biennial Review proceeding arguing that Section 22.321(c) should be repealed, the *Second Further Notice* sought comment on whether there is any need to retain this provision.[43]

14. While the WT Biennial Review comments regarding EEO requirements focused on Section 22.321, Section 90.168 of the Commission's rules, "Equal Employment Opportunities," contains the same provisions as those in Section 22.321, including paragraph (c), which requires a complaints report annually regardless of the licensee's size. Section 90.168 states that it applies to *all* CMRS (which includes the Part 22 PMS), and thus it entirely subsumes Section 22.321.

15. AT&T, CMA, EWA, and Verizon endorse the Commission's proposal to delete Section 22.321(c),[44] with CMA also asserting that, if the Commission eliminates Section 22.321(c), then common

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[36] AT&T Comments at 3.

[37] EWA *Ex Parte* Letter at 4.

[38] *See*, *e.g*., CMA Comments at 3 (indicating that CMA members routinely use automatic and remote monitoring facilities and that Section 22.325 "should be deleted as an unnecessary regulation that inhibits efficiencies in critical messaging operations").

[39] *See* Final Rules (Appendix A).

[40] 47 CFR § 22.321(c).

[41] *Id*.

[42] 47 CFR § 1.815.

[43] *Second Further Notice*, 32 FCC Rcd at 2573 (citing Verizon Biennial Review Comments). The *Second Further Notice* did not seek comment on the other subsections of Section 22.321, which set forth licensee obligations for equal opportunity programs and policies to assure nondiscriminatory practices in recruitment, placement, promotion, and other areas of employment practices. 47 CFR § 22.321.

[44] *See* AT&T Comments at 4; CMA Comments at 3-4 (arguing that deletion of Section 22.321(c)'s complaints report requirement for licensees with fewer than 16 employees is warranted); EWA *Ex Parte* Letter at 3-4 (arguing that deletion of Section 22.321(c)'s complaints report requirement for licensees with fewer than 16 employees is

carrier licensees and permittees with fewer than 16 full-time employees would no longer be subject to an EEO complaints report filing requirement at the Commission.[45] None of the commenters in this Cellular Reform proceeding or the WT Biennial Review proceeding addressed Section 90.168.

16. *Discussion*. Given that all CMRS licensees are subject to Section 90.168, including Section 90.168(c), Section 22.321 is duplicative and, accordingly, we delete the rule in its entirety.[46] As to the Part 90 reporting requirement, the Commission did not propose to remove that requirement, nor did any commenters suggest doing so. Part 90 rules are therefore beyond the scope of this proceeding and we decline at this time to eliminate the complaints reporting requirement in Section 90.168.[47]

D. Section 22.927—Responsibility for Mobile Stations, and Section 22.3—Authorization Required

17. As noted above, the *Second Further Notice* invited comment generally on other steps or measures the Commission could take to ensure that Cellular licensees benefit from the same level of flexibility available to other commercial wireless licensees.[48] In response, CTIA argues that repeal of Section 22.927, entitled "Responsibility for mobile stations,"[49] would be "consistent with this objective," because the rule is another example of asymmetric regulation.[50] Under Section 22.927, Cellular licensees are "responsible for exercising effective operational control over mobile stations receiving service through their Cellular systems," including mobile stations operated by subscribers to a different Cellular licensee. Section 22.927 thus addresses service to "roamers," although it does not use that particular term.

18. *Discussion*. Pursuant to Section 1.903(c) of the Commission's rules, the "[a]uthority for subscribers to operate mobile or fixed stations in the Wireless Radio Services [WRS]," which includes the Cellular Service, "is included in the authorization held by the licensee providing service to them."[51] Thus, when a WRS licensee, as the host carrier, provides service to a subscriber of another carrier (i.e., a subscriber that is outside its own provider's service area), the subscriber's use of his or her mobile phone

(Continued from previous page)
warranted, and asserting that Section 22.321 is unnecessary in its entirety); Verizon Comments at 4-5 (arguing that deletion of Section 22.321(c) is a "good first step," but that the Commission should go further and eliminate Section 1.815 as well).

[45] CMA Comments at 3. *See also* EWA *Ex Parte* Letter at 3-4.

[46] *See* Final Rules (Appendix A). As noted above, Verizon also argues that Section 1.815 should be deleted (Verizon Comments at 4-5). Verizon's request is beyond the scope of this proceeding, and we decline to consider it here.

[47] In any event, neither CMA nor EWA adequately demonstrates why licensees with fewer than 16 employees should be exempt from this requirement; they merely claim that complaints are rarely filed against small carriers with fewer than 16 employees. CMA Comments at 3; EWA *Ex Parte* Letter at 4.

[48] *Second Further Notice*, 32 FCC Rcd at 2573 (asking specifically if commenters deem unnecessary any other rules that apply to Part 22 licensees but not to the flexibly licensed services under Part 24 or 27).

[49] 47 CFR § 22.927.

[50] CTIA Comments at 4-5. CTIA also argues that the rule is "superfluous" because, according to CTIA, licensees are subject to "specific technical and operating rules set forth elsewhere in Parts 1, 20, and 22 of the Commission's rules," but does not cite to any specific rules in support of its statement. *See id.*

[51] 47 CFR § 1.903(c) (indicating limited exceptions not relevant here). Section 1.903 was adopted in 1998 as part of an omnibus consolidation, revision, and streamlining of Commission rules governing license application procedures for many wireless services, to facilitate full implementation of what was then the Commission's new ULS. *See Biennial Regulatory Review—Amendment of Parts 0, 1, 13, 22, 24, 26, 27, 80, 87, 90, 95, 97, and 101 of the Commission's Rules to Facilitate the Development and Use of the Universal Licensing System in the Wireless Telecommunications Services, et al.*, WT Docket No. 98-20 (other docket nos. omitted), Report and Order, 13 FCC Rcd 21027 (1998) (*ULS R&O*); *see also id*. at Appendix F (consolidating certain service-specific rules into 47 CFR § 1.903).

to access the spectrum falls under that host carrier's authorization. Section 1.903(c) thus captures the purpose underlying Section 22.927, albeit with less detail.[52] While the detailed provision in Section 22.927 regarding the host carrier's responsibility under its authorization may have been warranted when the Cellular Service was in its nascency, we find that this additional rule is unnecessary these many decades later. As CTIA observes, the rule creates asymmetry, as the rules for commercial wireless services established much later than the Cellular Service—such as PCS and AWS—do not have a counterpart to Section 22.927. Consistent with one of our key goals in this proceeding to eliminate unnecessary asymmetric regulations, we delete Section 22.927.[53]

19. Further, a related legacy rule that applies to all Part 22 licensees, Section 22.3,[54] is also no longer necessary. This rule specifies that PMS stations must be used and operated only in accordance with applicable Commission rules and only with a valid authorization granted by the Commission. It further specifies that authority for subscribers to operate mobile or fixed PMS stations is included in the authorization of the licensee providing service to them. The same provisions are included in the later-adopted Section 1.903, which applies more broadly to numerous wireless services in addition to the PMS.[55] We therefore find it in the public interest to delete it from our rules as duplicative.[56]

IV. POSSIBLE RELOCATION OF RULES TO PART 27

20. The Commission sought comment in the *Second Further Notice* on whether to migrate the Part 22 Cellular and Part 24 PCS rules to Part 27, and on whether the Commission should initiate a separate rulemaking to revise the Part 27 rules and reserve the possible relocation of Cellular and PCS rules to that separate proceeding.[57] It specified that commenters should address "whether the Commission should reorganize Part 27 in order to accommodate these additional Part 22 and Part 24 rules more efficiently."[58] In addition, the Commission noted that there are other geographically-licensed, auctioned services that are not included in Part 27, including Public Coast (Part 80), Specialized Mobile Radio (SMR), Location and Monitoring, and 220 MHz (Part 90), and 218-219 MHz (Part 95), and that of these, only SMR is used today by wireless carriers to provide services directly to consumers nationwide. The Commission sought comment on whether it should move the Part 22 Cellular and Part 24 PCS rules

[52] We also note that Cellular licensees today typically have two-way roaming agreements in place with other Cellular licensees. *See* 47 CFR § 20.12.

[53] *See* Final Rules (Appendix A).

[54] 47 CFR § 22.3.

[55] *See ULS R&O*, *supra* note 51; 47 CFR § 1.903.

[56] *See* Final Rules (Appendix A).

[57] *Second Further Notice*, 32 FCC Rcd at 2574-75 (noting that it was seeking to revisit the issues and refresh the record, as the Commission had sought comment on these same issues when this Cellular Reform proceeding was launched in 2012). In connection with the 2012 proposal to issue geographic-area (CMA-based) "overlay licenses" through competitive bidding in two stages, the Commission had queried whether, in the event that it were to adopt a geographic-based regime that would include overlay licenses, the new Cellular rules should be incorporated into Part 27. *See NPRM,* 27 FCC Rcd at 1771 (also suggesting that, if the Cellular rules were moved into Part 27, then the rules for PCS should also be moved into Part 27). The only commenter that responded, the Rural Wireless Association, opposed a relocation of any Part 22 and Part 24 rules to Part 27. *See R&O*, 29 FCC Rcd at 14125 (citing RWA's Comments filed May 15, 2012). In the *R&O*, the Commission's transition of the Cellular Service to a geographic-based regime did not entail an auction of overlay licenses, which commenters by and large opposed; instead, based in part on a new proposal by an industry coalition, the Commission adopted a transition approach for the Cellular Service that preserves direct site-based access to Unserved Area while dramatically reducing licensees' regulatory burdens, and in that context, the Commission decided not to pursue a relocation of Part 22 Cellular and Part 24 PCS rules. *See Second R&O*, 32 FCC Rcd at 2575 (citing *R&O*, 29 FCC Rcd at 14125*).*

[58] *Second Further Notice*, 32 FCC Rcd at 2575.

to Part 27 in conjunction with moving those other service rule parts to Part 27 as well.[59]

21. CTIA states support in broad terms for migrating the Part 22 Cellular and Part 24 PCS rules to Part 27.[60] EWA argues that there are important reasons for distinguishing Part 90 SMR systems in the context of a possible rule migration, and "strongly recommends against a wholesale relocation of the [Part 90] SMR service to Part 27 . . . ."[61] In particular, it urges that the Commission leave under Part 90 the rules governing non-Enhanced SMR (non-ESMR) systems.[62] No other commenter addressed our queries on these issues.

22. *Discussion*. While CTIA recommends that we evaluate "whether and how to consolidate the rules" and resolve inconsistencies among different service rules (absent unique circumstances for particular services), it offers only one example of rules that could be consolidated for multiple services.[63] EWA focuses solely on the difficulties associated with relocation of Part 90 SMR rules and does not address any other rules in this context. As EWA's comments highlight, disparate types of operations found in certain rule parts would make it challenging to consolidate Part 22 Cellular, Part 24 PCS, and other wireless mobile service rules into a single set of regulations. Such an exercise would entail painstaking review of numerous rules to determine those that can be consolidated and those that must be retained for individual services. In the absence of strong support on the record for this endeavor, which would require a significant investment of staff resources to complete, we decline to pursue the issue at this time.

V. OTHER REGULATIONS RAISED BY COMMENTERS

23. In response to the Commission's query in the *Second Further Notice* as to whether any other Part 22 rules are ripe for removal in light of changed technology, electronic licensing/recordkeeping, or other modernizations that have occurred over the past two decades, commenters request deletion of two Cellular Service rules—Sections 22.921 and 22.925.[64] In addition, one commenter requests deletion of paragraph (a) of Section 22.143,[65] which applies to all Part 22 licensees. We discuss the commenters' specific proposals below.[66]

24. *Section 22.921—911 Call Processing Procedures*. AT&T argues that Section 22.921 of

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[59] *Id*., 32 FCC Rcd at 2575.

[60] CTIA Comments at 5 (contending that this would significantly reduce the number of pages comprising the rules in Parts 22, 24, and 27, and assist with training and compliance). It adds that, while a benefit of considering consolidation would be to determine whether inconsistencies are warranted by unique circumstances of a particular service, retention of certain service-specific technical requirements would be warranted "because of the particular spectrum bands involved," and it notes as examples the Cellular radiated power rule and the rule for determining a Cellular licensee's CGSA. *Id*. at 5-6.

[61] For example, it contends, the "intermingling of channels among [Part 90] site-based licensees and the substantial commonality of operational characteristics among site-based Part 90 systems, both private internal and commercial SMR, argue strongly in favor of regulating these systems under the well-established Part 90 rules." EWA Comments at 4 (adding its contention that the purpose of the Part 27 rules is "not intended for nor particularly aligned with site-specific based private internal and commercial SMR operations.").

[62] EWA Comments at 2 (noting that Sprint Corporation (Sprint) and Southern Communications Services, d/b/a Southern Linc (Southern) operate ESMR systems and are members of EWA). While EWA states that it would support the decision of ESMR entities if they prefer to have their rules migrated, neither Sprint nor Southern filed comments in response to the *Second Further Notice*.

[63] CTIA Comments at 5 (suggesting that a single rule should be adopted for all CMRS licensees that establishes the same license term absent unique circumstances).

[64] 47 CFR §§ 22.921, 22.925.

[65] 47 CFR § 22.143(a).

[66] *Second Further Notice*, 32 FCC Rcd at 2573.

our rules, pursuant to which certain Cellular Service mobile telephones that are capable of operating in the analog mode "must incorporate a special procedure for processing 911 calls,"[67] is now obsolete because, among other reasons, it is "unaware of any carrier that still offers analog devices or operates an analog Cellular system."[68] We disagree. Commission data show that, contrary to AT&T's understanding, some carriers are still using analog technology in the Cellular Service band[69]—and Section 22.921 ensures that 911 calls get through in those circumstances.[70] Under these circumstances, the deletion of this rule would not serve the public interest, and, accordingly, we decline to take such action in this proceeding.

25. *Section 22.925—Prohibition on Airborne Operation of Cellular Telephones*. AT&T and Qualcomm Incorporated (Qualcomm) argue that Section 22.925, which prohibits the operation of Cellular Service telephones aboard "airplanes, balloons or any other type of aircraft . . . while such aircraft are airborne . . . ,"[71] should be eliminated, or at least modified.[72] The Commission has an open proceeding in WT Docket No. 13-301 that addresses the use of mobile services aboard aircraft.[73] The issues that AT&T and Qualcomm raise regarding the use of Cellular Service spectrum for communications to, from, and onboard aircraft are being dealt with in that proceeding, and we therefore decline to consider the issues here.[74]

26. *Section 22.143(a)—Commencement of Construction Prior to Grant of Application*. Section 22.143 permits applicants to begin construction of PMS facilities prior to grant of their applications; paragraph (a) specifies that such construction may begin "35 days after the date of the Public Notice listing the application for that facility as acceptable for filing."[75] EWA argues that Section 22.143(a) should be deleted, asserting that comparable provisions do not exist for other wireless services, and that other portions of the rule put applicants on notice that they assume the risk of constructing prior

[67] 47 CFR § 22.921 (specifying "analog mode described in the standard document ANSI TIA/EIA-553-A-1999 Mobile Station—Base Station Compatibility Standard (approved October 14, 1999 . . .)" and indicating where it is available for purchase). Specifically, the rule states that the incorporated procedure "must recognize when a 911 call is made and, at such time, must override any programming in the mobile unit that determines the handling of a non-911 call and permit the call to be transmitted through the analog systems of other carriers." *Id*. In addition, at least one of the 911 call system selection processes endorsed or approved by the Commission must be incorporated into the special procedure under this rule. *Id*.

[68] AT&T Comments at 4.

[69] *See* Mobile Deployment Form 477 Data, https://www.fcc.gov/mobile-deployment-form-477-data.

[70] Although AT&T is correct in noting (*see* AT&T Comments at 4) that wireless 911 provisions reside in 47 CFR § 20.18, there is no provision in that rule addressing the specific requirements that apply to Cellular analog systems under 47 CFR § 22.921.

[71] 47 CFR § 22.925. This rule also requires a notice to be posted on or near each Cellular telephone installed in any aircraft, stating that use of Cellular telephones while the aircraft is on the ground is subject to Federal Aviation Administration regulations. *See id*.

[72] AT&T Comments at 4-5; Qualcomm Reply Comments at 2-3 (June 13, 2017). *See also* Letter from Colleen Thompson, Area Manager, Federal Regulatory, AT&T Services, Inc., to Marlene H. Dortch, Secretary FCC (filed Nov. 15, 2017) (AT&T *Ex Parte* Letter) (reporting on a meeting on Nov. 13, 2017, with Commission staff from several bureaus to discuss Section 22.925).

[73] *See Expanding Access to Mobile Wireless Service Onboard Aircraft*, WT Docket No. 13-301, Notice of Proposed Rulemaking, 29 FCC Rcd 17132 (2013) (Airborne Wireless proceeding).

[74] AT&T filed reply comments in the Airborne Wireless proceeding (i.e., WT Docket No. 13-301); it also filed in that docket a copy of the AT&T *Ex Parte* Letter filed in the instant Cellular Reform docket.

[75] 47 CFR § 22.143 (specifying also, however, that applicants must not *operate* such facilities until the Commission grants the application).

to grant.[76] We disagree. The same Public-Notice-plus-35-day period is specified in Section 90.169 of our rules for several other commercial wireless radio services.[77] Pre-grant construction under Section 22.143 is subject to several conditions, including, among others, that no petitions to deny or mutually exclusive (competing) applications have been filed.[78] When the Commission reduced the waiting period from the original 60-day and 90-day post-Public Notice periods to the existing "Public-Notice-plus-35-days" provision, it agreed that applicants should know within that timeframe whether any petition to deny or competing application had been filed, and retained these conditions to disallow construction "when we can not be reasonably certain that we will be able to grant the application."[79] The Commission has also recognized that, "[b]ecause construction of [PMS] facilities entails not only the financial risk to the applicant . . . but also environmental and other consequences affecting the public, . . . it would not be in the public interest to allow construction . . . until it is reasonably certain that the facilities can be authorized."[80] In a similar vein, it is in the public interest to minimize the Commission's risk of having to expend taxpayer resources to issue notification to the applicant, pursuant to Section 22.143(b), to stop construction.[81] For all these reasons, we decline to delete Section 22.143(a) at this time.

VI. PROCEDURAL MATTERS

27. *Paperwork Reduction Act Analysis*. The Third Report and Order contains new and modified information collection requirements subject to the Paperwork Reduction Act of 1995 (PRA).[82] It will be submitted to the Office of Management and Budget (OMB) for review under Section 3507(d) of the PRA. OMB, the general public, and other Federal agencies will be invited to comment on the new and modified information collection requirements contained in the rules adopted in this proceeding.[83] In addition, pursuant to the Small Business Paperwork Relief Act of 2002,[84] the Commission previously sought specific comment on how the Commission might further reduce the information collection burden for small business concerns with fewer than 25 employees. We have assessed the effects of the rule changes we are adopting on small business concerns and find that businesses with fewer than 25 people will benefit from the additional reforms, i.e., deletion of Sections 22.3, 22.301, 22.303, 22.321, 22.325, and 22.927, which will provide added flexibility for Cellular licensees no matter their size.

28. *Congressional Review Act*. The Commission will send a copy of today's Third Report and Order to Congress and the Government Accountability Office pursuant to the Congressional Review

[76] EWA *Ex Parte* Letter at 4.

[77] 47 CFR § 90.169(a).

[78] 47 CFR § 22.143(d)(1), (2).

[79] *Revision of Part 22 of the Commission's Rules Governing the Public Mobile Services, et al*., CC Docket Nos. 95-115, 94-46, and 93-116, RM No. 8367, Report and Order, 9 FCC Rcd 6513, 6552-63 (1994) (*Part 22 Rewrite Order*) (adding that, if a petition to deny is filed, "it brings into question whether the application can be granted"; also noting that the previous waiting period was 60 days after the date of the public notice announcing tentative selectees for the Cellular Service, and 90 days after release of the applicable acceptable for filing public notice for the Paging and Radiotelephone Service).

[80] *Part 22 Rewrite Order*, 9 FCC Rcd at 6553. Note that, for applicants for licenses awarded by competitive bidding, which includes commercial wireless services such as PCS and AWS, the Commission has also established a waiting period, tailored to our competitive bidding process: pre-grant construction is permitted only upon release of the Public Notice listing the post-auction long-form application for that facility as acceptable for filing (by which time, mutual exclusivity has been eliminated and the Commission is reasonably certain that the application can be granted). *See* 47 CFR § 1.2113.

[81] 47 CFR § 22.143(b).

[82] Pub. L. No. 104-13.

[83] The Commission will publish a notice in the *Federal Register* inviting the public to comment on the new and modified requirements, as required by the PRA. *See* 44 U.S.C. §§ 3501-3520.

[84] Public Law 107-198, *see* 44 U.S.C. § 3506(c)(4).

Act.[85]

29. *Final Regulatory Flexibility Analysis*. The Regulatory Flexibility Act of 1980, as amended (RFA), requires that an agency prepare a regulatory flexibility analysis for notice and comment rulemakings, unless the agency certifies that "the rule will not, if promulgated, have a significant economic impact on a substantial number of small entities."[86] Accordingly, we have prepared a Final Regulatory Flexibility Analysis (FRFA) concerning the possible impact on small entities of the rule changes contained in the Third Report and Order. The FRFA is attached as Appendix B. The Commission will send a copy of this Third Report and Order, including the FRFA, to the Chief Counsel for Advocacy of the Small Business Administration.

30. *Contact Information*. For further information regarding this Third Report and Order, contact Nina Shafran at (202) 418-2781, or Nina.Shafran@fcc.gov.

VII. ORDERING CLAUSES

31. Accordingly, IT IS ORDERED, pursuant to Sections 1, 2, 4(i), 4(j), 7, 301, 303, 307, 308, 309, and 332 of the Communications Act of 1934, as amended, 47 U.S.C. §§ 151, 152, 154(i), 154(j), 157, 301, 303, 307, 308, 309, and 332, that this THIRD REPORT AND ORDER in WT Docket No. 12-40 IS ADOPTED.

32. IT IS FURTHER ORDERED that the THIRD REPORT AND ORDER SHALL BE EFFECTIVE 30 days after publication of a summary in the *Federal Register*.

33. IT IS FURTHER ORDERED that Part 22 of the Commission's rules, 47 CFR Part 22, IS AMENDED as specified in Appendix A, effective 30 days after publication in the *Federal Register* except as otherwise provided herein.

34. IT IS FURTHER ORDERED that the amendment adopted in this THIRD REPORT AND ORDER, and specified in Appendix A, to 47 CFR § 22.303, which contains new or modified information collection requirements that require approval by the Office of Management and Budget (OMB) under the Paperwork Reduction Act, WILL BECOME EFFECTIVE after OMB review and approval, on the effective date specified in a notice that the Commission will publish in the *Federal Register* announcing such approval and effective date.

35. IT IS FURTHER ORDERED that this Cellular Reform proceeding in WT Docket No. 12-40, including RM Nos. 11510 and 11660, IS HEREBY TERMINATED.

36. IT IS FURTHER ORDERED, pursuant to Section 801(a)(1)(A) of the Congressional Review Act, 5 U.S.C. § 801(a)(1)(A), that the Commission SHALL SEND a copy of the THIRD REPORT AND ORDER to Congress and to the Government Accountability Office.

[85] *See* 5 U.S.C. § 801(a)(1)(A).

[86] 5 U.S.C. §§ 601 *et seq*.

37. IT IS FURTHER ORDERED that the Commission's Consumer and Governmental Affairs Bureau, Reference Information Center, SHALL SEND a copy of the THIRD REPORT AND ORDER, including the Final Regulatory Flexibility Analysis, to the Chief Counsel for Advocacy of the Small Business Administration.

FEDERAL COMMUNICATIONS COMMISSION

Marlene H. Dortch
Secretary

APPENDIX A

Final Rules

Part 22 of Title 47 of the Code of Federal Regulations is amended as follows:

PART 22—PUBLIC MOBILE SERVICES

1. The authority citation for part 22 continues to read as follows:

   Authority: 47 U.S.C. 154, 222, 303, 309 and 332.

2. Section 22.3 is removed and reserved.

§ 22.3 [Reserved]

3. Section 22.301 is removed and reserved.

§ 22.301 [Reserved]

4. Section 22.303 is removed and reserved.

§ 22.303 [Reserved]

5. Section 22.321 is removed and reserved.

§ 22.321 [Reserved]

6. Section 22.325 is removed and reserved.

§ 22.325 [Reserved]

7. Section 22.927 is removed and reserved.

§ 22.927 [Reserved]

APPENDIX B

Final Regulatory Flexibility Analysis

1. As required by the Regulatory Flexibility Act of 1980, as amended (RFA),[1] an Initial Regulatory Flexibility Analysis (IRFA) was incorporated in the *Second Further Notice of Proposed Rulemaking* (*Second Further Notice*), released in March 2017.[2] The Commission sought written public comment on the proposals in the *Second Further Notice*, including comment on the IRFA. This present Final Regulatory Flexibility Analysis (FRFA) conforms to the RFA.[3]

A. Need for and Objectives of the Rules

2. In the *Third Report and Order*, the Commission takes additional steps to reduce unnecessary regulatory burdens, not only for licensees in the 800 MHz Cellular Radiotelephone (Cellular) Service, but for other Part 22 licensees as well. The revisions will provide Cellular and other Part 22 licensees with more consistency in licensing across commercial wireless services as well as enhanced flexibility, thereby freeing up more resources for investment in new technologies and greater spectrum efficiency to meet increasing consumer demand for advanced wireless services. With this *Third Report and Order*, we conclude an important chapter in the Commission's extensive regulatory reform agenda, and we terminate the proceeding in WT Docket No. 12-40, including RM Nos. 11510 and 11660.

3. Specifically, we delete the following administrative and recordkeeping rules for all Part 22 licensees: Sections 22.301 and 22.303, concerning station inspections and the retention of hard copies of station authorizations and other station records; and Section 22.325, concerning station control points and personnel on duty at those control points.[4] Removing these provisions will eliminate needless burdens that are inconsistent with the Commission's practices and with the predominant use of electronic records storage and access, and will also eliminate asymmetry across competing commercial mobile radio services (CMRS), as the Commission's rules for newer wireless services such as PCS, certain AWS, and the 700 MHz Service do not include such provisions. These rules were adopted more than two decades ago, establishing obligations for which there is no longer a benefit to outweigh the costs and burdens of compliance imposed on licensees. In addition, we delete Sections 22.3 and 22.927, which set forth service provider obligations concerning their authorizations and subscribers' Cellular mobile stations, as these rules are no longer necessary. We also delete Section 22.321, concerning equal employment opportunity programs, policies, and complaint reports, as duplicative of other regulations.

4. In the absence of strong support on the record, the Commission declines at this time to pursue the issues of possible relocation of the Part 22 Cellular, Part 24 PCS, and other wireless mobile service rules into a single set of regulations, and possible reorganization of the Part 27 rules. The

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[1] *See* 5 U.S.C. § 603. The RFA, *see* 5 U.S.C. §§ 601 – 612, has been amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA), Pub. L. No. 104-121, Title II, 110 Stat. 857 (1996).

[2] *See Amendment of Parts 1 and 22 of the Commission's Rules with Regard to the Cellular Service, Including Changes in Licensing of Unserved Area*, *Amendment of the Commission's Rules with Regard to Relocation of Part 24 to Part 27; Interim Restrictions and Procedures for Cellular Service Applications*; *Amendment of Parts 0, 1, and 22 of the Commission's Rules with Regard to Frequency Coordination for the Cellular Service*; *Amendment of the Commission's Rules Governing Radiated Power Limits for the Cellular Service*; *Amendment of Parts 1, 22, 24, 27, 74, 80, 90, 95, and 101 to Establish Uniform License Renewal, Discontinuance of Operation, and Geographic Partitioning and Spectrum Disaggregation Rules and Policies for Certain Wireless Radio Services; 2016 Biennial Review of Telecommunications Regulations*, WT Docket Nos. 12-40, 10-112, and 16-138, RM Nos. 11510 and 11660, Second Report and Order, Report and Order, and Second Further Notice of Proposed Rulemaking, 32 FCC Rcd 2518 (2017) (herein, "*Second Further Notice*").

[3] *See* 5 U.S.C. § 604.

[4] 47 CFR §§ 22.301, 22.303, 22.325.

Commission also declines to delete, as requested by certain commenters, two Cellular Service rules—Sections 22.921 and 22.925—and Section 22.143(a), which applies to all Part 22 licensees. The Commission finds that Sections 22.921 and 22.143(a) continue to serve the public interest, and the restrictions in Section 22.925 are being addressed in a separate proceeding.

B. Summary of Significant Issues Raised by Public Comments in Response to the IRFA

5. There were no comments filed that specifically addressed the rules and policies proposed in the IRFA.

C. Response to Comments by the Chief Counsel for Advocacy of the Small Business Administration

6. Pursuant to the Small Business Jobs Act of 2010, which amended the RFA, the Commission is required to respond to any comments filed by the Chief Counsel for Advocacy of the Small Business Administration (SBA), and to provide a detailed statement of any change made to the proposed rules as a result of those comments.[5]

7. The Chief Counsel did not file any comments in response to the proposed rules in this proceeding.

D. Description and Estimate of the Number of Small Entities to Which the Rules Will Apply

8. The RFA directs agencies to provide a description of, and where feasible, an estimate of the number of small entities that may be affected by the rules adopted herein.[6] The RFA generally defines the term "small entity" as having the same meaning as the terms "small business," "small organization," and "small governmental jurisdiction."[7] In addition, the term "small business" has the same meaning as the term "small business concern" under the Small Business Act.[8] A "small business concern" is one which: (1) is independently owned and operated; (2) is not dominant in its field of operation; and (3) satisfies any additional criteria established by the SBA.[9]

9. *Small Businesses, Small Organizations, and Small Governmental Jurisdictions*. Our actions, over time, may affect small entities that are not easily categorized at present. We therefore describe here, at the outset, three broad groups of small entities that could be directly affected herein.[10] First, while there are industry specific size standards for small businesses that are used in the regulatory flexibility analysis, according to data from the SBA's Office of Advocacy, in general a small business is an independent business having fewer than 500 employees.[11] These types of small businesses represent 99.9% of all businesses in the United States, which translates to 28.8 million businesses.[12]

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[5] 5 U.S.C. § 604(a)(3).

[6] *See* 5 U.S.C. § 604(a)(3).

[7] 5 U.S.C. § 601(6).

[8] 5 U.S.C. § 601(3) (incorporating by reference the definition of "small-business concern" in the Small Business Act, 15 U.S.C. § 632). Pursuant to 5 U.S.C. § 601(3), the statutory definition of a small business applies "unless an agency, after consultation with the Office of Advocacy of the Small Business Administration and after opportunity for public comment, establishes one or more definitions of such term which are appropriate to the activities of the agency and publishes such definition(s) in the Federal Register."

[9] 15 U.S.C. § 632(a).

[10] *See* 5 U.S.C. § 601(3)-(6).

[11] *See* SBA, Office of Advocacy, "Frequently Asked Questions, Question 1 – What is a small business?" https://www.sba.gov/sites/default/files/advocacy/SB-FAQ-2016_WEB.pdf (June 2016).

10. Next, the type of small entity described as a "small organization" is generally "any not-for-profit enterprise which is independently owned and operated and is not dominant in its field."[13] Nationwide, as of August 2016, there were approximately 356,494 small organizations based on registration and tax data filed by nonprofits with the Internal Revenue Service (IRS).[14]

11. Finally, the small entity described as a "small governmental jurisdiction" is defined generally as "governments of cities, counties, towns, townships, villages, school districts, or special districts, with a population of less than fifty thousand."[15] U.S. Census Bureau data from the 2012 Census of Governments[16] indicate that there were 90,056 local governmental jurisdictions consisting of general purpose governments and special purpose governments in the United States.[17] Of this number there were 37,132 general purpose governments (county,[18] municipal and town or township[19]) with populations of less than 50,000 and 12,184 special purpose governments (independent school districts[20] and special districts[21]) with populations of less than 50,000. The 2012 U.S. Census Bureau data for most types of governments in the local government category show that the majority of these governments have

(Continued from previous page)

[12] *See* SBA, Office of Advocacy, "Frequently Asked Questions, Question 2- How many small businesses are there in the U.S.?" https://www.sba.gov/sites/default/files/advocacy/SB-FAQ-2016_WEB.pdf (June 2016).

[13] 5 U.S.C. § 601(4).

[14] Data from the Urban Institute, National Center for Charitable Statistics (NCCS) reporting on nonprofit organizations registered with the IRS was used to estimate the number of small organizations. Reports generated using the NCCS online database indicated that as of August 2016 there were 356,494 registered nonprofits with total revenues of less than $100,000. Of this number, 326,897 entities filed tax returns with 65,113 registered nonprofits reporting total revenues of $50,000 or less on the IRS Form 990-N for Small Exempt Organizations and 261,784 nonprofits reporting total revenues of $100,000 or less on some other version of the IRS Form 990 within 24 months of the August 2016 data release date. *See* http://nccs.urban.org/sites/all/nccs-archive/html//tablewiz/tw.php where the report showing this data can be generated by selecting the following data fields: Report: "The Number and Finances of All Registered 501(c) Nonprofits"; Show: "Registered Nonprofits"; By: "Total Revenue Level (years 1995, Aug to 2016, Aug)"; and For: "2016, Aug" then selecting "Show Results".

[15] 5 U.S.C. § 601(5).

[16] *See* 13 U.S.C. § 161. The Census of Government is conducted every five (5) years compiling data for years ending with "2" and "7". *See also* Program Description Census of Government https://factfinder.census.gov/faces/affhelp/jsf/pages/metadata.xhtml?lang=en&type=program&id=program.en.COG#

[17] *See* U.S. Census Bureau, 2012 Census of Governments, Local Governments by Type and State: 2012 - United States-States. https://factfinder.census.gov/bkmk/table/1.0/en/COG/2012/ORG02.US01. Local governmental jurisdictions are classified in two categories - General purpose governments (county, municipal and town or township) and Special purpose governments (special districts and independent school districts).

[18] *See* U.S. Census Bureau, 2012 Census of Governments, County Governments by Population-Size Group and State: 2012 - United States-States. https://factfinder.census.gov/bkmk/table/1.0/en/COG/2012/ORG06.US01. There were 2,114 county governments with populations less than 50,000.

[19] *See* U.S. Census Bureau, 2012 Census of Governments, Subcounty General-Purpose Governments by Population-Size Group and State: 2012 - United States – States. https://factfinder.census.gov/bkmk/table/1.0/en/COG/2012/ORG07.US01. There were 18,811 municipal and 16,207 town and township governments with populations less than 50,000.

[20] *See* U.S. Census Bureau, 2012 Census of Governments, Elementary and Secondary School Systems by Enrollment-Size Group and State: 2012 - United States-States. https://factfinder.census.gov/bkmk/table/1.0/en/COG/2012/ORG11.US01. There were 12,184 independent school districts with enrollment populations less than 50,000.

[21] *See* U.S. Census Bureau, 2012 Census of Governments, Special District Governments by Function and State: 2012 - United States-States, https://factfinder.census.gov/bkmk/table/1.0/en/COG/2012/ORG09.US01. The U.S. Census Bureau data did not provide a population breakout for special district governments.

populations of less than 50,000.[22] Based on this data, we estimate that at least 49,316 local government jurisdictions fall in the category of "small governmental jurisdictions."[23]

12. *Wireless Telecommunications Carriers (except Satellite)*. This industry comprises establishments engaged in operating and maintaining switching and transmission facilities to provide communications via the airwaves. Establishments in this industry have spectrum licenses and provide services using that spectrum, such as cellular services, paging services, wireless internet access, and wireless video services.[24] The appropriate size standard under SBA rules is that such a business is small if it has 1,500 or fewer employees.[25] For this industry, U.S. Census Bureau data for 2012 show that there were 967 firms that operated for the entire year.[26] Of this total, 955 firms had employment of 999 or fewer employees and 12 had employment of 1000 employees or more.[27] Thus, under this category and the associated size standard, the Commission estimates that the majority of wireless telecommunications carriers (except satellite) are small entities.

13. The Commission's own data—available in its Universal Licensing System (ULS)—indicate that, as of May 17, 2018, there are 264 Cellular Service licensees that will be affected by our actions today.[28] The Commission does not know how many of these licensees are small, as the Commission does not collect that information for these types of entities. Also, according to internally developed Commission data, 413 carriers reported that they were engaged in the provision of wireless telephony, including the Cellular Service, PCS, and Specialized Mobile Radio (SMR) services.[29] Of this total, an estimated 261 have 1,500 or fewer employees.[30] Thus, using available data, we estimate that the majority of wireless firms can be considered small.

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[22] *See* U.S. Census Bureau, 2012 Census of Governments, County Governments by Population-Size Group and State: 2012 - United States-States - https://factfinder.census.gov/bkmk/table/1.0/en/COG/2012/ORG06.US01; Subcounty General-Purpose Governments by Population-Size Group and State: 2012 - United States–States - https://factfinder.census.gov/bkmk/table/1.0/en/COG/2012/ORG07.US01; and Elementary and Secondary School Systems by Enrollment-Size Group and State: 2012 - United States-States. https://factfinder.census.gov/bkmk/table/1.0/en/COG/2012/ORG11.US01. While U.S. Census Bureau data did not provide a population breakout for special district governments, if the population of less than 50,000 for this category of local government is consistent with the other types of local governments, the majority of the 38, 266 special district governments have populations of less than 50,000.

[23] *Id.*

[24] U.S. Census Bureau, 2012 NAICS Definitions, "517210 Wireless Telecommunications Carriers (Except Satellite)," *See* https://factfinder.census.gov/faces/affhelp/jsf/pages/metadata.xhtml?lang=en&type=ib&id=ib.en./ECN.NAICS2012.517210.

[25] 13 CFR § 121.201, NAICS code 517210.

[26] U.S. Census Bureau, *2012 Economic Census of the United States*, Table EC1251SSSZ5, Information: Subject Series: Estab and Firm Size: Employment Size of Firms for the U.S.: 2012 NAICS Code 517210. https://factfinder.census.gov/bkmk/table/1.0/en/ECN/2012_US/51SSSZ5//naics~517210.

[27] *Id*. Available census data does not provide a more precise estimate of the number of firms that have employment of 1,500 or fewer employees; the largest category provided is for firms with "1000 employees or more."

[28] *See* http://wireless.fcc.gov/uls. For the purposes of this FRFA, consistent with Commission practice for wireless services, the Commission estimates the number of licensees based on the number of unique FCC Registration Numbers.

[29] *See* Federal Communications Commission, Wireline Competition Bureau, Industry Analysis and Technology Division, Trends in Telephone Service at Table 5.3 (Sept. 2010), https://apps.fcc.gov/edocs_public/attachmatch/DOC-301823A1.pdf.

[30] *Id.*

E. Description of Projected Reporting, Recordkeeping, and Other Compliance Requirements for Small Entities

14. The *Third Report and Order* does not impose any additional reporting, recordkeeping, or other compliance requirements on small entities, nor on any other entities. Rather, it eliminates several existing reporting and recordkeeping requirements, which will benefit small entities as well as all other entities that operate Cellular Service facilities. The deleted rules include Sections 22.301 and 22.303, which collectively require that hard copies of license authorizations and other records be maintained by all Part 22 licensees for each station, and that such records and the station itself be made available for inspection upon request.[31] Small entities as well as other Part 22 entities will no longer be burdened by these requirements. Licensees will continue to have access to their official authorizations in the ULS, which is available electronically at all times. Similarly, members of the public will continue to have access to reference copies in the ULS, which reflects the most up-to-date information concerning all authorizations.

15. The *Third Report and Order* also deletes Section 22.325, which requires that "[e]ach station in the Public Mobile Services [ ] have at least one control point and a person on duty who is responsible for station operation."[32] The requirement has become technologically obsolete, as commercial wireless licensees routinely monitor their network operations by automatic and remote mechanisms. Part 22 licensees, including small entities, will no longer be burdened by it, thus freeing up their resources and providing them with the same flexibility as other CMRS licensees to determine how to manage their networks to comply with the Commission's operational rules.

16. All CMRS licensees will continue to be subject to the current annual equal employment opportunity (EEO) complaints report filing requirement. The requirement is set forth in Section 22.321(c), which applies to Part 22 licensees regardless of size, and is also set forth in the later-adopted Section 90.168(c), which applies more broadly to *all* CMRS licensees regardless of size.[33] Section 90.168 contains the same provisions as Section 22.321, including Section 22.321(c), and thus it subsumes Section 22.321 in its entirety. On this basis, the Commission deletes Section 22.321 in its entirety as duplicative.

17. The *Third Report and Order* deletes two other rules: Section 22.3, which applies to all Part 22 licensees, and Section 22.927, which applies only to Cellular Service licensees. Both rules set forth certain licensee obligations concerning operations pursuant to a valid FCC authorization, and service to subscribers of a different commercial wireless system (i.e., "roamers"). A later-adopted rule, Section 1.903, which applies to numerous wireless services, including all Part 22 licensees, imposes essentially the same obligations as Sections 22.3 and 22.927, thus rendering these Part 22 rules duplicative. By deleting Sections 22.321, 22.3, and 22.927, the Commission removes licensees' compliance obligations under one group of regulations where the same obligations exist under different provisions, and thereby simplifies compliance by eliminating regulations that are largely duplicative.

18. Small entities and other licensees will also continue to be subject to Section 22.921, requiring certain Cellular Service mobile telephones that are capable of operating in the analog mode to "incorporate a special procedure for processing 911 calls,"[34] and Section 22.143(a), which allows applicants to begin construction of Public Mobile Services (PMS) facilities "35 days after the date of the

[31] Deletion of these rules does not affect the Commission's statutory station inspection authority. *See* 47 U.S.C. § 303(n).

[32] 47 CFR § 22.325.

[33] 47 CFR § 22.321(c).

[34] 47 CFR § 22.921.

Public Notice listing the application for that facility as acceptable for filing."[35] Commenters have not demonstrated that these rules are burdensome or no longer needed. Moreover, the Commission finds that these regulations continue to serve the public interest.

F. Steps Taken to Minimize the Significant Economic Impact on Small Entities, and Significant Alternatives Considered

19. The RFA requires an agency to describe any significant alternatives that it has considered in reaching its approach, which may include the following four alternatives (among others): "(1) the establishment of differing compliance or reporting requirements or timetables that take into account the resources available to small entities; (2) the clarification, consolidation, or simplification of compliance and reporting requirements under the rule for such small entities; (3) the use of performance rather than design standards; and (4) an exemption from coverage of the rule, or any part thereof, for such small entities."[36]

20. The rules eliminated in the *Third Report and Order* are expected to have a beneficial economic impact on small entities because all Cellular Service and other Part 22 licensees will be subject to fewer recordkeeping, reporting, and compliance burdens. While the record does not enable a precise quantification of costs and benefits, we know that these requirements impose burdens that require expenditures of personnel and other resources. Specifically, removal of the requirements under Sections 22.301 and 22.303 to print (or request that the Commission print and mail) hard copies of FCC authorizations and retain them as part of each station's records every time the Commission grants an application will allow small entities and other Part 22 licensees to rely on the electronic availability of such authorizations in ULS, thereby realizing long-term cost savings. Similarly, elimination of the requirement under Section 22.325 to maintain control points for each station and to have a person on duty in charge of station operations is expected to decrease the costs of maintaining facilities and to allow small entities as well as licensees of all sizes to realize the cost savings inherent in remote monitoring and automatic functions for station operations. Likewise, the deletion of Sections 22.3, 22.321, and 22.927 will simplify compliance burdens by removing duplicative regulations. In addition, all of the rule deletions adopted in the *Third Report and Order* put Cellular Service and other Part 22 licensees more on regulatory par with licensees in competing CMRS such as PCS, AWS, and the 700 MHz Service.

21. A few commenters suggested that the Commission could eliminate the annual EEO complaints report requirement for licensees with fewer than 16 full-time employees. However, the commenters failed to take note of the fact that same requirement is also in another rule part that applies to *all* CMRS licensees—a rule that is outside the scope of this proceeding. Thus, the Commission declined to eliminate this requirement. In any event, the commenters that focused on Section 22.321(c) failed to demonstrate adequately why licensees with fewer than 16 employees should be exempt from the requirement.

22. The Commission also declined to delete three rules—Sections 22.925, 22.921, and 22.143(a)—raised by commenters. Section 22.925 prohibits the operation of Cellular Service mobiles aboard "airplanes, balloons or any other type of aircraft . . . while such aircraft are airborne . . . ."[37] The issues raised by commenters regarding this prohibition are being addressed by the Commission in another proceeding, WT Docket No. 13-301, and therefore the Commission declines to consider them here. Regarding Section 22.921, contrary to commenters' understanding, Commission data show that analog technology is still being used in the Cellular Service band.[38] The specific requirements in Section 22.921 thus continue to ensure that 911 calls get through even when analog technology is used by Cellular carriers. The other rule that was considered but not deleted is Section 22.143(a), which permits applicants

[35] 47 CFR § 22.143(a).

[36] 5 U.S.C. § 603(c)(1) - (4).

[37] 47 CFR § 22.925.

[38] *See* Mobile Deployment Form 77 Data, https://www.fcc.gov/mobile-deployment-form-477-data.

to begin construction of PMS facilities prior to grant of their applications.[39] The Commission finds that this rule also continues to serve the public interest. The 35-day waiting period for commencing pre-grant construction, which a commenter raised for deletion, allows time for the Commission to be reasonably certain that it will be able to grant the application for the facility at issue (including determining that no petitions to deny or competing applications have been timely filed).

Report to Congress

The Commission will send a copy of the *Third Report and Order*, including this FRFA, in a report to Congress pursuant to the Congressional Review Act.[40] In addition, the Commission will send a copy of the *Third Report and Order*, including this FRFA, to the Chief Counsel for Advocacy of the SBA. A copy of the *Third Report and Order* and FRFA (or summaries thereof) also will be published in the *Federal Register*.[41]

[39] 47 CFR § 22.143 (specifying also, however, that applicants must not *operate* such facilities until the Commission grants the application).

[40] 5 U.S.C. § 801(a)(1)(A).

[41] 5 U.S.C. § 604(b).

APPENDIX C

List of Commenters

Comments

AT&T Services, Inc. (AT&T)
CTIA
Critical Messaging Association
Enterprise Wireless Alliance (EWA)
Verizon

Reply Comments

Qualcomm Incorporated

Ex Parte Letters

AT&T
EWA
Gogo Inc.

STATEMENT OF
CHAIRMAN AJIT PAI

Re: *Amendment of Parts 1 and 22 of the Commission's Rules with Regard to the Cellular Service, Including Changes in Licensing of Unserved Area*, WT Docket No. 12-40, RM No. 11510; *Amendment of the Commission's Rules with Regard to Relocation of Part 24 to Part 27; Interim Restrictions and Procedures for Cellular Service Applications; Amendment of Parts 0, 1, and 22 of the Commission's Rules with Regard to Frequency Coordination for the Cellular Service; Amendment of Part 22 of the Commission's Rules Regarding Certain Administrative and Filing Requirements; Amendment of the Commission's Rules Governing Radiated Power Limits for the Cellular Service*, RM No. 11660; *Amendments of Parts 1, 22, 24, 27, 74, 80, 90, 95, and 101 to Establish Uniform License Renewal, Discontinuance of Operation, and Geographic Partitioning and Spectrum Disaggregation Rules and Policies for Certain Wireless Radio Services*, WT Docket No. 10-112; *2016 Biennial Review of Telecommunications Regulations*, WT Docket No. 16-138.

Throughout my tenure, I've emphasized the need to eliminate unnecessary and outdated regulations. And in this *Order* alone, we're eliminating six such rules. Three of them impose antiquated administrative and recordkeeping burdens on a subset of wireless licensees, including those in the 800 MHz cellular band. For instance, licensees have to maintain hard copies of such authorizations and make them available for inspection by the Commission. Given that license authorizations are now available electronically through the Commission's Universal Licensing System (ULS), this is pointless. The other three rules that we're removing from the Code of Federal Regulations apply to the same subset of wireless licensees but are duplicative of rules contained elsewhere. They serve no purpose but to clutter our rulebook.

Many thanks to the staff who worked on this item. From the Wireless Telecommunications Bureau: Linda Chang, Thomas Derenge, Chas Eberle, Jessica Greffenius, Roger Noel, Thomas Reed, Moslem Sawez, Nina Shafran, Don Stockdale, Cecelia Sulhoff, and Suzanne Tetreault; from the Office of General Counsel: Deborah Broderson, David Horowitz, and Bill Richardson; from the Office of Communications Business Opportunities: Sanford Williams and Chana Wilkerson; from the Wireline Competition Bureau: Suzanne Yellen; and from the Media Bureau: Lewis Pulley.

Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	
Amendment of Parts 1 and 22 of the Commission's Rules with Regard to the Cellular Service, Including Changes in Licensing of Unserved Area	)	WT Docket No. 12-40 (*terminated*) RM No. 11510 (*terminated*)
	)	
Amendment of the Commission's Rules with Regard to Relocation of Part 24 to Part 27	)	
	)	
Interim Restrictions and Procedures for Cellular Service Applications	)	
	)	
Amendment of Parts 0, 1, and 22 of the Commission's Rules with Regard to Frequency Coordination for the Cellular Service	)	
	)	
Amendment of Part 22 of the Commission's Rules Regarding Certain Administrative and Filing Requirements	)	
	)	
Amendment of the Commission's Rules Governing Radiated Power Limits for the Cellular Service	)	RM No. 11660 (*terminated*)
	)	
Amendment of Parts 1, 22, 24, 27, 74, 80, 90, 95, and 101 to Establish Uniform License Renewal, Discontinuance of Operation, and Geographic Partitioning and Spectrum Disaggregation Rules and Policies for Certain Wireless Radio Services	)	WT Docket No. 10-112
	)	
2016 Biennial Review of Telecommunications Regulations	)	WT Docket No. 16-138

THIRD REPORT AND ORDER

Adopted: July 12, 2018 **Released: July 13, 2018**

By the Commission: Chairman Pai issuing a statement.

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I. INTRODUCTION

1. In this Third Report and Order, we take additional steps to reduce unnecessary regulatory burdens for licensees in the 800 MHz Cellular Radiotelephone (Cellular) Service as well as other Part 22 licensees, thereby freeing up more resources for investment in new technologies and greater spectrum efficiency to meet increasing consumer demand for advanced wireless services. Specifically, we modernize our rules by eliminating several Part 22 recordkeeping and reporting obligations that were adopted more than two decades ago—obligations for which there is no longer a benefit to outweigh the compliance costs and burdens imposed on licensees. We also eliminate certain Cellular Service-specific rules that are no longer necessary. Our revisions today will provide Cellular and other Part 22 licensees with enhanced flexibility and advance our goal of ensuring more consistency in licensing across commercial wireless services, while taking into account unique features of each service. With this Third Report and Order we conclude an important chapter in the Commission's extensive regulatory reform agenda and terminate the proceeding in WT Docket No. 12-40, including RM Nos. 11510 and 11660.

II. BACKGROUND

2. In 1981, the Commission adopted its initial Cellular Service rules; these provided the foundation of the commercial wireless industry and made mobile services broadly available to the American public nationwide.[1] In 2012, the Commission released a Cellular Reform *Notice of Proposed Rulemaking,* which was intended to modernize the legacy site-based Cellular licensing scheme and transition it to a geographically based licensing model.[2] In 2014, the Commission adopted a *Report and Order* (*R&*O)*,* which modernized Cellular Service licensing in several respects.[3] The centerpiece of the *R&O* was the adoption of a geographically-based licensing regime, with licenses based on Cellular Geographic Service Area (CGSA) boundaries; this added significant new flexibility for licensees to

[1] *See generally An Inquiry Into the Use of the Bands 825-845 MHz and 870-890 MHz for Cellular Communications Systems; and Amendment of Parts 2 and 22 of the Commission's Rules Relative to Cellular Communications Systems,* CC Docket No. 79-318, Report and Order*,* 86 F.C.C.2d 469 (1981).

[2] *Amendment of Parts 1 and 22 of the Commission's Rules with Regard to the Cellular Service, Including Changes in Licensing of Unserved Area*; *Amendment of the Commission's Rules with Regard to Relocation of Part 24 to Part 27*; *Interim Restrictions and Procedures for Cellular Service Applications*, WT Docket No. 12-40, RM No. 11510, Notice of Proposed Rulemaking and Order, 27 FCC Rcd 1745, 1747 n.3, 1750-52, 1758 (2012) (*NPRM*). Under the legacy site-based model, applications with comprehensive technical data and prior FCC approval had been required for new Cellular systems and for modifications of an existing system that would expand the licensee's authorized Cellular Geographic Service Area (CGSA), no matter how slight the expansion. Based on Commission data when it released the *NPRM*, approximately 80 percent of the 1,468 Cellular Market Area (CMA) channel blocks were almost completely licensed already, with only limited unlicensed area remaining, primarily in Alaska and other rural areas in the western United States. *See NPRM*, 27 FCC Rcd at 1747, 1750-55, 1768-1769.

[3] *Amendment of Parts 1 and 22 of the Commission's Rules with Regard to the Cellular Service, Including Changes in Licensing of Unserved Area, et al.,* WT Docket No. 12-40, RM Nos. 11510 and 11660, Report and Order and Further Notice of Proposed Rulemaking, 29 FCC Rcd 14100 (2014) (*R&O* and *Further Notice,* respectively).

improve their systems within those boundaries.[4] The *R&O* also added significant opportunities for licensees to expand their service coverage without prior authorization, resulting in a substantial reduction in administrative burdens for both licensees and FCC staff.[5] In the *Further Notice*, the Commission proposed additional Cellular licensing reforms and overdue reforms of the Cellular radiated power and related technical rules that could facilitate the ability of Cellular licensees to deploy advanced broadband services.[6]

3. In the 2017 *Second Report and Order*, the Commission modernized numerous Cellular technical rules, including the outdated radiated power and related rules, to permit power measurement using power spectral density.[7] These changes facilitate the use of Cellular spectrum to provide advanced mobile broadband services, such as 4G long term evolution (LTE), while protecting public safety communications from increased potential for unacceptable interference.[8] The *Second R&O* also revised rules to further eliminate unnecessary filings and other regulatory burdens for Cellular licensees.[9] The Commission's reforms resulted in Cellular Service rules more akin to the flexible licensing schemes found in other similar mobile services, such as the Broadband Personal Communications Service (PCS),[10] the commercial service in the 700 MHz band (700 MHz Service),[11] the 600 MHz Service,[12] and the Advanced Wireless Services (AWS),[13] to help ensure that carriers are treated similarly regardless of technology choice.

4. In the *Second Further Notice*, to build on reforms adopted in the *R&O* and *Second R&O* and to respond to certain submissions by commenters in the Commission's 2016 Biennial Review proceeding,[14] the Commission proposed and sought comment on additional reforms of its Part 22 rules

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[4] See the *R&O* for the full discussion of the revised rules adopted (29 FCC Rcd at 14102-26 (Section II) and 14156-63 (Appendix A (Final Rules)).

[5] *See id*., 29 FCC Rcd at 14115-18. The *R&O* also established a field strength limit rule tailored to reflect the continued ability to expand Cellular service area coverage. *See id*. at 14109-10.

[6] *Further Notice*, 29 FCC Rcd at 14126-52.

[7] *See Amendment of Parts 1 and 22 of the Commission's Rules with Regard to the Cellular Service, Including Changes in Licensing of Unserved Area*, *Amendment of the Commission's Rules with Regard to Relocation of Part 24 to Part 27; Interim Restrictions and Procedures for Cellular Service Applications*; *Amendment of Parts 0, 1, and 22 of the Commission's Rules with Regard to Frequency Coordination for the Cellular Service*; *Amendment of the Commission's Rules Governing Radiated Power Limits for the Cellular Service*; *Amendment of Parts 1, 22, 24, 27, 74, 80, 90, 95, and 101 to Establish Uniform License Renewal, Discontinuance of Operation, and Geographic Partitioning and Spectrum Disaggregation Rules and Policies for Certain Wireless Radio Services; 2016 Biennial Review of Telecommunications Regulations*, WT Docket Nos. 12-40, 10-112, and 16-138, RM Nos. 11510 and 11660, Second Report and Order, Report and Order, and Second Further Notice of Proposed Rulemaking, 32 FCC Rcd 2518 (2017). Herein, we reference the Second Report and Order and the Report and Order collectively as "*Second R&O*"; we reference the Second Further Notice of Proposed Rulemaking as "*Second Further Notice*."

[8] *Second R&O*, 32 FCC Rcd at 2535-56; *see also id*. at 2562-64.

[9] *Id*., 32 FCC Rcd at 2557-61, 2567-70 (adopting a more flexible rule concerning permanent discontinuance of operations, eliminating certain filing requirements for minor system changes, and deleting the Part 22 rules pertaining to Cellular Service license renewals).

[10] *See generally* 47 CFR §§ 24.1 *et seq*.

[11] *See generally* 47 CFR Part 27.

[12] *See generally Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, GN Docket No. 12-268, Report and Order, 29 FCC Rcd 6567 (2014) (*BIA Report and Order*) (subsequent history omitted); 47 CFR § 27.5(l).

[13] *See generally* 47 CFR Part 27.

[14] *Second Further Notice*, 32 FCC Rcd at 2570-75. The Commission had solicited comments in a public notice in its 2016 Biennial Review of Telecommunications Regulations proceeding. *Commission Seeks Public Comment in 2016 Biennial Review of Telecommunications Regulations*, WT Docket No. 16-138 (other docket numbers omitted),

governing not only the Cellular Service but other Part 22 Public Mobile Services (PMS) as well.[15] The Commission also invited comment on whether other measures could be taken to allow Part 22 licensees to benefit from the same level of flexibility available to other commercial wireless licensees.[16] In that context, the Commission raised the possibility of relocating—to Part 27 of the Commission's rules—certain Part 22 rules, as well as the Part 24 PCS rules and other rules governing geographically licensed wireless services.[17]

5. In response to the *Second Further Notice*, five parties filed comments and one party filed reply comments; three parties subsequently filed *ex parte* letters.[18] Commenters generally support the Commission's proposed deletion of the Part 22 rules addressed in the *Second Further Notice*. Only two commenters address the issue of possible relocation of rules to Part 27 and possible reorganization of that rule part—one favoring the idea and the other opposing it. In addition, some commenters propose deleting other rules that had not been previously considered by the Commission in this proceeding. The record and our decisions are set forth below under specific headings pertaining to these various rules and issues.

III. ELIMINATION OF UNNECESSARY RULES

6. In the sections below, we delete the following administrative and recordkeeping rules for Part 22 licensees: Sections 22.301 and 22.303, concerning station inspections and the retention of hard copies of station authorizations and other station records; and Section 22.325, concerning station control points and personnel on duty at those control points.[19] Removing these provisions will eliminate needless burdens that are inconsistent with the Commission's practices and the now-predominant use of electronic records storage and access, and it will also eliminate asymmetry across competing commercial mobile radio services (CMRS), as the Commission's rules for newer wireless services such as PCS, certain AWS, and the 700 MHz Service do not include such provisions. We also delete Section 22.321, concerning equal employment opportunities, as duplicative, as well as Sections 22.3 and 22.927, which set forth service provider obligations concerning their authorizations and subscribers' Cellular mobile stations.[20] These rules are no longer necessary, as explained below.

A. Sections 22.301, 22.303—Station Inspection, Retention of Station Authorizations

7. In the *Second Further Notice*, the Commission proposed and sought comment on deletion of Sections 22.301 and 22.303 of the Commission's rules, which collectively require that hard copies of license authorizations and other records be maintained by all Part 22 licensees for each station and that such records and the station itself be made available for inspection upon request.[21] The Commission

(Continued from previous page)
Public Notice, 31 FCC Rcd 12166, 12174-75 (2016) (*Biennial Review PN*). Although the Commission has considered in this Cellular Reform proceeding certain issues that were initially raised by commenters in response to the *Biennial Review PN* in WT Docket No. 16-138 (WT Biennial Review proceeding), such consideration does not otherwise impact review of other comments and issues raised in response to that *PN*.

[15] The other services governed by Part 22 of our rules are Paging, Air-Ground, Rural, and Offshore Radiotelephone.

[16] *Second Further Notice*, 32 FCC Rcd at 2571, 2574.

[17] *Id*., 32 FCC Rcd at 2574-75.

[18] *See* Appendix C for a list of parties that submitted comments, reply comments, and *ex parte* letters.

[19] 47 CFR §§ 22.301, 22.303, 22.325.

[20] 47 CFR §§ 22.321, 22.3, 22.927.

[21] *Second Further Notice*, 32 FCC Rcd at 2571-72 (citing comments submitted by CTIA and Verizon in response to the *Further Notice*, and by CTIA and T-Mobile USA, Inc. in response to the *Biennial Review PN*). Section 22.301 specifically requires that, "[u]pon reasonable request, the licensee of any station authorized in the Public Mobile Services must make the station and station records available for inspection by authorized representatives of the Commission at any reasonable hour." 47 CFR § 22.301. Noting the rule's requirement that the *station itself*, not just the station's records, be available for inspection by the Commission, the Commission emphasized that,

questioned whether the benefits of maintaining hard copies outweigh the costs and burdens to Part 22 licensees in the age of electronic licensing and recordkeeping, particularly as license authorizations are maintained in the Commission's Universal Licensing System (ULS).[22] The Commission also sought comment on a suggestion that, even if we eliminate Sections 22.301 and 22.303, we should nonetheless affirmatively require Part 22 licensees "to have electronic copies [of licenses] easily accessible to personnel and FCC inspectors."[23]

8. Commenters addressing this issue unanimously endorse the Commission's proposal to delete Sections 22.301 and 22.303; they assert that these administrative requirements are burdensome and inconsistent with today's licensing practices.[24] AT&T and Verizon point out that, since 2014, the Commission has deemed the electronic version of an authorization—stored in ULS—to be the official Commission record, and it no longer sends printed copies of authorizations through the U.S. Postal Service unless so requested by the licensee.[25] The Enterprise Wireless Alliance (EWA) adds that a "physical copy of a license can never be more and could be less up-to-date than ULS data."[26] The commenters further argue that, with the movement to geographic-based licensing (which provides licensees with the flexibility to make certain changes to their systems without Commission filings), individual authorizations are no longer relevant and may not include all operating parameters.[27] This fact of current-day operations, the Critical Messaging Association (CMA) claims, can create problems when state and local officials, unfamiliar with the Commission's geographic licensing model, do not find paper

(Continued from previous page)
regardless of whether we retain a rule in Part 22 explicitly requiring licensees to make their stations available for inspection, we retain our general station inspection authority under Section 303(n) of the Communications Act, 47 U.S.C. § 303(n). *See Second Further Notice,* 32 FCC Rcd at 2572. Section 22.303 more broadly requires Part 22 licensees to retain, among other documentation, the authorization for each station as a permanent part of station records.

[22] *Second Further Notice*, 32 FCC Rcd at 2572.

[23] *Id*., 32 FCC Rcd at 2572 (citing comments submitted by Public Knowledge in the WT Biennial Review proceeding). Public Knowledge did not submit comments or reply comments following release of the *Second Further Notice*.

[24] AT&T Comments at 2-3 (May 15, 2017); CMA Comments at 2-3 (May 15, 2017); CTIA Comments at 2-4 (May 15, 2017); EWA *Ex Parte* Letter at 2-3 (June 15, 2017); Verizon Comments at 2-3 (May 15, 2017). EWA's submission (styled as "Reply Comments") was filed outside the pleading cycle (*see Federal Register*, 82 Fed. Reg. 17959 (April 14, 2017) (summarizing the *Second Further Notice* and establishing the pleading cycle)). We consider EWA's submission as an *ex parte* letter in the interest of having a complete record, ensuring full and fair participation in this proceeding.

[25] AT&T Comments at 2 (citing *Wireless Telecommunications Bureau Implements Enhancements to the Commission's Universal Licensing System and Antenna Structure Registration System and Adopts Final Procedures for Providing Access to Official Electronic Authorizations*, WT Docket No. 14-161, Public Notice, 29 FCC Rcd 15252 (WTB 2014) (*Official Electronic Authorizations PN*); Verizon Comments at 2 (citing same). *See also* EWA *Ex Parte* Letter at 3.

[26] EWA *Ex Parte* Letter at 3.

[27] E.g., AT&T Comments at 2-3 (noting, at 3, that internal base stations whose Service Area Boundaries (SABs) "do not comprise the outer edge" of the CGSA are no longer issued site-specific authorizations, and that even a Cellular Service station that defines the SAB might today have a license that no longer includes all operating parameters," because Cellular licensees can now operate much like Part 24 and Part 27 licensees without having to report every modification to a system).

records at stations to reflect all sites as operated, leading in some cases to erroneous accusations by such authorities of unauthorized operations.[28]

9. *Discussion*. We find that Sections 22.301 and 22.303 have outlived the usefulness they may have had in the past and now impose administrative burdens without any corresponding public benefit. Because the Commission no longer routinely mails printed authorizations, licensees cannot comply with the rule's hard-copy requirement unless they themselves print, or request that the Bureau print and mail, an authorization every time an application is granted. Such a requirement does not serve the public interest. ULS is available electronically at all times: licensees have access to their official authorizations, while members of the public have access to reference copies reflecting the most up-to-date information concerning all authorizations.[29] And as AT&T observes, the movement away from site-specific filings renders on-site comparison of paper records and operating parameters unnecessary and largely infeasible.[30] Moreover, the Commission has not imposed the recordkeeping and station inspection requirements of Sections 22.301 and 22.303 on licensees in competing wireless services governed by Parts 24 and 27 of our rules. For all these reasons, we delete both of these rules.[31]

B. Section 22.325—Control Points

10. Section 22.325 of the Commission's rules requires that "[e]ach station in the Public Mobile Services [ ] have at least one control point and a person on duty who is responsible for station operation."[32] The Commission proposed and sought comment on eliminating Section 22.325 in the *Second Further Notice*.[33] It queried whether today automatic and remote monitoring render this rule unnecessary from a technological standpoint.[34]

11. Commenters addressing this issue agree with the proposal to delete this rule on grounds that it does not reflect licensees' existing automatic and remote monitoring facilities and is unnecessary.[35] AT&T adds that Cellular licensees have "developed extensive expertise in working with their counterparts" to comply with Commission rules governing coordination with adjacent channel and adjacent market licensees, interference avoidance, especially with respect to Part 90 public safety

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[28] CMA Comments at 2. According to CMA, while deleting the two rules might not "100% solve that problem," it would at least remove the "ostensible . . . requirement that all such sites be reflected" in hard copy records retained at every station. *Id*. at 2-3.

[29] *Official Electronic Authorizations PN*, 29 FCC Rcd at 15252-53.

[30] AT&T Comments at 2-3.

[31] *See* Final Rules (Appendix A). As was also noted in the *Second Further Notice*, the Commission retains station inspection authority under 47 U.S.C. § 303(n). With respect to Public Knowledge's request, given that electronic copies of authorizations are easily accessible to the public and FCC inspectors via ULS, we see no need to require Part 22 licensees "to have electronic copies [of licenses] easily accessible to personnel and FCC inspectors." *See supra* note 23.

[32] 47 CFR § 22.325. While the rule does not require that the person on duty be at the control point or continuously monitor all transmissions of the station, the control point must have facilities that enable the person on duty to turn off the transmitters in the event of a malfunction.

[33] *Second Further Notice*, 32 FCC Rcd at 2573.

[34] *Id*., 32 FCC Rcd at 2573.

[35] *See* AT&T Comments at 3 (stating that Cellular licensees "remotely monitor their network usage and operation and by necessity retain the ability to deactivate the radios as needed in the event of interference"); CMA Comments at 3 (stating that automatic and remote monitoring facilities are "routinely used by CMA members"); CTIA Comments at 3-4 (asserting that the rule is unique to Part 22 and is "another example of unnecessary and asymmetrical regulation," and that most licensees have centralized operations); EWA *Ex Parte* Letter at 4; Verizon Comments at 3 (stating that it maintains "Network Operations Centers that monitor all of its Commission-licensed operations and have the ability to power down transmitters due to malfunction . . . or any other reason," and claiming that this network architecture "is commonplace among wireless carriers.").

licensees operating in the 800 MHz band, and international agreements.[36] EWA contends that "licensees have every incentive to ensure that their facilities are operating properly and in compliance with FCC requirements," and the Commission "no longer needs to prescribe how licensees must accomplish that task."[37]

12. *Discussion*. Based on the record before us, we find that Section 22.325 is now technologically obsolete, as licensees today routinely monitor their network operations by automatic and remote mechanisms. And one commenter claims that the rule inhibits efficiencies in licensees' operations.[38] We therefore conclude that Section 22.325 no longer serves the public interest. As with Sections 22.301 and 22.303, discussed above, there is no similar provision in Part 24 or Part 27 of the Commission's rules related to station control points or the requirement to have a person on duty who is responsible for station operation. Part 22 licensees should have the same flexibility as Part 24 and Part 27 commercial wireless licensees to determine how to manage their networks to ensure compliance with the Commission's rules, including how best to avoid interference. Accordingly, we delete Section 22.325.[39]

C. Section 22.321(c)—Equal Employment Opportunities

13. Section 22.321(c) requires all Part 22 licensees (i.e., PMS licensees), regardless of their size, to submit an annual report to the Commission indicating whether any EEO complaints have been filed at the federal, state, or local level against the licensee.[40] For any such complaint, the report must state the parties involved, date of filing, court or agencies reviewing the complaint, appropriate file number, and disposition of the complaint.[41] All common carriers (i.e., not only Part 22 licensees) with at least 16 full-time employees are subject to the same requirement under Section 1.815 of the Commission's rules, which specifies that an annual employment report is to be submitted on FCC Form 395.[42] Pursuant to comments on the record in the WT Biennial Review proceeding arguing that Section 22.321(c) should be repealed, the *Second Further Notice* sought comment on whether there is any need to retain this provision.[43]

14. While the WT Biennial Review comments regarding EEO requirements focused on Section 22.321, Section 90.168 of the Commission's rules, "Equal Employment Opportunities," contains the same provisions as those in Section 22.321, including paragraph (c), which requires a complaints report annually regardless of the licensee's size. Section 90.168 states that it applies to *all* CMRS (which includes the Part 22 PMS), and thus it entirely subsumes Section 22.321.

15. AT&T, CMA, EWA, and Verizon endorse the Commission's proposal to delete Section 22.321(c),[44] with CMA also asserting that, if the Commission eliminates Section 22.321(c), then common

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[36] AT&T Comments at 3.

[37] EWA *Ex Parte* Letter at 4.

[38] *See*, *e.g.*, CMA Comments at 3 (indicating that CMA members routinely use automatic and remote monitoring facilities and that Section 22.325 "should be deleted as an unnecessary regulation that inhibits efficiencies in critical messaging operations").

[39] *See* Final Rules (Appendix A).

[40] 47 CFR § 22.321(c).

[41] *Id*.

[42] 47 CFR § 1.815.

[43] *Second Further Notice*, 32 FCC Rcd at 2573 (citing Verizon Biennial Review Comments). The *Second Further Notice* did not seek comment on the other subsections of Section 22.321, which set forth licensee obligations for equal opportunity programs and policies to assure nondiscriminatory practices in recruitment, placement, promotion, and other areas of employment practices. 47 CFR § 22.321.

[44] *See* AT&T Comments at 4; CMA Comments at 3-4 (arguing that deletion of Section 22.321(c)'s complaints report requirement for licensees with fewer than 16 employees is warranted); EWA *Ex Parte* Letter at 3-4 (arguing that deletion of Section 22.321(c)'s complaints report requirement for licensees with fewer than 16 employees is

carrier licensees and permittees with fewer than 16 full-time employees would no longer be subject to an EEO complaints report filing requirement at the Commission.[45] None of the commenters in this Cellular Reform proceeding or the WT Biennial Review proceeding addressed Section 90.168.

16. *Discussion*. Given that all CMRS licensees are subject to Section 90.168, including Section 90.168(c), Section 22.321 is duplicative and, accordingly, we delete the rule in its entirety.[46] As to the Part 90 reporting requirement, the Commission did not propose to remove that requirement, nor did any commenters suggest doing so. Part 90 rules are therefore beyond the scope of this proceeding and we decline at this time to eliminate the complaints reporting requirement in Section 90.168.[47]

D. Section 22.927—Responsibility for Mobile Stations, and Section 22.3—Authorization Required

17. As noted above, the *Second Further Notice* invited comment generally on other steps or measures the Commission could take to ensure that Cellular licensees benefit from the same level of flexibility available to other commercial wireless licensees.[48] In response, CTIA argues that repeal of Section 22.927, entitled "Responsibility for mobile stations,"[49] would be "consistent with this objective," because the rule is another example of asymmetric regulation.[50] Under Section 22.927, Cellular licensees are "responsible for exercising effective operational control over mobile stations receiving service through their Cellular systems," including mobile stations operated by subscribers to a different Cellular licensee. Section 22.927 thus addresses service to "roamers," although it does not use that particular term.

18. *Discussion*. Pursuant to Section 1.903(c) of the Commission's rules, the "[a]uthority for subscribers to operate mobile or fixed stations in the Wireless Radio Services [WRS]," which includes the Cellular Service, "is included in the authorization held by the licensee providing service to them."[51] Thus, when a WRS licensee, as the host carrier, provides service to a subscriber of another carrier (i.e., a subscriber that is outside its own provider's service area), the subscriber's use of his or her mobile phone

(Continued from previous page)
warranted, and asserting that Section 22.321 is unnecessary in its entirety); Verizon Comments at 4-5 (arguing that deletion of Section 22.321(c) is a "good first step," but that the Commission should go further and eliminate Section 1.815 as well).

[45] CMA Comments at 3. *See also* EWA *Ex Parte* Letter at 3-4.

[46] *See* Final Rules (Appendix A). As noted above, Verizon also argues that Section 1.815 should be deleted (Verizon Comments at 4-5). Verizon's request is beyond the scope of this proceeding, and we decline to consider it here.

[47] In any event, neither CMA nor EWA adequately demonstrates why licensees with fewer than 16 employees should be exempt from this requirement; they merely claim that complaints are rarely filed against small carriers with fewer than 16 employees. CMA Comments at 3; EWA *Ex Parte* Letter at 4.

[48] *Second Further Notice*, 32 FCC Rcd at 2573 (asking specifically if commenters deem unnecessary any other rules that apply to Part 22 licensees but not to the flexibly licensed services under Part 24 or 27).

[49] 47 CFR § 22.927.

[50] CTIA Comments at 4-5. CTIA also argues that the rule is "superfluous" because, according to CTIA, licensees are subject to "specific technical and operating rules set forth elsewhere in Parts 1, 20, and 22 of the Commission's rules," but does not cite to any specific rules in support of its statement. *See id.*

[51] 47 CFR § 1.903(c) (indicating limited exceptions not relevant here). Section 1.903 was adopted in 1998 as part of an omnibus consolidation, revision, and streamlining of Commission rules governing license application procedures for many wireless services, to facilitate full implementation of what was then the Commission's new ULS. *See Biennial Regulatory Review—Amendment of Parts 0, 1, 13, 22, 24, 26, 27, 80, 87, 90, 95, 97, and 101 of the Commission's Rules to Facilitate the Development and Use of the Universal Licensing System in the Wireless Telecommunications Services, et al.*, WT Docket No. 98-20 (other docket nos. omitted), Report and Order, 13 FCC Rcd 21027 (1998) (*ULS R&O*); *see also id*. at Appendix F (consolidating certain service-specific rules into 47 CFR § 1.903).

to access the spectrum falls under that host carrier's authorization. Section 1.903(c) thus captures the purpose underlying Section 22.927, albeit with less detail.[52] While the detailed provision in Section 22.927 regarding the host carrier's responsibility under its authorization may have been warranted when the Cellular Service was in its nascency, we find that this additional rule is unnecessary these many decades later. As CTIA observes, the rule creates asymmetry, as the rules for commercial wireless services established much later than the Cellular Service—such as PCS and AWS—do not have a counterpart to Section 22.927. Consistent with one of our key goals in this proceeding to eliminate unnecessary asymmetric regulations, we delete Section 22.927.[53]

19. Further, a related legacy rule that applies to all Part 22 licensees, Section 22.3,[54] is also no longer necessary. This rule specifies that PMS stations must be used and operated only in accordance with applicable Commission rules and only with a valid authorization granted by the Commission. It further specifies that authority for subscribers to operate mobile or fixed PMS stations is included in the authorization of the licensee providing service to them. The same provisions are included in the later-adopted Section 1.903, which applies more broadly to numerous wireless services in addition to the PMS.[55] We therefore find it in the public interest to delete it from our rules as duplicative.[56]

IV. POSSIBLE RELOCATION OF RULES TO PART 27

20. The Commission sought comment in the *Second Further Notice* on whether to migrate the Part 22 Cellular and Part 24 PCS rules to Part 27, and on whether the Commission should initiate a separate rulemaking to revise the Part 27 rules and reserve the possible relocation of Cellular and PCS rules to that separate proceeding.[57] It specified that commenters should address "whether the Commission should reorganize Part 27 in order to accommodate these additional Part 22 and Part 24 rules more efficiently."[58] In addition, the Commission noted that there are other geographically-licensed, auctioned services that are not included in Part 27, including Public Coast (Part 80), Specialized Mobile Radio (SMR), Location and Monitoring, and 220 MHz (Part 90), and 218-219 MHz (Part 95), and that of these, only SMR is used today by wireless carriers to provide services directly to consumers nationwide. The Commission sought comment on whether it should move the Part 22 Cellular and Part 24 PCS rules

[52] We also note that Cellular licensees today typically have two-way roaming agreements in place with other Cellular licensees. *See* 47 CFR § 20.12.

[53] *See* Final Rules (Appendix A).

[54] 47 CFR § 22.3.

[55] *See ULS R&O*, *supra* note 51; 47 CFR § 1.903.

[56] *See* Final Rules (Appendix A).

[57] *Second Further Notice*, 32 FCC Rcd at 2574-75 (noting that it was seeking to revisit the issues and refresh the record, as the Commission had sought comment on these same issues when this Cellular Reform proceeding was launched in 2012). In connection with the 2012 proposal to issue geographic-area (CMA-based) "overlay licenses" through competitive bidding in two stages, the Commission had queried whether, in the event that it were to adopt a geographic-based regime that would include overlay licenses, the new Cellular rules should be incorporated into Part 27. *See NPRM,* 27 FCC Rcd at 1771 (also suggesting that, if the Cellular rules were moved into Part 27, then the rules for PCS should also be moved into Part 27). The only commenter that responded, the Rural Wireless Association, opposed a relocation of any Part 22 and Part 24 rules to Part 27. *See R&O*, 29 FCC Rcd at 14125 (citing RWA's Comments filed May 15, 2012). In the *R&O*, the Commission's transition of the Cellular Service to a geographic-based regime did not entail an auction of overlay licenses, which commenters by and large opposed; instead, based in part on a new proposal by an industry coalition, the Commission adopted a transition approach for the Cellular Service that preserves direct site-based access to Unserved Area while dramatically reducing licensees' regulatory burdens, and in that context, the Commission decided not to pursue a relocation of Part 22 Cellular and Part 24 PCS rules. *See Second R&O*, 32 FCC Rcd at 2575 (citing *R&O*, 29 FCC Rcd at 14125*).*

[58] *Second Further Notice*, 32 FCC Rcd at 2575.

to Part 27 in conjunction with moving those other service rule parts to Part 27 as well.[59]

21. CTIA states support in broad terms for migrating the Part 22 Cellular and Part 24 PCS rules to Part 27.[60] EWA argues that there are important reasons for distinguishing Part 90 SMR systems in the context of a possible rule migration, and "strongly recommends against a wholesale relocation of the [Part 90] SMR service to Part 27 . . . ."[61] In particular, it urges that the Commission leave under Part 90 the rules governing non-Enhanced SMR (non-ESMR) systems.[62] No other commenter addressed our queries on these issues.

22. *Discussion*. While CTIA recommends that we evaluate "whether and how to consolidate the rules" and resolve inconsistencies among different service rules (absent unique circumstances for particular services), it offers only one example of rules that could be consolidated for multiple services.[63] EWA focuses solely on the difficulties associated with relocation of Part 90 SMR rules and does not address any other rules in this context. As EWA's comments highlight, disparate types of operations found in certain rule parts would make it challenging to consolidate Part 22 Cellular, Part 24 PCS, and other wireless mobile service rules into a single set of regulations. Such an exercise would entail painstaking review of numerous rules to determine those that can be consolidated and those that must be retained for individual services. In the absence of strong support on the record for this endeavor, which would require a significant investment of staff resources to complete, we decline to pursue the issue at this time.

V. OTHER REGULATIONS RAISED BY COMMENTERS

23. In response to the Commission's query in the *Second Further Notice* as to whether any other Part 22 rules are ripe for removal in light of changed technology, electronic licensing/recordkeeping, or other modernizations that have occurred over the past two decades, commenters request deletion of two Cellular Service rules—Sections 22.921 and 22.925.[64] In addition, one commenter requests deletion of paragraph (a) of Section 22.143,[65] which applies to all Part 22 licensees. We discuss the commenters' specific proposals below.[66]

24. *Section 22.921—911 Call Processing Procedures*. AT&T argues that Section 22.921 of

[59] *Id*., 32 FCC Rcd at 2575.

[60] CTIA Comments at 5 (contending that this would significantly reduce the number of pages comprising the rules in Parts 22, 24, and 27, and assist with training and compliance). It adds that, while a benefit of considering consolidation would be to determine whether inconsistencies are warranted by unique circumstances of a particular service, retention of certain service-specific technical requirements would be warranted "because of the particular spectrum bands involved," and it notes as examples the Cellular radiated power rule and the rule for determining a Cellular licensee's CGSA. *Id*. at 5-6.

[61] For example, it contends, the "intermingling of channels among [Part 90] site-based licensees and the substantial commonality of operational characteristics among site-based Part 90 systems, both private internal and commercial SMR, argue strongly in favor of regulating these systems under the well-established Part 90 rules." EWA Comments at 4 (adding its contention that the purpose of the Part 27 rules is "not intended for nor particularly aligned with site-specific based private internal and commercial SMR operations.").

[62] EWA Comments at 2 (noting that Sprint Corporation (Sprint) and Southern Communications Services, d/b/a Southern Linc (Southern) operate ESMR systems and are members of EWA). While EWA states that it would support the decision of ESMR entities if they prefer to have their rules migrated, neither Sprint nor Southern filed comments in response to the *Second Further Notice*.

[63] CTIA Comments at 5 (suggesting that a single rule should be adopted for all CMRS licensees that establishes the same license term absent unique circumstances).

[64] 47 CFR §§ 22.921, 22.925.

[65] 47 CFR § 22.143(a).

[66] *Second Further Notice*, 32 FCC Rcd at 2573.

our rules, pursuant to which certain Cellular Service mobile telephones that are capable of operating in the analog mode "must incorporate a special procedure for processing 911 calls,"[67] is now obsolete because, among other reasons, it is "unaware of any carrier that still offers analog devices or operates an analog Cellular system."[68] We disagree. Commission data show that, contrary to AT&T's understanding, some carriers are still using analog technology in the Cellular Service band[69]—and Section 22.921 ensures that 911 calls get through in those circumstances.[70] Under these circumstances, the deletion of this rule would not serve the public interest, and, accordingly, we decline to take such action in this proceeding.

25. *Section 22.925—Prohibition on Airborne Operation of Cellular Telephones*. AT&T and Qualcomm Incorporated (Qualcomm) argue that Section 22.925, which prohibits the operation of Cellular Service telephones aboard "airplanes, balloons or any other type of aircraft . . . while such aircraft are airborne . . . ,"[71] should be eliminated, or at least modified.[72] The Commission has an open proceeding in WT Docket No. 13-301 that addresses the use of mobile services aboard aircraft.[73] The issues that AT&T and Qualcomm raise regarding the use of Cellular Service spectrum for communications to, from, and onboard aircraft are being dealt with in that proceeding, and we therefore decline to consider the issues here.[74]

26. *Section 22.143(a)—Commencement of Construction Prior to Grant of Application*. Section 22.143 permits applicants to begin construction of PMS facilities prior to grant of their applications; paragraph (a) specifies that such construction may begin "35 days after the date of the Public Notice listing the application for that facility as acceptable for filing."[75] EWA argues that Section 22.143(a) should be deleted, asserting that comparable provisions do not exist for other wireless services, and that other portions of the rule put applicants on notice that they assume the risk of constructing prior

[67] 47 CFR § 22.921 (specifying "analog mode described in the standard document ANSI TIA/EIA-553-A-1999 Mobile Station—Base Station Compatibility Standard (approved October 14, 1999 . . .)" and indicating where it is available for purchase). Specifically, the rule states that the incorporated procedure "must recognize when a 911 call is made and, at such time, must override any programming in the mobile unit that determines the handling of a non-911 call and permit the call to be transmitted through the analog systems of other carriers." *Id*. In addition, at least one of the 911 call system selection processes endorsed or approved by the Commission must be incorporated into the special procedure under this rule. *Id*.

[68] AT&T Comments at 4.

[69] *See* Mobile Deployment Form 477 Data, https://www.fcc.gov/mobile-deployment-form-477-data.

[70] Although AT&T is correct in noting (*see* AT&T Comments at 4) that wireless 911 provisions reside in 47 CFR § 20.18, there is no provision in that rule addressing the specific requirements that apply to Cellular analog systems under 47 CFR § 22.921.

[71] 47 CFR § 22.925. This rule also requires a notice to be posted on or near each Cellular telephone installed in any aircraft, stating that use of Cellular telephones while the aircraft is on the ground is subject to Federal Aviation Administration regulations. *See id*.

[72] AT&T Comments at 4-5; Qualcomm Reply Comments at 2-3 (June 13, 2017). *See also* Letter from Colleen Thompson, Area Manager, Federal Regulatory, AT&T Services, Inc., to Marlene H. Dortch, Secretary FCC (filed Nov. 15, 2017) (AT&T *Ex Parte* Letter) (reporting on a meeting on Nov. 13, 2017, with Commission staff from several bureaus to discuss Section 22.925).

[73] *See Expanding Access to Mobile Wireless Service Onboard Aircraft*, WT Docket No. 13-301, Notice of Proposed Rulemaking, 29 FCC Rcd 17132 (2013) (Airborne Wireless proceeding).

[74] AT&T filed reply comments in the Airborne Wireless proceeding (i.e., WT Docket No. 13-301); it also filed in that docket a copy of the AT&T *Ex Parte* Letter filed in the instant Cellular Reform docket.

[75] 47 CFR § 22.143 (specifying also, however, that applicants must not *operate* such facilities until the Commission grants the application).

to grant.[76] We disagree. The same Public-Notice-plus-35-day period is specified in Section 90.169 of our rules for several other commercial wireless radio services.[77] Pre-grant construction under Section 22.143 is subject to several conditions, including, among others, that no petitions to deny or mutually exclusive (competing) applications have been filed.[78] When the Commission reduced the waiting period from the original 60-day and 90-day post-Public Notice periods to the existing "Public-Notice-plus-35-days" provision, it agreed that applicants should know within that timeframe whether any petition to deny or competing application had been filed, and retained these conditions to disallow construction "when we can not be reasonably certain that we will be able to grant the application."[79] The Commission has also recognized that, "[b]ecause construction of [PMS] facilities entails not only the financial risk to the applicant . . . but also environmental and other consequences affecting the public, . . . it would not be in the public interest to allow construction . . . until it is reasonably certain that the facilities can be authorized."[80] In a similar vein, it is in the public interest to minimize the Commission's risk of having to expend taxpayer resources to issue notification to the applicant, pursuant to Section 22.143(b), to stop construction.[81] For all these reasons, we decline to delete Section 22.143(a) at this time.

VI. PROCEDURAL MATTERS

27. *Paperwork Reduction Act Analysis*. The Third Report and Order contains new and modified information collection requirements subject to the Paperwork Reduction Act of 1995 (PRA).[82] It will be submitted to the Office of Management and Budget (OMB) for review under Section 3507(d) of the PRA. OMB, the general public, and other Federal agencies will be invited to comment on the new and modified information collection requirements contained in the rules adopted in this proceeding.[83] In addition, pursuant to the Small Business Paperwork Relief Act of 2002,[84] the Commission previously sought specific comment on how the Commission might further reduce the information collection burden for small business concerns with fewer than 25 employees. We have assessed the effects of the rule changes we are adopting on small business concerns and find that businesses with fewer than 25 people will benefit from the additional reforms, i.e., deletion of Sections 22.3, 22.301, 22.303, 22.321, 22.325, and 22.927, which will provide added flexibility for Cellular licensees no matter their size.

28. *Congressional Review Act*. The Commission will send a copy of today's Third Report and Order to Congress and the Government Accountability Office pursuant to the Congressional Review

[76] EWA *Ex Parte* Letter at 4.

[77] 47 CFR § 90.169(a).

[78] 47 CFR § 22.143(d)(1), (2).

[79] *Revision of Part 22 of the Commission's Rules Governing the Public Mobile Services, et al*., CC Docket Nos. 95-115, 94-46, and 93-116, RM No. 8367, Report and Order, 9 FCC Rcd 6513, 6552-63 (1994) (*Part 22 Rewrite Order*) (adding that, if a petition to deny is filed, "it brings into question whether the application can be granted"; also noting that the previous waiting period was 60 days after the date of the public notice announcing tentative selectees for the Cellular Service, and 90 days after release of the applicable acceptable for filing public notice for the Paging and Radiotelephone Service).

[80] *Part 22 Rewrite Order*, 9 FCC Rcd at 6553. Note that, for applicants for licenses awarded by competitive bidding, which includes commercial wireless services such as PCS and AWS, the Commission has also established a waiting period, tailored to our competitive bidding process: pre-grant construction is permitted only upon release of the Public Notice listing the post-auction long-form application for that facility as acceptable for filing (by which time, mutual exclusivity has been eliminated and the Commission is reasonably certain that the application can be granted). *See* 47 CFR § 1.2113.

[81] 47 CFR § 22.143(b).

[82] Pub. L. No. 104-13.

[83] The Commission will publish a notice in the *Federal Register* inviting the public to comment on the new and modified requirements, as required by the PRA. *See* 44 U.S.C. §§ 3501-3520.

[84] Public Law 107-198, *see* 44 U.S.C. § 3506(c)(4).

Act.[85]

29. *Final Regulatory Flexibility Analysis*. The Regulatory Flexibility Act of 1980, as amended (RFA), requires that an agency prepare a regulatory flexibility analysis for notice and comment rulemakings, unless the agency certifies that "the rule will not, if promulgated, have a significant economic impact on a substantial number of small entities."[86] Accordingly, we have prepared a Final Regulatory Flexibility Analysis (FRFA) concerning the possible impact on small entities of the rule changes contained in the Third Report and Order. The FRFA is attached as Appendix B. The Commission will send a copy of this Third Report and Order, including the FRFA, to the Chief Counsel for Advocacy of the Small Business Administration.

30. *Contact Information*. For further information regarding this Third Report and Order, contact Nina Shafran at (202) 418-2781, or Nina.Shafran@fcc.gov.

VII. ORDERING CLAUSES

31. Accordingly, IT IS ORDERED, pursuant to Sections 1, 2, 4(i), 4(j), 7, 301, 303, 307, 308, 309, and 332 of the Communications Act of 1934, as amended, 47 U.S.C. §§ 151, 152, 154(i), 154(j), 157, 301, 303, 307, 308, 309, and 332, that this THIRD REPORT AND ORDER in WT Docket No. 12-40 IS ADOPTED.

32. IT IS FURTHER ORDERED that the THIRD REPORT AND ORDER SHALL BE EFFECTIVE 30 days after publication of a summary in the *Federal Register*.

33. IT IS FURTHER ORDERED that Part 22 of the Commission's rules, 47 CFR Part 22, IS AMENDED as specified in Appendix A, effective 30 days after publication in the *Federal Register* except as otherwise provided herein.

34. IT IS FURTHER ORDERED that the amendment adopted in this THIRD REPORT AND ORDER, and specified in Appendix A, to 47 CFR § 22.303, which contains new or modified information collection requirements that require approval by the Office of Management and Budget (OMB) under the Paperwork Reduction Act, WILL BECOME EFFECTIVE after OMB review and approval, on the effective date specified in a notice that the Commission will publish in the *Federal Register* announcing such approval and effective date.

35. IT IS FURTHER ORDERED that this Cellular Reform proceeding in WT Docket No. 12-40, including RM Nos. 11510 and 11660, IS HEREBY TERMINATED.

36. IT IS FURTHER ORDERED, pursuant to Section 801(a)(1)(A) of the Congressional Review Act, 5 U.S.C. § 801(a)(1)(A), that the Commission SHALL SEND a copy of the THIRD REPORT AND ORDER to Congress and to the Government Accountability Office.

[85] *See* 5 U.S.C. § 801(a)(1)(A).

[86] 5 U.S.C. §§ 601 *et seq*.

37. IT IS FURTHER ORDERED that the Commission's Consumer and Governmental Affairs Bureau, Reference Information Center, SHALL SEND a copy of the THIRD REPORT AND ORDER, including the Final Regulatory Flexibility Analysis, to the Chief Counsel for Advocacy of the Small Business Administration.

FEDERAL COMMUNICATIONS COMMISSION

Marlene H. Dortch
Secretary

APPENDIX A

Final Rules

Part 22 of Title 47 of the Code of Federal Regulations is amended as follows:

PART 22—PUBLIC MOBILE SERVICES

1. The authority citation for part 22 continues to read as follows:

   Authority: 47 U.S.C. 154, 222, 303, 309 and 332.

2. Section 22.3 is removed and reserved.

§ 22.3 [Reserved]

3. Section 22.301 is removed and reserved.

§ 22.301 [Reserved]

4. Section 22.303 is removed and reserved.

§ 22.303 [Reserved]

5. Section 22.321 is removed and reserved.

§ 22.321 [Reserved]

6. Section 22.325 is removed and reserved.

§ 22.325 [Reserved]

7. Section 22.927 is removed and reserved.

§ 22.927 [Reserved]

APPENDIX B

Final Regulatory Flexibility Analysis

1. As required by the Regulatory Flexibility Act of 1980, as amended (RFA),[1] an Initial Regulatory Flexibility Analysis (IRFA) was incorporated in the *Second Further Notice of Proposed Rulemaking* (*Second Further Notice*), released in March 2017.[2] The Commission sought written public comment on the proposals in the *Second Further Notice*, including comment on the IRFA. This present Final Regulatory Flexibility Analysis (FRFA) conforms to the RFA.[3]

A. Need for and Objectives of the Rules

2. In the *Third Report and Order*, the Commission takes additional steps to reduce unnecessary regulatory burdens, not only for licensees in the 800 MHz Cellular Radiotelephone (Cellular) Service, but for other Part 22 licensees as well. The revisions will provide Cellular and other Part 22 licensees with more consistency in licensing across commercial wireless services as well as enhanced flexibility, thereby freeing up more resources for investment in new technologies and greater spectrum efficiency to meet increasing consumer demand for advanced wireless services. With this *Third Report and Order*, we conclude an important chapter in the Commission's extensive regulatory reform agenda, and we terminate the proceeding in WT Docket No. 12-40, including RM Nos. 11510 and 11660.

3. Specifically, we delete the following administrative and recordkeeping rules for all Part 22 licensees: Sections 22.301 and 22.303, concerning station inspections and the retention of hard copies of station authorizations and other station records; and Section 22.325, concerning station control points and personnel on duty at those control points.[4] Removing these provisions will eliminate needless burdens that are inconsistent with the Commission's practices and with the predominant use of electronic records storage and access, and will also eliminate asymmetry across competing commercial mobile radio services (CMRS), as the Commission's rules for newer wireless services such as PCS, certain AWS, and the 700 MHz Service do not include such provisions. These rules were adopted more than two decades ago, establishing obligations for which there is no longer a benefit to outweigh the costs and burdens of compliance imposed on licensees. In addition, we delete Sections 22.3 and 22.927, which set forth service provider obligations concerning their authorizations and subscribers' Cellular mobile stations, as these rules are no longer necessary. We also delete Section 22.321, concerning equal employment opportunity programs, policies, and complaint reports, as duplicative of other regulations.

4. In the absence of strong support on the record, the Commission declines at this time to pursue the issues of possible relocation of the Part 22 Cellular, Part 24 PCS, and other wireless mobile service rules into a single set of regulations, and possible reorganization of the Part 27 rules. The

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[1] *See* 5 U.S.C. § 603. The RFA, *see* 5 U.S.C. §§ 601 – 612, has been amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA), Pub. L. No. 104-121, Title II, 110 Stat. 857 (1996).

[2] *See Amendment of Parts 1 and 22 of the Commission's Rules with Regard to the Cellular Service, Including Changes in Licensing of Unserved Area*, *Amendment of the Commission's Rules with Regard to Relocation of Part 24 to Part 27; Interim Restrictions and Procedures for Cellular Service Applications*; *Amendment of Parts 0, 1, and 22 of the Commission's Rules with Regard to Frequency Coordination for the Cellular Service*; *Amendment of the Commission's Rules Governing Radiated Power Limits for the Cellular Service*; *Amendment of Parts 1, 22, 24, 27, 74, 80, 90, 95, and 101 to Establish Uniform License Renewal, Discontinuance of Operation, and Geographic Partitioning and Spectrum Disaggregation Rules and Policies for Certain Wireless Radio Services; 2016 Biennial Review of Telecommunications Regulations*, WT Docket Nos. 12-40, 10-112, and 16-138, RM Nos. 11510 and 11660, Second Report and Order, Report and Order, and Second Further Notice of Proposed Rulemaking, 32 FCC Rcd 2518 (2017) (herein, "*Second Further Notice*").

[3] *See* 5 U.S.C. § 604.

[4] 47 CFR §§ 22.301, 22.303, 22.325.

Commission also declines to delete, as requested by certain commenters, two Cellular Service rules—Sections 22.921 and 22.925—and Section 22.143(a), which applies to all Part 22 licensees. The Commission finds that Sections 22.921 and 22.143(a) continue to serve the public interest, and the restrictions in Section 22.925 are being addressed in a separate proceeding.

B. Summary of Significant Issues Raised by Public Comments in Response to the IRFA

5. There were no comments filed that specifically addressed the rules and policies proposed in the IRFA.

C. Response to Comments by the Chief Counsel for Advocacy of the Small Business Administration

6. Pursuant to the Small Business Jobs Act of 2010, which amended the RFA, the Commission is required to respond to any comments filed by the Chief Counsel for Advocacy of the Small Business Administration (SBA), and to provide a detailed statement of any change made to the proposed rules as a result of those comments.[5]

7. The Chief Counsel did not file any comments in response to the proposed rules in this proceeding.

D. Description and Estimate of the Number of Small Entities to Which the Rules Will Apply

8. The RFA directs agencies to provide a description of, and where feasible, an estimate of the number of small entities that may be affected by the rules adopted herein.[6] The RFA generally defines the term "small entity" as having the same meaning as the terms "small business," "small organization," and "small governmental jurisdiction."[7] In addition, the term "small business" has the same meaning as the term "small business concern" under the Small Business Act.[8] A "small business concern" is one which: (1) is independently owned and operated; (2) is not dominant in its field of operation; and (3) satisfies any additional criteria established by the SBA.[9]

9. *Small Businesses, Small Organizations, and Small Governmental Jurisdictions*. Our actions, over time, may affect small entities that are not easily categorized at present. We therefore describe here, at the outset, three broad groups of small entities that could be directly affected herein.[10] First, while there are industry specific size standards for small businesses that are used in the regulatory flexibility analysis, according to data from the SBA's Office of Advocacy, in general a small business is an independent business having fewer than 500 employees.[11] These types of small businesses represent 99.9% of all businesses in the United States, which translates to 28.8 million businesses.[12]

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[5] 5 U.S.C. § 604(a)(3).

[6] *See* 5 U.S.C. § 604(a)(3).

[7] 5 U.S.C. § 601(6).

[8] 5 U.S.C. § 601(3) (incorporating by reference the definition of "small-business concern" in the Small Business Act, 15 U.S.C. § 632). Pursuant to 5 U.S.C. § 601(3), the statutory definition of a small business applies "unless an agency, after consultation with the Office of Advocacy of the Small Business Administration and after opportunity for public comment, establishes one or more definitions of such term which are appropriate to the activities of the agency and publishes such definition(s) in the Federal Register."

[9] 15 U.S.C. § 632(a).

[10] *See* 5 U.S.C. § 601(3)-(6).

[11] *See* SBA, Office of Advocacy, "Frequently Asked Questions, Question 1 – What is a small business?" https://www.sba.gov/sites/default/files/advocacy/SB-FAQ-2016_WEB.pdf (June 2016).

10. Next, the type of small entity described as a "small organization" is generally "any not-for-profit enterprise which is independently owned and operated and is not dominant in its field."[13] Nationwide, as of August 2016, there were approximately 356,494 small organizations based on registration and tax data filed by nonprofits with the Internal Revenue Service (IRS).[14]

11. Finally, the small entity described as a "small governmental jurisdiction" is defined generally as "governments of cities, counties, towns, townships, villages, school districts, or special districts, with a population of less than fifty thousand."[15] U.S. Census Bureau data from the 2012 Census of Governments[16] indicate that there were 90,056 local governmental jurisdictions consisting of general purpose governments and special purpose governments in the United States.[17] Of this number there were 37,132 general purpose governments (county,[18] municipal and town or township[19]) with populations of less than 50,000 and 12,184 special purpose governments (independent school districts[20] and special districts[21]) with populations of less than 50,000. The 2012 U.S. Census Bureau data for most types of governments in the local government category show that the majority of these governments have

(Continued from previous page)

[12] *See* SBA, Office of Advocacy, "Frequently Asked Questions, Question 2- How many small businesses are there in the U.S.?" https://www.sba.gov/sites/default/files/advocacy/SB-FAQ-2016_WEB.pdf (June 2016).

[13] 5 U.S.C. § 601(4).

[14] Data from the Urban Institute, National Center for Charitable Statistics (NCCS) reporting on nonprofit organizations registered with the IRS was used to estimate the number of small organizations. Reports generated using the NCCS online database indicated that as of August 2016 there were 356,494 registered nonprofits with total revenues of less than $100,000. Of this number, 326,897 entities filed tax returns with 65,113 registered nonprofits reporting total revenues of $50,000 or less on the IRS Form 990-N for Small Exempt Organizations and 261,784 nonprofits reporting total revenues of $100,000 or less on some other version of the IRS Form 990 within 24 months of the August 2016 data release date. *See* http://nccs.urban.org/sites/all/nccs-archive/html//tablewiz/tw.php where the report showing this data can be generated by selecting the following data fields: Report: "The Number and Finances of All Registered 501(c) Nonprofits"; Show: "Registered Nonprofits"; By: "Total Revenue Level (years 1995, Aug to 2016, Aug)"; and For: "2016, Aug" then selecting "Show Results".

[15] 5 U.S.C. § 601(5).

[16] *See* 13 U.S.C. § 161. The Census of Government is conducted every five (5) years compiling data for years ending with "2" and "7". *See also* Program Description Census of Government https://factfinder.census.gov/faces/affhelp/jsf/pages/metadata.xhtml?lang=en&type=program&id=program.en.COG#

[17] *See* U.S. Census Bureau, 2012 Census of Governments, Local Governments by Type and State: 2012 - United States-States. https://factfinder.census.gov/bkmk/table/1.0/en/COG/2012/ORG02.US01. Local governmental jurisdictions are classified in two categories - General purpose governments (county, municipal and town or township) and Special purpose governments (special districts and independent school districts).

[18] *See* U.S. Census Bureau, 2012 Census of Governments, County Governments by Population-Size Group and State: 2012 - United States-States. https://factfinder.census.gov/bkmk/table/1.0/en/COG/2012/ORG06.US01. There were 2,114 county governments with populations less than 50,000.

[19] *See* U.S. Census Bureau, 2012 Census of Governments, Subcounty General-Purpose Governments by Population-Size Group and State: 2012 - United States – States. https://factfinder.census.gov/bkmk/table/1.0/en/COG/2012/ORG07.US01. There were 18,811 municipal and 16,207 town and township governments with populations less than 50,000.

[20] *See* U.S. Census Bureau, 2012 Census of Governments, Elementary and Secondary School Systems by Enrollment-Size Group and State: 2012 - United States-States. https://factfinder.census.gov/bkmk/table/1.0/en/COG/2012/ORG11.US01. There were 12,184 independent school districts with enrollment populations less than 50,000.

[21] *See* U.S. Census Bureau, 2012 Census of Governments, Special District Governments by Function and State: 2012 - United States-States, https://factfinder.census.gov/bkmk/table/1.0/en/COG/2012/ORG09.US01. The U.S. Census Bureau data did not provide a population breakout for special district governments.

populations of less than 50,000.[22] Based on this data, we estimate that at least 49,316 local government jurisdictions fall in the category of "small governmental jurisdictions."[23]

12. *Wireless Telecommunications Carriers (except Satellite)*. This industry comprises establishments engaged in operating and maintaining switching and transmission facilities to provide communications via the airwaves. Establishments in this industry have spectrum licenses and provide services using that spectrum, such as cellular services, paging services, wireless internet access, and wireless video services.[24] The appropriate size standard under SBA rules is that such a business is small if it has 1,500 or fewer employees.[25] For this industry, U.S. Census Bureau data for 2012 show that there were 967 firms that operated for the entire year.[26] Of this total, 955 firms had employment of 999 or fewer employees and 12 had employment of 1000 employees or more.[27] Thus, under this category and the associated size standard, the Commission estimates that the majority of wireless telecommunications carriers (except satellite) are small entities.

13. The Commission's own data—available in its Universal Licensing System (ULS)—indicate that, as of May 17, 2018, there are 264 Cellular Service licensees that will be affected by our actions today.[28] The Commission does not know how many of these licensees are small, as the Commission does not collect that information for these types of entities. Also, according to internally developed Commission data, 413 carriers reported that they were engaged in the provision of wireless telephony, including the Cellular Service, PCS, and Specialized Mobile Radio (SMR) services.[29] Of this total, an estimated 261 have 1,500 or fewer employees.[30] Thus, using available data, we estimate that the majority of wireless firms can be considered small.

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[22] *See* U.S. Census Bureau, 2012 Census of Governments, County Governments by Population-Size Group and State: 2012 - United States-States - https://factfinder.census.gov/bkmk/table/1.0/en/COG/2012/ORG06.US01; Subcounty General-Purpose Governments by Population-Size Group and State: 2012 - United States–States - https://factfinder.census.gov/bkmk/table/1.0/en/COG/2012/ORG07.US01; and Elementary and Secondary School Systems by Enrollment-Size Group and State: 2012 - United States-States. https://factfinder.census.gov/bkmk/table/1.0/en/COG/2012/ORG11.US01. While U.S. Census Bureau data did not provide a population breakout for special district governments, if the population of less than 50,000 for this category of local government is consistent with the other types of local governments, the majority of the 38, 266 special district governments have populations of less than 50,000.

[23] *Id.*

[24] U.S. Census Bureau, 2012 NAICS Definitions, "517210 Wireless Telecommunications Carriers (Except Satellite)," *See* https://factfinder.census.gov/faces/affhelp/jsf/pages/metadata.xhtml?lang=en&type=ib&id=ib.en./ECN.NAICS2012.517210.

[25] 13 CFR § 121.201, NAICS code 517210.

[26] U.S. Census Bureau, *2012 Economic Census of the United States*, Table EC1251SSSZ5, Information: Subject Series: Estab and Firm Size: Employment Size of Firms for the U.S.: 2012 NAICS Code 517210. https://factfinder.census.gov/bkmk/table/1.0/en/ECN/2012_US/51SSSZ5//naics~517210.

[27] *Id*. Available census data does not provide a more precise estimate of the number of firms that have employment of 1,500 or fewer employees; the largest category provided is for firms with "1000 employees or more."

[28] *See* http://wireless.fcc.gov/uls. For the purposes of this FRFA, consistent with Commission practice for wireless services, the Commission estimates the number of licensees based on the number of unique FCC Registration Numbers.

[29] *See* Federal Communications Commission, Wireline Competition Bureau, Industry Analysis and Technology Division, Trends in Telephone Service at Table 5.3 (Sept. 2010), https://apps.fcc.gov/edocs_public/attachmatch/DOC-301823A1.pdf.

[30] *Id.*

E. Description of Projected Reporting, Recordkeeping, and Other Compliance Requirements for Small Entities

14. The *Third Report and Order* does not impose any additional reporting, recordkeeping, or other compliance requirements on small entities, nor on any other entities. Rather, it eliminates several existing reporting and recordkeeping requirements, which will benefit small entities as well as all other entities that operate Cellular Service facilities. The deleted rules include Sections 22.301 and 22.303, which collectively require that hard copies of license authorizations and other records be maintained by all Part 22 licensees for each station, and that such records and the station itself be made available for inspection upon request.[31] Small entities as well as other Part 22 entities will no longer be burdened by these requirements. Licensees will continue to have access to their official authorizations in the ULS, which is available electronically at all times. Similarly, members of the public will continue to have access to reference copies in the ULS, which reflects the most up-to-date information concerning all authorizations.

15. The *Third Report and Order* also deletes Section 22.325, which requires that "[e]ach station in the Public Mobile Services [ ] have at least one control point and a person on duty who is responsible for station operation."[32] The requirement has become technologically obsolete, as commercial wireless licensees routinely monitor their network operations by automatic and remote mechanisms. Part 22 licensees, including small entities, will no longer be burdened by it, thus freeing up their resources and providing them with the same flexibility as other CMRS licensees to determine how to manage their networks to comply with the Commission's operational rules.

16. All CMRS licensees will continue to be subject to the current annual equal employment opportunity (EEO) complaints report filing requirement. The requirement is set forth in Section 22.321(c), which applies to Part 22 licensees regardless of size, and is also set forth in the later-adopted Section 90.168(c), which applies more broadly to *all* CMRS licensees regardless of size.[33] Section 90.168 contains the same provisions as Section 22.321, including Section 22.321(c), and thus it subsumes Section 22.321 in its entirety. On this basis, the Commission deletes Section 22.321 in its entirety as duplicative.

17. The *Third Report and Order* deletes two other rules: Section 22.3, which applies to all Part 22 licensees, and Section 22.927, which applies only to Cellular Service licensees. Both rules set forth certain licensee obligations concerning operations pursuant to a valid FCC authorization, and service to subscribers of a different commercial wireless system (i.e., "roamers"). A later-adopted rule, Section 1.903, which applies to numerous wireless services, including all Part 22 licensees, imposes essentially the same obligations as Sections 22.3 and 22.927, thus rendering these Part 22 rules duplicative. By deleting Sections 22.321, 22.3, and 22.927, the Commission removes licensees' compliance obligations under one group of regulations where the same obligations exist under different provisions, and thereby simplifies compliance by eliminating regulations that are largely duplicative.

18. Small entities and other licensees will also continue to be subject to Section 22.921, requiring certain Cellular Service mobile telephones that are capable of operating in the analog mode to "incorporate a special procedure for processing 911 calls,"[34] and Section 22.143(a), which allows applicants to begin construction of Public Mobile Services (PMS) facilities "35 days after the date of the

[31] Deletion of these rules does not affect the Commission's statutory station inspection authority. *See* 47 U.S.C. § 303(n).

[32] 47 CFR § 22.325.

[33] 47 CFR § 22.321(c).

[34] 47 CFR § 22.921.

Public Notice listing the application for that facility as acceptable for filing."[35] Commenters have not demonstrated that these rules are burdensome or no longer needed. Moreover, the Commission finds that these regulations continue to serve the public interest.

F. Steps Taken to Minimize the Significant Economic Impact on Small Entities, and Significant Alternatives Considered

19. The RFA requires an agency to describe any significant alternatives that it has considered in reaching its approach, which may include the following four alternatives (among others): "(1) the establishment of differing compliance or reporting requirements or timetables that take into account the resources available to small entities; (2) the clarification, consolidation, or simplification of compliance and reporting requirements under the rule for such small entities; (3) the use of performance rather than design standards; and (4) an exemption from coverage of the rule, or any part thereof, for such small entities."[36]

20. The rules eliminated in the *Third Report and Order* are expected to have a beneficial economic impact on small entities because all Cellular Service and other Part 22 licensees will be subject to fewer recordkeeping, reporting, and compliance burdens. While the record does not enable a precise quantification of costs and benefits, we know that these requirements impose burdens that require expenditures of personnel and other resources. Specifically, removal of the requirements under Sections 22.301 and 22.303 to print (or request that the Commission print and mail) hard copies of FCC authorizations and retain them as part of each station's records every time the Commission grants an application will allow small entities and other Part 22 licensees to rely on the electronic availability of such authorizations in ULS, thereby realizing long-term cost savings. Similarly, elimination of the requirement under Section 22.325 to maintain control points for each station and to have a person on duty in charge of station operations is expected to decrease the costs of maintaining facilities and to allow small entities as well as licensees of all sizes to realize the cost savings inherent in remote monitoring and automatic functions for station operations. Likewise, the deletion of Sections 22.3, 22.321, and 22.927 will simplify compliance burdens by removing duplicative regulations. In addition, all of the rule deletions adopted in the *Third Report and Order* put Cellular Service and other Part 22 licensees more on regulatory par with licensees in competing CMRS such as PCS, AWS, and the 700 MHz Service.

21. A few commenters suggested that the Commission could eliminate the annual EEO complaints report requirement for licensees with fewer than 16 full-time employees. However, the commenters failed to take note of the fact that same requirement is also in another rule part that applies to *all* CMRS licensees—a rule that is outside the scope of this proceeding. Thus, the Commission declined to eliminate this requirement. In any event, the commenters that focused on Section 22.321(c) failed to demonstrate adequately why licensees with fewer than 16 employees should be exempt from the requirement.

22. The Commission also declined to delete three rules—Sections 22.925, 22.921, and 22.143(a)—raised by commenters. Section 22.925 prohibits the operation of Cellular Service mobiles aboard "airplanes, balloons or any other type of aircraft . . . while such aircraft are airborne . . . ."[37] The issues raised by commenters regarding this prohibition are being addressed by the Commission in another proceeding, WT Docket No. 13-301, and therefore the Commission declines to consider them here. Regarding Section 22.921, contrary to commenters' understanding, Commission data show that analog technology is still being used in the Cellular Service band.[38] The specific requirements in Section 22.921 thus continue to ensure that 911 calls get through even when analog technology is used by Cellular carriers. The other rule that was considered but not deleted is Section 22.143(a), which permits applicants

[35] 47 CFR § 22.143(a).

[36] 5 U.S.C. § 603(c)(1) - (4).

[37] 47 CFR § 22.925.

[38] *See* Mobile Deployment Form 77 Data, https://www.fcc.gov/mobile-deployment-form-477-data.

to begin construction of PMS facilities prior to grant of their applications.[39] The Commission finds that this rule also continues to serve the public interest. The 35-day waiting period for commencing pre-grant construction, which a commenter raised for deletion, allows time for the Commission to be reasonably certain that it will be able to grant the application for the facility at issue (including determining that no petitions to deny or competing applications have been timely filed).

Report to Congress

The Commission will send a copy of the *Third Report and Order*, including this FRFA, in a report to Congress pursuant to the Congressional Review Act.[40] In addition, the Commission will send a copy of the *Third Report and Order*, including this FRFA, to the Chief Counsel for Advocacy of the SBA. A copy of the *Third Report and Order* and FRFA (or summaries thereof) also will be published in the *Federal Register*.[41]

[39] 47 CFR § 22.143 (specifying also, however, that applicants must not *operate* such facilities until the Commission grants the application).

[40] 5 U.S.C. § 801(a)(1)(A).

[41] 5 U.S.C. § 604(b).

APPENDIX C

List of Commenters

Comments

AT&T Services, Inc. (AT&T)
CTIA
Critical Messaging Association
Enterprise Wireless Alliance (EWA)
Verizon

Reply Comments

Qualcomm Incorporated

Ex Parte Letters

AT&T
EWA
Gogo Inc.

STATEMENT OF
CHAIRMAN AJIT PAI

Re: *Amendment of Parts 1 and 22 of the Commission's Rules with Regard to the Cellular Service, Including Changes in Licensing of Unserved Area*, WT Docket No. 12-40, RM No. 11510; *Amendment of the Commission's Rules with Regard to Relocation of Part 24 to Part* 27*; Interim Restrictions and Procedures for Cellular Service Applications; Amendment of Parts 0, 1, and 22 of the Commission's Rules with Regard to Frequency Coordination for the Cellular Service; Amendment of Part 22 of the Commission's Rules Regarding Certain Administrative and Filing Requirements; Amendment of the Commission's Rules Governing Radiated Power Limits for the Cellular Service*, RM No. 11660; *Amendments of Parts 1, 22, 24, 27, 74, 80, 90, 95, and 101 to Establish Uniform License Renewal, Discontinuance of Operation, and Geographic Partitioning and Spectrum Disaggregation Rules and Policies for Certain Wireless Radio Services*, WT Docket No. 10-112; *2016 Biennial Review of Telecommunications Regulations*, WT Docket No. 16-138.

Throughout my tenure, I've emphasized the need to eliminate unnecessary and outdated regulations. And in this *Order* alone, we're eliminating six such rules. Three of them impose antiquated administrative and recordkeeping burdens on a subset of wireless licensees, including those in the 800 MHz cellular band. For instance, licensees have to maintain hard copies of such authorizations and make them available for inspection by the Commission. Given that license authorizations are now available electronically through the Commission's Universal Licensing System (ULS), this is pointless. The other three rules that we're removing from the Code of Federal Regulations apply to the same subset of wireless licensees but are duplicative of rules contained elsewhere. They serve no purpose but to clutter our rulebook.

Many thanks to the staff who worked on this item. From the Wireless Telecommunications Bureau: Linda Chang, Thomas Derenge, Chas Eberle, Jessica Greffenius, Roger Noel, Thomas Reed, Moslem Sawez, Nina Shafran, Don Stockdale, Cecelia Sulhoff, and Suzanne Tetreault; from the Office of General Counsel: Deborah Broderson, David Horowitz, and Bill Richardson; from the Office of Communications Business Opportunities: Sanford Williams and Chana Wilkerson; from the Wireline Competition Bureau: Suzanne Yellen; and from the Media Bureau: Lewis Pulley.

FCC NEWS from the Federal Communications Commission

Media Contact:
Cecilia Sulhoff, 202-418-0587
cecilia.sulhoff@fcc.gov

For Immediate Release

FCC ELIMINATES UNNECESSARY CELLULAR SERVICE RULES

WASHINGTON, July 12, 2018—The Federal Communications Commission took additional steps today to modernize its Cellular Service rules by eliminating obsolete and unnecessary regulatory burdens applicable to the Cellular Service and other Part 22 licensees. In the *Third Report & Order* adopted today, the Commission furthers its efforts to repeal outdated regulations.

Today's Order eliminates impediments placed upon Cellular service licensees as well as other Part 22 licensees. The revisions will streamline the Commission's rules by reversing obsolete or unnecessarily burdensome rules, and they will allow licensees to focus resources on investment in new technologies and services to meet increasing consumer demand.

Among other things, the *Third Report and Order*:

- Modernizes record-keeping rules by deleting rules requiring licensees to retain hard copies of station authorizations and other station records.
- Eliminates the outdated requirement for licensees to maintain station control points and personnel on duty at those control points.
- Eliminates duplicative rules pertaining to operation of mobile stations, operational control of mobile devices, and equal opportunity regulations.

The actions taken in this *Third Report and Order* will provide Cellular and other Part 22 licensees with increased flexibility and will align the Cellular rules with rules applicable to other commercial wireless services.

Action by the Commission July 12, 2018 by Report and Order (FCC 18-92). Chairman Pai, Commissioners O'Rielly, Carr, and Rosenworcel approving. Chairman Pai and Commissioner Carr issuing separate statements.

WT Docket Nos. 12-40, 10-112, 16-138; RM Nos. 11510, 11660;

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This is an unofficial announcement of Commission action. Release of the full text of a Commission order constitutes official action. See MCI v. FCC, 515 F.2d 385 (D.C. Cir. 1974).

STATEMENT OF
CHAIRMAN AJIT PAI

Re: *Amendment of Parts 1 and 22 of the Commission's Rules with Regard to the Cellular Service, Including Changes in Licensing of Unserved Area*, WT Docket No. 12-40, RM No. 11510; *Amendment of the Commission's Rules with Regard to Relocation of Part 24 to Part* 27*; Interim Restrictions and Procedures for Cellular Service Applications; Amendment of Parts 0, 1, and 22 of the Commission's Rules with Regard to Frequency Coordination for the Cellular Service; Amendment of Part 22 of the Commission's Rules Regarding Certain Administrative and Filing Requirements; Amendment of the Commission's Rules Governing Radiated Power Limits for the Cellular Service*, RM No. 11660; *Amendments of Parts 1, 22, 24, 27, 74, 80, 90, 95, and 101 to Establish Uniform License Renewal, Discontinuance of Operation, and Geographic Partitioning and Spectrum Disaggregation Rules and Policies for Certain Wireless Radio Services*, WT Docket No. 10-112; *2016 Biennial Review of Telecommunications Regulations*, WT Docket No. 16-138.

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Many thanks to the staff who worked on this item. From the Wireless Telecommunications Bureau: Linda Chang, Thomas Derenge, Chas Eberle, Jessica Greffenius, Roger Noel, Thomas Reed, Moslem Sawez, Nina Shafran, Don Stockdale, Cecelia Sulhoff, and Suzanne Tetreault; from the Office of General Counsel: Deborah Broderson, David Horowitz, and Bill Richardson; from the Office of Communications Business Opportunities: Sanford Williams and Chana Wilkerson; from the Wireline Competition Bureau: Suzanne Yellen; and from the Media Bureau: Lewis Pulley.

Kathy Noel

From: Cathyrose <cathy13rose@gmail.com>
Sent: Monday, August 26, 2019 10:44 AM
To: Roy Sapau
Subject: Email list 5G

Dear Roy, Thank you for explaining what Encinitas is doing re 5G and I would like to attend your workshop.
Thank you,
Cathyrose
760-809-1393

Kathy Noel

From: Annemarie Clisby
Sent: Wednesday, August 28, 2019 4:13 PM
To: Roy Sapau
Subject: FW: Make the Encinitas Small Cell Antenna Ordinance Protective for Our Residential Areas Immediately

From: Cathyrose <cathy13rose@gmail.com>
Sent: Wednesday, August 28, 2019 3:51 PM
To: Council Members <council@encinitasca.gov>
Subject: Make the Encinitas Small Cell Antenna Ordinance Protective for Our Residential Areas Immediately

Dear City Council Members,

Good afternoon, I have lived in Encinitas since 1983 before Encinitas was a city. I have watched it grow from flower fields and natural habitat to a bustling city.

I very rarely come to meetings and express my feelings but this issue in all my 36 years of living here is extremely important!

I am requesting that the ordinance to be more protective immediately, applied to all applications in process, before there is a flood of small cell antenna applications/installations in our neighborhoods.

We can't wait for a small cell antenna community meeting.

We ask that the Encinitas small cell antenna ordinance incorporate the best practices of protective small cell antennas ordinances of the California Cities of Mill Valley and Los Altos; Calabasas; Fairfield, Petaluma and San Ramon; and Hercules.

- Mill Valley and Los Altos ordinances, prepared by Gail Karish telecommunications attorney for Best Best & Krieger LLP, prohibit small cell antennas in residential areas.

- The Calabasas ordinance does not allow small cell antennas in residential areas.

- The Fairfield, Petaluma and San Ramon ordinances require setbacks to sensitive area and residential areas and structures.

- The Hercules ordinance is the best administration for control of the application and shot clock process, requires ANSI 222 class III poles for all small cell installations, and prohibits new antenna support structures in residential areas.

Thank you for reading this. I'll see you tonight as well!

Sincerely,

Cathyrose Johnson

760-809-1393

Kathy Noel

From: Annemarie Clisby
Sent: Tuesday, September 3, 2019 11:47 AM
To: Roy Sapau
Subject: FW: 5 G cell tower opposition

-----Original Message-----
From: Chad DeSatnick <c.desatnick@mac.com>
Sent: Saturday, August 31, 2019 9:39 PM
To: Council Members <council@encinitasca.gov>
Subject: 5 G cell tower opposition

August 30, 2019
Chad Desatnick
1015 Hygeia Avenue
Encinitas CA 92024

> City of Encinitas Council Mayor Blakespear, Deputy Mayor Hubbard, and
> City Council Members Kellie Shay Hinze, Tony Kranz, and Joe Mosca

> I have a perception of harm from microwave antennas in close
> proximity to my home and to the businesses I frequent in Encinitas. I'm afraid for my physical well-being, for my family, and for my property value should an antenna be placed in front of my home. The FCC exposure limits protect us from adverse thermal effects such as shock, burns and being heated, but not from the harmful biological effects known by our scientists for more than 50 years. I implore you to protect me, us. I perceive that small cell antenna in the right-of-way in front of a home means 20 percent devaluation in property value and sickness and untold suffering to one or more members of that household. The city of Encinitas needs a small cell ordinance immediately so that there is oversight about placement of small cell antennas in our community and especially our sensitive and residential areas. As written this urgency ordinance provides a convenient administrative process for the Telecom to put small cell antennas anywhere they want. I say this because there is an absence of administrative teeth that would empower the city of Encinitas to enforce the location preference (e.g. prevent small cell antenna installation in front of homes), control the application and shot clock process and installation quality. My request for the City of Encinitas is that this ordinance be sent back to staff for major upgrade that would reflect the protective aspects of the Calabasas and Hercules ordinances that are part of this record. Please note that these ordinances have been certified by their city councils to meet all requirements of the FCC directives, and therefore serve as appropriate baselines for our community. Let's not open the door to indiscriminate placement of small cell antennas in our residential areas and the cluttering of our visual space. If the city deems it necessary to have an ordinance in place immediately, then please make approval conditional on adding the following protective features garnered from the Calabasas municipal code section 17.12.050(C) and Hercules Title 10 Chapter 16 ordinances as a condition of approval. These are a few of many important examples from these ordinances. Location Preference: remove the residential areas from Encinitas Section 10.a. This would be consistent with Calabasas 17.12.050(C) 3. "Preferred Zones and Locations" which does not include residential areas. (Note: Calabasas ordinance re-enforces this zoning preference in sections that specifically address small cell location in right of way… and asserts in the preamble that the ordinance is compliant to FCC directives.) Application Process: Require a pre-application site inspection and pre-application meeting for verification that all application requirements have been met before accepting an application (Hercules Section 10-16.108 General Policies, General Application Process, para 8) Require that all support structures are certified to meet ANSI 222 as part of the application process (Hercules Section 10-16.113.E.14

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Kathy Noel

From: Annemarie Clisby
Sent: Wednesday, August 28, 2019 1:22 PM
To: Roy Sapau
Subject: FW: No to 5G

From: Cherie Basu <cheriebasu@yahoo.com>
Sent: Wednesday, August 28, 2019 1:16 PM
To: Council Members <council@encinitasca.gov>
Subject: No to 5G

I am against 5g. There are too many dangerous effects to our health. We must
limit exposure in residential neighborhoods. I got a health problem from close exposure to 4g.

Cherie Basu
1712 Greentree Rd
Encinitas, CA

Kathy Noel

From: Christian Marcotte <christian@fancyfoodcart.com>
Sent: Thursday, September 19, 2019 1:16 PM
To: Roy Sapau
Cc: Council Members
Subject: 5G workshop 9/23

I am very concerned with the rush to install 5G technology without any substantial and independent health studies.

I would very much like the city council to follow the lead of other cities and put a hold on 5G deployment until further health studies can be conducted. There is not burning emergency requiring this technology other than corporate desire for increased profits.

Short of putting deployment on hold, I am asking city council to be more protective of its citizens and put in place an ordinance that will not allow small cell towers to be within 500 feet homes and schools (INCLUDING private, charter schools, pre-schools and daycare).

Thank you!
-- Christian Marcotte

Christian Marcotte - www.FancyFoodCart.com - CEO
ph: (831) 621-3788 - christian@fancyfoodcart.com

Kathy Noel

From: Annemarie Clisby
Sent: Tuesday, September 3, 2019 11:36 AM
To: Roy Sapau
Subject: FW: Against 5G cell towers in Encinitas

From: Circe Wallace <cwallace@teamwass.com>
Sent: Sunday, September 1, 2019 2:55 PM
To: Council Members <council@encinitasca.gov>
Subject: Against 5G cell towers in Encinitas

Dear Council,

As stewards for our quaint beach town you have a responsibility to protect the health of your constituents and our children where you can.

We do NOT NEED 5G towers in our residential neighborhoods. This is coming from a Cardiff taxpaying homeowner who has never had good WiFi in my home. I have two children in the school system.

Please wait for the research and accept that a rush to this is a potential liability and danger to our babies.

P.s. your rule about now allowing short term rentals for airbn for accessory units has made it increasingly difficult for this dual income family to afford to live here.

With respect,

Circe Wallace
Long time homeowner
Built in 97
1651 somerset ave.
Cardiff ca 92007

Circe Wallace
Executive Vice President
Action Sports & Olympics
CWALLACE@TEAMWASS.COM
WASSERMAN CARLSBAD | T: (760) 602 6200

Kathy Noel

From: Annemarie Clisby
Sent: Thursday, August 22, 2019 7:53 AM
To: Roy Sapau
Subject: FW: 5G Towers

From: Claire Slattery <clarita313@gmail.com>
Sent: Wednesday, August 21, 2019 11:07 PM
To: Catherine Blakespear <cblakespear@encinitasca.gov>; Jody Hubbard <jhubbard@encinitasca.gov>; Council Members <council@encinitasca.gov>; Tony Kranz <tkranz@encinitasca.gov>; Joe Mosca <jmosca@encinitasca.gov>; Kellie Shay Hinze <khinze@encinitasca.gov>
Subject: 5G Towers

August 21, 2019

From:
Claire Slattery
1655 Burgundy Road
Encinitas, CA 92024

To: City of Encinitas Council Mayor Blakespear, Deputy Mayor Hubbard, and City Council Members Kellie Shay Hinze, Tony Kranz, and Joe Mosca

Re: Encinitas Small Cell Antenna Urgency Ordinance

I have a perception of harm from microwave antennas in close proximity to my home and to the businesses I frequent in Encinitas. I'm afraid for my physical well-being, for my family, and for my property value should an antenna be placed in front of my home. The FCC exposure limits protect us from adverse thermal effects such as shock, burns and being heated, but not from the harmful biological effects known by our scientists for more than 50 years. I implore you to protect us.

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The city of Encinitas needs a small cell ordinance immediately so that there is oversight about placement of small cell antennas in our community and especially our sensitive and residential areas.

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My request for the City of Encinitas is that this ordinance be sent back to staff for major upgrade that would reflect the protective aspects of the Calabasas and Hercules ordinances that are part of this record. Please note that these ordinances have been certified by their city councils to meet all requirements of the FCC directives, and therefore serve as appropriate baselines for our community. Let's not open the door to indiscriminate placement of small cell antennas in our residential areas and the cluttering of our visual space.

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<u>Application Process</u>:

· Require a pre-application site inspection and pre-application meeting for verification that all application requirements have been met before accepting an

application (Hercules Section 10-16.108 General Policies, General Application Process, paragraph 8)

· Require that all support structures are certified to meet ANSI 222 as part of the application process (HerculesSection 10-16.113.E.14 Small Cell and Small Wireless Facilities).

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Thank you for being proactive for all of our safety.

Sincerely,

Claire Slattery

Kathy Noel

From: Annemarie Clisby
Sent: Wednesday, August 21, 2019 11:34 AM
To: Roy Sapau
Subject: FW: Encinitas Small Cell Antenna Urgency Ordinance

From: Claudia Seifert <claudiaseifert11@gmail.com>
Sent: Wednesday, August 21, 2019 11:32 AM
To: Catherine Blakespear <cblakespear@encinitasca.gov>; Jody Hubbard <jhubbard@encinitasca.gov>; Council Members <council@encinitasca.gov>; Tony Kranz <tkranz@encinitasca.gov>; Joe Mosca <jmosca@encinitasca.gov>; Kellie Shay Hinze <khinze@encinitasca.gov>
Subject: Encinitas Small Cell Antenna Urgency Ordinance

Claudia Seifert
1871 Avendia Josefa
Encinitas CA

August 20, 2019

City of Encinitas Council
Mayor Blakespear, Deputy Mayor Hubbard, and City Council Members Kellie Shay Hinze, Tony Kranz, and Joe Mosca

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Thank you for being proactive for all of our safety.

Claudia Seifert,
A very concerned citizen

Claudia Seifert
760.828.8577

"I could either watch it happen or be a part of it." ~ Elon Musk

"Vision without action is merely a dream. Action without vision just passes the time. Vision with action can change the world." ~ Joel A. Barker

Kathy Noel

From: Annemarie Clisby
Sent: Wednesday, August 21, 2019 3:47 PM
To: Roy Sapau
Subject: FW: Encinitas Small Cell Antenna Ordinance
Attachments: 5G-Risk-The-Scientific-Perspecitve.pdf

From: Anjali Corinne S <anjalicore2011@gmail.com>
Sent: Wednesday, August 21, 2019 3:26 PM
To: Catherine Blakespear <cblakespear@encinitasca.gov>; Jody Hubbard <jhubbard@encinitasca.gov>; Council Members <council@encinitasca.gov>; Tony Kranz <tkranz@encinitasca.gov>; Joe Mosca <jmosca@encinitasca.gov>; Kellie Shay Hinze <khinze@encinitasca.gov>
Subject: Encinitas Small Cell Antenna Ordinance

City of Encinitas Council
Mayor Blakespear, Deputy Mayor Hubbard, and City Council Members Kellie Shay Hinze, Tony Kranz, and Joe Mosca

Re: Encinitas Small Cell Antenna Urgency Ordinance

Dear Mayor Blakespear and City Council:

Please take a brief look at the attached article on 5G, chapter 7, which shows **scientific studies** about the harmful affects of microwave radiation related. What is emphasized is that the **precautionary principle** is needed in the case of 5G because of the lack of health and safety testing including risk assessment.

The precautionary principle may only be invoked when the three preliminary conditions are met:

identification of potentially adverse effects; evaluation of the scientific data available; the extent of scientific uncertainty.

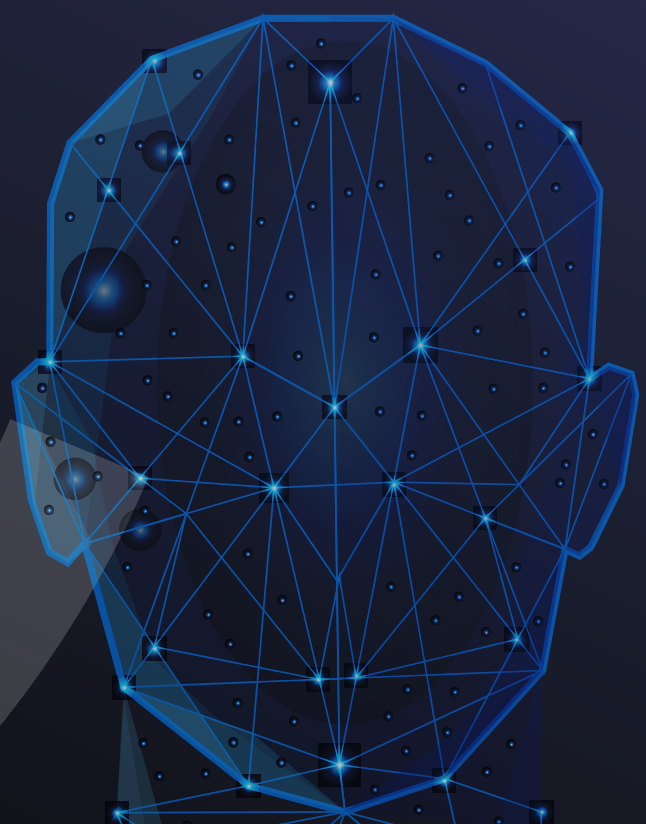
Thank you for considering this extremely important evidence that shows the need to protect your citizens.

Sincerely,
Corinne Schreiner

MARTIN L. PALL, PHD
PROFESSOR EMERITUS OF BIOCHEMISTRY & BASIC MEDICAL SCIENCES,
WASHINGTON STATE UNIVERSITY

5G RISK:
THE SCIENTIFIC PERSPECTIVE

- The **Intracellular Mechanism** of Harm from Wireless Radiation
- The **Eight Primary Areas** of Biological Harm



5G CRISIS
AWARENESS & ACCOUNTABILITY

the5Gsummit.com

5G Risk: The Scientific Perspective

Compelling Evidence for Eight Distinct Types of Great Harm Caused by Electromagnetic Field (EMF) Exposures and the Mechanism that Causes Them

Written and Compiled by

Martin L. Pall, PhD

Professor Emeritus of Biochemistry and Basic Medical Sciences
Washington State University

BA degree in Physics, Phi Beta Kappa, with honors, Johns Hopkins University;
PhD in Biochemistry & Genetics, Caltech.

martin_pall@wsu.edu
503-232-3883

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Chapter 3 ▪ Pg 32 Strong Evidence for Cumulative and Irreversible EMF Effects

Chapter 4 ▪ Pg 39 EMFs Including Wi-Fi May Be Particularly Damaging to Young People

Chapter 5 ▪ Pg 41 The Importance of the SCENIHR 2015 Documentand the Many Omissions, Flaws and Falsehoods in That Document

Chapter 6 ▪ Pg 84 The U.S. Early Role in Recognizing Non-Thermal EMF Effects and How This Was Abandoned Starting in 1986: U.S. Failure to Research Health Impacts of Cell Phone Towers, Cell Phones, Wi-Fi, Smart Meters and Now 5G. What Is the Current Position of U.S. Government Agencies?

Chapter 7 ▪ Pg 113 The Great Risks of 5G: What We Know and What We Don't Know

SUMMARY

We know that there is a massive literature, providing a high level of scientific certainty, for each of eight pathophysiological effects caused by non-thermal microwave frequency EMF exposures. This is shown in from 12 to 35 reviews on each specific effect, with each review listed in Chapter 1, providing a substantial body of evidence on the existence of each effect. Such EMFs:

1. **Attack our nervous systems including our brains leading to widespread neurological/ neuropsychiatric effects and possibly many other effects. This nervous system attack is of great concern.**
2. **Attack our endocrine (that is hormonal) systems. In this context, the main things that make us functionally different from single celled creatures are our nervous system and our endocrine systems – even a simple planaria worm needs both of these. Thus the consequences of the disruption of these two regulatory systems is immense, such that it is a travesty to ignore these findings.**
3. **Produce oxidative stress and free radical damage, which have central roles in essentially all chronic diseases.**
4. **Attack the DNA of our cells, producing single strand and double strand breaks in cellular DNA and oxidized bases in our cellular DNA. These in turn produce cancer and also mutations in germ line cells which produce mutations in future generations.**
5. **Produce elevated levels of apoptosis (programmed cell death), events especially important in causing both neurodegenerative diseases and infertility.**
6. **Lower male and female fertility, lower sex hormones, lower libido and increased levels of spontaneous abortion and, as already stated, attack the DNA in sperm cells.**
7. **Produce excessive intracellular calcium [Ca2+]i and excessive calcium signaling.**
8. **Attack the cells of our bodies to cause cancer. Such attacks are thought to act via 15 different mechanisms during cancer causation.**

There is also a substantial literature showing that EMFs also cause other effects including life threatening cardiac effects (Chapter 3). In addition substantial evidence suggests EMF causation of very early onset dementias, including Alzheimer's, digital and other types of dementias (Chapter 3); and there is evidence that EMF exposures in utero and shortly after birth can cause ADHD and autism (Chapter 5).

Each of these effects is produced via the main mechanism of action of microwave/lower frequency EMFs, activation of voltage-gated calcium channels (VGCCs) (Chapter 2). Each of them is produced via what are called downstream effects of VGCC activation.
It follows from this that we have a good understanding not only that these effects occur, but also how they can occur. The extraordinary sensitivity of the VGCC voltage sensor to the forces of the EMFs tells us that the current safety guidelines allow us to be exposed to EMF levels that are something like 7.2 million times too high. That sensitivity is predicted by the physics. Therefore, the physics and the biology are each pointing to the same mechanism of action of non-thermal EMFs.

The different effects produced are obviously very deep concerns. They become much deeper and become existential threats when one considers that several of these effects are both cumulative and eventually irreversible. There is substantial evidence for the cumulative nature and eventual irreversibility of the neurological/neuropsychiatric effects, of the reproductive effects, the mutational DNA effects, the cardiac effects, of some but not other of the hormonal effects (Chapter 3); any causation of ADHD and autism may add additional concerns (here the cumulative nature is probably limited to the perinatal period). When we know that sperm counts have dropped by more than 50% throughout the technologically advanced countries on earth, it is difficult to avoid the conclusion that the vast majority of the population in those countries is already substantially impacted. The same conclusion can be made based on the widespread nature of the neuropsychiatric effects in those countries. Both of those effects will get much much worse even with no increase in current exposures, due to the cumulative nature and irreversibility of these effects. I expect we will see crash in human reproduction almost to zero as happened in the Magras and Xenos mouse study which I estimate to occur within about 5 years, without any increases in our exposures. Obviously 4G and 5G will make the situation much worse. Similarly I expect that the deterioration in brain function that we are already seeing will seal our fate if we fail to act rapidly and vigorously. Our collective brain function may become completely incapable of dealing with such a mega-crisis situation.

Now it can be argued that some of these may not develop as I expect, although those expectations are based on the best available evidence. One may even be able to argue this for all of those expectations. However, when we have substantial risk of multiple existential threats to every single technologically advanced country on earth, failure to act vigorously means there is a very high probability of complete destruction of these societies. And the chaos which would inevitably ensue, in a world that still has nuclear weapons, may well lead to extinction. In the face of these types or risk, the only reasonable course is to move with great vigor to stop new exposures and lower current exposures. One can still access the internet, using wired connections. And we can lower

cell phone tower and cell phone radiation substantially. Smart meters, if needed, can work via wired connections.

Over 60% of this document (Chapters 5 & 6), is focused on the failures of statements from SCENIHR, the telecommunications industry, the U.S. FCC and the U.S. FDA to reflect the science. Their statements repeatedly omit much, often all of the most important science. Their statements are rife not only with omissions, but also with easily demonstrable falsehoods and with false logic. These have often occurred at times where we know that they knew better. These have occurred along with vigorous efforts by the telecommunications industry to corrupt the science by attacking individual scientists whose only fault is that they have obtained important findings that the industry does not like. These attacks have occurred along with vigorous efforts to corrupt two agencies that have important regulatory roles.

There are also possible concerns about individual industry-linked research studies. All wireless communication devices put out polarized EMFs that carry information via pulsations. Both the pulsations and the polarization make these EMFs much more biologically active. There are three other factors that also influence the production of effects. Several industry-linked studies may have used these factors, along with using very tiny numbers of individual animals in their studies, to produce studies which may have been designed to fail (Chapter 5). It is not clear at this point whether this type of concern is quite limited or whether it is very broad.

The European Commission has done nothing to protect European citizens from any of these very serious health hazards and the U.S. FDA, EPA and National Cancer Institute have done nothing to protect American citizens. The U.S. FCC has been much worse than that, acting vigorously with wanton disregard for our health.

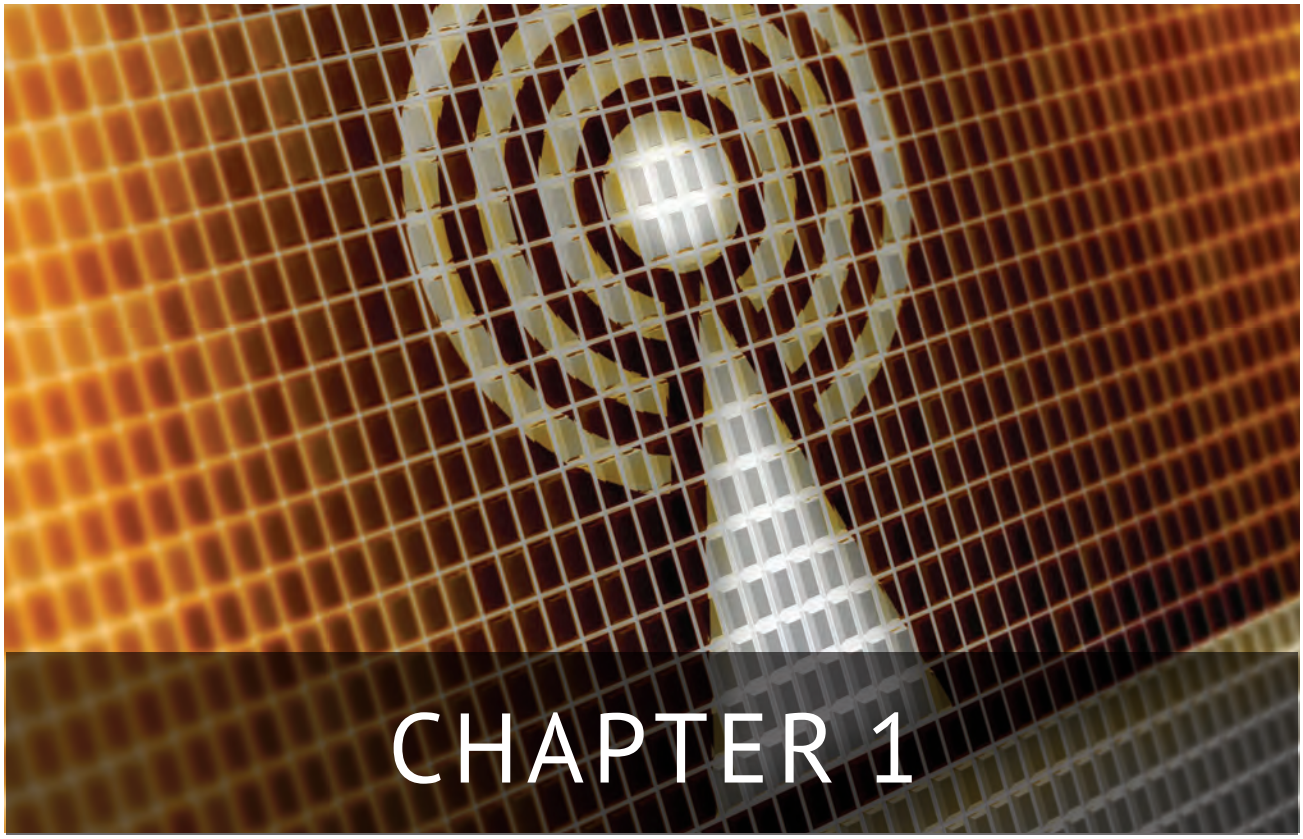
PREFACE

The document that follows was, in its original form, sent to many of the authorities of the European Union, in conjunction with other documents sent to the same people by a group of European scientists. It was in response two documents that were, in turn, written by Mr. Ryan and Dr. Vinciūnas responding to a large group of European and other international scientists expressing great concern about the safety of 5G. I was asked by the leaders of the group of scientists to write my own response to those two documents. Mr. Ryan made the statement that "There is consistent evidence presented by national and international bodies (International Commission on Non Ionising Radiation Protection - ICNIRP, Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR) that exposure to electromagnetic fields does not represent a health risk, if it remains below the limits set by Council Recommendation 1999/519/EC1." In fact, that is not either the ICNIRP or SCENIHR position – their position, and similar positions have been taken by the U.S. FCC, FDA and the National Cancer Institute, is that the evidence is inconsistent or conflicting and therefore, in their view, no conclusions can be drawn. Some of these organization have also stated that there is no known mechanism by which effects can be produced. What is shown below is that there is a vast amount of evidence in the independent scientific literature that conflicts with both the conclusion about lack of demonstrated effects and the conclusion about lack of mechanism.

The European Commission, according to the Ryan and Vinciūnas documents and the U.S. National Cancer Institute, according to their web site, are each depending on the SCENIHR 2015 document to make judgments about EMF effects. Consequently, the reliability of SCENIHR 2015 is an essential element in determining the reliability of both of their assessments.

The document that is presented below, differs from the document that was emailed to EU authorities in three different ways: **1**. The original document was sent as an email with multiple attachments. In this document attachments are simply provided as citations. The current document is a stand-alone document. **2**. Some material is inserted to discuss positions taken by the U.S. FCC, FDA and National Cancer Institure, so as to be particularly relevant to the U.S. situation. **3**. Substantial additional evidence is also provided.

The revised document contains seven chapters followed by a citation list for the entire document.



CHAPTER 1

Eight Extremely Well-Documented Effects of Non-Thermal EMF Exposures: Role of Pulsations, Other Factors that Influence EMF Effects

Both the earlier Ryan document and the more recent Arūnas document each fail to pay any attention to the extensive scientific literature that has been accumulated on non-thermal electromagnetic field (EMF) effects. The scientific consensus of independent scientists based on information accumulated over the last 7 decades is just the opposite of what each of them states. I am copying into this document, at the end of Chapter 1, a series of 8 extremely well-documented effects of such EMF exposure, together with a list of review articles, most of them being peer reviewed articles published in well respected journals in the PubMed database, *that have each reviewed a body of evidence demonstrating the existence of each such effect.*

What are the effects produced by non-thermal exposures to microwave frequency EMFs, where we have an extensive scientific literature? Each of the following effects has been documented in from 12 to 34 reviews, listed at the end of Chapter 1.

1. Three types of cellular DNA attacks, producing single strand breaks in the cellular DNA, double strand breaks in cellular DNA and oxidized bases in cellular DNA. Each of these DNA changes have roles in cancer causation and in producing

the most important mutational changes in humans and diverse animals. Double stranded DNA breaks produce chromosomal breaks, rearrangements, deletions and duplications and copy number mutations; they also produce gene amplification, an important mechanism in cancer causation. Single strand breaks in cellular DNA cause aberrant recombination events leading to copy number mutations. Oxidized bases cause point mutations. When these occur in somatic cells, they can each have roles in causing cancer. When these occur in germ line cells (and they have be shown to occur in sperm following EMF exposures), they cause the three most important types of mutations in future generations, chromosomal mutations, copy number mutations and point mutations.
(21 different reviews documenting these types of cellular DNA damage)

2. A wide variety of changes leading to lowered male fertility, lowered female fertility, increased spontaneous abortion, lowered levels of estrogen, progesterone and testosterone, lowered libido (18 reviews). Human sperm count has dropped to below 50% of what used to be considered normal throughout the technologically advanced countries of the world [1]. Reproductive rates have fallen below replacement levels in every technologically advanced country of the world, with a single exception. These include every EU country, the U.S., Canada, Japan, South Korea, Taiwan, Singapore, Australia and New Zealand. Reproduction averages, in these countries, about 73% of replacement levels according to 2015 or 2016 data. A study on mouse reproduction [2] showed that radio/microwave frequency EMF exposure at doses well within our current safety guidelines produced substantial dose-dependent decreases in reproduction within the first set of litters; further exposure produced dose-dependent complete or almost complete sterility that was found to be largely irreversible. When we have a technology that is universally present in these technologically advanced countries, that we know impacts reproduction, and reproduction has already dropped well below replacement levels, and we may be facing a catastrophic and irreversible decline in reproduction and there are more and more plans to expose us still further, don't you think that we should take note of the science? Mr. Ryan and Dr. Vinciūnas seem to be saying not at all. (Please note that the U.S. FCC and FDA also completely ignore this existential threat)

3. Neurological/neuropsychiatric effects (25 reviews). My own paper on this [3] and two earlier reviews cited in it found that there are whole series of repeatedly found EMF effects which have also become extremely widespread complaints in our technologically advanced societies, namely: sleep disturbance/insomnia; fatigue/tiredness; headache; depression/depressive symptoms; lack of concentration/attention/cognitive dysfunction; dizziness/vertigo; memory changes; restlessness/

tension/anxiety/stress/agitation; irritability. These findings are not just based on epidemiological findings but are also based on profound impacts of EMFs, at levels well within our safety guidelines, on brain structure and function and also on the mechanism of non-thermal EMF action discussed below. When we have these neuropsychiatric effects becoming more and more common in technologically advanced societies all over the world, and we know each of these is caused EMF exposures, shouldn't we take note of this relationship?

4. Apoptosis/cell death (13 reviews). The two most important consequences of large increases in apoptosis (programmed cell death) are in causation of the neurodegenerative diseases and lowered reproduction although there are others.

5. Oxidative stress/free radical damage (19 reviews). Oxidative stress has roles in all or almost all chronic diseases. It is reported to have essential roles in producing the reproductive effects and the attacks on cellular DNA and may also have roles in producing the neurological effects and some of the cancer-causing effects shown to be produced here by EMF exposures.

6. Widespread endocrine (that is hormonal) effects (12 reviews). The steroid hormone levels drop with EMF exposure, whereas other hormone levels increase with initial exposure. The neuroendocrine hormones and insulin levels often drop with prolonged EMF exposure, possibly due to endocrine exhaustion.

7. Increases in intracellular calcium ([Ca2+]i) levels following EMF exposure (15 reviews). Calcium signaling also increases following EMF exposure.

8. Cancer causation (35 reviews). Brain cancer, salivary cancer, acoustic neuromas and two other types of cancer go up with cell phone use. People living near cell phone towers have increased cancer rates. Other types of EMFs are each implicated. Short wave radio, radio ham operators and people exposed to radar all are reported to have increased cancer incidence. Perhaps most telling, heavy-long term cell phone users have the highest incidence of brain cancer and have predominantly cancer increases on the ipsilateral side of the head (the side they use their cell phones), as opposed to the contralateral side. I have a paper [7], focused not on whether EMFs cause cancer but rather on how they can cause cancer. The paper shows that "downstream effects" of the main target of the EMFs in the cells of our bodies, can cause cancer in 15 different ways, including increases in cancer initiation, promotion and progression. Progression effects include both tissue invasion and metastasis. Each of these cancer causation effects are caused via mechanisms produced by downstream effects of the main non-thermal EMF mechanism, as discussed in Chapter 2.

9. Therapeutic effects of such EMFs. Such EMFs when focused on a specific region of the body where there is some dysfunction and when used at specific intensities, can have therapeutic effects. In my 2013 paper [4], I cited 12 different reviews where EMF stimulation of bone growth was used therapeutically. There are something like 4000 papers on various therapeutic effects. Strangely, the telecommunications industry does not acknowledge these therapeutic effects, preferring rather to maintain the fiction that there are no non-thermal effects.

There is another set of reviews, 13 in this case, with each showing that pulsed EMFs are, in most cases, much more biologically active than are non-pulsed EMFs. This is particularly important because all wireless communication devices communicate via pulsations, making them potentially much more dangerous. It follows from this that if you wish to study the effects of Wi-Fi, cell phones, cordless phones, cell phone towers, smart meters or 5G, you had better study the real thing or at least something that pulses very much like the real thing. There are many studies that don't do this, but falsely claim to be genuine Wi-Fi, cell phone or cordless phone studies. Other factors that influence the occurrence of non-thermal EMF effects include the frequency being used, the polarization of the EMFs and the cell type being studied [4,5,8-11]. Furthermore there are intensity "windows" that produce maximum biological effects, such that both lower and higher intensities produce much less effect [5,8,9]. These window effect studies clearly show that dose-response curves are both non-linear and non-monotone, such that it is difficult or impossible to predict effects based on relative intensity even when all other factors are the same. The role of each of these factors is completely ignored by ICNIRP, SCENIHR, the U.S. FCC, FDA and National Cancer Institute as well as by many other industry-friendly groups. When each of these organizations concludes that "results are inconsistent" they are comparing studies based on superficial similarities but not on these demonstrated causal factors. What is being observed, therefore, is genuine biological heterogeneity, not inconsistency. It has been known since the beginning of modern science in the 16th century that how you do your studies is important in determining what results are obtained. How is it possible that ICNIRP, SCENIHR, the U.S. FCC, FDA and National Cancer Institute have forgotten this important fact?

The primary literature studies demonstrating roles of pulsation, frequency, polarization, cell type and intensity windows in determining biological effects are entirely dependent on having genuine effects to study. None of these studies could have been done without an effect to study. Consequently, the claims that there are no well-documented EMF effects are nonsense, based not only on the eight extremely well-documented effects summarized above, but also on the entire literature demonstrating the role of pulsation, frequency, polarization, cell type and intensity windows.

Now I haven't said anything about how these non-thermal EMF effects are produced. I am taking much of Chapter 2 from a recent paper [11].

Reviews each showing important health-related non-thermal effects of microwave frequency electromagnetic fields (EMFs).

Specific effects and reviews each reporting the effect in multiple primary literature studies:

Cellular DNA damage: Single strand and double strand breaks in cellular DNA and oxidized bases in cellular DNA, leading to chromosomal and other mutational changes:

1. Glaser ZR, PhD. 1971 Naval Medical Research Institute Research Report, June 1971. Bibliography of Reported Biological Phenomena ("Effects") and Clinical Manifestations Attributed to Microwave and Radio-Frequency Radiation. Report No. 2 Revised. https://scholar.google.com/scholar?q=Glaser+naval+medical+microwave+radio-frequency+1972&btnG=&hl=en&as_sdt=0%2C38 (Accessed Sept. 9, 2017)

2. Goldsmith JR. 1997 Epidemiologic evidence relevant to radar (microwave) effects. Environ Health Perspect 105(Suppl 6):1579-1587.

3. Yakymenko IL, Sidorik EP, Tsybulin AS. 1999 [Metabolic changes in cells under electromagnetic radiation of mobile communication systems]. Ukr Biokhim Zh (1999), 2011 Mar-Apr:20-28.

4. Aitken RJ, De Iuliis GN. 2007 Origins and consequences of DNA damage in male germ cells. Reprod Biomed Online 14:727-733.

5. Hardell, L., Sage, C. 2008. Biological effects from electromagnetic field exposure and public exposure standards. Biomed. Pharmacother. 62, 104-109.

6. Hazout A, Menezo Y, Madelenat P, Yazbeck C, Selva J, Cohen-Bacrie P. 2008 [Causes and clinical implications of sperm DNA damages]. Gynecol Obstet Fertil ;36:1109-1117.

7. Phillips JL, Singh NP, Lai H. 2009 Electromagnetic fields and DNA damage. Pathophysiology 16:79-88.

8. Ruediger HW. 2009 Genotoxic effects of radiofrequency electromagnetic fields. Pathophysiology. 16:89-102.

9. Makker K, Varghese A, Desai NR, Mouradi R, Agarwal A. 2009 Cell phones: modern man's nemesis? Reprod Biomed Online 18:148-157.

10. Yakymenko I, Sidorik E. 2010 Risks of carcinogenesis from electromagnetic radiation and mobile telephony devices. Exp Oncol 32:729-736.

11. Yakimenko IL, Sidorik EP, Tsybulin AS. 2011 [Metabolic changes in cells under electromagnetic radiation of mobile communication systems]. Ukr Biokhim Zh (1999). 2011 Mar-Apr;83(2):20-28.

12. Gye MC, Park CJ. 2012 Effect of electromagnetic field exposure on the reproductive system. Clin Exp Reprod Med 39:1-9. doi.org/10.5653/cerm.2012.39.1.1

13. Pall, ML. 2013. Electromagnetic fields act via activation of voltage-gated calcium channels to produce beneficial or adverse effects. J Cell Mol Med 17:958-965. doi: 10.1111/jcmm.12088.

14. Pall, M. L. 2015 Scientific evidence contradicts findings and assumptions of Canadian Safety Panel 6: microwaves act through voltage-gated calcium channel activation to induce biological impacts at non-thermal levels, supporting a paradigm shift for microwave/lower frequency electromagnetic field action. Rev. Environ. Health 3, 99-116. doi: 10.1515/reveh-2015-0001.

15. Hensinger P, Wilke E. 2016. Mobilfunk-Studienergebnisse bestätigen Risiken Studienrecherche 2016-4 veröffentlicht. Umwelt Medizin Gesellshaft 29:3/2016.

16. Houston BJ, Nixon B, King BV, De Iuliis GN, Aitken RJ. 2016 The effects of radiofrequency electromagnetic radiation on sperm function. Reproduction 152:R263-R276.

17. Batista Napotnik T, Reberšek M, Vernier PT, Mali B, Miklavčič D. 2016 Effects of high voltage nanosecond electric pulses on eukaryotic cells (in vitro): A systematic review. Bioelectrochemistry. 2016 Aug;110:1-12. doi: 10.1016/j.bioelechem.2016.02.011.

18. Asghari A, Khaki AA, Rajabzadeh A, Khaki A. 2016 A review on Electromagnetic fields (EMFs) and the reproductive system. Electron Physician. 2016 Jul 25;8(7):2655-2662. doi: 10.19082/2655.

19. Pall ML. 2018 How cancer can be caused by microwave frequency electromagnetic field (EMF) exposures: EMF activation of voltage-gated calcium channels (VGCCs) can cause cancer including tumor promotion, tissue invasion and metastasis via 15 mechanisms. Chapter 7 in Mobile Communications and Public Health, Marko Markov, Ed., CRC press, pp 163-184.

20. Pall ML. 2018 Wi-Fi is an important threat to human health. Environ Res 164:404-416.

21. Wilke I. 2018 Biological and pathological effects of 2.45 GHz on cells, fertility, brain and behavior. Umwelt Medizin Gesselshaft 2018 Feb 31 (1).

Lowered fertility, including tissue remodeling changes in the testis, lowered sperm count and sperm quality, lowered female fertility including ovarian remodeling, oocyte (follicle) loss, lowered estrogen, progesterone and testosterone levels (that is sex hormone levels), increased spontaneous abortion incidence, lowered libido:

1. Glaser ZR, PhD. 1971 Naval Medical Research Institute Research Report, June 1971. Bibliography of Reported Biological Phenomena ("Effects") and Clinical Manifestations Attributed to Microwave and Radio-Frequency Radiation. Report No. 2 Revised. https://scholar.google.com/scholar?q=Glaser+naval+medical+microwave+radio-frequency+1972&btnG=&hl=en&as_sdt=0%2C38 (Accessed Sept. 9, 2017)

2. Tolgskaya MS, Gordon ZV. 1973. Pathological Effects of Radio Waves, Translated from Russian by B Haigh. Consultants Bureau, New York/London, 146 pages.

3. Goldsmith JR. 1997 Epidemiological evidence relevant to radar (microwave) effects. Environ Health Perspect 105(Suppl 6):1579-1587.

4. Aitken RJ, De Iuliis GN. 2007 Origins and consequences of DNA damage in male germ cells. Reprod Biomed Online 14:727-733.

5. Hazout A, Menezo Y, Madelenat P, Yazbeck C, Selva J, Cohen-Bacrie P. 2008 [Causes and clinical implications of sperm DNA damages]. Gynecol Obstet Fertil ;36:1109-1117.

6. Makker K, Varghese A, Desai NR, Mouradi R, Agarwal A. 2009 Cell phones: modern man's nemesis? Reprod Biomed Online 18:148-157.

7. Kang N, Shang XJ, Huang YF. 2010 [Impact of cell phone radiation on male reproduction]. Zhonghua Nan Ke Xue 16:1027-1030.

8. Gye MC, Park CJ. 2012 Effect of electromagnetic field exposure on the reproductive system. Clin Exp Reprod Med 39:1-9. doi.org/10.5653/cerm.2012.39.1.1

9. La Vignera S, Condorelli RA, Vicari E, D'Agata R, Calogero AE. 2012 Effects of the exposure to mobile phones on male reproduction: a review of the literature. J Androl 33:350-356.

10. Carpenter DO. 2013 Human disease resulting from exposure to electromagnetic fields. Rev Environ Health 2013;28:159-172.

11. Nazıroğlu M, Yüksel M, Köse SA, Özkaya MO. 2013 Recent reports of Wi-Fi and mobile phone-induced radiation on oxidative stress and reproductive signaling pathways in females and males. J Membr Biol 246:869-875.

12. Adams JA, Galloway TS, Mondal D, Esteves SC, Mathews F. 2014 Effect of mobile telephones on sperm quality: a systematic review and meta-analysis. Environ Int 70:106-112.

13. Liu K, Li Y, Zhang G, Liu J, Cao J, Ao L, Zhang S. 2014 Association between mobile phone use and semen quality: a systematic review and meta-analysis. Andrology 2:491-501.

14. K Sri N. 2015 Mobile phone radiation: physiological & pathophysiological considerations. Indian J Physiol Pharmacol 59:125-135.

15. Hensinger P, Wilke E. 2016. Mobilfunk-Studienergebnisse bestätigen Risiken Studienrecherche 2016-4 veröffentlicht. Umwelt Medizin Gesellshaft 29:3/2016.

16. Houston BJ, Nixon B, King BV, De Iuliis GN, Aitken RJ. 2016 The effects of radiofrequency electromagnetic radiation on sperm function. Reproduction 152:R263-R276

17. Pall ML. 2018 Wi-Fi is an important threat to human health. Environ Res 164:404-416.

18. Wilke I. 2018 Biological and pathological effects of 2.45 GHz on cells, fertility, brain and behavior. Umwelt Medizin Gesselshaft 2018 Feb 31 (1).

Neurological/neuropsychiatric effects:

1. Marha K. 1966 Biological Effects of High-Frequency Electromagnetic Fields (Translation). ATD Report 66-92. July 13, 1966 (ATD Work Assignment No. 78, Task 11). http://www.dtic.mil/docs/citations/AD0642029 (accessed March 12, 2018)

2. Glaser ZR, PhD. 1971 Naval Medical Research Institute Research Report, June 1971. Bibliography of Reported Biological Phenomena ("Effects") and Clinical Manifestations Attributed to Microwave and Radio-Frequency Radiation. Report No. 2 Revised. https://scholar.google.com/scholar?q=Glaser+naval+medical+microwave+radio-frequency+1972&btnG=&hl=en&as_sdt=0%2C38 (Accessed Sept. 9, 2017)

3. Tolgskaya MS, Gordon ZV. 1973. Pathological Effects of Radio Waves, Translated from Russian by by Haigh. Consultants Bureau, New York/London, 146 pages.

4. Bise W. 1978 Low power radio-frequency and microwave effects on human electroencephalogram and behavior. Physiol Chem Phys 10:387-398.

5. Raines, J. K. 1981. Electromagnetic Field Interactions with the Human Body: Observed Effects and Theories. Greenbelt, Maryland: National Aeronautics and Space Administration 1981; 116 p.

6. Frey AH. 1993 Electromagnetic field interactions with biological systems. FASEB J 7:272-281.

7. Lai H. 1994 Neurological effects of radiofrequency electromagnetic radiation. In: Advances in Electromagnetic Fields in Living Systems, Vol. 1, J.C. Lin, Ed., Plenum Press, New York, pp. 27-88.

8. Grigor'ev IuG. 1996 [Role of modulation in biological effects of electromagnetic radiation]. Radiats Biol Radioecol 36:659-670.

9. Lai, H 1998 Neurological effects of radiofrequency electromagnetic radiation. https://mapcruzin.com/radiofrequency/henry_lai2.htm.

10. Aitken RJ, De Iuliis GN. 2007 Origins and consequences of DNA damage in male germ cells. Reprod Biomed Online 14:727-733.

11. Hardell, L., Sage, C. 2008. Biological effects from electromagnetic field exposure and public exposure standards. Biomed. Pharmacother. 62, 104-109.

12. Makker K, Varghese A, Desai NR, Mouradi R, Agarwal A. 2009 Cell phones: modern man's nemesis? Reprod Biomed Online 18:148-157.

13. Khurana VG, Hardell L, Everaert J, Bortkiewicz A, Carlberg M, Ahonen M. 2010 Epidemiological evidence for a health risk from mobile phone base stations. Int J Occup Environ Health 16:263-267.

14. Levitt, B. B., Lai, H. 2010. Biological effects from exposure to electromagnetic radiation emitted by cell tower base stations and other antenna arrays. Environ. Rev. 18, 369-395. doi.org/10.1139/A10-018

15. Carpenter DO. 2013 Human disease resulting from exposure to electromagnetic fields. Rev Environ Health 2013;28:159-172.

16. Politański P, Bortkiewicz A, Zmyślony M. 2016 [Effects of radio- and microwaves emitted by wireless communication devices on the functions of the nervous system selected elements]. Med Pr 67:411-421.

17. Hensinger P, Wilke E. 2016. Mobilfunk-Studienergebnisse bestätigen Risiken Studienrecherche 2016-4 veröffentlicht. Umwelt Medizin Gesellshaft 29:3/2016.

18. Pall ML. 2016 Microwave frequency electromagnetic fields (EMFs) produce widespread neuropsychiatric effects including depression. J Chem Neuroanat 75(Pt B):43-51. doi: 10.1016/j.jchemneu.2015.08.001.

19. Hecht, Karl. 2016 Health Implications of Long-Term Exposures to Electrosmog. Brochure 6 of A Brochure Series of the Competence Initiative for the Protection of Humanity, the Environment and Democracy. http://kompetenzinitiative.net/KIT/wp-content/uploads/2016/07/KI_Brochure-6_K_Hecht_web.pdf (accessed Feb. 11, 2018)

20. Sangün Ö, Dündar B, Çömlekçi S, Büyükgebiz A. 2016 The Effects of Electromagnetic Field on the Endocrine System in Children and Adolescents. Pediatr Endocrinol Rev 13:531-545.

21. Belyaev I, Dean A, Eger H, Hubmann G, Jandrisovits R, Kern M, Kundi M, Moshammer H, Lercher P, Müller K, Oberfeld G, Ohnsorge P, Pelzmann P, Scheingraber C, Thill R. 2016 EUROPAEM EMF Guideline 2016 for the prevention, diagnosis and treatment of EMF-related health problems and illnesses. Rev Environ Health DOI 10.1515/reveh-2016-0011.

22. Zhang J, Sumich A, Wang GY. 2017 Acute effects of radiofrequency electromagnetic field emitted by mobile phone on brain function. Bioelectromagnetics 38:329-338. doi: 10.1002/bem.22052.

23. Lai H. 2018. A Summary of Recent Literature (2007–2017) on Neurological Effects of Radio Frequency Radiation. Chapter 8 in Mobile Communications and Public Health, Marko Markov, Ed., CRC press, pp 185-220.

24. Pall ML. 2018 Wi-Fi is an important threat to human health. Environ Res 164:404-416.

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Apoptosis/cell death (an important process in production of neurodegenerative diseases that is also important in producing infertility responses):

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3. Raines, J. K. 1981. Electromagnetic Field Interactions with the Human Body: Observed Effects and Theories. Greenbelt, Maryland: National Aeronautics and Space Administration 1981; 116 p.

4. Hardell L, Sage C. 2008. Biological effects from electromagnetic field exposure and public exposure standards. Biomed. Pharmacother. 62:104-109. doi: 10.1016/j.biopha.2007.12.004.

5. Makker K, Varghese A, Desai NR, Mouradi R, Agarwal A. 2009 Cell phones: modern man's nemesis? Reprod Biomed Online 18:148-157.

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7. Yakymenko I, Sidorik E. 2010 Risks of carcinogenesis from electromagnetic radiation and mobile telephony devices. Exp Oncol 32:729-736.

8. Yakimenko IL, Sidorik EP, Tsybulin AS. 2011 [Metabolic changes in cells under electromagnetic radiation of mobile communication systems]. Ukr Biokhim Zh (1999). 2011 Mar-Apr;83(2):20-28.

9. Pall, ML. 2013. Electromagnetic fields act via activation of voltage-gated calcium channels to produce beneficial or adverse effects. J Cell Mol Med 17:958-965. doi: 10.1111/jcmm.12088.

10. Pall ML. 2016 Microwave frequency electromagnetic fields (EMFs) produce widespread neuropsychiatric effects including depression. J Chem Neuroanat 75(Pt B):43-51. doi: 10.1016/j.jchemneu.2015.08.001.

11. Batista Napotnik T, Reberšek M, Vernier PT, Mali B, Miklavčič D. 2016 Effects of high voltage nanosecond electric pulses on eukaryotic cells (in vitro): A systematic review. Bioelectrochemistry. 2016 Aug;110:1-12. doi: 10.1016/j.bioelechem.2016.02.011.

12. Asghari A, Khaki AA, Rajabzadeh A, Khaki A. 2016 A review on Electromagnetic fields (EMFs) and the reproductive system. Electron Physician. 2016 Jul 25;8(7):2655-2662. doi: 10.19082/2655.

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Oxidative stress/free radical damage (important mechanisms involved in almost all chronic diseases; direct cause of cellular DNA damage):

1. Raines, J. K. 1981. Electromagnetic Field Interactions with the Human Body: Observed Effects and Theories. Greenbelt, Maryland: National Aeronautics and Space Administration 1981; 116 p.

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5. Desai NR, Kesari KK, Agarwal A. 2009 Pathophysiology of cell phone radiation: oxidative stress and carcinogenesis with focus on the male reproductive system. Reproduct Biol Endocrinol 7:114.

6. Yakymenko I, Sidorik E. 2010 Risks of carcinogenesis from electromagnetic radiation and mobile telephony devices. Exp Oncol 32:729-736.

7. Yakimenko IL, Sidorik EP, Tsybulin AS. 2011 [Metabolic changes in cells under electromagnetic radiation of mobile communication systems]. Ukr Biokhim Zh (1999). 2011 Mar-Apr;83(2):20-28.

8. Consales, C., Merla, C., Marino, C., et al. 2012. Electromagnetic fields, oxidative stress, and neurodegeneration. Int. J. Cell Biol. 2012: 683897.

9. LaVignera et al 2012 La Vignera S, Condorelli RA, Vicari E, D'Agata R, Calogero AE. 2012 Effects of the exposure to mobile phones on male reproduction: a review of the literature. J Androl 33:350-356.

10. Pall, ML. 2013. Electromagnetic fields act via activation of voltage-gated calcium channels to produce beneficial or adverse effects. J Cell Mol Med 17:958-965. doi: 10.1111/jcmm.12088.

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12. Pall, M. L. 2015. Scientific evidence contradicts findings and assumptions of Canadian Safety Panel 6: microwaves act through voltage-gated calcium channel activation to induce biological impacts at non-thermal levels, supporting a paradigm shift for microwave/lower frequency electromagnetic field action. Rev. Environ. Health 3, 99-116.

13. Yakymenko I, Tsybulin O, Sidorik E, Henshel D, Kyrylenko O, Kysylenko S. 2015 Oxidative mechanisms of biological activity of low-intensity radiofrequency radiation. Electromagnetic Biol Med: Early Online 1-16. ISSN: 1536-8378.

14. Hensinger P, Wilke E. 2016. Mobilfunk-Studienergebnisse bestätigen Risiken Studienrecherche 2016-4 veröffentlicht. Umwelt Medizin Gesellshaft 29:3/2016.

15. Houston BJ, Nixon B, King BV, De Iuliis GN, Aitken RJ. 2016 The effects of radiofrequency electromagnetic radiation on sperm function. Reproduction 152:R263-R276.

16. Dasdag S, Akdag MZ. 2016 The link between radiofrequencies emitted from wireless technologies and oxidative stress. J Chem Neuroanat 75(Pt B):85-93.

17. Wang H, Zhang X. 2017 Magnetic fields and reactive oxygen species. Int J Mol Sci. 2017 Oct 18;18(10). pii: E2175. doi: 10.3390/ijms18102175.

18. Pall ML. 2018 Wi-Fi is an important threat to human health. Environ Res 164:404-416.

19. Wilke I. 2018 Biological and pathological effects of 2.45 GHz on cells, fertility, brain and behavior. Umwelt Medizin Gesselshaft 2018 Feb 31 (1).

Endocrine, that is hormonal effects:

1. Glaser ZR, PhD. 1971 Naval Medical Research Institute Research Report, June 1971. Bibliography of Reported Biological Phenomena ("Effects") and Clinical Manifestations Attributed to Microwave and Radio-Frequency Radiation. Report No. 2 Revised. https://scholar.google.com/scholar?q=Glaser+naval+medical+microwave+radio-frequency+1972&btnG=&hl=en&as_sdt=0%2C38 (Accessed Sept. 9, 2017)

2. Tolgskaya MS, Gordon ZV. 1973. Pathological Effects of Radio Waves, Translated from Russian by B Haigh. Consultants Bureau, New York/London, 146 pages.

3. Raines, J. K. 1981. Electromagnetic Field Interactions with the Human Body: Observed Effects and Theories. Greenbelt, Maryland: National Aeronautics and Space Administration 1981; 116 p.

4. Hardell, L., Sage, C. 2008. Biological effects from electromagnetic field exposure and public exposure standards. Biomed. Pharmacother. 62, 104-109.

5. Makker K, Varghese A, Desai NR, Mouradi R, Agarwal A. 2009 Cell phones: modern man's nemesis? Reprod Biomed Online 18:148-157.

6. Gye MC, Park CJ. 2012 Effect of electromagnetic field exposure on the reproductive system. Clin Exp Reprod Med 39:1-9. doi.org/10.5653/cerm.2012.39.1.1

7. Pall, M. L. 2015. Scientific evidence contradicts findings and assumptions of Canadian Safety Panel 6: microwaves act through voltage-gated calcium channel activation to induce biological impacts at non-thermal levels, supporting a paradigm shift for microwave/lower frequency electromagnetic field action. Rev. Environ. Health 3, 99-116.

8. Sangün Ö, Dündar B, Çömlekçi S, Büyükgebiz A. 2016 The Effects of Electromagnetic Field on the Endocrine System in Children and Adolescents. Pediatr Endocrinol Rev 13:531-545.

9. Hecht, Karl. 2016 Health Implications of Long-Term Exposures to Electrosmog. Brochure 6 of A Brochure Series of the Competence Initiative for the Protection of Humanity, the Environment and Democracy. http://kompetenzinitiative.net/KIT/wp-content/uploads/2016/07/KI_Brochure-6_K_Hecht_web.pdf (accessed Feb. 11, 2018)

10. Asghari A, Khaki AA, Rajabzadeh A, Khaki A. 2016 A review on Electromagnetic fields (EMFs) and the reproductive system. Electron Physician. 2016 Jul 25;8(7):2655-2662. doi: 10.19082/2655.

11. Pall ML. 2018 Wi-Fi is an important threat to human health. Environ Res 164:404-416.

12. Wilke I. 2018 Biological and pathological effects of 2.45 GHz on cells, fertility, brain and behavior. Umwelt Medizin Gesselshaft 2018 Feb 31 (1).

Increased intracellular calcium: intracellular calcium is maintained at very low levels (typically about 2 X 10-9 M) except for brief increases used to produce regulatory responses, such that sustained elevation of intracellular calcium levels produces many pathophysiological (that is disease-causing) responses).

1. Adey WR. 1988 Cell membranes: the electromagnetic environment and cancer promotion. Neurochem Res.13:671-677.

2. Walleczek, J. 1992. Electromagnetic field effects on cells of the immune system: the role of calcium signaling. FASEB J. 6, 3177-3185.

3. Adey, WR. 1993 Biological effects of electromagnetic fields. J Cell Biochem 51:410-416.

4. Frey AH. 1993 Electromagnetic field interactions with biological systems. FASEB J 7:272-281.

5. Funk RHW, Monsees T, Özkucur N. 2009 Electromagnetic effects—Form cell biology to medicine. Prog Histochem Cytochem 43:177-264.

6. Yakymenko IL, Sidorik EP, Tsybulin AS. 1999 [Metabolic changes in cells under electromagnetic radiation of mobile communication systems]. Ukr Biokhim Zh (1999), 2011 Mar-Apr:20-28.

7. Gye MC, Park CJ. 2012 Effect of electromagnetic field exposure on the reproductive system. Clin Exp Reprod Med 39:1-9. doi.org/10.5653/cerm.2012.39.1.1

8. Pall, ML. 2013. Electromagnetic fields act via activation of voltage-gated calcium channels to produce beneficial or adverse effects. J Cell Mol Med 17:958-965. doi: 10.1111/jcmm.12088.

9. Pall ML. 2014 Electromagnetic field activation of voltage-gated calcium channels: role in therapeutic effects. Electromagn Biol Med. 2014 Apr 8 doi: 10.3109/15368378.2014.906447.

10. Pall ML. 2015 How to approach the challenge of minimizing non-thermal health effects of microwave radiation from electrical devices. International Journal of Innovative Research in Engineering & Management (IJIREM) ISSN: 2350-0557, Volume-2, Issue -5, September 2015; 71-76.

11. Pall, M. L. 2015 Scientific evidence contradicts findings and assumptions of Canadian Safety Panel 6: microwaves act through voltage-gated calcium channel activation to induce biological impacts at non-thermal levels, supporting a paradigm shift for microwave/lower frequency electromagnetic field action. Rev. Environ. Health 3, 99-116. doi: 10.1515/reveh-2015-0001.

12. Pall ML. 2016 Electromagnetic fields act similarly in plants as in animals: Probable activation of calcium channels via their voltage sensor. Curr Chem Biol 10: 74-82.

13. Pall ML. 2016 Microwave frequency electromagnetic fields (EMFs) produce widespread neuropsychiatric effects including depression. J Chem Neuroanat 75(Pt B):43-51. doi: 10.1016/j.jchemneu.2015.08.001.

14. Batista Napotnik T, Reberšek M, Vernier PT, Mali B, Miklavčič D. 2016 Effects of high voltage nanosecond electric pulses on eukaryotic cells (in vitro): A systematic review. Bioelectrochemistry. 2016 Aug;110:1-12. doi: 10.1016/j.bioelechem.2016.02.011.

15. Asghari A, Khaki AA, Rajabzadeh A, Khaki A. 2016 A review on electromagnetic fields (EMFs) and the reproductive system. Electron Physician. 2016 Jul 25;8(7):2655-2662. doi: 10.19082/2655.

Pulsed EMFs are, in most cases much more biologically active than are non-pulsed EMFs. *This is important because all wireless communication devices communicate via pulsations and because the "smarter" the devices are, the more they pulse because the pulsations convey the information. What should be obvious is that you cannot study such pulsation roles if there were no biological effects produced by such EMFs. The pulsation studies alone tell us that there are many such EMF effects.*

1. Osipov YuA, 1965 [Labor hygiene and the effect of radiofrequency electromagnetic fields on workers]. Leningrad Meditsina Publishing House, 220 pp.

2. Pollack H, Healer J. 1967 Review of Information on Hazards to Personnel from High-Frequency Electromagnetic Radiation. Institute for Defense Analyses; Research and Engineering Support Division. IDA/HQ 67-6211, Series B, May 1967.

3. Frey AH. 1974 Differential biologic effects of pulsed and continuous electromagnetic fields and mechanisms of effect. Ann N Y Acad Sci 238: 273-279.

4. Creighton MO, Larsen LE, Stewart-DeHaan PJ, Jacobi JH, Sanwal M, Baskerville JC, Bassen HE, Brown DO, Trevithick JR. 1987 In vitro studies of microwave-induced cataract. II. Comparison of damage observed for continuous wave and pulsed microwaves. Exp Eye Res 45:357-373.

5. Grigor'ev IuG. 1996 [Role of modulation in biological effects of electromagnetic radiation]. Radiats Biol Radioecol 36:659-670.

6. Belyaev I. 2005 Non-thermal biological effects of microwaves. Microwave Rev 11:13-29.

7. Belyaev I. 2005 Non-thermal biological effects of microwaves: current knowledge, further perspective and urgent needs. Electromagn Biol Med 24(3):375-403.

8. Markov MS. 2007 Pulsed electromagnetic field therapy: History, state of the art and future. The Environmentalist 27:465-475.

9. Van Boxem K, Huntoon M, Van Zundert J, Patijn J, van Kleef M, Joosten EA. 2014 Pulsed radiofrequency: a review of the basic science as applied to the pathophysiology of radicular

pain: a call for clinical translation. Reg Anesth Pain Med. 2014 Mar-Apr;39(2):149-59.

10. Belyaev, I. 2015. Biophysical mechanisms for nonthermal microwave effects. In: Electromagnetic Fields in Biology and Medicine, Marko S. Markov, ed, CRC Press, New York, pp 49-67.

11. Pall, M. L. 2015 Scientific evidence contradicts findings and assumptions of Canadian Safety Panel 6: microwaves act through voltage-gated calcium channel activation to induce biological impacts at non-thermal levels, supporting a paradigm shift for microwave/lower frequency electromagnetic field action. Rev. Environ. Health 3, 99-116. doi: 10.1515/reveh-2015-0001.

12. Panagopoulos DJ, Johansson O, Carlo GL. 2015 Real versus simulated mobile phone exposures in experimental studies. BioMed. Res. Int. 2015, article ID 607053, 8 pages. doi: 10.1155/2015/607053.

13. Batista Napotnik T, Reberšek M, Vernier PT, Mali B, Miklavčič D. 2016 Effects of high voltage nanosecond electric pulses on eukaryotic cells (in vitro): A systematic review. Bioelectrochemistry. 2016 Aug;110:1-12. doi: 10.1016/j.bioelechem.2016.02.011.

Cancer causation by EMF exposures:

1. Dwyer, M. J., Leeper, D. B. 1978 A Current Literature Report on the Carcinogenic Properties of Ionizing and Nonionizing Radiation. DHEW Publication (NIOSH) 78-134, March 1978.

2. Marino AA, Morris DH. 1985 Chronic electromagnetic stressors in the environment. A risk factor in human cancer. J environ sci health C3:189-219.

3. Adey WR. 1988 Cell membranes: the electromagnetic environment and cancer promotion. Neurochem Res.13:671-677.

4. Adey WR. 1990 Joint actions of environmental nonionizing electromagnetic fields and chemical pollution in cancer promotion. Environ Health Perspect 86:297-305.

5. Frey AH. 1993 Electromagnetic field interactions with biological systems. FASEB J 7:272-281.

6. Goldsmith JR. 1995 Epidemiological evidence of radiofrequency radiation (microwave) effects on health in military, broadcasting and occupational settings. Int J Occup Environ Health 1:47-57.

7. Goldsmith JR. 1997 Epidemiologic evidence relevant to radar (microwave) effects. Env Health Perspect 105(Suppl 6):1579-1587.

8. Kundi M, Mild K, Hardell L, Mattsson M. 2004 Mobile telephones and cancer – a review of the epidemiological evidence. J Toxicol Env Health, Part B 7:351-384.

9. Kundi M. 2004 Mobile phone use and cancer. Occup Env Med 61:560-570.

10. Behari J, Paulraj R. 2007 Biomarkers of induced electromagnetic field and cancer. Indian J Exp Biol 45:77-85.

11. Hardell L, Carlberg M, Soderqvist F, Hansson Mild K. 2008 Meta-analysis of long-term mobile phone use and the association with brain tumors. Int J Oncol 32:1097-1103.

12. Khurana VG, Teo C, Kundi M, Hardell L, Carlberg M. 2009 Cell phones and brain tumors: a review including the long-term epidemiologic data. Surg Neurol 72:205-214.

13. Desai NR, Kesari KK, Agarwal A. 2009 Pathophysiology of cell phone radiation: oxidative stress and carcinogenesis with focus on the male reproductive system. Reproduct Biol Endocrinol 7:114.

14. Davanipour Z, Sobel E. 2009 Long-term exposure to magnetic fields and the risks of Alzheimer's disease and breast cancer: Further biological research. Pathophysiology 16:149-156.

15. Yakymenko I, Sidorik E. 2010 Risks of carcinogenesis from electromagnetic radiation and mobile telephony devices. Exp Oncol 32:729-736.

16. Carpenter DO. 2010 Electromagnetic fields and cancer: the cost of doing nothing. Rev Environ Health 25:75-80.

17. Giuliani L, Soffriti M (Eds). 2010 NON-THERMAL EFFECTS AND MECHANISMS OF INTERACTION BETWEEN ELECTROMAGNETIC FIELDS AND LIVING MATTER, RAMAZZINI INSTITUTE EUR. J. ONCOL. LIBRARY Volume 5, National Institute for the Study and Control of Cancer and Environmental Diseases "Bernardino Ramazzini" Bologna, Italy 2010, 400 page monograph.

18. Khurana, V. G., Hardell, L., Everaert, J., Bortkiewicz, A., Carlberg, M., Ahonen, M. 2010 Epidemiological evidence for a health risk from mobile phone base stations. Int. J. Occup. Environ. Health 16, 263-267.

19. Yakymenko, I., Sidorik, E., Kyrylenko, S., Chekhun, V. 2011. Long-term exposure to microwave radiation provokes cancer growth: evidences from radars and mobile communication systems. Exp. Oncol. 33(2), 62-70.

20. Biointiative Working Group, David Carpenter and Cindy Sage (eds). 2012 Bioinitiative 2012: A rationale for biologically-based exposure standards for electromagnetic radiation. http://www.bioinitiative.org/participants/why-we-care/

21. Ledoigt G, Belpomme D. 2013 Cancer induction molecular pathways and HF-EMF irradiation. Adv Biol Chem 3:177-186.

22. Hardell L, Carlberg M. 2013 Using the Hill viewpoints from 1965 for evaluating strengths of evidence of the risk for brain tumors associated with use of mobile and cordless phones. Rev Environ Health 28:97-106. doi: 10.1515/reveh-2013-0006.

23. Hardell L, Carlberg M, Hansson Mild K. 2013 Use of mobile phones and cordless phones is associated with increased risk for glioma and acoustic neuroma. Pathophysiology 2013;20(2):85-110.

24. Carpenter DO. 2013 Human disease resulting from exposure to electromagnetic fields. Rev Environ Health 2013;28:159-172.gj

25. Davis DL, Kesari S, Soskolne CL, Miller AB, Stein Y. 2013 Swedish review strengthens grounds for concluding that radiation from cellular and cordless phones is a probable human carcinogen. Pathophysiology 20:123-129.

26. Morgan LL, Miller AB, Sasco A, Davis DL. 2015 Mobile phone radiation causes brain tumors and should be classified as a probable human carcinogen (2A). Int J Oncol 46(5): 1865-1871.

27. Mahdavi M, Yekta R, Tackallou SH. 2015 Positive correlation between ELF and RF electromagnetic fields on cancer risk. J Paramed Sci 6(3), ISSN 2008-4978.

28. Carlberg M, Hardell L. 2017 Evaluation of Mobile Phone and Cordless Phone Use and Glioma Risk Using the Bradford Hill Viewpoints from 1965 on Association or Causation. BioMed Res Int 2017, Article ID 9218486, https://doi.org/10.1155/2017/9218486

29. Bortkiewicz A, Gadzicka E, Szymczak W. 2017 Mobile phone use and risk for intracranial tumors and salivary gland tumors - A meta-analysis. Int J Occup Med Environ Health 30:27-43.

30. Bielsa-Fernández P, Rodríguez-Martín B. 2017 [Association between radiation from mobile phones and tumour risk in adults]. Gac Sanit. 2017 Apr 12. pii: S0213-9111(17)30083-3. doi: 10.1016/j.gaceta.2016.10.014. [Epub ahead of print]

31. Alegría-Loyola MA, Galnares-Olalde JA, Mercado M. 2017 [Tumors of the central nervous system]. Rev Med Inst Mex Seguro Soc 55:330-334.

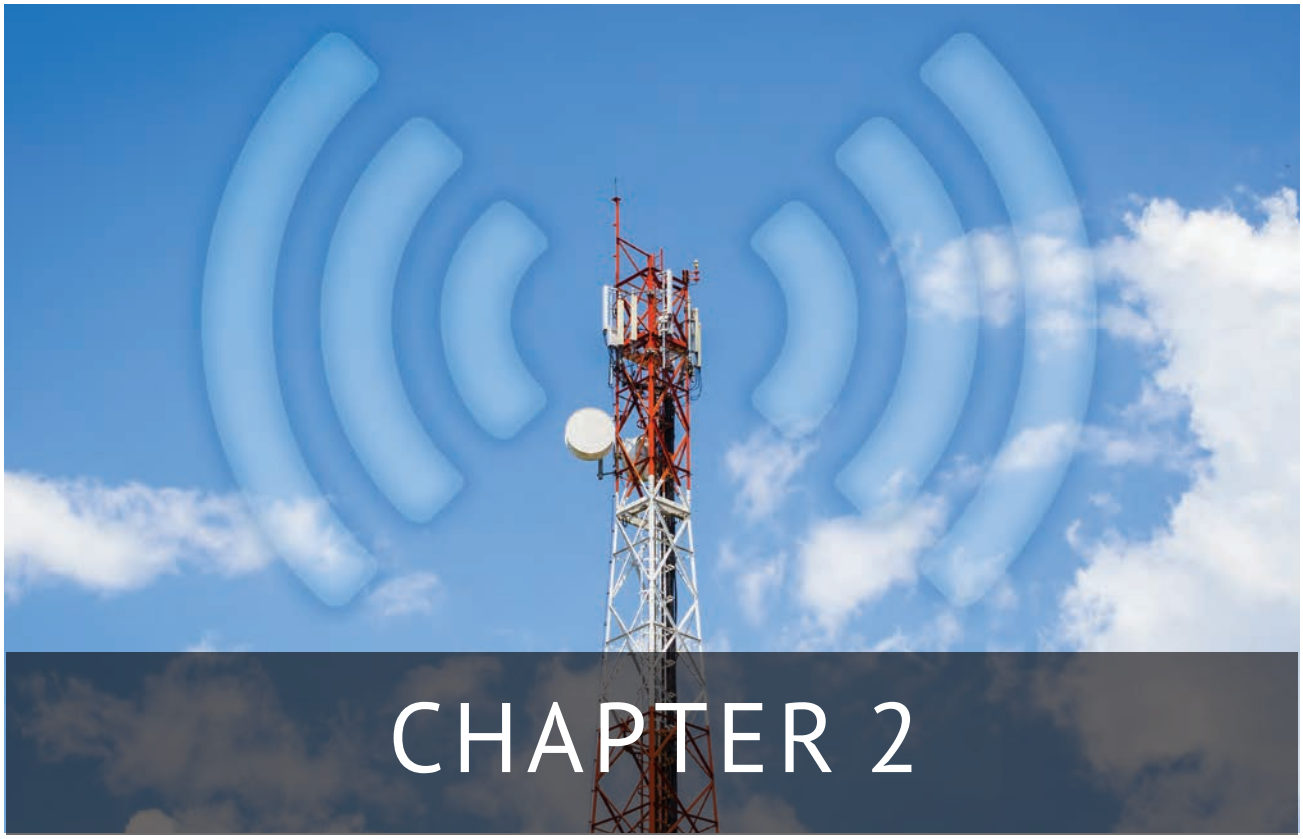
32. Prasad M, Kathuria P, Nair P, Kumar A, Prasad K. 2017 Mobile phone use and risk of brain tumours: a systematic review of association between study quality, source of funding, and research outcomes. Neurol Sci. 2017 Feb 17. doi: 10.1007/s10072-017-2850-8. [Epub ahead of print].

33. Miller A. 2017 References on cell phone radiation and cancer. https://ehtrust.org/references-cell-phone-radio-frequency-radiation-cancer/ (Accessed Sept. 9, 2017)

34. Hardell L. 2017 World Health Organization, radiofrequency radiation and health – a hard nut to crack (Review). Int J Oncol 51:405-413.

35. Pall ML. 2018 How cancer can be caused by microwave frequency electromagnetic field (EMF) exposures: EMF activation of voltage-gated calcium channels (VGCCs) can cause cancer including tumor promotion, tissue invasion and metastasis via 15 mechanisms. Chapter 7 in: Mobile Communications and Public Health, Marko Markov, Ed., CRC Press, pp 163-184.

Each of these reviews, typically cite from 5 to over 100 primary literature citations, each showing that non-thermal EMF exposures produce the effect under which they are listed. It follows from this, that there are not only 11 or more reviews documenting each of these effects, but there is also a massive primary literature documenting these effects as well. It follows from this that the ICNIRP, FCC and International Safety Guidelines, which are entirely based only on thermal effects are inadequate and there have been petitions and other statements of international groups of scientists expressing great concern about this. *It follows that the ICNIRP, FCC and International safety guidelines are completely unscientific and cannot be relied upon to protect our safety.*



CHAPTER 2

How Each Such EMF Effect Is Produced via Voltage-Gated Calcium Channel Activation: Role of the Voltage Sensor in Producing the Extraordinary Sensitivity to EMF Effects

The Pall, 2013 [4] study showed that in 24 different studies (there are now a total of 26 [5]), effects of low-intensity EMFs, both microwave frequency and also lower frequency EMFs, could be blocked by calcium channel blockers, drugs that are specific for blocking voltage-gated calcium channels (VGCCs). There were 5 different types of calcium channel blockers used in these studies each thought to be highly specific, each structurally distinct and each binding to a different site on the VGCCs. *In studies where multiple effects were studied, all studied effects were blocked or greatly lowered by calcium channel blockers.* These studies show that EMFs produce diverse non-thermal effects via VGCC activation in many human and animal cells and even in plant cells where some similar calcium channels are involved [6]. Furthermore, many different effects shown to be produced in repeated studies by EMF exposures, including the effects discussed above, can each be produced by downstream effects of VGCC activation, via increased intracellular calcium [Ca2+]i, as discussed below.

Various EMFs act via VGCC activation, as shown by calcium channel blocker studies. These include microwave frequency EMFs, nanosecond pulse EMFs, intermediate

frequency EMFs, extremely low frequency EMFs and even static electrical fields and static magnetic fields.

It is important to discuss why the VGCCs are so sensitive to activation by these low-intensity EMFs. Each of the VGCCs have a voltage sensor which is made up of 4 alpha helixes, each designated as an S4 helix, in the plasma membrane. Each of these S4 helixes has 5 positive charges on it, for a total of 20 positive charges making up the VGCC voltage sensor [5,8]. Each of these charges is within the lipid bilayer part of the plasma membrane. The electrical forces on the voltage sensor are extraordinarily high for three distinct reasons [5,8]. 1. The 20 charges on the voltage sensor make the forces on voltage sensor 20 times higher than the forces on a single charge. 2. Because these charges are within the lipid bilayer section of the membrane where the dielectric constant is about 1/120th of the dielectric constant of the aqueous parts of the cell, the law of physics called Coulomb's law, predicts that the forces will be approximately 120 times higher than the forces on charges in the aqueous parts of the cell. 3. Because the plasma membrane has a high electrical resistance whereas the aqueous parts of the cell are highly conductive, the electrical gradient across the plasma membrane is estimated to be concentrated about 3000-fold. The combination of these factors means that comparing the forces on the voltage sensor with the forces on singly charged groups in the aqueous parts of the cell, the forces on the voltage sensor are approximately 20 X 120 X 3000 = 7.2 million times higher [5,8]. The physics predicts, therefore, extraordinarily strong forces activating the VGCCs via the voltage sensor. It follows that the biology tells us that the VGCCs are the main target of the EMFs and the physics tells us why they are the main target. *Thus the physics and biology are pointing in exactly the same direction.*

We have, then, very strong arguments that the EMFs act directly on the voltage-sensor to activate the VGCCs. There are several other types of evidence, each providing important evidence supporting this view:

1. In a study published by Pilla [12], it was found that pulsed EMFs produced an "instantaneous" increase in calcium/calmodulin-dependent nitric oxide synthesis in cells in culture. What this study [12] showed was that following EMF exposure, the cells in culture, must have produced a large increase in [Ca2+]i, this in turn produced a large increase in nitric oxide synthesis, the nitric oxide diffused out of the cells and out of the aqueous medium above the cells into the gas phase, where the nitric oxide was detected by a nitric oxide electrode. This entire sequence occurred in less than 5 seconds. This eliminates almost any conceivable indirect effect, except possibly via plasma membrane depolarization. Therefore, it is likely that the pulsed EMFs are

acting directly on the voltage sensors of the VGCCs and possibly the voltage-gated sodium channels, to produce the [Ca2+]i increase.

2. There are also additional findings pointing to the voltage sensor as the direct target of the EMFs. In addition to the VGCCs, there are also voltage-gated sodium, potassium and chloride channels, with each of these having a voltage sensor similar to those found in the VGCCs. Lu et al [13] reported that voltage gated sodium channels, in addition to the VGCCs were activated by EMFs. Tabor et al [14] found that Mauthner cells, specialized neurons with special roles in triggering rapid escape mechanisms in fish, were almost instantaneously activated by electrical pulses, which acted via voltage-gated sodium channel activation to subsequently produce large [Ca2+]i increases. Zhang et al [15] reported that in addition to the VGCCs, potassium and chloride channels were each activated by EMFs, although these other voltage-gated ion channels had relatively modest roles, compared with the VGCCs, in producing biological effects. Each of these three studies [13-15] used specific blockers for these other voltage-gated ion channels to determine their roles. The Tabor et al [14] study also used genetic probing to determine the role of the voltage-gated sodium channels. Lu et al [13] also used whole cell patch clamp measurements to measure the rapid influx of both sodium and calcium into the cell via the voltage-gated channels following EMF exposure. Sodium influx, particularly in electrically active cells, acts in the normal physiology to depolarize the plasma membrane, leading to VGCC activation such that the voltage-gated sodium channels may act primarily via indirect activation of the VGCCs. In summary then, we have evidence that in animal including human cells, seven distinct classes of voltage-gated ion channels are each activated by EMF exposures: From Ref. [4], four classes of voltage-gated ion channels were shown from calcium channel blocker studies, to be activated by EMFs, L-type, T-type, N-type and P/Q –type VGCCs. In this paragraph we have evidence that three other channels are also activated, voltage-gated sodium channels, voltage-gated potassium channels and voltage-gated chloride channels. Furthermore the plant studies strongly suggest that the so called TPC channels, which contain a similar voltage sensor, are activated in plants allowing calcium influx into plants to produce similar EMF-induced responses [6]. In summary, then we have evidence for eight different ion channels being activated by EMF exposure, four classes of VGCCs, one class each of voltage-gated sodium, potassium and chloride channels and also one class of plant channel, with each of these channels having a similar voltage-sensor regulating its opening. One can put those observations together with the powerful findings from the physics, that the electrical forces on the voltage-sensor are stunningly strong, something like 7.2

million times stronger than the forces on the singly charged groups in the aqueous phases of the cell. Now you have a stunningly powerful argument that the voltage sensor is the predominant direct target of the EMFs.

3. The most important study on this subject, was published by Tekieh et al [16]. It showed that microwave frequency EMFs directly activate the VGCCs in isolated membranes. A variety of microwave frequencies were used in these studies and each such frequency produced VGCC activation in a completely cell-free system. This study clearly shows that the EMF activation of the VGCCs is direct and not due to some indirect regulatory effect.

How then does the estimated sensitivity of the voltage-sensor, about 7.2 million times greater forces than the forces on singly charged groups, compare with previous estimates of levels of EMF exposure needed to produce biological effects? The ICNIRP 2009 [17] safety guidelines allowed for 2 to 10 W/m2 exposure, depending upon frequency. In contrast, the Bioinitiative Working Group 2007 [18] proposed a precautionary target level of 3 to 6 W/m2 or about a million-fold lower, using a safety factor of 10. If one uses a more commonly used safety factor of 50 to 100, then the 7.2 million-fold sensitivity of the voltage-sensor, predicted by the physics, falls right in the middle of the Bioinitiative Working Group 2007 calculations. So again, it can be argued that the physics and the biology are pointing in the same direction, in this case pointing to the same approximate range of sensitivity.

You may be wondering why I am spending so much time and space going through each of these studies. The answer is that a well over a trillion dollar (or trillion euro) set of industries, the telecommunications industry, has been putting out propaganda for over two decades, arguing that there cannot be a mechanism of action of these non-thermal EMFs to produce biological effects; and that these EMFs are too weak to do anything and that only thermal effects are documented. It is essential to dot every i and cross every t with regard to the main mechanism of action of non-thermal effects. That is exactly what has been done here.

How Can the Diverse Effects of Such EMF Exposures Be Produced by VGCC Activation?

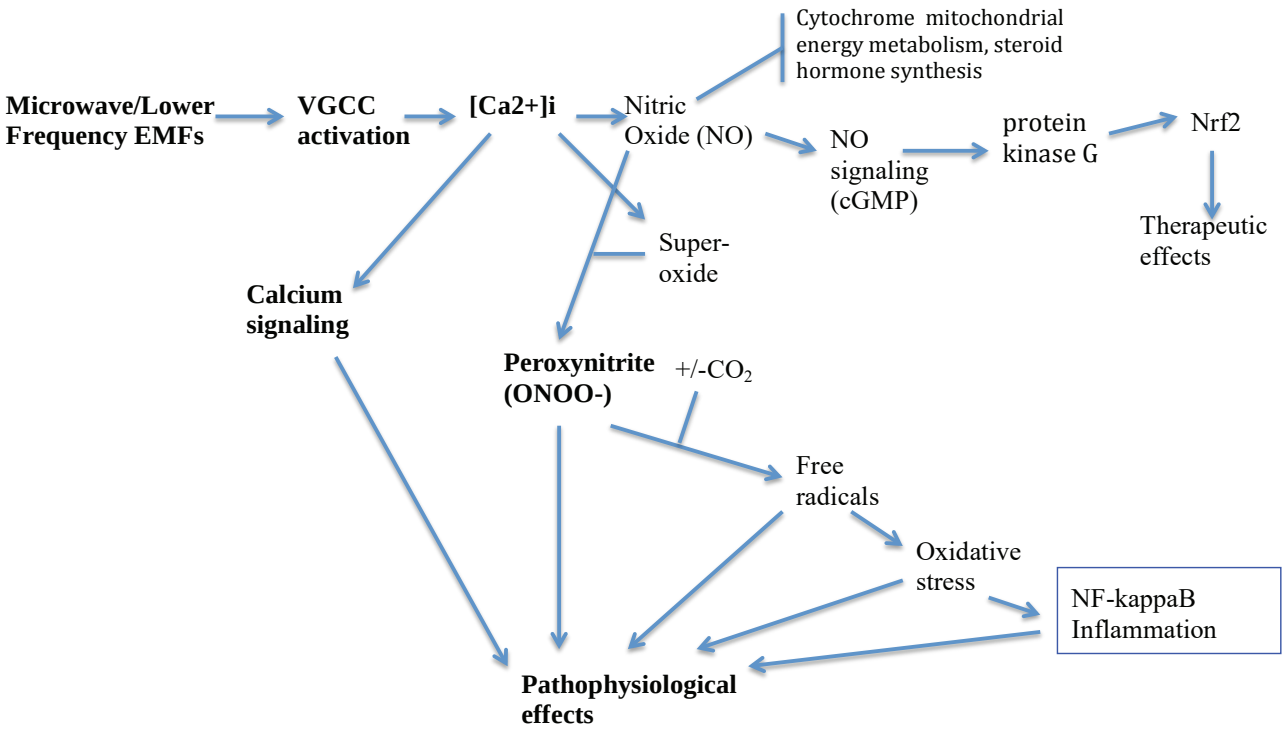


Fig. 1 How EMFs Act via VGCC Activation to Produce Various Effects

The mechanisms by which various effects can be generated by VGCC activation are outlined in Fig. 1. Going across the top of Fig. 1, it can be seen that increased intracellular calcium [Ca2+]i can increase nitric oxide (NO) synthesis, stimulating the NO signaling pathway (going to the right from top, center), to produce therapeutic effects. NO (very top) can also bind to cytochromes and inhibit their activity. NO binding to the terminal oxidase in the mitochondria inhibits energy metabolism and lowers, therefore, ATP. NO binding to cytochrome P450s, lowers synthesis of steroid hormones, including estrogen, progesterone and testosterone. The P450 lowering also lowers detoxification and vitamin D activity. Most of the pathophysiological effects are produced by the peroxynitrite/free radical/oxidative stress pathway center to lower right (Fig. 1) and also by excessive calcium signaling pathway (slightly left of center, Fig. 1). Some of the ways these are thought to produce various well-established EMF effects are outlined in Table 1.

Table 1. How Eight Established Effects of EMFs Can Be Produced by VGCC Activation

EMF effect	Probable mechanism(s)
Oxidative stress	Produced by elevated levels of peroxynitrite and the free radical breakdown products of peroxynitrite and its CO_2 adduct. Four studies of EMF exposure, cited in [4] showed that oxidative stress following exposure was associated with major elevation of 3-nitrotyrosine, a marker of peroxynitrite, thus confirming this interpretation. Two other studies each found 3-nitrotyrosine elevation, both following 35 GHz exposures [19,20].
Lowered male/ female fertility, elevated spontaneous abortion, lowered libido	Both the lowered male fertility and lowered female fertility are associated with and presumably caused by the oxidative stress in the male and female reproductive organs. Spontaneous abortion is often caused by chromosomal mutations, so the germ line mutations may have a causal role. Lowered libido may be caused by lowered estrogen, progesterone and testosterone levels. It seems likely that these explanations may be oversimplified. One additional mechanism that may be important in producing lowered fertility is that VGCC activation and consequent high [Ca2+]i levels is known to have a key role in avoiding polyspermy. Consequently, if this response is triggered before any fertilization of an egg has occurred, it may prevent any sperm from fertilizing and egg.
Neurological/ neuropsychiatric effects	Of all cells in the body, the neurons have the highest densities of VGCCs, due in part to the VGCC role and [Ca2+]i role in the release of every neurotransmitter in the nervous system. Calcium signaling regulates synaptic structure and function in 5 different ways, each likely to be involved here. Oxidative stress and apoptosis are both thought to have important roles. Lowered sleep and increased fatigue are likely to involve lowered nocturnal melatonin and increased nocturnal norepinephrine.
Apoptosis	Apoptosis can be produced by excessive Ca2+ levels in the mitochondria and by double strand breaks in cellular DNA; it seems likely that both of these mechanisms are involved following EMF exposure. A third mechanism for triggering apopotosis, endoplasmic reticulum stress (see bottom row in this Table), may also be involved.
Cellular DNA damage	Cellular DNA damage is produced by the free radical breakdown products of peroxynitrite directly attacking the DNA [7].
Changes in non-steroid hormone levels	The release of non-steroid hormones is produced by VGCC activation and [Ca2+]i elevation. The immediate effects of EMF exposures is to increase hormone release and to raise, therefore, hormone levels. However many hormone systems become "exhausted" as a consequence of chronic EMF exposures. The mechanism of exhaustion is still uncertain, but it may involve oxidative stress and inflammation.
Lowered steroid hormone	Steroid hormones are synthesized through the action of cytochrome P450 enzymes; activity of these hormones is inhibited by binding of high levels of nitric oxide (NO) leading to lowered hormone synthesis.

EMF effect	Probable mechanism(s)
Calcium overload	Produced by excessive activity of the VGCCs; secondary calcium overload is produced by oxidative stress activation of TRPV1, TRPM2 and possibly some other TRP receptors, opening the calcium channel of these receptors.
Heat shock protein induction	There is a large literature showing that excessive [Ca2+]i induces very large increases in heat shock proteins. This is thought to be produced by complex calcium signaling changes involving the endoplasmic reticulum, mitochondria and the cytosol and also involving excessive [Ca2+]i producing increasing protein misfolding [21-23]. It should be noted that some calcium is essential for proper protein folding in the endoplasmic reticulum such that only excessive calcium leads to misfolding and consequent endoplasmic reticulum stress.

Each of the seven established EMF effects, discussed above, can be generated through the mechanisms outlined in Fig. 1, as shown by Table 1. An eighth, heat shock protein induction can also be so explained (Table 1). Several other such effects, including EMF causation of cataracts, breakdown of the blood-brain barrier, lowered nocturnal melatonin are also so explained, as discussed earlier [5]. The primary mechanism for therapeutic effects was discussed in [4,24,25] and was also shown to be generated via such VGCC downstream effects. Fifteen mechanisms for EMF cancer causation are described in ref [7]; these are far too complex to describe in this document so the reader is referred to ref [7].

It can be seen, in summary, that we are far beyond the issue whether there are non-thermal EMF effects. Rather many researchers have identified many established effects of EMF exposure. The main direct targets of non-thermal EMF exposure, the VGCCs have also been identified and how these get activated by EMF exposure acting on the VGCC voltage-sensor has also been determined. And finally we have identified how a wide variety of these effects can be generated via downstream effects produced by such VGCC activation.

Our current safety guidelines are based only on heating (thermal) effects. Heating is produced predominantly by forces on singly charged groups in the aqueous phases of the cell but the forces on the voltage sensor are approximately 7.2 million times higher. Therefore, our current safety guidelines are allowing us to be exposed to EMFs that are approximately 7.2 million times too strong. That 7.2 million figure is somewhat similar to the estimate given by the Bioinitiative Report and by the Building Biologists, based on completely different considerations.

It should be obvious, that non-thermal EMFs:

1. Attack our nervous systems including our brains leading to widespread

neuropsychiatric effects and possibly many other effects. This nervous system attack is of great concern.

2. Attack our endocrine (that is hormonal) systems. In this context, the main things that make us functionally different from single celled creatures are our nervous system and our endocrine systems – even a simple planaria worm needs both of these. Thus the consequences of the disruption of these two regulatory systems is immense, such that it is a travesty to ignore these findings.

3. Produce oxidative stress and free radical damage, which have central roles in all common chronic diseases.

4. Attack the DNA of our cells, producing single strand and double strand breaks in cellular DNA and oxidized bases in our cellular DNA. These in turn produce both cancer and mutations in germ line cells with germ line mutations producing mutations impacting future generations.

5. Produce elevated levels of apoptosis (programmed cell death), events especially important in causing both neurodegenerative diseases and infertility.

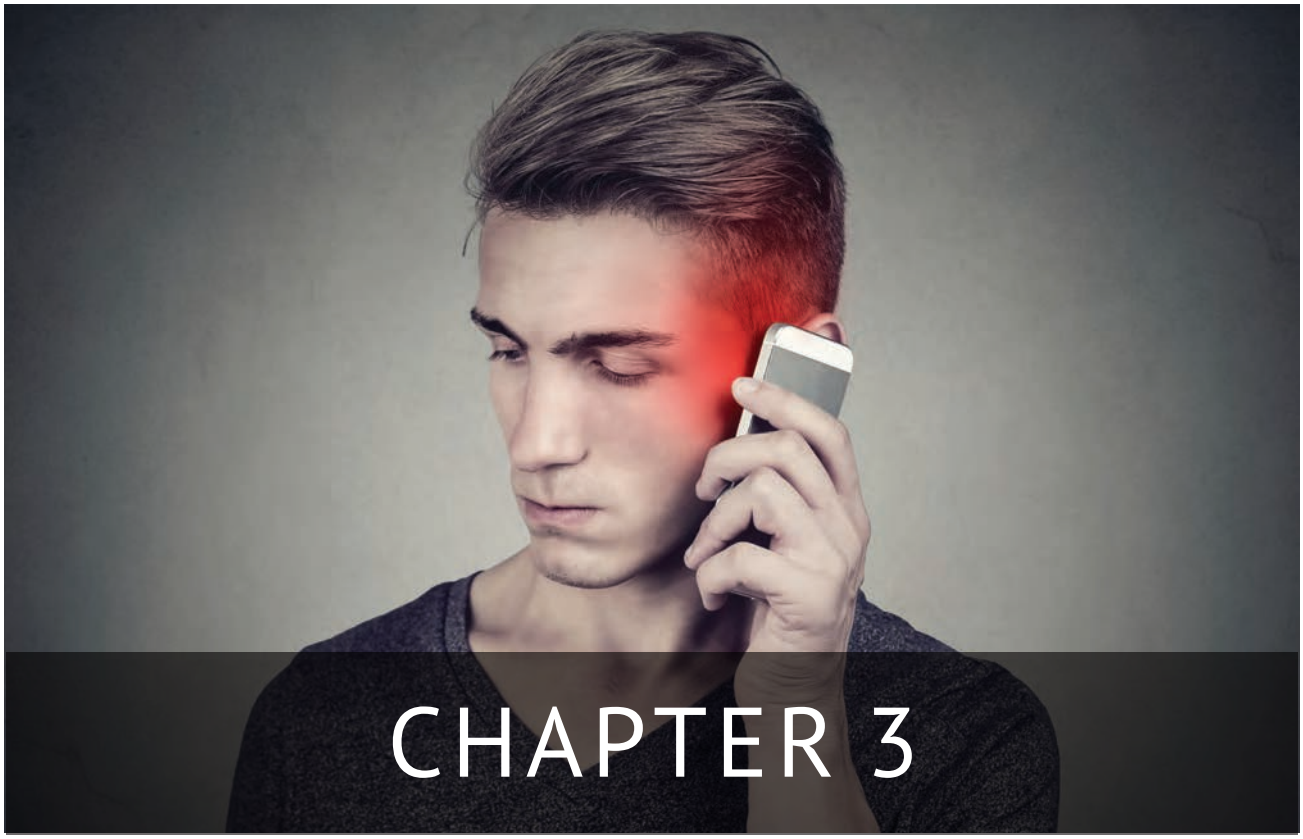
6. Lower male and female fertility, lowered sex hormones, lowered libido, increased levels of spontaneous abortion and, as already stated, attacks on the DNA in sperm cells.

7. Produce excessive intracellular calcium [Ca2+]i and increased calcium signaling.

8. Act in the cells of our bodies via 15 different mechanisms to cause cancer.

By attacking all of these important systems in the body, EMFs attack everything we care about including our health (in many ways), our reproductive systems, the integrity of our genomes and our ability to produce healthy offspring.

There are 79 different reviews listed at the end of Chapter 1, with each documenting the existence of one or more of these various non-thermal EMF effects. What, then, do the two organization reports that the EU authorities and U.S. authorities rely upon, ICNIRP and SCENIHR 2015, have to say about these independent reviews. The answer is absolutely nothing! Neither one of them uses any of these independent reviews to assess EMF effects. This whole area is discussed in much more detail in Chapter 5, below.



Strong Evidence for Cumulative and Irreversible EMF Effects

Two questions that must be raised about the effects of these low-intensity EMFs producing biological effects is are they cumulative and are they reversible? I am aware of several different types of evidence for cumulative effects and also for irreversible effects.

Three of the human occupational exposure studies from the 1970's reviewed in the Raines, National Aeronautics and Space Administration (NASA) study [26], showed that effects increased substantially with increasing time of exposure to a particular type and intensity of EMF. While these three studies each show cumulative effects but they provide no data on possible irreversibility of these neurological/neuropsychiatric effects. However the largest review of such occupational exposures (Hecht [28]) does provide substantial evidence on the cumulative nature and irreversibility of these neurological/neuropsychiatric effects.

Hecht [28] reviewed 60 different studies of occupational exposures that were done between 1960 and 1990 in the Soviet Union and East Germany. These were occupational exposure studies of over 3500 people, who were exposed to microwave frequency EMFs at intensities of less than 1/1000th of our safety guidelines. These studies [28] found that these EMFs produced neuropsychiatric effects similar to those

found in my much more recent study [3], listed in Chapter 1 as well as on cardiac effects. Neither the neuropsychiatric findings nor the cardiac findings were unique however. Similar neuropsychiatric effects have been found to be caused by low intensity EMF exposures [27,29-34]. Cardiac effects have also been found in humans [26,29,30,32,34,35] similar to those found by Hecht [28].

Hecht [28] reports that exposures at those very low intensities for up to 3 years produced increased sympathetic nervous system activity, apparently in response to the EMF stress, following the classic stress sequence described by Hans Selye in 1953. No other effects were apparent during this circa 3 year period. However longer exposure produced observable neurological/neuropsychiatric and cardiac effects as well as other effects which were initially modest. Exposures of 3 to 5 years typically produced effects that could be largely reversed after 2 to 3 years in a no-EMF exposure environment. Hecht states that "if detected early, effective therapy is possible." However longer than 4 to 5 years exposures produced more severe effects which did not reverse when the persons were subsequently put into a no-EMF exposure environment. These and other effects continued to worsen with 10 years of exposure or longer. This cumulative nature of such EMF exposures was noted in two earlier reviews cited by Hecht et al [36,37]. These studies, then, provide very large amounts of evidence both for the cumulative nature of these neuropsychiatric effects, as well as the apparent irreversibility of these effects as they become more severe. Hecht also notes that "decline in health status increasingly amplifies EMF effects." This a pattern of increasing apparent sensitivity produced by previous exposure is similar to that described in the Western literature on electromagnetic hypersensitivity (EHS), something that Hecht recognizes [28]. EHS something that is discussed very briefly below in this section.

There are strong similarities between the Hecht [28] findings on microwave frequency EMFs in humans and the impacts of such EMFs on cellular and organ histology in rodents, as were reviewed in Tolgskaya and Gordon [38] and discussed in Pall [3]. In rodents, initially non-thermal exposures over periods of 1 to 2 months produced modest changes in structure of the brain and of the neurons. When such exposures ceased, most of the structural changes disappeared – that is the changes were largely reversed when the animals were placed back into a no-EMF environment. However more months of exposure produced much more severe impacts on brain and neuronal structure and these were irreversible [38, 3]. More recent, Western country and other country studies cited in [3], provide much further support for brain impacts similar to those found in Soviet and also other country brain studies reviewed by Tolgskaya and Gordon[38]. Tolgskaya and Gordon [38,3] also reported findings that in histological studies, the nervous system was the most sensitive organ in the body, followed closely

by effects on the heart and the testis, although many other organs were also impacted. Thus, the Tolgskaya and Gordon review [38,3] provides very important support for the findings of neurological/neuropsychiatric effects, the cardiac effects, discussed immediately above and below, and the reproductive effects discussed in Chapter 1. By comparing the animal studies with the human studies, one can see the striking similarities, with the major difference being that the effects in rodents are much more rapid than the effects on humans. Given the much higher metabolic rates in rodents and much lower life spans in rodents, the timing difference is not surprising. With regard to the issues of cumulative nature and irreversibility, both rodent and human studies provide strong support for both neurological and neuropsychiatric effects showing both cumulative nature and irreversibility and show a similar pattern of cumulative effects with the cardiac effects.

What are the cardiac effects discussed briefly above, that are produced by non-thermal microwave frequency EMF exposures? The effects include tachycardia (rapid heartbeat) where some people with apparent EHS, on blinded exposure to cordless phone radiation have instantaneous tachycardia, an effect that is also essentially instantaneously reversible on cessation of exposure [28,35,36]. So tachycardia can be an almost instantaneous response to EMFs and it is sometimes also found with arrhythmia. Prolonged exposures produce both arrhythmias and bradycardia (slow heart beat) [26-30,32]. Similar EMF cardiac effects were seen in animal studies, with the earliest of these going back to the late 1960s.

Some of the early studies on long-term EMF cardiac effects are listed in Table 2, below. They show that such chronic exposures produce bradycardia and sometimes arrhythmia. The early Soviet studies (labeled USSR) reported similar findings to those found in the western studies (Table 2).

Table 2. Chronic Exposure, Non-Thermal EMF Cardiac Effects from NASA Review [26]

Study	Effects Reported
Schwan 1977	Cardiology changes
Dwyer 1978	Bradycardia, hypotension
Sadicikova (USSR)	Bradycardia, hypo & hypertension, cardiac pain, systolic murmur
Kalyada (USSR)	“cardiovascular changes”

Study	Effects Reported
Sadichikova (USSR)	Changes in cardiovascular system
Pressman 1970	QRS interval in ECG increased (bradycardia), also arrhythmia
Domanski (USSR)	Bradycardia, hypotension, ECG changes (shows both bradycardia and arrhythmia)
Lerner (1980)	Bradycardia
Stuchley (1978)	Bradycardia (measured in 2 ways), hyper & hypotension, cardiac pain, systolic murmur.

Arrhythmias, especially when they are accompanied by bradycardia, are often associated with sudden cardiac death. We are having an epidemic of young, apparently healthy athletes dying in the middle of an athletic competition of apparent sudden cardiac death, which may, therefore be possibly caused by EMF exposures [39]. Some of these individuals have been saved from death [39] and subsequently found to be suffering from bradycardia and arrhythmias. Another type of cardiac effect is that when apparent EHS people are exposed to Wi-Fi, cell phone, cell phone tower or smart meter radiation, they are reported to suffer from heart palpitations. Each of these four types of cardiac effects, tachycardia, arrhythmias, bradycardia and heart palpitations involve aberrations in the electrical control of the heartbeat. How can these be produced?

The heartbeat is controlled by pacemaker cells in what is called the sino-atrial node of the heart. Those pacemaker cells have been shown to have very high densities of the T-type VGCCs which may make these cells particularly susceptible to direct effects of the EMFs (recall that EMFs act via VGCC activation). The T-type and the L-type VGCCs have essential roles in controlling the heartbeat. It follows that EMF exposures, acting directly on the pacemaker cells of the heart, can produce tachycardia responses. Furthermore, gene mutations in a VGCC gene that produce increased VGCC activity can produce both tachycardia and arrhythmia in young babies carrying those mutations; these young children die of sudden cardiac death at a very young age. How then do we get bradycardia? Bradycardia is produced when EMFs chronically impact the sino-atrial node, such that the dysfunction involved in heart failure, which is very complex, produces dysfunction of the pacemaker cells of the heart, producing bradycardia [40].

It follows from this that EMF-produced bradycardia and chronic arrhythmias are likely to be caused by heart-failure-like changes that particularly impact the sino-atrial node of the heart, including the tissue remodeling found in heart failure. This model has

been confirmed by the findings of Liu et al [41], who found that pulsed microwave frequency EMF produced tissue remodeling that specifically impacted the sino-atrial node of the heart with remodeling changes similar to those found in heart failure [40]. Heart failure develops in a cumulative fashion and, based on current medicine at least, is an irreversible process involving tissue remodeling and a large number of other biochemical and physiological changes [41]. It seems likely, therefore, that the EMF effects on the heart are both cumulative and irreversible.

You will recall, from the discussion at the beginning of Chapter 1, that there are 18 reviews documenting that EMF produces lowered fertility. These act via diverse mechanisms. These include tissue remodeling changes in the testis, lowered sperm count and sperm quality, lowered female fertility including ovary remodeling and oocyte apoptosis, lowered estrogen, progesterone and testosterone levels (that is sex hormone levels), increased spontaneous abortion incidence, and lowered libido. We already have sperm count drops to below 50% of normal in every technologically advanced country on earth [1]. We also have fertility drops to well below replacement levels in every technologically advanced country on earth, with one exception. Clinical observations argue that while there are sometimes technical fixes that allow some reproduction, infertility appears to be inherently irreversible. The Magras and Xenos [2] in mice, also discussed in Chapter 1 shows that radiofrequency radiation exposures well below our safety guidelines, produce immediate drops in mouse reproduction in the first litter. Further exposures to the same EMF levels produced a crash in reproduction essentially to zero, a crash that appeared to be essentially irreversible.

We don't know that humans will behave very similarly to mice. We do know that the EMFs produce the diverse effects on human reproduction listed in the previous paragraph. My prediction is that even if exposures level off where they are now, we will start seeing crashes in reproduction within about 5 years. If we go ahead with 5G, that crash may be almost instantaneous.

Mutation accumulation produced by cellular DNA damage is likely to be both cumulative and irreversible, as well, because later mutations are highly unlikely to reverse previously occurring mutations. It has been estimated that all we need to have is an increase in germ line mutation of 2 ½ to 3-fold, to become over time, extinct from the very high levels of mutations in each newborn. From the high levels of DNA damage produced in human sperm from common EMF exposures, we may be already well above that level.

It follows from this that we already face four existential threats produced by microwave frequency EMF exposures to the survival of every technologically advanced society on earth:

1. Cumulative and irreversible neurological/neuropsychiatric effects.
2. Cumulative and irreversible reproductive effects.
3. Cumulative and irreversible cardiac effects, leading to sudden cardiac death.
4. DNA effects in germ line, including sperm cells, leading to major impacts on our gene pool and high mutation frequencies.

Any one of these can destroy us on its own and with the ever increasing exposures and especially the vast increases in exposure that the 5G rollout will inevitably produce, that destruction is likely to be imminent. These don't even take into consideration the cancer effects, the hormonal effects or other effects produced by increased oxidative stress or increased apoptotic cell death. There is extraordinary evidence for each of these effects of EMF exposure, which have been repeatedly documented in the reviews listed in Chapter 1.

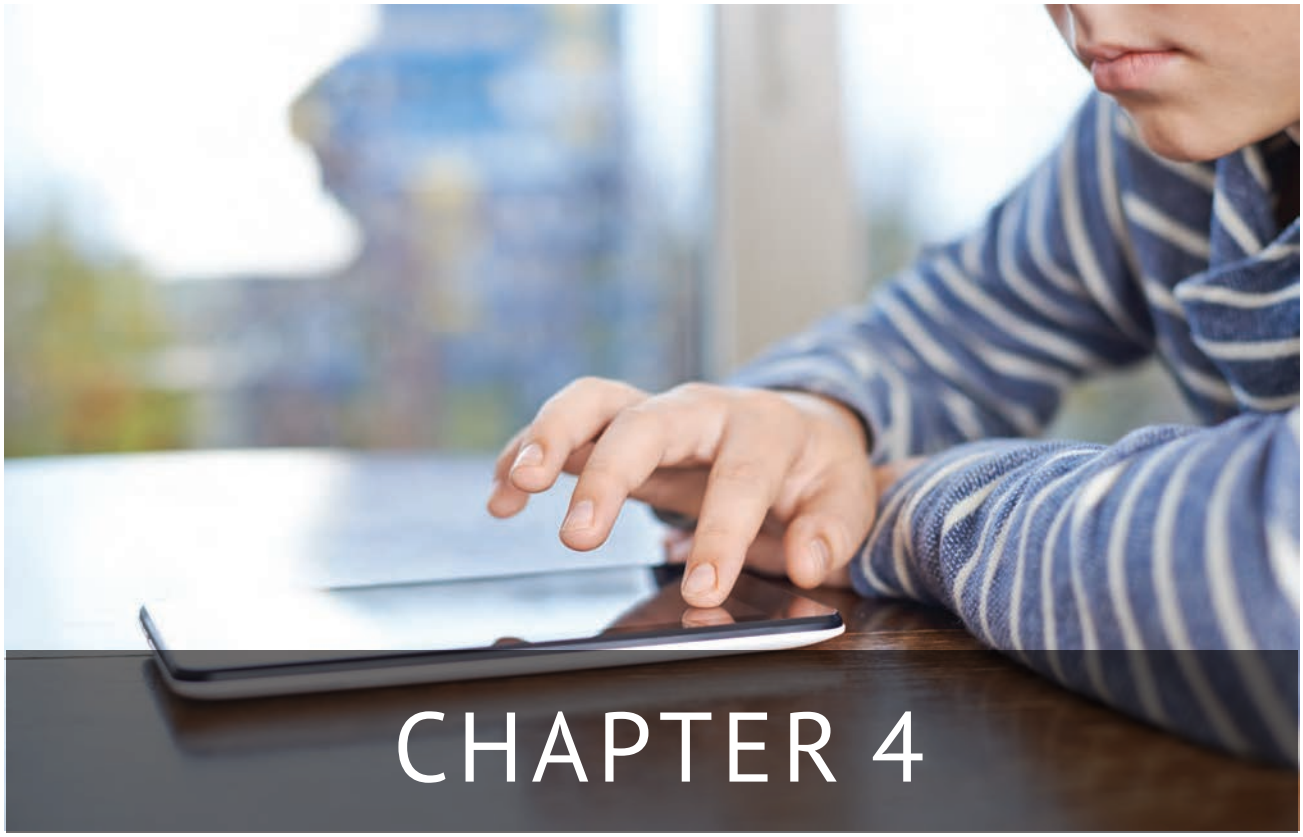
The following information is derived from an abstract that I used for a talk at the Neuroscience 2016 meeting in Los Angeles, a meeting that was focused on Alzheimer's disease and similar dementias. The discussion here raises the question of whether Alzheimer's and other dementias may be still another set of irreversible diseases where cumulative effects of microwave frequency EMFs may have important causal roles. Dementias and other types of neurological deaths have had unexplained rapid recent increases [42-44]. The parallel between these increases and the increases in cell phone and other EMF exposures suggested that such exposures may cause dementia increases [45]. Reports show people circa age 30 developing Alzheimer's or other very early onset dementias and even younger people are reported to develop digital dementias, dementias caused by heavy use of digital devices [46-48]. One of the questions being raised here, is whether digital dementias are caused, at least in part, by the EMF exposures produced by these digital devices and the Wi-Fi fields involved in their usage, rather than solely by such things as screen time, as is often assumed. As you have seen in Chapter 2, microwave and lower frequency EMFs act via activation of the VGCCs, leading to increases in intracellular calcium ([Ca2+]i) and downstream effects including increased Ca2+ signaling, NO, superoxide, peroxynitrite, free radicals, oxidative stress, NF-kappaB and mitochondrial dysfunction.

Each of these downstream effects have been shown to have important roles in causing Alzheimer's disease and other neurodegenerative diseases [49-51]. These all suggest plausible mechanisms for action for EMFs causing Alzheimer's disease. Furthermore the amyloid-beta protein (Aβ) which has an specific role in causing Alzheimer's disease, is produced in increasing amounts by elevated [Ca2+]i, and small Aβ aggregates form Ca2+ channels in the plasma membrane and aggregates also raise [Ca2+]i via

increased VGCC and RYRr activity, suggesting a vicious cycle between Aβ and [Ca2+]i in Alzheimers disease. This argues that increased intracellular calcium levels, produced by the EMFs increases Aβ and increased Aβ increases intracellular calcium, in what may be the central mechanism in causing Alzheimer's disease.

Four rodent studies support an EMF role in Alzheimer's disease. A series of short pulses of EMFs in young rats, produced the following in the equivalent of middle aged rats: elevated brain Aβ and oxidative stress; lowered cognition and memory [52,53]. 900 MHz exposures produces oxidative stress, increased Aβ and lowered miR-107, all found in Alzheimer's disease brains [52-55]. There are many animal studies showing roles for [Ca2+]i through both VGCCs and RYRs in causing Alzheimer's disease in rodent models; these include studies with calcium channel blockers and studies of transgenic mice with varying VGCC and RYR expression. Very low EMF exposures can produce, however, protective responses [56,57]; this is not surprising because EMF therapy is thought to act via NO signaling and protein kinase G (see Fig.1, Chapter 2) and this pathway is reported to protect from Alzheimer's disease. Epidemiological studies have shown that exposure of humans of 50/60 Hz EMFs, which also act via VGCC activation, can cause elevated Alzheimer's disease incidence [58,59]. Interestingly, a 1997 article in Microwave News, discussing two such epidemiological findings on EMFs and Alzheimer's disease in humans, found that occupational exposures to EMFs produced as much as a four-fold increase in Alzheimer's disease [59A]. That same article [59A] suggested a similar mechanism to the mechanism suggested here, namely that increased [Ca2+]i following EMF exposure produces increases in Aβ. In conclusion, a wide range of studies support the view that low intensity microwave frequency exposures acting via VGCC activation and [Ca2+]i, can produce increases in Aβ and other causal factors of Alzheimer's disease in humans and in animals and EMFs have been shown to produce Alzheimer's effects in rats.

These various findings on EMFs and Alzheimer's disease, the increasingly early onset of dementias and the occurrence of digital dementias, all suggest we may have another very high level threat caused by EMF exposures, possibly involving cumulative EMF effects and leading to severe, irreversible brain damage.

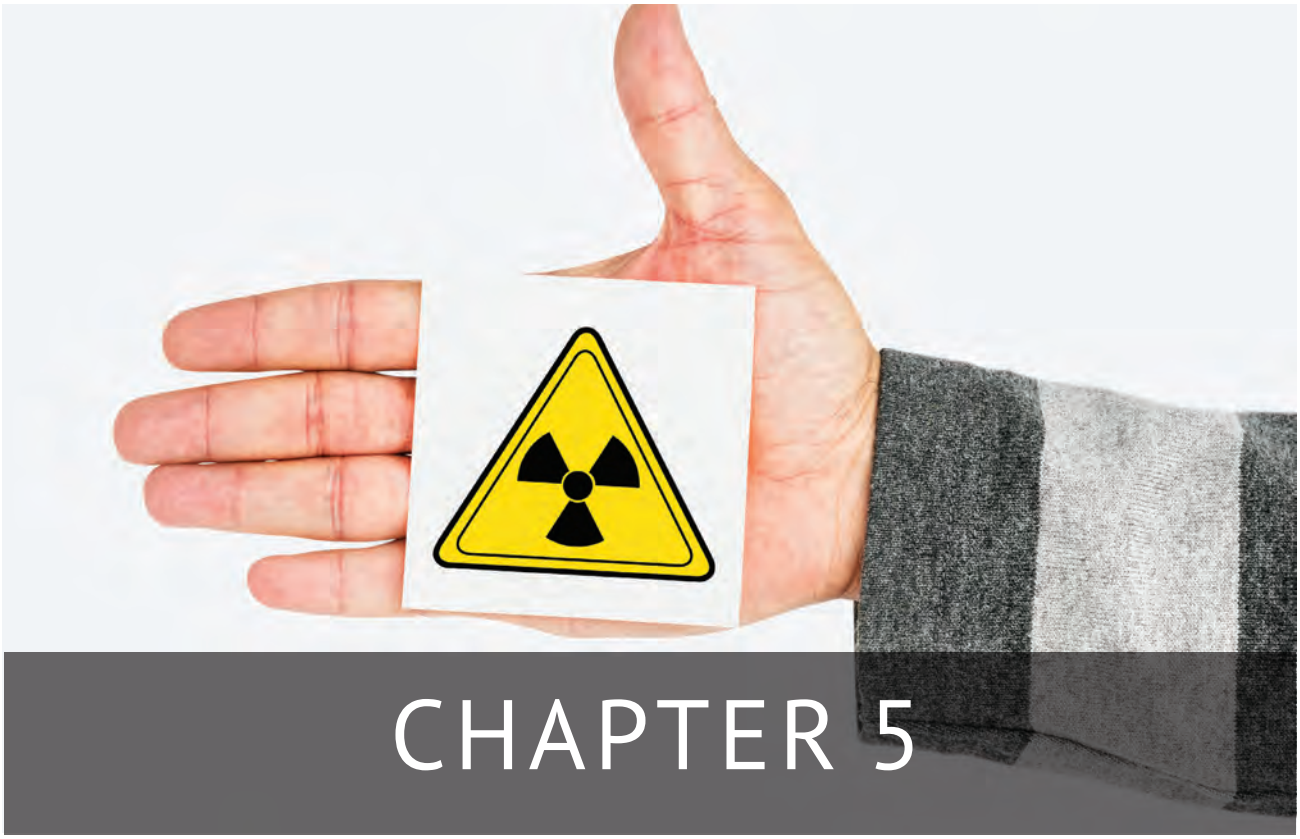


CHAPTER 4

EMFs Including Wi-Fi May Be Particularly Damaging to Young People

Most arguments that have been made that microwave frequency EMFs may be much more damaging to young children have centered on the much smaller skulls and skull thickness in young children, increasing the exposure of their brains to EMFs [60, 61]. However there are other arguments to be made. EMFs have been shown to be particularly active in producing effects on embryonic stem cells [62-71]. Because such stem cells occur at much higher cell densities in children, with stem cell densities the highest in the fetus and decreasing with increasing age [62, 63], impacts on young children are likely to be much higher than in adults. The decreased DNA repair and increased DNA damage following EMF exposure, in conjunction with the increased cell division in young children, strongly suggest that young children may be increasingly susceptible to cancer following such exposures [62-64, 71]. Two reviews discussed in the next chapter provide further evidence on higher cancer susceptibility of children. EMF action on stem cells may also cause young children to be particularly susceptible to disruption of brain development [66,71], something that may be relevant to autism causation.

It is my belief that the role of [Ca2+]i in synapse development is also relevant to the possible EMF causation of autism. The Hecht review of Soviet occupational exposure studies [28] reports that "younger persons show a greater sensitivity to electromagnetic fields than adults." These are all very problematic issues and we cannot rule out the possibility that there are other problematic issues as well. Redmayne and Johansson [72] reviewed the literature showing that there are age-related effects, such that young people are more sensitive to EMF effects. It follows from these various findings that the placement of Wi-Fi into schools around the country and the not uncommon placing of cell phone towers on schools may well both be a high level threats to the health of our children as well being a threat to teachers and any very sensitive fetuses teachers may be carrying, as well. Mr. Barrie Trower, a retired military intelligence expert from the U.K. has been going around the world, at his expense, speaking against Wi-Fi in schools. His knowledge on this is based in part on classified information which he is unable to discuss, but has given him great concern.



CHAPTER 5

The Importance of the SCENIHR 2015 Document and the Many Omissions, Flaws and Falsehoods in That Document

One thing that I think we can all agree upon, is that the SCENIHR 2015 [73] document is an important document. The reason for its importance is that previous industry-friendly documents, and there have been many of them, have only reviewed very limited amounts of the literature on EMF effects. Consequently all of these other documents are open to the criticism that they have cherry picked what little data they have chosen to discuss. SCENIHR 2015 [73] has a reference list of almost 48 pages in length, going from page 233 to 280. So it appears that SCENIHR 2015 may have done a much more thorough and defensible review of the literature. Our assessement of SCENIHR 2015 [73] is important because of the confidence expressed in this document both by Mr. Ryan and Dr. Vinciūnas and also by the U.S. National Cancer Institute. The question that is being raised here is whether SCENIHR 2015 is thorough and defensible or not.

The Speit/Schwarz Controversy: How SCENIHR Has Put Out Seven Falsehoods in Support of the Industry Progaganda Position

I am going to start by discussing a single particularly important issue from [73]. At the end of Table 5 in [73]. there is a claim that a 2013 study by Speit et al [74] was unable

to replicate the findings of a 2008 study published by Schwarz et al [75]. In Table 5 they state further that Speit el al found "No effect on DNA integrity (MN) and DNA migration (comet); Repetition study of Schwarz et al, 2008." What is called loss of DNA integrity here, measured by formation of micronuclei (MN), is caused by the formation of double strand breaks in cellular DNA. The comet assay measures single strand breaks in cellular DNA. Schwarz et al [75] found strong evidence that there were large increases in both single strand and double strand breaks in cellular DNA following very low intensity exposures to a cell phone-like pulsed radiation, but SCENIHR claims that Speit et al [74] were unable to repeat the earlier study. Elsewhere (p.89, bottom) SCENIHR states that "By using the same exposure system and the same experimental protocols as the authors of the original study, they failed to confirm the results. They did not find any explanation for these conflicting results (Speit et al, 2013)."

A careful examination of both [74] and [75] finds the following: 1. Speit et al [74] used a lymphocytic cell line, HL-60; Schwarz et al [75] studied human fibroblasts. This is a big difference because, as we have already said, different cell types behave differently. 2. Speit et al [74] used 1800 MHz radiation; Schwarz et al [75] used 1950 MHz radiation (the frequency of UMTS, also called 3G). Again we have a potentially important difference because effects are influenced by the frequency used. 3. Speit et al [74] used a continuous wave EMF; Schwarz et al [75] used a highly pulsed EMF, with high levels of both KHz and MHz pulsations to mimic the pulsation pattern of 3G cell phones. This is expected to produce very large differences between the two studies. 4. Speit et al [74] used a reverberation exposure chamber; Schwarz et al [75] did not use any exposure chamber. This could be another very large difference between the two studies, a difference that will be discussed toward the end of this chapter. 5. So where did the claim come from that Speit was trying to repeat the Schwarz study? Speit et al [74] says in their paper that they were trying to repeat another study (not Schwarz) that was described in a report but was never published. 6. Speit et al [74] do not even cite the Schwarz et al [75] paper, so obviously they did not intend to repeat Schwarz. We have then SCENIHR 2015 stating three multifaceted falsehoods that Speit et al [74] tried to repeat the earlier studies of Schwarz et al [75], that they were unable to repeat those Schwarz et al [75] studies and that they used identical methodology to that used by Schwarz et al [75]. In addition to those three are four underlying falsehoods – namely that the two studies used very different methodologies, notably differing in the cell type studied, differing in the frequency used, differing widely in the in pulsations used and differing in the use of an exposure chamber. *Each of these falsehoods are SCENIHR's not Speit et al [74]'s, each of them can be easily seen to be false by even a superficial reading of these two papers.*

As you might guess, there is a major story behind all of this. The very low intensity exposure used in the Schwarz et al [75] study produced large numbers of DNA breaks, larger than that produced by 1600 chest X-rays. This conclusion can be made by comparing the results of Schwarz et al [75] with the earlier study of Lutz and Adlkofer [76]. From this comparison, it seems clear that non-ionizing radiation similar to 3G radiation can be much more dangerous to the DNA of our cells than is a similar energy of ionizing radiation. When this was found, the industry went into attack mode, attacking the two Professors who collaborated in [75], Prof. Franz Adlkofer in Germany and Prof. Hugo Rüdinger in Austria. The first couple of years of these attacks have been described in some detail on pp 117-131 in Dr. Devra Davis' book Disconnect [77]. Before the SCENIHR 2015 document was drafted, it was clear that the publishers who had published Adlkofer's and Rüdinger's work, not just the Schwarz et al [75] study but other papers by the same research group, had long since rejected the industry propaganda claims. In addition. Adlkofer had won a lawsuit in the German courts against his main accuser. He has subsequently since won a second such lawsuit. The last paragraph on p.89 in SCENIHR 2015 is word for word industry propaganda. What is clear is that SCENIHR is wittingly or unwittingly serving as a propagandist for the industry in and that process, SCENIHR has no difficulty in putting forth seven obvious, individually important falsehoods.

One question that needs to be raised is how is it possible for microwave frequency EMFs to produce much more cellular DNA damage than a comparable energy level of ionizing radiation? Both ionizing radiation and microwave/lower frequency EMFs act via free radicals to attack the DNA. If you examine Fig. 1, Chapter 2, you will see how low intensity microwave frequency EMFs can act (p. 20). The free radicals that attack the DNA are breakdown products peroxynitrite.. The sequence of events leading to those free radicals starts, of course with the extraordinarily high sensitivity of the VGCC voltage sensor to the electrical forces of the EMFs that open the VGCC calcium channels. Following that there are three steps in the process leading to peroxynitrite elevation each of which have high levels of amplification. The first of these is that when the VGCC channels are open, they allow the influx of about a million calcium ion per second into the cell. The second amplification is that elevated intracellular calcium [Ca2+]i activates the synthesis of both nitric oxide (NO) and superoxide. The third amplification is that the formation of peroxynitrite is proportional to the product of nitric oxide concentration times the superoxide concentration. When you have three sequential amplification mechanisms, you can get a very large response, in this case free radical attack on cellular DNA, from a very small initial signal. That is where much of the existential crises are coming are from, with EMFs threatening the survival of every technologically advanced country on earth.

Going back to falsehoods perpetrated by SCENIHR regarding Speit/Schwarz, here are two possible interpretations for those seven falsehoods. One is that SCENIHR is simply an industry propaganda organ. The second is that we have a group of scientists (SCENIHR) who are largely incompetent and that it is just coincidence that these seven falsehoods serve the industry propaganda case. Either of these interpretations completely destroy the claims of confidence in SCENIHR that Mr. Ryan and Dr. Vinciūnas made in the documents they wrote that were referred to in the Preface of this document.

I have written here another 27 pages critiquing the SCENIHR 2015 [73] document. If you are already convinced that the SCENIHR claims that there are no established non-thermal EMF effects are false and that we have eight extremely well documented effects (Chapter 1) and that we have detailed mechanisms of how these effects are produced (Chapter 2), then I suggest you skip to the summary of Chapter 5 starting on p. 57 and then go on to the consider the U.S. situation in Chapter 6 and 5G in Chapter 7. If, however, you are not so convinced, you need to read the intervening 27 pages.

22 Reviews on EMF Effects, 20 of Which Are Ignored by SCENIHR, Two of Which Are Discussed in [73] but Essentially Dismissed

Now let's go on to consider how SCENIHR 2015 [73] considers the many independent reviews, listed in Chapter 1, which disagree with them and also fall into the 2009 through 2013 period that SCENIHR claims to have thoroughly considered. See Table 3.

Table 3: 2009 to 2013 Reviews that Should Have Been Cited and Discussed in SCENIHR 2015

Citation	Brief Summary	What does SCENIHR 2015 say about it?
[78] Khurana VG, Teo C, Kundi M, Hardell L, Carlberg M. 2009 Cell phones and brain tumors: a review including the long-term epidemiologic data. Surg Neurol 72:205-214.	Meta-analysis study of cell phone usage and brain cancer. The results indicate that using a cell phone for > or = 10 years approximately doubles the risk of being diagnosed with a brain tumor on the same ("ipsilateral") side of the head preferred for cell phone use. The data achieve statistical significance for glioma and acoustic neuroma but not for meningioma. CONCLUSION: The authors conclude that there is adequate epidemiologic evidence to suggest a link between prolonged cell phone usage and the development of an ipsilateral brain tumor.	Nothing. Review is not cited and not discussed.

Citation	Brief Summary	What does SCENIHR 2015 say about it?
[79] Desai NR, Kesari KK, Agarwal A. 2009 Pathophysiology of cell phone radiation: oxidative stress and carcinogenesis with focus on the male reproductive system. Reproduct Biol Endocrinol 7:114.	This review identifies the plasma membrane as a target of RF-EMW. In addition, the effects of RF-EMW on plasma membrane structures (i.e. NADH oxidase, phosphatidylserine, ornithine decarboxylase) and voltage-gated calcium channels are discussed. We explore the disturbance in reactive oxygen species (ROS) metabolism caused by RF-EMW and delineate NADH oxidase mediated ROS formation as playing a central role in oxidative stress (OS) due to cell phone radiation (with a focus on the male reproductive system). This review also addresses: 1) the controversial effects of RF-EMW on mammalian cells and sperm DNA as well as its effect on apoptosis, 2) epidemiological, in vivo animal and in vitro studies on the effect of RF-EMW on male reproductive system.	Nothing. Review is not cited and not discussed.
[80] Makker K, Varghese A, Desai NR, Mouradi R, Agarwal A. 2009 Cell phones: modern man's nemesis? Reprod Biomed Online 18:148-157.	Effects of cell phone exposure on the cardiovascular system, sleep and cognitive function, as well as localized and general adverse effects, genotoxicity potential, neurohormonal secretion and tumour induction. The proposed mechanisms by which cell phones adversely affect various aspects of human health, and male fertility in particular, are explained, and the emerging molecular techniques and approaches for elucidating the effects of mobile phone radiation on cellular physiology using high-throughput screening techniques, such as metabolomics and microarrays, are discussed. A novel study is described, which is looking at changes in semen parameters, oxidative stress markers and sperm DNA damage in semen samples exposed in vitro to cell phone radiation.	Nothing. Review is not cited and not discussed.
[81] Ruediger HW. 2009 Genotoxic effects of radiofrequency electromagnetic fields. Pathophysiology. 16:89-102.	101 publications are exploited which have studied genotoxicity of radiofrequency electromagnetic fields (RF-EMF) in vivo and in vitro. Of these 49 report a genotoxic effect and 42 do not. In addition, 8 studies failed to detect an influence on the genetic material, but showed that RF-EMF enhanced the genotoxic action of other chemical or physical agents. Variation in results may in part be explained by the different cellular systems and from the variety of analytical methods being used. Taking altogether there is ample evidence that RF-EMF can alter the genetic material of exposed cells in vivo and in vitro and in more than one way. This genotoxic action may be mediated by microthermal effects in cellular structures, formation of free radicals, or an interaction with DNA-repair mechanisms.	Nothing. Review is not cited and not discussed.

Citation	Brief Summary	What does SCENIHR 2015 say about it?
[82] Phillips JL, Singh NP, Lai H. 2009 Electromagnetic fields and DNA damage. Pathophysiology 16:79-88.	A major concern of the adverse effects of exposure to non-ionizing electromagnetic field (EMF) is cancer induction. Since the majority of cancers are initiated by damage to a cell's genome, studies have been carried out to investigate the effects of electromagnetic fields on DNA and chromosomal structure. Additionally, DNA damage can lead to changes in cellular functions and cell death. Single cell gel electrophoresis, also known as the 'comet assay', has been widely used in EMF research to determine DNA damage, reflected as single-strand breaks, double-strand breaks, and crosslinks. Studies have also been carried out to investigate chromosomal conformational changes and micronucleus formation in cells after exposure to EMF. This review describes the comet assay and its utility to qualitatively and quantitatively assess DNA damage, reviews studies that have investigated DNA strand breaks and other changes in DNA structure, and then discusses important lessons learned from our work in this area.	Nothing. Review is not cited and not discussed.
[83] Davanipour Z, Sobel E. 2009 Long-term exposure to magnetic fields and the risks of Alzheimer's disease and breast cancer: Further biological research. Pathophysiology 16:149-156.	Extremely low frequency (ELF) and radio frequency (RF) magnetic fields (MFs) pervade our environment. Whether or not these magnetic fields are associated with increased risk of serious diseases, e.g., cancers and Alzheimer's disease, is thus important when developing a rational public policy. Our objective was to provide an unbiased review of the current knowledge and to provide our general and specific conclusions. **RESULTS**: The evidence indicates that long-term significant occupational exposure to ELF MF may certainly increase the risk of both Alzheimer's disease and breast cancer. There is now evidence that two relevant biological processes (increased production of amyloid beta and decreased production of melatonin) are influenced by high long-term ELF MF exposure that may lead to Alzheimer's disease. There is further evidence that one of these biological processes (decreased melatonin production) may also lead to breast cancer. Finally, there is evidence that exposures to RF MF and ELF MF have similar biological consequences. **CONCLUSION**: It is important to mitigate ELF and RF MF exposures through equipment design changes and environmental placement of electrical equipment.	Nothing. Review is not cited and not discussed.

Citation	Brief Summary	What does SCENIHR 2015 say about it?
[84] Yakymenko I, Sidorik E. 2010 Risks of carcinogenesis from electromagnetic radiation and mobile telephony devices. Exp Oncol 32:729-736.	Latest epidemiological data reveal a significant increase in risk of development of some types of tumors in chronic (over 10 years) users of mobile phone. It was detected a significant increase in incidence of brain tumors (glioma, acoustic neuroma, meningioma), parotid gland tumor, seminoma in long-term users of mobile phone, especially in cases of ipsilateral use (case-control odds ratios from 1.3 up to 6.1). Two epidemiological studies have indicated a significant increase of cancer incidence in people living close to the mobile telephony base station as compared with the population from distant area. These data raise a question of adequacy of modern safety limits of electromagnetic radiation (EMR) exposure for humans. For today the limits were based solely on the conception of thermal mechanism of biological effects of RF/MW radiation. Meantime the latest experimental data indicate the significant metabolic changes in living cell under the low-intensive (non-thermal) EMR exposure. Among reproducible biological effects of low-intensive MWs are reactive oxygen species overproduction, heat shock proteins expression, DNA damages, apoptosis. Practical steps must be done for reasonable limitation of excessive EMR exposure, along with the implementation of new safety limits of mobile telephony devices radiation, and new technological decisions, which would take out the source of radiation from human brain.	Nothing. Review is not cited and not discussed.
[85] Carpenter DO. 2010 Electromagnetic fields and cancer: the cost of doing nothing. Rev Environ Health 25:75-80.	Concern of health hazards from EMFs has increased as the use of cell phones and other wireless devices has grown in all segments of society, especially among children. While there has been strong evidence for an association between leukemia and residential or occupational exposure to ELF EMFs for many years, the standards in existence are not sufficiently stringent to protect from an increased risk of cancer. For RF EMFs, standards are set at levels designed to avoid tissue heating, in spite of convincing evidence of adverse biological effects at intensities too low to cause significant heating. Recent studies demonstrate elevations in rates of brain cancer and acoustic neuroma only on the side of the head where individuals used their cell phone. Individuals who begin exposure at younger ages are more vulnerable. These data indicate that the existing standards for radiofrequency exposure are not adequate. While there are many unanswered questions, the cost of doing nothing will result in an increasing number of people, many of them young, developing cancer.	Nothing. Review is not cited and not discussed.

Citation	Brief Summary	What does SCENIHR 2015 say about it?
[86] Giuliani L, Soffritti M (Eds). 2010 NON-THERMAL EFFECTS AND MECHANISMS OF INTERACTION BETWEEN ELECTROMAGNETIC FIELDS AND LIVING MATTER, RAMAZZINI INSTITUTE EUR. J. ONCOL. LIBRARY Volume 5, National Institute for the Study and Control of Cancer and Environmental Diseases "Bernardino Ramazzini" Bologna, Italy 2010, 400 page monograph.	Contains entire articles on: 1. Influence of mobile phone radiation on cognitive function 2. Impact of DECT cordless phone radiation on heart rate variability and on the autonomic nervous system. 3 & 4. Two articles on the impact of radiofrequency radiation on the blood-brain barrier. 5 & 6. Two articles on microwave/radiofrequency radiation and cancer causation. 7. Epidemiological studies of EMF impact on human reproduction.	Nothing. Review is not cited and not discussed.
[87] Khurana, V. G., Hardell, L., Everaert, J., Bortkiewicz, A., Carlberg, M., Ahonen, M. 2010 Epidemiological evidence for a health risk from mobile phone base stations. Int. J. Occup. Environ. Health 16, 263-267.	We identified a total of 10 epidemiological studies that assessed for putative health effects of mobile phone base stations (cell phone antennae). Seven of these studies explored the association between base station proximity and neurobehavioral effects and three investigated cancer. We found that eight of the 10 studies reported increased prevalence of adverse neurobehavioral symptoms or cancer in populations living at distances < 500 meters from base stations. None of the studies reported exposure above accepted international guidelines, suggesting that current guidelines may be inadequate in protecting the health of human populations. We believe that comprehensive epidemiological studies of long-term mobile phone base station exposure are urgently required to more definitively understand its health impact.	Nothing. Review is not cited and not discussed.
[88] Levitt, B. B., Lai, H. 2010. Biological effects from exposure to electromagnetic radiation emitted by cell tower base stations and other antenna arrays. Environ. Rev. 18, 369-395. doi.org/10.1139/A10-018	Both anecdotal reports and some epidemiology studies, reviewed in this study, have found headaches, skin rashes, sleep disturbances, depression, decreased libido, increased rates of suicide, concentration problems, dizziness, memory changes, increased risk of cancer, tremors, and other neurophysiological effects in populations near base stations. Cardiac effects were also reported. Symptoms reported may be classic microwave sickness, first described in 1978. Nonionizing electromagnetic fields are among the fastest growing forms of environmental pollution. Some extrapolations can be made from research other than epidemiology regarding biological effects from exposures at levels far below current exposure guidelines.	Nothing. Review is not cited and not discussed.

Citation	Brief Summary	What does SCENIHR 2015 say about it?
[89] Kang N, Shang XJ, Huang YF. 2010 [Impact of cell phone radiation on male reproduction]. Zhonghua Nan Ke Xue 16:1027-1030.	With the popularized use cell phones, more and more concern has been aroused over the effects of their radiation on human health, particularly on male reproduction. Cell phone radiation may cause structural and functional injuries of the testis, alteration of semen parameters, reduction of epididymal sperm concentration and decline of male fertility. This article presents an overview on the impact of cell phone radiation on male reproduction.	Nothing. Review is not cited and not discussed.
[90] Yakymenko, I., Sidorik, E., Kyrylenko, S., Chekhun, V. 2011. Long-term exposure to microwave radiation provokes cancer growth: evidences from radars and mobile communication systems. Exp. Oncol. 33(2), 62-70.	The carcinogenic effect of MW irradiation is typically manifested after long term (up to 10 years and more) exposure. Nevertheless, even a year of operation of a powerful base transmitting station for mobile communication reportedly resulted in a dramatic increase of cancer incidence among population living nearby. In addition, model studies in rodents unveiled a significant increase in carcinogenesis after 17-24 months of MW exposure both in tumor-prone and intact animals. To that, such metabolic changes, as overproduction of reactive oxygen species, 8-hydroxi-2-deoxyguanosine formation, or ornithine decarboxylase activation under exposure to low intensity MW confirm a stress impact of this factor on living cells. We also address the issue of standards for assessment of biological effects of irradiation. It is now becoming increasingly evident that assessment of biological effects of non-ionizing radiation based on physical (thermal) approach used in recommendations of current regulatory bodies, including the International Commission on Non-Ionizing Radiation Protection (ICNIRP) Guidelines, requires urgent reevaluation. We conclude that recent data strongly point to the need for re-elaboration of the current safety limits for non-ionizing radiation using recently obtained knowledge. We also emphasize that the everyday exposure of both occupational and general public to MW radiation should be regulated based on a precautionary principles which imply maximum restriction of excessive exposure.	Nothing. Review is not cited and not discussed.

Citation	Brief Summary	What does SCENIHR 2015 say about it?
[91] Yakimenko IL, Sidorik EP, Tsybulin AS. 2011 [Metabolic changes in cells under electromagnetic radiation of mobile communication systems]. Ukr Biokhim Zh (1999). 2011 Mar-Apr;83(2):20-28.	Review is devoted to the analysis of biological effects of microwaves. The results of last years' researches indicated the potential risks of long-term low-level microwaves exposure for human health. The analysis of metabolic changes in living cells under the exposure of microwaves from mobile communication systems indicates that this factor is stressful for cells. Among the reproducible effects of low-level microwave radiation are overexpression of heat shock proteins, an increase of reactive oxygen species level, an increase of intracellular Ca2+, damage of DNA, inhibition of DNA reparation, and induction of apoptosis. Extracellular-signal-regulated kinases ERK and stress-related kinases p38MAPK are involved in metabolic changes. Analysis of current data suggests that the concept of exceptionally thermal mechanism of biological effects of microwaves is not correct. In turn, this raises the question of the need to revaluation of modern electromagnetic standards based on thermal effects of non-ionizing radiation on biological systems.	Nothing. Review is not cited and not discussed.
[92] Gye MC, Park CJ. 2012 Effect of electromagnetic field exposure on the reproductive system. Clin Exp Reprod Med 39:1-9. doi.org/10.5653/cerm.2012.39.1.1 . Clin Exp Reprod Med 39:1-9. doi.org/10.5653/cerm.2012.39.1.1	The safety of human exposure to an ever-increasing number and diversity of electromagnetic field (EMF) sources both at work and at home has become a public health issue. To date, many in vivo and in vitro studies have revealed that EMF exposure can alter cellular homeostasis, endocrine function, reproductive function, and fetal development in animal systems. Reproductive parameters reported to be altered by EMF exposure include male germ cell death, the estrous cycle, reproductive endocrine hormones, reproductive organ weights, sperm motility, early embryonic development, and pregnancy success. At the cellular level, an increase in free radicals and [Ca(2+)]i may mediate the effect of EMFs and lead to cell growth inhibition, protein misfolding, and DNA breaks. The effect of EMF exposure on reproductive function differs according to frequency and wave, strength (energy), and duration of exposure. In the present review, the effects of EMFs on reproductive function are summarized according to the types of EMF, wave type, strength, and duration of exposure at cellular and organism levels.	Nothing. Review is not cited and not discussed.

Citation	Brief Summary	What does SCENIHR 2015 say about it?
[93] La Vignera S, Condorelli RA, Vicari E, D'Agata R, Calogero AE. 2012 Effects of the exposure to mobile phones on male reproduction: a review of the literature. J Androl 33:350-356.	The use of mobile phones is now widespread. A great debate exists about the possible damage that the radiofrequency electromagnetic radiation (RF-EMR) emitted by mobile phones exerts on different organs and apparatuses. The aim of this article was to review the existing literature exploring the effects of RF-EMR on the male reproductive function in experimental animals and humans. Studies have been conducted in rats, mice, and rabbits using a similar design based upon mobile phone RF exposure for variable lengths of time. Together, the results of these studies have shown that RF-EMR decreases sperm count and motility and increases oxidative stress. In humans, 2 different experimental approaches have been followed: one has explored the effects of RF-EMR directly on spermatozoa and the other has evaluated the sperm parameters in men using or not using mobile phones. The results showed that human spermatozoa exposed to RF-EMR have decreased motility, morphometric abnormalities, and increased oxidative stress, whereas men using mobile phones have decreased sperm concentration, decreased motility (particularly rapid progressive motility), normal morphology, and decreased viability. These abnormalities seem to be directly related to the duration of mobile phone use.	Nothing. Review is not cited and not discussed.

Citation	Brief Summary	What does SCENIHR 2015 say about it?
[94] Biointiative Working Group, David Carpenter and Cindy Sage (eds). 2012 Bioinitiative 2012: A rationale for biologically-based exposure standards for electromagnetic radiation. http://www.bioinitiative.org/participants/why-we-care/	Sections on EMF effects: SECTION 4: EVIDENCE FOR INADEQUACY OF THE STANDARDS SECTION 5: EVIDENCE FOR EFFECTS ON GENE AND PROTEIN EXPRESSION SECTION 6: EVIDENCE FOR GENOTOXIC EFFECTS – RFR AND ELF DNA DAMAGE SECTION 7: EVIDENCE FOR STRESS RESPONSE (STRESS PROTEINS) SECTION 8: EVIDENCE FOR EFFECTS ON IMMUNE FUNCTION SECTION 9: EVIDENCE FOR EFFECTS ON NEUROLOGY AND BEHAVIOR SECTION 10: EFFECTS OF EMF FROM WIRELESS COMMUNICATION UPON THE BLOOD-BRAIN BARRIER SECTION 11: EVIDENCE FOR BRAIN TUMORS AND ACOUSTIC NEUROMAS SECTION 12: EVIDENCE FOR CHILDHOOD CANCERS (LEUKEMIA) SECTION 13: EVIDENCE FOR EFFECTS ON MELATONIN: ALZHEIMER'S DISEASE AND BREAST CANCER SECTION 14: EVIDENCE FOR BREAST CANCER PROMOTION SECTION 15: EVIDENCE FOR DISRUPTION BY THE MODULATING SIGNAL SECTION 16: PLAUSIBLE GENETIC AND METABOLIC MECHANISMS FOR BIOEFFECTS OF VERY WEAK ELF MAGNETIC FIELDS ON LIVING TISSUE SECTION 17 EVIDENCE BASED ON EMF MEDICAL THERAPEUTICS SECTION 18: FERTILITY AND REPRODUCTION EFFECTS OF EMF SECTION 19: FETAL AND NEONATAL EFFECTS OF EMF SECTION 20: FINDINGS IN AUTISM CONSISTENT WITH EMF AND RFR	Nothing. Review is not cited and not discussed.

Citation	Brief Summary	What does SCENIHR 2015 say about it?
[4] Pall, ML. 2013. Electromagnetic fields act via activation of voltage-gated calcium channels to produce beneficial or adverse effects. J Cell Mol Med 17:958-965. doi: 10.1111/jcmm.12088.	The direct targets of extremely low and microwave frequency range electromagnetic fields (EMFs) in producing non-thermal effects have not been clearly established. However, studies in the literature, reviewed here, provide substantial support for such direct targets. Twenty-three studies have shown that voltage-gated calcium channels (VGCCs) produce these and other EMF effects, such that the L-type or other VGCC blockers block or greatly lower diverse EMF effects. Furthermore, the voltage-gated properties of these channels may provide biophysically plausible mechanisms for EMF biological effects. Downstream responses of such EMF exposures may be mediated through Ca(2+) /calmodulin stimulation of nitric oxide synthesis. Potentially, physiological/therapeutic responses may be largely as a result of nitric oxide-cGMP-protein kinase G pathway stimulation. A well-studied example of such an apparent therapeutic response, EMF stimulation of bone growth, appears to work along this pathway. However, pathophysiological responses to EMFs may be as a result of nitric oxide-peroxynitrite-oxidative stress pathway of action. A single such well-documented example, EMF induction of DNA single-strand breaks in cells, as measured by alkaline comet assays, is reviewed here. Such single-strand breaks are known to be produced through the action of this pathway. Data on the mechanism of EMF induction of such breaks are limited; what data are available support this proposed mechanism. Other Ca(2+) -mediated regulatory changes, independent of nitric oxide, may also have roles. This article reviews, then, a substantially supported set of targets, VGCCs, whose stimulation produces non-thermal EMF responses by humans/higher animals with downstream effects involving Ca(2+) /calmodulin-dependent nitric oxide increases, which may explain therapeutic and pathophysiological effects.	This was cited. Sole statement is: "(see Pall, 2013 for a review of studies suggesting effects through voltage-gated calcium channels)." None of the important implications listed on the left are used in any way in the rest of the SCENIHR 2015 document See text for further discussion..

Citation	Brief Summary	What does SCENIHR 2015 say about it?
[95] Nazıroğlu M, Yüksel M, Köse SA, Özkaya MO. 2013 Recent reports of Wi-Fi and mobile phone-induced radiation on oxidative stress and reproductive signaling pathways in females and males. J Membr Biol 246:869-875.	The aim of the study was to discuss the mechanisms and risk factors of EMR changes on reproductive functions and membrane oxidative biology in females and males. It was reported that even chronic exposure to EMR did not increase the risk of reproductive functions such as increased levels of neoantigens abort. However, the results of some studies indicate that EMR induced endometriosis and inflammation and decreased the number of follicles in the ovarium or uterus of rats. In studies with male rats, exposure caused degeneration in the seminiferous tubules, reduction in the number of Leydig cells and testosterone production as well as increases in luteinizing hormone levels and apoptotic cells. In some cases of male and female infertility, increased levels of oxidative stress and lipid peroxidation and decreased values of antioxidants such as melatonin, vitamin E and glutathione peroxidase were reported in animals exposed to EMR. In conclusion, the results of current studies indicate that oxidative stress from exposure to Wi-Fi and mobile phone-induced EMR is a significant mechanism affecting female and male reproductive systems.	This was listed on p.285 under Literature identified but not cited. SCENIHR chose not to cite or discuss this paper, although they had identified it.
[96] Ledoigt G, Belpomme D. 2013 Cancer induction molecular pathways and HF-EMF irradiation. Adv Biol Chem 3:177-186.	The response of cells to different types of electromagnetic fields can be induced by low-level (athermal) high frequency (HF) electromagnetic fields (EMFs) exposure associated with mobile phone technologies. There are many examples of biological effects involving the epigenome. EMFs could trigger protein activation mediated by ligands, such as Ca2+, that alter the conformation of binding proteins, especially the NADPH plasmic membrane oxidase, so inducing increased formation of reactive oxygen species (ROS) that may alter proteomic functions. Classical antiapoptotic and procarcinogenic signaling pathways that are commonly found activated in human malignancies and in inflammation mainly involve the transcription factor NF-kB. The microenvironment that exists during chronic inflammation can contribute to cancer progression. The data support the proposition that long term HF-EMF exposure associated with improper use of cell phones can potentially cause cancer.	Nothing. Review is not cited and not discussed.

Citation	Brief Summary	What does SCENIHR 2015 say about it?
[97] Hardell L, Carlberg M. 2013 Using the Hill viewpoints from 1965 for evaluating strengths of evidence of the risk for brain tumors associated with use of mobile and cordless phones. Rev Environ Health 28:97-106. doi: 10.1515/reveh-2013-0006.	**BACKGROUND**: Wireless phones, i.e., mobile phones and cordless phones, emit radiofrequency electromagnetic fields (RF-EMF) when used. An increased risk of brain tumors is a major concern. The International Agency for Research on Cancer (IARC) at the World Health Organization (WHO) evaluated the carcinogenic effect to humans from RF-EMF in May 2011. It was concluded that RF-EMF is a group 2B, i.e., a "possible", human carcinogen. Bradford Hill gave a presidential address at the British Royal Society of Medicine in 1965 on the association or causation that provides a helpful framework for evaluation of the brain tumor risk from RF-EMF. **METHODS**: All nine issues on causation according to Hill were evaluated. Regarding wireless phones, only studies with long-term use were included. In addition, laboratory studies and data on the incidence of brain tumors were considered. **RESULTS**: The criteria on strength, consistency, specificity, temporality, and biologic gradient for evidence of increased risk for glioma and acoustic neuroma were fulfilled. Additional evidence came from plausibility and analogy based on laboratory studies. Regarding coherence, several studies show increasing incidence of brain tumors, especially in the most exposed area. Support for the experiment came from antioxidants that can alleviate the generation of reactive oxygen species involved in biologic effects, although a direct mechanism for brain tumor carcinogenesis has not been shown. In addition, the finding of no increased risk for brain tumors in subjects using the mobile phone only in a car with an external antenna is supportive evidence. Hill did not consider all the needed nine viewpoints to be essential requirements. **CONCLUSION**: Based on the Hill criteria, glioma and acoustic neuroma should be considered to be caused by RF-EMF emissions from wireless phones and regarded as carcinogenic to humans, classifying it as group 1 according to the IARC classification. Current guidelines for exposure need to be urgently revised.	Nothing. Review is not cited and not discussed. The Hill criteria are THE well-accepted way of analyzing biological plausiblility of epidemiological evidence. It is unacceptable for SCENIHR not to consider this review when attempting to analyze epidemiological evidence of EMF cancer causation.

Citation	Brief Summary	What does SCENIHR 2015 say about it?
[98] Hardell L, Carlberg M, Hansson Mild K. 2013 Use of mobile phones and cordless phones is associated with increased risk for glioma and acoustic neuroma. Pathophysiology 2013;20(2):85-110.	The International Agency for Research on Cancer (IARC) at WHO evaluation of the carcinogenic effect of RF-EMF on humans took place during a 24-31 May 2011 meeting at Lyon in France. The Working Group consisted of 30 scientists and categorised the radiofrequency electromagnetic fields from mobile phones, and from other devices that emit similar non-ionising electromagnetic fields (RF-EMF), as Group 2B, i.e., a 'possible', human carcinogen. The decision on mobile phones was based mainly on the Hardell group of studies from Sweden and the IARC Interphone study. We give an overview of current epidemiological evidence for an increased risk for brain tumours including a meta-analysis of the Hardell group and Interphone results for mobile phone use. Results for cordless phones are lacking in Interphone. The meta-analysis gave for glioma in the most exposed part of the brain, the temporal lobe, odds ratio (OR)=1.71, 95% confidence interval (CI)=1.04-2.81 in the ⩾10 years (>10 years in the Hardell group) latency group. Ipsilateral mobile phone use ⩾1640h in total gave OR=2.29, 95% CI=1.56-3.37. The results for meningioma were OR=1.25, 95% CI=0.31-4.98 and OR=1.35, 95% CI=0.81-2.23, respectively. Regarding acoustic neuroma ipsilateral mobile phone use in the latency group ⩾10 years gave OR=1.81, 95% CI=0.73-4.45. For ipsilateral cumulative use ⩾1640h OR=2.55, 95% CI=1.50-4.40 was obtained. Also use of cordless phones increased the risk for glioma and acoustic neuroma in the Hardell group studies. Survival of patients with glioma was analysed in the Hardell group studies yielding in the >10 years latency period hazard ratio (HR)=1.2, 95% CI=1.002-1.5 for use of wireless phones. This increased HR was based on results for astrocytoma WHO grade IV (glioblastoma multiforme). Decreased HR was found for low-grade astrocytoma, WHO grades I-II, which might be caused by RF-EMF exposure leading to tumour-associated symptoms and earlier detection and surgery with better prognosis. Some studies show increasing incidence of brain tumours whereas other studies do not. It is concluded that one should be careful using incidence data to dismiss results in analytical epidemiology. The IARC carcinogenic classification does not seem to have had any significant impact on governments' perceptions of their responsibilities to protect public health from this widespread source of radiation.	This paper is cited and discussed very briefly. See text for discussion.

Citation	Brief Summary	What does SCENIHR 2015 say about it?
[99] Davis DL, Kesari S, Soskolne CL, Miller AB, Stein Y. 2013 Swedish review strengthens grounds for concluding that radiation from cellular and cordless phones is a probable human carcinogen. Pathophysiology 20:123-129.	Mobile phones are two-way microwave radios that also emit low levels of electromagnetic radiation. Inconsistent results have been published on potential risks of brain tumors tied with mobile phone use as a result of important methodological differences in study design and statistical power. Some studies have examined mobile phone users for periods of time that are too short to detect an increased risk of brain cancer, while others have misclassified exposures by placing those with exposures to microwave radiation from cordless phones in the control group, or failing to attribute such exposures in the cases. In 2011, the World Health Organization, International Agency for Research on Cancer (IARC) advised that electromagnetic radiation from mobile phone and other wireless devices constitutes a "possible human carcinogen," 2B. Recent analyses not considered in the IARC review that take into account these methodological shortcomings from a number of authors find that brain tumor risk is significantly elevated for those who have used mobile phones for at least a decade. Studies carried out in Sweden indicate that those who begin using either cordless or mobile phones regularly before age 20 have greater than a fourfold increased risk of ipsilateral glioma. Given that treatment for a single case of brain cancer can cost between $100,000 for radiation therapy alone and up to $1 million depending on drug costs, resources to address this illness are already in short supply and not universally available in either developing or developed countries. Significant additional shortages in oncology services are expected at the current growth of cancer. No other environmental carcinogen has produced evidence of an increased risk in just one decade. Empirical data have shown a difference in the dielectric properties of tissues as a function of age, mostly due to the higher water content in children's tissues. High resolution computerized models based on human imaging data suggest that children are indeed more susceptible to the effects of EMF exposure at microwave frequencies. If the increased brain cancer risk found in young users in these recent studies does apply at the global level, the gap between supply and demand for oncology services will continue to widen. Many nations, phone manufacturers, and expert groups, advise prevention in light of these concerns by taking the simple precaution of "distance" to minimize exposures to the brain and body. We note that brain cancer is the proverbial "tip of the iceberg"; the rest of the body is also showing effects other than cancers.	Nothing. Review is not cited and not discussed.

Of these 22 reviews, 19 are found in the PubMed database, the most widely used medical database in the world, so there is no excuse for not discussing these 19, but only two of them were discussed (see below). With regard to the eight different types of effects that I consider established non-thermal EMF effects, each of them were reviewed in multiple studies described in Table 3 as follows: Cancer 12 reviews [78,82,83-87,90,94,96-98]; Oxidative stress/free radicals 8 reviews [79,80,84,90,92,-96]; Cellular DNA damage 10 review [4,79,80-82,84,90-92,94]; Apoptosis/cell death 3 reviews [79,82,91]; Lowered fertility 7 reviews [80,86,89,92-95]; Neurological/neuropsychiatric effects 4 reviews [80,87,88,94]; Calcium overload 4 reviews [4,91,92,96]; Endocrine effects 2 reviews [92,95]. It is not clear why so many important reviews on effects are not found in SCENIHR 2015 [73]. What is perhaps surprising, is that these reviews also document many other effects, none of which are clearly acknowledged by SCENIHR. These include stress responses; breakdown of the blood-brain barrier; fetal and neonatal effects; therapeutic effects; Alzheimer's disease; increased nitric oxide; endometriosis; changes in protein levels (proteomics) and changes in gene expression; NF-kappaB elevation; increased suicide; changes in protein kinase activity including ERK and p32MAPK; mechanisms associated with oxidative stress including elevated NADPH/NADH oxidase increased lipid peroxidation and decreased enzymatic antioxidant activity, increased ornithine decarboxylase; and autism. It can be seen from this that the SCENIHR 2015 document seems to be systematically avoiding considering substantial bodies of evidence regarding a very large range of repeatedly reported EMF effects, each of which challenges the SCENIHR position that no effects are established.

Three specific issues regarding apparent cancer causation by EMFs need to be discussed here. Five of these reviews each review a body of evidence showing that cancer rates are higher on the side of the head where people use their cell phones and cordless phones, the ipsilateral side, as opposed to the opposite side of the head, called the contralateral side [78,84,85,98,99]. These are very important studies because they are not likely to be affccted by how complete the reporting data are, or whether there are affects produced by chemicals, ionizing radiation or other EMFs; each of these factors should not be specific for the side of the head impacted. The contralateral side of the head serves as a control that can be compared with the ipsilateral side of the head. What is strange about the SCENIHR 2015 document, is that it avoids discussing all of these data presented in these five reviews. That is even true for [98] which is discussed very briefly in SCENIHR 2015. Only one body of evidence from [98] is discussed in SCENIHR 2015 but several others are not discussed, including the two bodies of evidence which each find statistically significant rises in ipsilateral cancer as compared with contralateral cancer. The ipsilateral findings produce very strong arguments that cell phones and/or cordless phones do cause brain cancer in humans. The best

evidence suggests that both cell phones and cordless phones do cause cancer. What does SCENIHR 2015 [73] say about ipsilateral cancer? [73] states, on p. 74 that **"ORs for glioma were higher in subjects who reported phone use mostly on the same side of the head (ipsilateral) as their tumour than for use on the opposite side (contralateral). For meningioma, ORs for temporal lobe tumours were slightly lower than for other locations, while a similar pattern as for glioma of higher ipsilateral ORs compared to contralateral ORs was seen."** On p. 76, SCENIHR states that **"Afterwards, in an attempt to quantify the relationship, Interphone and the Hardell studies were analysed in a meta-analytical approach (Hardell et al., 2013a), an OR of 1.71 (CI: 1.04-2.81) was found for temporal glioma among ipsilateral mobile phone users of 10+ years of use...."** On p. 77, regarding a study designed to assess the reliability of self-reported cell phone usage in young brain cancer patients, a study not designed to assess ipsilateral effects in patients whose cancer cases may likely have been caused by cell phone usage, the SCENIHR 2015 document states "No clear patterns were seen when comparing ipsilateral and contralateral use." That is not surprising. It can be seen from this that 2 out of 3 studies that SCENIHR discussed argue that there is increased ipsilateral cancer and argue therefore that cell phones or cordless phones do cause cancer. Furthermore, they ignore large amounts of data, cited in [78,84,85,98,99] that provide further support for this view. When SCENIHR wishes to take the opposite position from that taken in these reviews, it is incumbent on SCENIHR to cite them, to discuss the data and opinion presented in those reviews and then and only then can they argue for their position. Having failed to do those things, SCENIHR loses credibility in any argument that they are doing what they can to protect our health. The same is true for all of the other effects where they similarly fail to cite large numbers of obviously relevant reviews, each arguing for various health effects produced by EMF exposures.

Two other findings from these reviews are important in assessing EMF cancer causation. Refs. [85 and 99] each provide evidence that younger people are more susceptible to cancer causation by EMFs than are adults. SCENIHR takes the opposite view but cannot argue credibly without considering those who differ. The other finding found in [97] is that the epidemiological evidence on cancer causation by microwave frequency EMFs satisfies most of the Hill criteria. The Hill criteria are THE well-accepted criteria that allow one to distinguish chance associations from causal roles in epidemiology. Because epidemiology is the main basis for the arguments that SCENIHR makes against the conclusion that EMFs cause cancer, it is essential that SCENIHR carefully examine the Hill criteria. They fail to do so. They also ignored this study where these criteria were examined and where it was concluded that the majority of the Hill criteria argue that EMFs do cause cancer. This again, undercuts any claim that SCENIHR has carefully considered critically important findings with regard to EMF health effects.

There are several places in the SCENIHR 2015 document, where they state that no mechanisms have been identified by which claimed effects of EMFs can be produced. These can be found by searching the SCENIHR 2015 document using "mechanism" as the search term. However [4] clearly states that the VGCC activation mechanism triggered by EMF exposure can produce, via this mechanism, cellular DNA damaging effects, can produce therapeutic effects and can produce oxidative stress effects. It can be seen, therefore that SCENIHR has no problem making repeated claims that have been falsified by information that they presumably have examined. It also can be seen from this, that even in the cases where SCENIHR cites and very briefly discusses a review that disagrees with them, one can have no assurance that the information is used by SCENIHR in its assessment of health impacts. The causation of cellular DNA damage by EMFs acting via VGCC activation also has important implications with regard to cancer causation. Because almost all cases of cancer start with mutagenic DNA damage in the cell destined to become a cancer cell, this shows how EMFs can initiate the process of carcinogenesis.

It is clear that the SCENIHR 2015 document neither cited nor discussed 20 out of 22 reviews that have documented non-thermal effects of EMFs. In addition, the most important findings of the two that were cited in the document were ignored in the document as well. Therefore SCENIHR has systematically avoided discussing the most important implications of reviews that fell into the time frame they purport to have studied and disagreed with SCENIHR on the existence of important effects. The question can be raised, however, as to whether the SCENIHR has done a better job in its consideration of primary literature citations. To answer that question, I am using a database of important primary literature, regarding effects of cell phone EMFs that we are commonly exposed to.

23 Genuine Cell Phone Studies, Each of Which Should Be Discussed in SCENIHR 2015, 20 of Which Are Not.

Panagopoulos et al [100] showed that whereas 46 out of 48 studies on genuine cell phone radiation showed health-related effects, the majority of studies on simulated cell phones reported no statistically significant effects. They [100] interpreted the difference of results as having been caused by the lowered pulsation rate of the "simulated" cell phone exposures. While I am sure that is part of the explanation, there may be other possible differences that are discussed later in this chapter.

Of those 48 genuine cell phone studies, 23 fell into the time frame (Jan. 2009 through Dec. 2013) reviewed in SCENIHR, 2015. Because of the importance of cell phones and therefore cell phone radiation in our lives, I am using these 23 as a database of primary literature studies that should all be covered in the SCENIHR 2015 [73] document.

How many of these 23 were reviewed and cited in SCENIHR 2015? The answer is four (17%) and I will discuss how each of them were discussed below. I have inserted 17 of these into Table 4 below, but six were left out, because they are easy to summarize. These six are all Drosophila studies, none of which were discussed in SCENIHR 2015 [73] but are easy to summarize. All six Drosophila studies were focused on lowered fertility following EMF exposure, with the majority of these focused on lowered female fertility. Four of the six found increased apoptosis following cell phone EMF exposaure and four of the six also found cellular DNA damage following exposure. These are important because of the similarities of each of these effects to effects found in mammals. They are also important because they found DNA damage in Drosophila eggs, whereas mammalian eggs no similar studies have been done because of the difficulty in doing so. Two of these six Drosophila studies, also identified a low intensity exposure window which produced much larger effects than did lower or higher intensities. These exposure windows make it difficult or impossible to predict EMF effects based on EMF intensities. However, the industry and industry friendly groups such as SCENIHR repeatedly make such false predictions.

In mammals there are many studies showing DNA damage in sperm following EMF exposure. This DNA damage in germ line cells is particularly importance because of the importance of mutations passed onto progeny. Table 4 summarizes the other 17 genuine cell phone radiation findings that that SCENIHR 2015 [73] should be discussing, 15 of which were not discussed or cited in SCENIHR 2015.

Table 4 follows:

Table 4: Genuine Cell Phone Studies that Fell into the 2009 through 2013 SCENIHR 2015 period

Citation studied	Cell Phone Effects Reported	SCENIHR comments
1. Mailankot M, Kunnath AP, Jayalekshmi H, Koduru B, Valsalan R. 2009 Radio frequency electromagnetic radiation (RF-EMR) from GSM (0.9/1.8GHz) mobile phones induces oxidative stress and reduces sperm motility in rats. Clinics (Sao Paulo) 64:561-565.	The present study was designed to evaluate the effects of RF-EMR from mobile phones on free radical metabolism and sperm quality. **MATERIALS AND METHODS**: Male albino Wistar rats (10-12 weeks old) were exposed to RF-EMR from an active GSM (0.9/1.8 GHz) mobile phone for 1 hour continuously per day for 28 days. Controls were exposed to a mobile phone without a battery for the same period. The phone was kept in a cage with a wooden bottom in order to address concerns that the effects of exposure to the phone could be due to heat emitted by the phone rather than to RF-EMR alone. Animals were sacrificed 24 hours after the last exposure and tissues of interest were harvested. RESULTS: One hour of exposure to the phone did not significantly change facial temperature in either group of rats. No significant difference was observed in total sperm count between controls and RF-EMR exposed groups. However, rats exposed to RF-EMR exhibited a significantly reduced percentage of motile sperm. Moreover, RF-EMR exposure resulted in a significant increase in lipid peroxidation and low GSH content in the testis and epididymis. **CONCLUSION**: Given the results of the present study, we speculate that RF-EMR from mobile phones negatively affects semen quality and may impair male fertility.	Listed under literature identified but not cited. SCENIHR knew about this paper but decided not to discuss it.

Citation studied	Cell Phone Effects Reported	SCENIHR comments
2. Gul A, Celebi H, Uğraş S. 2009 The effects of microwave emitted by cellular phones on ovarian follicles in rats. Arch Gynecol Obstet 280:729-733. doi: 10.1007/s00404-009-0972-9.	The aim of this study was to investigate whether there were any toxic effects of microwaves of cellular phones on ovaries in rats. **METHODS**: In this study, 82 female pups of rats, aged 21 days (43 in the study group and 39 in the control group) were used. Pregnant rats in the study group were exposed to mobile phones that were placed beneath the polypropylene cages during the whole period of pregnancy. The cage was free from all kinds of materials, which could affect electromagnetic fields. A mobile phone in a standby position for 11 h and 45 min was turned on to speech position for 15 min every 12 h and the battery was charged continuously. On the 21st day after the delivery, the female rat pups were killed and the right ovaries were removed. The volumes of the ovaries were measured and the number of follicles in every tenth section was counted. **RESULTS**: The analysis revealed that in the study group, the number of follicles was lower than that in the control group. The decreased number of follicles in pups exposed to mobile phone microwaves suggest that intrauterine exposure has toxic effects on ovaries. CONCLUSION: We suggest that the microwaves of mobile phones might decrease the number of follicles in rats by several known and, no doubt, countless unknown mechanisms.	Not cited and not discussed by SCENIHR.

Citation studied	Cell Phone Effects Reported	SCENIHR comments
3. Imge EB, Kiliçoğlu B, Devrim E, Cetin R, Durak I. 2010 Effects of mobile phone use on brain tissue from the rat and a possible protective role of vitamin C - a preliminary study. Int J Radiat Biol 86:1044-1049. doi: 10.3109/09553002.2010.501838.	To evaluate effects of mobile phone use on brain tissue and a possible protective role of vitamin C. **MATERIALS AND METHODS**: Forty female rats were divided into four groups randomly (Control, mobile phone, mobile phone plus vitamin C and, vitamin C alone). The mobile phone group was exposed to a mobile phone signal (900 MHz), the mobile phone plus vitamin C group was exposed to a mobile phone signal (900 MHz) and treated with vitamin C administered orally (per os). The vitamin C group was also treated with vitamin C per os for four weeks. Then, the animals were sacrificed and brain tissues were dissected to be used in the analyses of malondialdehyde (MDA), antioxidant potential (AOP), superoxide dismutase, catalase (CAT), glutathione peroxidase (GSH-Px), xanthine oxidase, adenosine deaminase (ADA) and 5'nucleotidase (5'-NT). RESULTS: Mobile phone use caused an inhibition in 5'-NT and CAT activities as compared to the control group. GSH-Px activity and the MDA level were also found to be reduced in the mobile phone group but not significantly. Vitamin C caused a significant increase in the activity of GSH-Px and non-significant increase in the activities of 5'-NT, ADA and CAT enzymes. **CONCLUSION**: Our results suggest that vitamin C may play a protective role against detrimental effects of mobile phone radiation in brain tissue.	Not cited and not discussed by SCENIHR.
4. Sharma VP, Kumar NR. 2010 Changes in honeybee behavior under the influence of cell phone radiation. Curr Science 98: 1376-1378.	Honeybee behaviour and biology has been affected by electrosmog since these insects have magnetite in their bodies which helps them in navigation. There are reports of sudden disappearance of bee populations from honeybee colonies. The reason is still not clear. We have compared the performance of honeybees in cellphone radiation exposed and unexposed colonies. A significant ($p < 0.05$) decline in colony strength and in the egg laying rate of the queen was observed. The behaviour of exposed foragers was negatively influenced by the exposure, there was neither honey nor pollen in the colony at the end of the experiment.	Not cited and not discussed by SCENIHR.

Citation studied	Cell Phone Effects Reported	SCENIHR comments
5. Vecchio F, Babiloni C, Ferreri F, Buffo P, Cibelli G, Curcio G, van Dijkman S, Melgari JM, Giambattistelli F, Rossini PM. 2010 Mobile phone emission modulates inter-hemispheric functional coupling of EEG alpha rhythms in elderly compared to young subjects. Clin Neurophysiol 121:163-171. doi: 10.1016/j.clinph.2009.11.002.	It has been reported that GSM electromagnetic fields (GSM-EMFs) of mobile phones modulate--after a prolonged exposure--inter-hemispheric synchronization of temporal and frontal resting electroencephalographic (EEG) rhythms in normal young subjects [Vecchio et al., 2007]. Here we tested the hypothesis that this effect can vary on physiological aging as a sign of changes in the functional organization of cortical neural synchronization. **METHODS**: Eyes-closed resting EEG data were recorded in 16 healthy elderly subjects and 5 young subjects in the two conditions of the previous reference study. The GSM device was turned on (45 min) in one condition and was turned off (45 min) in the other condition. Spectral coherence evaluated the inter-hemispheric synchronization of EEG rhythms at the following bands: delta (about 2-4 Hz), theta (about 4-6 Hz), alpha 1 (about 6-8 Hz), alpha 2 (about 8-10 Hz), and alpha 3 (about 10-12 Hz). The aging effects were investigated comparing the inter-hemispheric EEG coherence in the elderly subjects vs. a young group formed by 15 young subjects (10 young subjects of the reference study; Vecchio et al., 2007). RESULTS: Compared with the young subjects, the elderly subjects showed a statistically significant ($p<0.001$) increment of the inter-hemispheric coherence of frontal and temporal alpha rhythms (about 8-12 Hz) during the GSM condition. **CONCLUSIONS**: These results suggest that GSM-EMFs of a mobile phone affect inter-hemispheric synchronization of the dominant (alpha) EEG rhythms as a function of the physiological aging. SIGNIFICANCE: This study provides further evidence that physiological aging is related to changes in the functional organization of cortical neural synchronization.	Was cited and discussed – see text.

Citation studied	Cell Phone Effects Reported	SCENIHR comments
6. Kumar NR, Sangwan S, Badotra P. 2011 Exposure to cell phone radiations produces biochemical changes in worker honey bees. Toxicol Int. 2011 Jan;18(1):70-2. doi: 10.4103/0971-6580.75869.	The present study was carried out to find the effect of cell phone radiations on various biomolecules in the adult workers of Apis mellifera L. The results of the treated adults were analyzed and compared with the control. Radiation from the cell phone influences honey bees' behavior and physiology. There was reduced motor activity of the worker bees on the comb initially, followed by en masse migration and movement toward "talk mode" cell phone. The initial quiet period was characterized by rise in concentration of biomolecules including proteins, carbohydrates and lipids, perhaps due to stimulation of body mechanism to fight the stressful condition created by the radiations. At later stages of exposure, there was a slight decline in the concentration of biomolecules probably because the body had adapted to the stimulus.	Not cited and not discussed by SCENIHR.
7. Favre D. 2011 Mobile phone-induced honeybee worker piping. Apidologie 42:270-279.	Electromagnetic waves originating from mobile phones were tested for potential effects on honeybee behavior. Mobile phone handsets were placed in the close vicinity of honeybees. The sound made by the bees was recorded and analyzed. The audiograms and spectrograms revealed that active mobile phone handsets have a dramatic impact on the behavior of the bees, namely by inducing the worker piping signal. In natural conditions, worker piping either announces the swarming process of the bee colony or is a signal of a disturbed bee colony.	Not cited and not discussed by SCENIHR.

Citation studied	Cell Phone Effects Reported	SCENIHR comments
8. Cammaerts MC, Debeir O, Cammaerts R. 2011. Changes in Paramecium caudatum (protozoa) near a switched-on GSM telephone. Electromagn Biol Med. 2011 Mar;30(1):57-66. doi: 10.3109/15368378.2011.566778.	The protozoan Paramecium caudatum was examined under normal conditions versus aside a switched-on GSM telephone (900 MHz; 2 Watts). Exposed individuals moved more slowly and more sinuously than usual. Their physiology was affected: they became broader, their cytopharynx appeared broader, their pulse vesicles had difficult in expelling their content outside the cell, their cilia less efficiently moved, and trichocysts became more visible. All these effects might result from some bad functioning or damage of the cellular membrane. The first target of communication electromagnetic waves might thus be the cellular membrane.	Listed under literature identified but not cited. SCENIHR knew about this paper but decided not to discuss it.
9. Çam ST, Seyhan N. 2012 Single-strand DNA breaks in human hair root cells exposed to mobile phone radiation. Int J Radiat Biol 88:420-424. doi: 10.3109/09553002.2012.666005.	To analyze the short-term effects of radiofrequency radiation (RFR) exposure on genomic deoxyribonucleic acid (DNA) of human hair root cells. SUBJECTS AND METHODS: Hair samples were collected from eight healthy human subjects immediately before and after using a 900-MHz GSM (Global System for Mobile Communications) mobile phone for 15 and 30 min. Single-strand DNA breaks of hair root cells from the samples were determined using the 'comet assay'. **RESULTS**: The data showed that talking on a mobile phone for 15 or 30 min significantly increased ($p < 0.05$) single-strand DNA breaks in cells of hair roots close to the phone. Comparing the 15-min and 30-min data using the paired t-test also showed that significantly more damages resulted after 30 min than after 15 min of phone use. CONCLUSIONS: A short-term exposure (15 and 30 min) to RFR (900-MHz) from a mobile phone caused a significant increase in DNA single-strand breaks in human hair root cells located around the ear which is used for the phone calls.	Not cited and not discussed by SCENIHR.

Citation studied	Cell Phone Effects Reported	SCENIHR comments
10. Vecchio F, Tombini M, Buffo P, Assenza G, Pellegrino G, Benvenga A, Babiloni C, Rossini PM. 2012 Mobile phone emission increases inter-hemispheric functional coupling of electroencephalographic α rhythms in epileptic patients. Int J Psychophysiol 84:164-171. doi: 10.1016/j.ijpsycho.2012.02.002.	It has been reported that GSM electromagnetic fields (GSM-EMFs) of mobile phones modulate - after a prolonged exposure - inter-hemispheric synchronization of temporal and frontal resting electroencephalographic (EEG) rhythms in normal young and elderly subjects (Vecchio et al., 2007, 2010). Here we tested the hypothesis that this can be even more evident in epileptic patients, who typically suffer from abnormal mechanisms governing synchronization of rhythmic firing of cortical neurons. Eyes-closed resting EEG data were recorded in ten patients affected by focal epilepsy in real and sham exposure conditions. These data were compared with those obtained from 15 age-matched normal subjects of the previous reference studies. The GSM device was turned on (45 min) in the "GSM" condition and was turned off (45 min) in the other condition ("sham"). The mobile phone was always positioned on the left side in both patients and control subjects. Spectral coherence evaluated the inter-hemispheric synchronization of EEG rhythms at the following frequency bands: delta (about 2-4 Hz), theta (about 4-6 Hz), alpha1 (about 6-8 Hz), alpha2 (about 8-10 Hz), and alpha3 (about 10-12 Hz). The effects on the patients were investigated comparing the inter-hemispheric EEG coherence in the epileptic patients with the control group of subjects evaluated in the previous reference studies. Compared with the control subjects, epileptic patients showed a statistically significant higher inter-hemispheric coherence of temporal and frontal alpha rhythms (about 8-12 Hz) in the GSM than "Sham" condition. These results suggest that GSM-EMFs of mobile phone may affect inter-hemispheric synchronization of the dominant (alpha) EEG rhythms in epileptic patients. If confirmed by future studies on a larger group of epilepsy patients, the modulation of the inter-hemispheric alpha coherence due to the GSM-EMFs could have clinical implications and be related to changes in cognitive-motor function.	Was cited and discussed – see text.

Citation studied	Cell Phone Effects Reported	SCENIHR comments
11. Al-Damegh MA. 2012 Rat testicular impairment induced by electromagnetic radiation from a conventional cellular telephone and the protective effects of the antioxidants vitamins C and E. Clinics 67:785-792	**OBJECTIVE**: The aim of this study was to investigate the possible effects of electromagnetic radiation from conventional cellular phone use on the oxidant and antioxidant status in rat blood and testicular tissue and determine the possible protective role of vitamins C and E in preventing the detrimental effects of electromagnetic radiation on the testes. **MATERIALS AND METHODS**: The treatment groups were exposed to an electromagnetic field, electromagnetic field plus vitamin C (40 mg/kg/day) or electromagnetic field plus vitamin E (2.7 mg/kg/day). All groups were exposed to the same electromagnetic frequency for 15, 30, and 60 min daily for two weeks. RESULTS: There was a significant increase in the diameter of the seminiferous tubules with a disorganized seminiferous tubule sperm cycle interruption in the electromagnetism-exposed group. The serum and testicular tissue conjugated diene, lipid hydroperoxide, and catalase activities increased 3-fold, whereas the total serum and testicular tissue glutathione and glutathione peroxidase levels decreased 3-5 fold in the electromagnetism-exposed animals. **CONCLUSION**: Our results indicate that the adverse effect of the generated electromagnetic frequency had a negative impact on testicular architecture and enzymatic activity. This finding also indicated the possible role of vitamins C and E in mitigating the oxidative stress imposed on the testes and restoring normality to the testes.	Listed under literature identified but not cited. SCENIHR knew about this paper but decided not to discuss it.

Citation studied	Cell Phone Effects Reported	SCENIHR comments
12. Aldad TS, Gan G, Gao X-B, Taylor HS. 2012 Fetal radiofrequency radiation from 800-1900 MH-rated cellular telephone affects neurodevelopment and behavior in mice. Scientific Rep 2, article 312.	Neurobehavioral disorders are increasingly prevalent in children, however their etiology is not well understood. An association between prenatal cellular telephone use and hyperactivity in children has been postulated, yet the direct effects of radiofrequency radiation exposure on neurodevelopment remain unknown. Here we used a mouse model to demonstrate that in-utero radiofrequency exposure from cellular telephones does affect adult behavior. Mice exposed in-utero were hyperactive and had impaired memory as determined using the object recognition, light/dark box and step-down assays. Whole cell patch clamp recordings of miniature excitatory postsynaptic currents (mEPSCs) revealed that these behavioral changes were due to altered neuronal developmental programming. Exposed mice had dose-responsive impaired glutamatergic synaptic transmission onto layer V pyramidal neurons of the prefrontal cortex. We present the first experimental evidence of neuropathology due to in-utero cellular telephone radiation. Further experiments are needed in humans or non-human primates to determine the risk of exposure during pregnancy.	Was cited and discussed, see text.

Citation studied	Cell Phone Effects Reported	SCENIHR comments
13. Liu C, Gao P, Xu SC, Wang Y, Chen CH, He MD, Yu ZP, Zhang L, Zhou Z. 2013 Mobile phone radiation induces mode-dependent DNA damage in a mouse spermatocyte-derived cell line: a protective role of melatonin. Int J Radiat Biol. 2013. 89: 993-1001. doi: 10.3109/ 09553002.2013.811309.	A mouse spermatocyte-derived GC-2 cell line was exposed to a commercial mobile phone handset once every 20 min in standby, listen, dialed or dialing modes for 24 h. DNA damage was determined using an alkaline comet assay. **RESULTS**: The levels of DNA damage were significantly increased following exposure to MPR in the listen, dialed and dialing modes. Moreover, there were significantly higher increases in the dialed and dialing modes than in the listen mode. Interestingly, these results were consistent with the radiation intensities of these modes. However, the DNA damage effects of MPR in the dialing mode were efficiently attenuated by melatonin pretreatment. **CONCLUSIONS**: These results regarding mode-dependent DNA damage have important implications for the safety of inappropriate mobile phone use by males of reproductive age and also suggest a simple preventive measure: Keeping mobile phones as far away from our body as possible, not only during conversations but during 'dialed' and 'dialing' operation modes. Since the 'dialed' mode is actually part of the standby mode, mobile phones should be kept at a safe distance from our body even during standby operation. Furthermore, the protective role of melatonin suggests that it may be a promising pharmacological candidate for preventing mobile phone use-related reproductive impairments.	Not cited and not discussed by SCENIHR.

Citation studied	Cell Phone Effects Reported	SCENIHR comments
14. Koca O, Gökçe AM, Öztürk MI, Ercan F, Yurdakul N, Karaman MI. 2013 Effects of intensive cell phone (Philips Genic 900) use on the rat kidney tissue. Urol J. 2013 Spring;10:886-891.	To investigate effects of electromagnetic radiation (EMR) emitted by cell phones on the rat kidney tissue. **MATERIALS AND METHODS**: Twenty-one male Albino rats were divided into 3 groups, each comprising 7 rats. Group 1 was exposed to a cell phone in speech mode for 8 hours/day for 20 days and their kidneys were removed. Group 2 was exposed to EMR for 20 days and then their kidneys were removed after an interval of 20 days. Cell phone used in the present study was Philips Genie 900, which has the highest specific absorption rate on the market. **RESULTS**: Light microscopic examination of the kidney tissues obtained from the first group of rats revealed glomerular damage, dilatation of Bowman's capsule, formation of large spaces between the tubules, tubular damage, perivascular edema, and inflammatory cell infiltration. The mean severity score was 4.64 ± 1.7 in group 1, 4.50 ± 0.8 in group 2, and 0 in group 3. While there was no significant difference between group 1 and group 2 (P > .05), the mean severity scores of groups 1 and 2 were significantly higher than that of the control group (P = .001 for each). **CONCLUSION**: Considering the damage in rat kidney tissue caused by EMR-emitting cell phones, high-risk individuals should take protective measures.	Not cited and not discussed by SCENIHR.

Citation studied	Cell Phone Effects Reported	SCENIHR comments
15. Meo SA, Al Rubeaan K. 2013 Effects of exposure to electromagnetic field radiation (EMFR) generated by activated mobile phones on fasting blood glucose. Int J Occup Med Environ Health 26:235-241. doi: 10.2478/s13382-013-0107-1.	Extensive use of mobile phones has been accompanied by a common public debate about possible adverse effects on human health. No study has been published so far to establish any association between the fastest growing innovation of mobile phone and fasting blood glucose. The aim was to determine the effects of exposure to electromagnetic field radiation generated by mobile phones on fasting blood glucose in Wistar Albino rats. **MATERIALS AND METHODS**: 40 Male Albino rats (Wistar Strain) were divided into 5 equally numerous groups. Group A served as the control one, group B received mobile phone radiation for less than 15 min/day, group C: 15-30 min/day, group D: 31-45 min/day, and group E: 46-60 min/day for a total period of 3 months. Fasting blood glucose was determined by using Spectrophotometer and serum insulin by Enzyme-linked Immunosorbent Assay (ELISA). The Homeostatic Model (HOMA-B) was applied for the assessment of β-cell function and (HOMA-IR) for resistance to insulin. **RESULTS**: Wister Albino rats exposed to mobile phone radiation for longer than 15 min a day for a total period of 3 months had significantly higher fasting blood glucose ($p < 0.015$) and serum insulin ($p < 0.01$) compared to the control group. HOMA-IR for insulin resistance was significantly increased ($p < 0.003$) in the groups that were exposed for 15-30 and 46-60 min/day compared to the control rats. **CONCLUSION**: The results of the present study show an association between long-term exposure to activated mobile phones and increase in fasting blood glucose and serum insulin in Albino rats.	Not cited and not discussed by SCENIHR.

Citation studied	Cell Phone Effects Reported	SCENIHR comments
16. Tsybulin O, Sidorik E, Brieieva O, Buchynska L, Kyrylenko S, Henshel D, Yakymenko I. 2013 GSM 900 MHz cellular phone radiation can either stimulate or depress early embryogenesis in Japanese quails depending on the duration of exposure. Int J Radiat Biol 89:756-763. doi: 10.3109/09553002. 2013.791408.	Our study was designed to assess the effects of low intensity radiation of a GSM (Global System for Mobile communication) 900 MHz cellular phone on early embryogenesis in dependence on the duration of exposure. **MATERIALS AND METHODS**: Embryos of Japanese Quails were exposed in ovo to GSM 900 MHz cellular phone radiation during initial 38 h of brooding or alternatively during 158 h (120 h before brooding plus initial 38 h of brooding) discontinuously with 48 sec ON (average power density 0.25 μW/cm(2), specific absorption rate 3 μW/kg) followed by 12 sec OFF intervals. A number of differentiated somites were assessed microscopically. Possible DNA damage evoked by irradiation was assessed by an alkaline comet assay. **RESULTS**: Exposure to radiation from a GSM 900 MHz cellular phone led to a significantly altered number of differentiated somites. In embryos irradiated during 38 h the number of differentiated somites increased ($p < 0.001$), while in embryos irradiated during 158 h this number decreased ($p < 0.05$). The lower duration of exposure led to a significant ($p < 0.001$) decrease in a level of DNA strand breaks in cells of 38-h embryos, while the higher duration of exposure resulted in a significant ($p < 0.001$) increase in DNA damage as compared to the control. **CONCLUSION**: Effects of GSM 900 MHz cellular phone radiation on early embryogenesis can be either stimulating or deleterious depending on the duration of exposure.	Listed under literature identified but not cited. SCENIHR knew about this paper but decided not to discuss it.

Citation studied	Cell Phone Effects Reported	SCENIHR comments
17. Luo Q, Jiang Y, Jin M, Xu J, Huang HF. 2013 Proteomic analysis on the alteration of protein expression in the early-stage placental villous tissue of electromagnetic fields associated with cell phone exposure. Reprod Sci 20:1055-1061. doi: 10.1177/1933719112473660.	To explore the possible adverse effects and search for cell phone electromagnetic field (EMF)-responsive proteins in human early reproduction, a proteomics approach was employed to investigate the changes in protein expression profile induced by cell phone EMF in human chorionic tissues of early pregnancy in vivo. METHODS: Volunteer women about 50 days pregnant were exposed to EMF at the average absorption rate of 1.6 to 8.8 W/kg for 1 hour with the irradiation device placed 10 cm away from the umbilicus at the midline of the abdomen. The changes in protein profile were examined using 2-dimensional electrophoresis (2-DE). **RESULTS**: Up to 15 spots have yielded significant change at least 2- to 2.5-folds up or down compared to sham-exposed group. Twelve proteins were identified- procollagen-proline, eukaryotic translation elongation factor 1 delta, chain D crystal structure of human vitamin D-binding protein, thioredoxin-like 3, capping protein, isocitrate dehydrogenase 3 alpha, calumenin, Catechol-O-methyltransferase protein, proteinase inhibitor 6 (PI-6; SerpinB6) protein, 3,2-trans-enoyl-CoA isomerase protein, chain B human erythrocyte 2,3-bisphosphoglycerate mutase, and nucleoprotein. **CONCLUSION**: Cell phone EMF might alter the protein profile of chorionic tissue of early pregnancy, during the most sensitive stage of the embryos. The exposure to EMF may cause adverse effects on cell proliferation and development of nervous system in early embryos. Furthermore, 2-DE coupled with mass spectrometry is a promising approach to elucidate the effects and search for new biomarkers for environmental toxic effects.	Listed under literature identified but not cited. SCENIHR knew about this paper but decided not to discuss it.

If you look through the studies described in Table 4, you will see multiple studies in oxidative stress/free radical damage, on changes in tissue structure (sometimes called remodeling), on cellular DNA damage, on male fertility (and also one on female fertility), on behavioral changes and on neurological changes. There is also one study on insulin/type 2 diabetes (hormonal effect). It follows from this that five of the effects that were extensively documented in large numbers of reviews (Chapter 1) are further demonstrated, as being caused be cell phone radiation, in these studies. In addition

the tissue remodeling and proteomic changes discussed in Chapter 3 are also further demonstrated here. One question that needs to be raised with regard to SCENIHR is why so many clearly important primary literature studies of cell phone radiation (perhaps the most important source of human microwave irradiation) are not discussed in SCENIHR 2015. I will discuss certain particular articles that I think are particularly important for particular reasons. Subsequently, I will discuss the three articles that SCENIHR does discuss.

One of the more interesting studies not discussed by SCENIHR, is #11 in Table 4. This was published by a woman scientist in Saudi Arabia. What it shows is that 15, 30 or 60 minutes per day of cell phone radiation disrupts the structure of the rat testis and also produces high levels of oxidative stress as shown by measuring 5 different markers of oxidative stress. Such studies have been done for several decades, with oxidative stress having been shown in many different organs following EMF exposures. What is particularly important in this study is that high levels of two different antioxidants, vitamin C and vitamin E, were each shown to produce substantial protection of the testis structure from the EMF effects while partially normalizing the oxidative stress elevation. What this clearly shows is that the oxidative stress causes the testis tissue disruption. So we don't just have evidence for two effects, testis disruption and oxidative stress but we have strong evidence that one causes the other. It is exactly these connections that are essential for the progression of the science!

#13 is another study not discussed by SCENIHR which is particularly important. It looks at cell phone radiation DNA damage produced in a mouse spermatocyte-derived cell line. What it finds is that DNA damage is particularly high when the cell phone is in the dialed or dialing mode, as opposed to a listen mode. They also state that the radiation levels in the three modes correspond, at least roughly, to the DNA damage effects seen. They also show that pretreatment with melatonin (which is known to have antioxidant effects) greatly lowers the DNA damage produced by the cell phone EMF exposures. This is similar to the study discussed immediately above because it again shows that one effect, DNA damage is produced by another effect, namely oxidative stress/free radical elevation. You will recall that as discussed in Chapter 2, cellular DNA damage following EMF exposure is produced by the attacks by on the DNA by peroxynitrite derived free radicals. This study provides confirmation for that mechanism.

#14 is another study not discussed by SCENIHR which is also particularly important. It looks at the impact of cell phone radiation on kidney structure of rats, using six different measures of kidney structure. There were two groups of rats that were exposed to cell phone radiation which were both compared with each other and with normal unexposed control rats. The two exposed groups differed from each

other in one group the kidney structure was assessed immediately following the 20 day exposure period. The second exposure group was also exposed for 20 days but was given 20 days subsequently with no exposure to see if the kidney structure spontaneously recovered. There was no recovery seen in the second group, showing that the kidney damage was effectively irreversible. In Chapter 3, several tissue remodeling type effects produced by EMF exposure appeared to be irreversible. Study #14 may add an additional such effect to that list.

#15 is another study not discussed by SCENIHR which is also particularly important. In this study control (unexposed) rats were compared with rats exposed to cell phone radiation for: less than 15 minutes per day, 15 to 30 minutes per day, 31 to 45 minutes per day or 45 to 60 minutes per day. Rats exposed to over 15 minutes per day of cell phone radiation showed type 2 diabetes onset-like effects, with higher fasting glucose levels and higher serum insulin levels. This appears to be, therefore a study showing important hormone dysfunction. It should be noted that the same research group has found similar changes in people living near cell phone towers [101]. Consequently, this is still another situation where findings in experimental animal studies appear to be directly applicable to humans.

Of the papers that were discussed, it is my opinion that the Aldad et al paper (#12, Table 4) is perhaps the most important. The paper starts out discussing the very large increase in ADHD that we have had in recent years, an increase which suggests that one or more environmental changes must be involved. This paper is from a distinguished laboratory, Hugh Taylor's laboratory at Yale, and was published in one of the highly respected Nature journals and the paper, at this writing has been cited 89 times, showing a high level of scientific interest in it. The paper showed that prenatal exposure of pregnant mice to cell phone radiation produced three highly statistically significant changes in the adult mice. These were a decrease in measured memory function, increase in hyperactivity and increase in anxiety. They also showed that there was a dose dependent decrease in an important neurological parameter, the frequency of miniature excitatory postsynaptic currents, allowing the authors to conclude "that these behavioral changes were due to altered neuronal developmental programming." SCENIHR states the following about this study: "Neurodevelopment from a functional point of view was studied by Aldad et al. (2012) who exposed mice in utero and investigated them as adults for certain behavioural traits and electrophysiological characteristics. Exposure is poorly described but is reported to be to a muted telephone (900-1800 MHz) during the entire gestation period. After blinded investigations, the authors concluded that exposed animals displayed hyperactivity, memory deficiencies, decreased anxiety, and impaired glutamatergic transmission. Although the study employs relevant biological end-points, it cannot be used for any conclusions regarding

pre-natal mobile phone exposure and functional development of the brain." SCENIHR fails to tell us why they claim the exposures were poorly described nor do they provide any reasoning on why "it cannot be used for any conclusions regarding pre-natal mobile phone exposure and development of the brain." It is hard to see how such results could be found unless there are substantial effects of pre-natal exposure. Because the study used genuine cell phone radiation, the effects seen are disturbing. It would be reasonable for SCENIHR to call for more studies of this type to see if they can be replicated. Having said that there have been five subsequent studies that I found where pre-natal mouse exposure to non-thermal EMFs produced substantial and somewhat similar adult neurological effects and or behavioral effects [102-106]. These five included exposures to Wi-Fi and to DECT (cordless phone) EMFs. These studies provide, then, strong evidence that prenatal exposures to EMFs can in animals, produce ADHD-like effects even into adulthood. They also show that during the late prenatal period, the developing brain is particularly sensitive to the effects of microwave frequency EMFs and raise the issue of how long after birth such sensitivity is also seen. It is common for SCENIHR and other industry friendly organizations to treat experimental studies as if they had the weaknesses of epidemiological studies. They don't because they can and do in these cases, directly demonstrate causation. In epidemiology, causation can be inferred but not directly demonstrated. What about epidemiological evidence with regard to EMF causation of ADHD? There are two such studies that each provide evidence for an association between prenatal cell phone exposures and development of ADHD [107,108]. SCENIHR knew about both of these, since it discusses one of them which is, in turn, based on the earlier one. Why then did SCENIHR not make the connection of those two studies with at Aldad study (#12 in Table 4)? That is of course an important failure, given that the Aldad study greatly strengthens the argument for EMF causation of ADHD.

Given the current situation where there are a total of 6 studies showing that pre-natal EMF exposures, including cell phone, Wi-Fi and cordless phone EMFs can cause ADHD-like effects in mice and two human epidemiological studies suggesting a similar mechanism in humans and the parallel between the huge increase in ADHD in humans and the huge increase in microwave frequency EMF exposures, is there any other type of evidence that supports a causal role for EMFs? It turns out there is. EMFs act primarily via VGCC activation (Chapter 20. Genetic polymorphism studies show that elevated VGCC activity has a role in causing ADHD [109], acting to a substantial extent prenatally. This is the way real science works. It is not the way that SCENIHR works.

The Vecchio et al 2010 paper (#5, Table 4) was discussed in SCENIHR 2015 as follows: **"A study by Vecchio et al. (2010) analysed age-dependent EMF effects on alpha activity in waking EEGs in 16 older (47-84 years) and 15 younger subjects (20-37 years).**

Participants were exposed to a GSM signal (902.40 MHz, modulation frequencies: 8.33 and 217 Hz) for 45 min with a maximum SAR of 0.5 W/kg emitted by a commercially available mobile phone which was set using a test card in a double-blind cross-over paradigm. EEG was recorded for 5 min prior to and following exposure at 19 electrodes. The authors found an increased inter-hemispheric coherence of frontal alpha EEG activity after GSM exposure which was statistically significant for the elderly subjects but not for the young ones. This might point to a GSM-EMF related inter-hemispheric synchronization of alpha rhythms as a function of physiological aging." Another related study (#by the same research group was also cited and discussed SCENIHR 2015 [73] as follows: "Vecchio et al. (2012a) used the same study design to investigate an exposure effect in patients with epilepsy. Data from 10 patients were compared to results from 15 age- matched controls from previous studies. Patients showed a statistically significant higher inter-hemispheric coherence of temporal and frontal alpha-rhythms under exposure as compared to control subjects. According to the authors, these results might indicate a GSM exposure effect on inter-hemispheric synchronization of the dominant (alpha) EEG rhythms in epileptic patients."

What do I have to say about the two Vecchio studies? They are both based on an earlier 2007 study which showed that increased EEG coherence between the two hemispheres of the brain was produced by genuine cell phone EMF exposure. What the 2010 study (#5 in Table 4) shows is that the EMF-induced increased coherence is much higher in older adults than it is in younger adults. What the 2012 study (#10 in Table 4) shows is that the EMF-induced coherence seen in people with epilepsy is also much higher than in people without epilepsy. These three studies then provide large amounts of evidence for a neurological effect of cell phone radiation that is influenced by two variables, age and epilepsy. These findings should be looked at the context of the 23 reviews, listed in **Chapter 1**, each showing that EMFs produce both neurological and/or neuropsychiatric impacts on the brain. Here we have still another neurological effect, one that is influenced by age and epileptic condition. There are, then three important findings in these studies. One is that while we have had quite lot of evidence showing that children are more sensitive to EMF effects than adults, this is the first clear finding, to my knowledge, that suggests that older people may be more sensitive to a neurological effect. The linkage to epilepsy should not be surprising as some EHS people are reported to have seizures triggered by very low intensity EMF exposures. Finally, the communication between the two hemispheres of the brain has been known for over half a century to be through what is called the corpus callosum, a structure deeply buried in the middle of the brain, linking the two hemispheres. These effects increasing the coherence between the two hemispheres are probably produced, therefore, through the impact of the EMFs on the corpus callosum. That implies, in

turn, that the EMFs act much more deeply in the brain than the industry claims is possible.

The problem with SCENIHR is that it lives in a totally fictional universe where none of those EMF effect reviews exist or at least none of them have any relevance to the SCENIHR world. Neither of the two Vecchio et al studies, discussed in the previous two paragraphs, are used by SCENIHR [73] to make any conclusions about EMF effects or lack thereof – they are only cited in the quote that I gave you. We know that because because the citations are by author's last name and are, therefore easily searchable. Similarly, the Aldad et al (#12) study discussed two paragraphs further up, was also never cited except in the quotation given. So none of these three papers are used to assess any effects of EMFs or lack of effects. The same thing is true of the two reviews from Table 3 that were cited and discussed in [73]. They also were only cited in the quoted section and are never used to assess EMF effects or the mechanism of EMF action. As previously noted, there are several statements in SCENIHR 2015 [73] regarding lack of any available mechanism to explain claimed EMF effects, something that is directly contradicted by one of those cited and discussed reviews [4]. The consequence of all of that is that we have two very large and very consequential bodies of literature, the reviews on EMF effects and the literature on genuine cell phone radiation effects, which are entirely missing from any SCENIHR 2015 [73] conclusion.

Is There Another Systematic Effort by Industry to Corrupt the Literature that Has Been Followed to Some Extent by SCENIHR?

The important roles of pulsation, window effects, frequency, cell type and polarization in determining biological activity of EMFs were discussed in Chapter 1, where it was noted that SCENIHR fails to pay attention to any of these roles. That failure shows up in many places in the document. In Tables 5, 6, 7, 8, 9, 10, 11, 12, 13 and 14 of SCENIHR 2015 [73], the discussion of each table centers on how many studies found apparent effects and how many did not. But these numbers are irrelevant to the issue of whether there are effects or not. In fact one can argue that the industry, knowing about the roles of each of these factors, could fund any number of studies designed to give apparent negative results just by manipulating these factors to minimize responses and by only studying tiny numbers of individuals to produce low statistical power. This approach closely describes the approach used in seven studies of what were claimed to be genuine Wi-Fi studies that were described by Foster and Moulder [110] in Table 4 of their paper. Those seven studies were shown [11] to all have used an EMF that was not genuine Wi-Fi, despite claims to the contrary. They each used one of two types of reverberation exposure chamber for their rodent exposures, with each type of chamber greatly lowering the polarization of the EMFs [11] and also generating some level of

destructive interference from variable path lengths produced by the reverberations. Each of these changes from genuine Wi- Fi is predicted to lower effects. Foster and Moulder [110] concluded that there was no effect in any of these studies. However tiny numbers of rodents were studied, between 3 and 15 in each class, such that these studies have very low statistical power to conclude anything substantive.

It is not possible to conclude no effect even with large studies. At most one can claim that there is no statistically significant evidence of an effect. With tiny numbers, a claim of no effect is complete nonsense. This problem with "no effect" claims is documented in a section of Rothman et al., Modern Epidemiology, 3rd Edition, a highly respected source of information, cited over 19,000 times according to the Google Scholar database. It states (p. 151, bottom) that: "A common misinterpretation of significance tests is that there no difference between two observed groups because the null test is not statistically significant, in that P is greater that the cutoff for declaring statistical significance (again, usually 0.05). This interpretation confuses a descriptive issue (whether two observed groups differ) with an inference about the superpopulation. The significance test refers only to the superpopulation, not the observed groups. To say that the difference is not statistically significant means only that one cannot reject the null hypothesis that the superpopulation groups are the same; it does not imply that the two groups are the same." All such claims of "no effect" are, therefore flawed. When they are made regarding very small studies with very low statistical power, they are particularly deeply flawed.
Were these seven studies designed to fail? I don't think we can say for certain but they certainly look as if they may have been. They also raise the serious question about whether the industry may be corrupting the science, by using their knowledge of the roles of pulsation, window effects, frequency, cell type and polarization.

The SCENIHR 2015 document has 127 places in the 221 pages of text where the term "no effect" was found (these can be easily found by searching the document using "no effect" for the search terms (that also picks up "no effects" statements. The first two of these 127 places are used properly, to describe the null hypothesis. Each of the other 125 should not be there, with each of those 125 overstating the case and therefore, improperly supporting the industry propaganda case.

In any case, the only way to show that there are inconsistencies or conflicts in the EMF literature is to carefully repeat studies finding such effects, not to flood the literature with studies done under other conditions. The logic used throughout SCENIHR 2015 [73] of just counting numbers of studies is deeply flawed.

SUMMARY OF FLAWS IN SCENIHR 2015

The first set of flaws, is that SCENIHR is perfectly willing to make statements which they know or should have known are false. The most egregious example of this is the Speit/Schwarz controversy described at the beginning of this chapter where there are seven clear falsehoods created by SCENIHR, each of which greatly strengthens the telecommunications industry propaganda positions. There are many others, described in this chapter that are substantive, but less egregious than the Speit/Schwarz falsehoods.

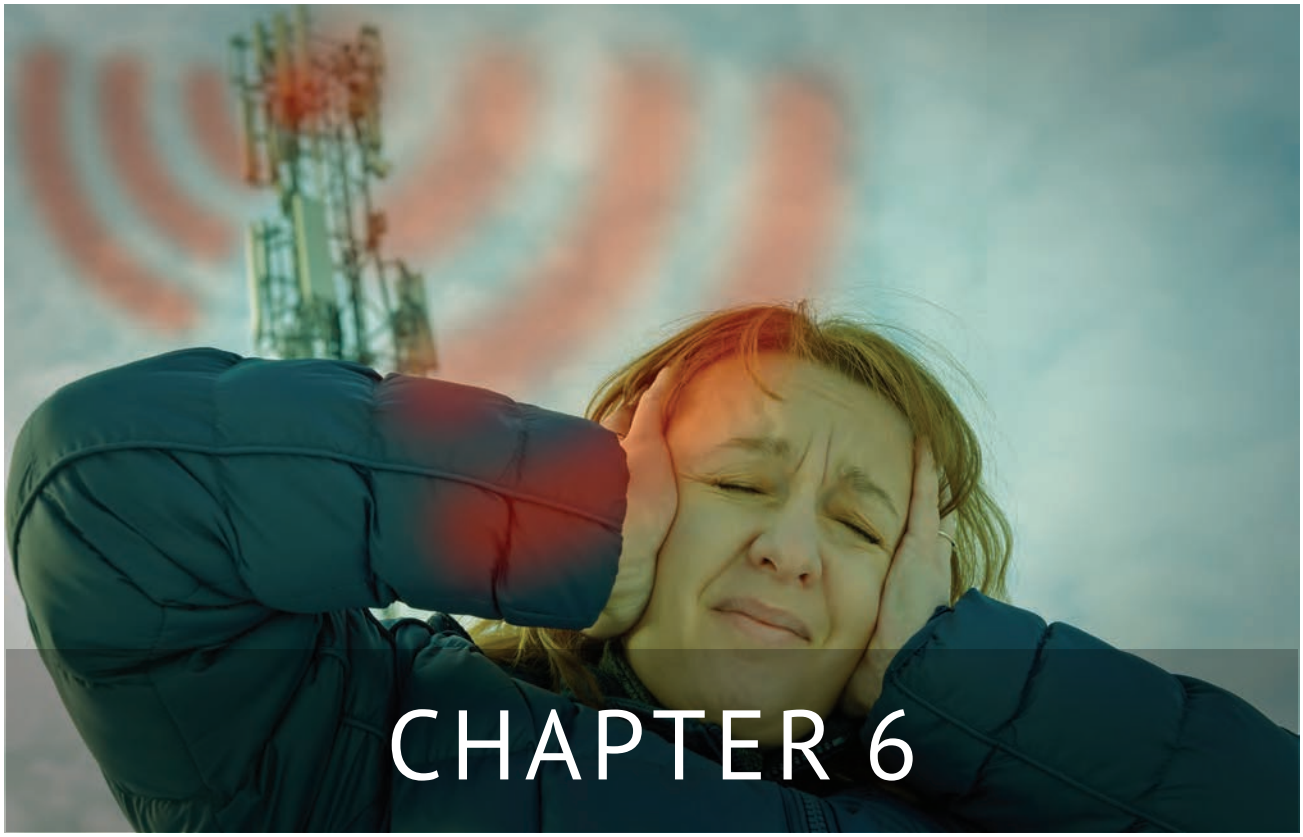
There is a vast literature, both in the review literature and in the primary literature studies, that disagrees strongly with the SCENIHR positions and is completely ignored by SCENIHR. In a few cases, such studies are cited and very briefly discussed by SCENIHR but then they have no impact on the assessments that SCENIHR makes in the SCENIHR 2015 document [73]. In most cases, they are neither cited nor discussed. The situation here is similar to an organization that has two sets of books, the fake books that are used in public and then a genuine set of books that includes all of the data that are too inconvenient to be included in the fake set of books.

The finally, we have three additional considerations which interact with each other to produce the completely bogus logic used by SCENIHR and by other organizations that have taken positions similar those taken by SCENIHR. One of those considerations comes from our knowledge that pulsation pattern, cell type, polarization and frequency can all influence biological effects and that there are exposure windows that produce much larger effects than are seen with either lower or higher intensities. Our knowledge of these factors mean that it is possible for the telecommunications industry to foster any number of studies where it is unlikely that statistically significant evidence of effects will be seen. I have presented examples where this may have been done. One of the most bizarre things about the SCENIHR 2015 document [73] is that there is a sentence on p. 101 where they state "In some of these cases, the effect seemed to be dependent on the cell type investigated and by the electromagnetic parameters applied (frequency, modulation)." Modulation and pulsation are the same thing. They know about these three factors and therefore, they know that these factors may explain differences in results obtained by different studies. But they still falsely assume that such differences imply inconsistencies in results and falsely assume that it makes sense to simply count apparent positive and apparent negative studies as a way of assessing whether there are effects or not.

SCENIHR has often falsely stated that these studies show no effects as opposed to lack of statistical significance of any effects. SCENIHR 2015 document has 125 places where such bogus claims of "no effect" are found. They repeatedly claim the literature

is inconsistent but studies done under different conditions are not inconsistent because they are more likely to be due to genuine biological heterogeneity of responses. The false logic described here is used, in turn, to support another highly pervasive false logic. I've documented where SCENIHR has simply counted numbers of studies showing so many findings of effects and some other number of findings of "no effect." But these numbers are meaningless, when the studies are done under different conditions and where the "no effect" numbers can easily be inflated by studies designed to produce such results. They are also, of course, meaningless, when large numbers of studies that show effects are eliminated by SCENIHR by the simple process of pretending they don't exist. You can see from this, that the entire logical framework behind the SCENIHR 2015 [73] document is completely bogus.

Lastly, before going on to the situation in the U.S. and with 5G, there is one other thing I want to state here. In 2005, Dr. Jared Diamond published a book [111] entitled "Collapse: How Societies Choose to Fail or Succeed." In it he documents how each society that "chose to fail," chose paths that had some short term gains but also had much more severe longer-term consequences. This is exactly what we have been doing with the EMFs, except that the consequences are much more severe than the collapse of one society – here all of the advanced technology societies on earth are at great risk.



CHAPTER 6

The U.S. Early Role in Recognizing Non-Thermal EMF Effects and How This Was Abandoned Starting in 1986: U.S. Failure to Research Health Impacts of Cell Phone Towers, Cell Phones, Wi-Fi, Smart Meters and Now 5G. What Is the Current Position of U.S. Government Agencies?

We in the U.S. often take great pride in our scientific research. That is, of course, especially true of U.S. scientists, of which I am one. We have far more Nobel laureates than any other country so we think of ourselves as being the #1 science country in the world. But we have had, over the past 20 years, almost no scientific primary literature studies, either laboratory studies or epidemiological studies, on non-thermal microwave frequency EMF effects. We had much more such research in this area 35 years ago,

In terms of non-thermal effects of microwave frequency (sometimes called radiofrequency) EMFs, the U.S. government published documents acknowledging the existence of large numbers of such non-thermal effects. This included the 1971 U.S. Office of Naval Medical Research Institute Report [30] and the 1981 report from the National Aeronautics and Space Administration (NASA) [26]. The most recent such report acknowledging widespread non-thermal EMF effects was the NCRP report

[112] published in 1986. It follows that for the past 32 years, the U.S.government has been in denial on what had been repeatedly recognized by our government and is of great importance to protecting our health. 1986 turns out to be a key year because in that year, the U.S. Environmental Protection Agency (EPA) shut down its in house research program studying non-thermal EMF effects. In 1986, the U.S. Office of Naval Research, which had been funding grants in this area, stopped funding any new grants – the already funded grants were funded to the end of the grant period but no new grants were funded past 1986. A few years later, I think it was in late 1994, a similar shutdown of grants went into effect at the NIEHS, the part of the National Institutes of Health (NIH) which supports environmental health research. In 1999, the last U.S. agency that had been funding some research in this area, The Department of Energy also shut down what little research it had been funding.

The consequences of those shutdowns is that of the 17 studies on people living near cell phone towers, not a single study has been done in the U.S. Of the 23 studies of effects of genuine Wi-Fi EMFs, each of them showing effects [11], not a single study was done in the U.S. Of the over 50 studies on genuine cell phone radiation effects, only single one was done in the U.S, the NTP cell phone cancer study required by the Congress. So we have a situation where the U.S. government is encouraging EMF exposures and, in many cases, making it impossible to avoid EMF exposures while doing nothing or almost nothing to ensure our safety. There are a tiny number of studies that somehow sneak through, such as the Aldad et al study (#12 in Table 4) discussed in the preceding chapter, which was funded through the Child and Human Development Institute of the NIH, but these are few and far between.

How did these shutdowns happen? I don't know about 1986 but have some useful information from 1994/1995.

Attacks by the Telecommunications Industry on Two U.S. Scientists

Dr. Henry Lai from the University of Washington and a collaborator, NP Singh were using the alkaline comet assay, discussed earlier in this document to measure single stranded breaks in cellular DNA. They found a substantial elevation of the levels following low level EMF exposure in late1994. Before that finding had even been published, they found that they were targets of a severe attack from the telecommunications industry. A key document providing evidence of this was what was called the "War-Gaming" memo [113], where an executive named Norm Sandler, head of the Corporate Communications Department of Motorola (at that time the largest cell phone company) sent the memo to Michael Kehs of a public relations campaign in Washington DC (dated Dec. 13, 1994), describing their planned response to these

at that time, unpublished findings. The memo stated that "While this work raises some interesting questions about possible biological effects, it is our understanding that there are too many uncertainties—related to the methodology employed, the findings that have been reported and the science that underlies them—to draw any conclusions about its significance at this time. Without additional work in this field, there is absolutely no basis to determine whether the researchers found what they report finding—or that the results have anything at all to do with DNA damage or health risks, especially at the frequencies and power levels of power levels of wireless communication devices.

In discussing the frequency differentiation issue, we should be able to say that Lai-Singh and Sarkar were not conducted at cellular (that is cell phone) frequencies."

> (**My comments are as follows**: It is true that Lai/Singh used a different frequency from that used by cell phones. So the industry was correct about that. But the findings also show that the industry claims that there cannot be any non-thermal effects are wrong, and that may be more important. Singh had a reputation of being a genuine international expert on comet assays, so I doubt that methodology was a problem. If this had nothing to do with DNA damage or health risks, Motorola would not be worrying about these findings. There were at that time (1994) previously published studies of EMF effects on cellular DNA including the concurrent Sarkar findings and including findings of chromosome breaks and rearrangements reported in [30]).

Further down, the memo: "I think we have sufficiently war-gamed the Lai-Singh issue, assuming that SAG (Scientific Advisory Group, a group linked to the telecom industry) and the CTIA (the umbrella telecom lobbying, publicity and legal organization) have done their homework. We want to run this by George Carlo and fill him in on contacts we have made."

Under Excerpts from Confidential Working Draft #3. **Question and Response**:

Q. How can Motorola downplay the significance of the Lai study when one of your own expert consultants is on record telling Microwave News that the results—if replicated—could throw previous notions of RF safety into question?

R. It is not a question of downplaying the significance of the Lai study. In his comments to Microwave News, Dr. Sheppard raised the key question: Can it be replicated and interpreted? We will wait and see."

(**My comments**: Replication needed to be done, so that was a valid point. The interpretation was and is clear – it is that EMF exposures produce large increases in

the numbers of single strand breaks in the cellular DNA.)

> "Action Planned: In addition to response materials prepared by SAG (see attached copies) we will work with SAG to identify appropriate experts to comment in general on the science of DNA research, in addition to any experts SAG may be able to recommend to publicly comment on one or both of these particular studies.
>
> Then they talk about Media Strategy where Motorola stays in the background with SAG and CTIA in front."

Three important things happened to Dr. Henry Lai at about this time [114,115]. In November 1994, before the War-Gaming memo had been written, a representative of the industry called the NIH claiming that money had been misspent from the Henry Lai grant for the DNA studies. Dr. Lai faxed the NIH an explanation which was accepted. However, the cutoff of new NIEHS funding appears to have occurred at this time, such that the industry pressure is likely to have been important. Furthermore [114] "The industry made a full-court press to discredit the DNA break study. A consistent and coordinated message was put out to marginalize Lai and Singh. For instance, in November 1994 (note: this was also before the War-Gaming memo was written), Q. Balzano, then a senior Motorola executive, wrote to us (Microwave News) that "Even if it is validated, the effects it purports to show may be inconsequential." (My comment is that DNA breaks produced at intensity levels well below safety guidelines are not inconsequential. If they were, the industry would not be worrying so much about them). Ron Nessen, the CTIA's top spokesman told a Florida newspaper that "It's not very relevant." He also tried to cast doubt on the comet assay pioneered by Singh to measure DNA breaks. It "may not be scientifically valid." Quite a number of months later, the head of the WTR (successor organization to SAG) wrote a 6 page letter to the President of the University of Washington to try to get him to fire both Lai and Singh [114, 115]. Neither was fired, but this is what you face when you get results that the telecommunications industry does not like.

> (**My comments**: The basic findings of the Lai and Singh studies have been replicated more than two dozen times, at this writing. There have also been many replicates of the findings of increased micronucleus formation and oxidized bases in the DNA following non-thermal EMF exposures. All of that replication and the 21 reviews that were listed in Chapter 1 each showing non-thermal cellular DNA damage have still not gotten the telecommunications industry to admit that these DNA effects are occurring. The industry apparently does not care about the replication but cares, rather, about having talking points. Furthermore, when the industry was trying to get Dr. Lai's research funding cut off or later was trying to

get both Lai and Singh fired, they were trying to prevent replication rather than encouraging it).

So Dr. Henry Lai was the first major scientist who came under vicious attack from the telecommunications industry and their allies, but he was certainly not the last. There are many such scientists including Prof. Adlkofer in Germany and Prof. Rüdinger in Austria. I know of nine others who have been attacked in the U.S. or in Europe. But here is a situation where the U.S. instead of leading world science in the right direction has been leading it into corruption. There are others.

I want to talk about another especially important case of such an attack on a U.S. scientist, that of Professor Om Gandhi. Gandhi is a professor at the University of Utah who, for many years was doing modeling of cell phone EMF exposures on the brains of humans. He was modeling such exposures for a substantial period of time of time based on the head of what was called standard anthropomorphic man (SAM). SAM was modeled from a 6 foot 2 inch, 200 pound man, a man in the upper 10% of men for head size and estimated skull thickness. He was doing such cell phone modeling for the telecommunications industry and received an important honor for this research. Because the safety guidelines are based only on thermal effects, the modeling was aimed at determining heating of the human brain by cell phone radiation.

Prof. Gandhi became concerned about the fact that both the head size and skull thickness of SAM was greater than that of most men and essentially all women and children and consequently began modeling a typical woman and typical 10 year old child, When he did that he found that the cell phone EMF exposures to the brain were much too high, even based on their own standards, standards that were and are only based on heating. The timing of these events was from 1975 through 1996. I will be quoting on what occurred subsequently. I have received permission from Dr. Devra Davis to make these quotes from pages 81 through 88 of her book Disconnect [77]. I will use a different font for those quotes so that you can see them easily.

Based on the new work he had produced, Gandhi called for a revision of the safety standards that regulated cell phones. The industry was stunned. For years, Gandhi had been one of those on whom they had counted. If Gandhi's work went uncontested, it would mean that children, women and men with smaller heads could not safely use some electronic devices or that these devices would have to be redesigned to emit less radio frequency radiation. The industry's first response was to cut off all of Gandhi's funding.

Going to p. 86 from [77]:

Gandhi explained that something has gone very wrong with standard setting in the

United States in the past few years.

> "Starting in the late 1980s, I chaired the committee to set standards for radio-frequency exposures before all cell phones ever existed. About a decade ago, C.K. Chou, then at the City of Hope Hospital, replaced me. Within two years, Chou had moved. He became a senior executive with Motorola—a clear conflict of interest. The committee that advises as to cell phone standards is supposed to be independent and had never before been led by someone from the very industry it advises. Under Chou's leadership, the committee relaxed standards for cell phones as of 2005. Having spent my entire life developing models of the brain, I know how things work. I also know that what we have done here is to ratchet up exposures, without actually telling people we have done so. Today's standards for cell phones have more than doubled the amount of radio-frequency radiation allowed into the brain."

The next quote starts at 2002, before the more than doubling of those radiation standards (pp. 87-88 from [77]).

By 2002 the gloves were off and the industry made it clear to Gandhi that they would take him on directly. Gandhi remembers being told by an industry colleague who was once a student and friend, "If you insist on publishing these papers saying that children get more exposed than adults and saying our test procedure is not valid, you can expect that we will not fund you."

Gandhi replied, "I am a university professor. I don't need your money."

Next industry tried to place an article by Chou critiquing Gandhi's models in the journal of which Gandhi had been editor and chief and in which he had published dozens of articles, and asked that either his (that is Gandhi's) article criticizing the grounds for setting standards be removed, or that they be allowed to publish Chou's rejoinder.

Gandhi reports that four different peer reviews of Chou's critique of my work indicated that Chou's critique of my work was 'scientific junk.' Only when the editor of the journal balked did the industry finally relent. Despite this success in beating back one attempt to discredit Gandhi's work, the effort to increase allowable amounts of radio frequency radiation was won on a major front. As the new chief of the standard-setting committee, Chou masterminded changes in the standards, and the committee, which now included a large majority of industry experts, issued new recommendations, ignoring Gandhi's analysis showing that these would effectively double exposures.

> (**I want to comment on this**. I've published three papers on the physics of EMF action [4,5,11]. In each of them, I have taken the industry arguments about the

physics seriously. Even though it was clear that the industry arguments were wrong, because of the clear existence of so many effects that occur at non-thermal levels of exposure, the industry arguments claiming that there could only be thermal effects were substantive and therefore, had to be considered. What I find, in the previous six paragraph, is that the industry itself is ready to throw out its own arguments, when they conflict with their ability to make massive profits. The issues here are very simple. Anyone with the most elementary understanding of the geometry of the head and a high school knowledge or physics, will know that a person with a smaller head and thinner skull will be exposed to higher brain levels of radiation from cell phones.)

What is obvious about this is that the industry does not care about health impacts, as long as they can maintain some deniability. What is also obvious is that the telecommunications industry can act to systematically corrupt an organization that, in effect, regulates the telecommunications industry. That in turn means that other organizations that, in effect, regulate the industry must be scrutinized for possible corruption. Those include ICNIRP, SCENIHR, WHO, the FCC and the FDA.

When Have Somewhat Similar Things Happened in Other Situations in the U.S.?

Is this approach to obfuscating the science unusual? Not really, but it appears to be much more extreme than usual, with the telecommunications industry and EMF effects. I suggest looking at the book on "Doubt Is Their Product: How Industry's Assault on Science Threatens Your Health" by Dr. David Michaels. I've cited a book review of that book here [116]. The review starts out with the statement that "Creating doubt – at least enough to derail government regulation – is an art form long practiced and highly perfected by some sectors of private industry. In the book, Professor David Michaels vividly demonstrates how each such industry channels some of its profit to 'product defense firms' and 'self interested scientists' who conduct research designed to cast doubt on the science that supports regulation." (I will add that it also casts doubt on the science that may support lawsuits, as well.) "As a result of the doubt created, regulation is long-delayed and thousands of people (or perhaps millions) suffer and die unnecessarily." The industries that are covered in the book include tobacco, lead, asbestos, Merck (the maker of Vioxx), global warming, chromium, beryllium, artificial butter flavoring (diacetyl, the cause of often fatal popcorn lung). I think you will see parallels with what went on with SCENIHR (Chapter 5) and with the telecommunications industry actions (this chapter). Part of the problem with these precedents, is that nobody went to prison, despite the many deaths and injuries that were perpetrated and in most of these cases, the industries involved ended up making

more money than they lost in the subsequent lawsuits. The precedent has been set that you can get away with almost anything if you are big enough and powerful enough and rich enough. That may have been sufficient to encourage the telecommunications industry to follow a similar, although, in my opinion, much more aggressive pathway.

One question that can be asked is whether there are any major international political figures who appear to have a good understanding of the EMF/health issue? When I was asked that question, I was able to come up with only one person. That person is President Vladimir Putin of Russia. This inference comes from an interview of Dr. Dietrich Klinghardt, who practices in Seattle, by Dr. Joseph Mercola, that occurred in December 2017, an interview that was entirely focused on EMF health effects [117]. In that context Dr. Klinghardt states that a lecture that Putin gave to the Russian assembly said, "We do not need to go to war with America. America is committing collective suicide by the way they are using electricity. We just have to wait until they are all in the psychiatric hospital." When I saw that, I asked myself whether it is plausible that Vladimir Putin has a deep understanding of the neuropsychiatric effects of the EMFs? And then I thought, of course, Vladimir Putin was the head of the KGB when the latter studies reviewed by Dr. Karl Hecht [28] were being done in the Soviet Union. The most important effects that were shown to be produced by the EMFs, in those studies, were the neuropsychiatric effects. Furthermore, the Putin statement apparently shows not only a substantial understanding of those effects but also the fact that they are cumulative and become irreversible, as shown in those studies [28] and in other studies discussed in Chapter 4. One thing that I would add is that President Putin apparently practices what he preaches. He avoids smart phones [118].

It is my opinion, that the CIA and other international intelligence agencies should examine these issues very carefully to assess whether they see the kinds of threats that I see. Those agencies are very good at obtaining information from various sources and determining probable threats to national and international security. It should not be difficult to come to an assessment, especially because some of us have done much of the work that needs to be done. The threat here is self-inflicted, it is not caused by any foreign power or set of powers. But it is the most serious national or international security threat that we have faced, in my opinion, with the exception of nuclear annihilation.

Propaganda:

In the initial days of the controversy regarding cell phones, in 1993, the industry developed a huge public relations effort in the face of lawsuits and adverse press reports impacting the industry. Paul Staiano, President of Motorola General Systems stated in a 1993 ABC 20/20 interview [119] that, "Forty years of research and more than

ten thousand studies have proved that cellular phones are safe." So I asked how many studies of cell phone safety or lack there of had been published by the end of 1993. The way I did that was to search in the PubMed database under (cell phones or cellular phones or mobile phones). I found about 11,000 hits, roughly 99% of them having nothing to do with health safety, and then looked at the few studies that had been published before the end of 1993. The only study I found that had any connection with health or safety, was one on driving safety while using a cellular phone, giving equivocal results with regard to driving safety. So there, were apparently no studies done on cell phone safety at that time. Furthermore, even if there had been any studies, they could not possibly show that "cellular phones are safe." At most they might show that there was no statistically significant evidence of an effect but that only shows that you have not proven an effect, not that you have proven the opposite. It can be seen, therefore, that this propaganda statement is complete nonsense. Furthermore, we know that the Panagopoulos et al [100] review, showed that 46 out of 48 genuine cell phone studies that they reviewed showed effects. So the facts are exactly opposite of the industry propaganda on this. If this was the beginning of propaganda in the U.S. let's look at something much more recent.

Berezow and Bloom Op-Ed Document: Recommendation to Limit Maryland School Wi-Fi Is Based on "Junk Science"

Berezow and Bloom, [120] start their 2017 op-ed with the claim that "The CEHPAC, an agency within Maryland's Department of Health and Mental Hygeine, has recommended that schools reduce or eliminate students' exposure to Wi-Fi because it believes wireless signals might cause cancer. *This is pure, unadulterated junk science. At least three separate, major areas of scientific knowledge can unambiguously confirm that wireless radiation is completely safe* (italics added)."

They continue with the physics [120], stating that "CEHPAC fails to realize that all radiation is not created equal. The energy of nuclear radiation, X-rays and UV light is high enough to damage our bodies and cause cancer. But other forms of radiation are energetically weak by comparison. They cannot cause cancer." This argument has validity with regard to individual photons, as I stated in my first paper on the activation of VGCCs by EMFs [4], but it is completely bogus with regard to EMFs as a whole. It has been known for 70 years that a person walking in front of a high powered radar machine will rapidly die, but Berezow and Bloom claim that cannot happen because the fields are "energetically weak." Furthermore, as discussed in Chapter 2 and elsewhere [5,11], the voltage sensor that controls the opening of the VGCCs is extraordinarily sensitive to electrical forces of EMFs, with the forces on the voltage sensor being approximately 7.2 million times greater than the forces on singly charged groups in

the aqueous parts of our cells and tissues. It can be seen, therefore, that Berezow and Bloom [120] while claiming to be experts, are profoundly ignorant of the relevant physics.

Berezow and Bloom [120] state that "According to the NIH's National Cancer Institute [121], well performed studies that included over one million people showed no connection between cell phone use and cancer." There is no such statement in the NCI 2016 [121] document – I suggest the reader look it up – it differs substantially from the op-ed characterization of it. The NCI 2016 [121] document, states that "there is currently no consistent evidence that non-ionizing radiation increases cancer risk" (sole supporting citation in NCI 2016 [121] was SCENIHR 2015 [73]). It has been shown above in Chapter 5, that SCENIHR 2015 is not a credible source of information on this and as shown, in Chapter 1, there are 35 different reviews that each provide strong evidence that EMFs do cause cancer. So claiming, that EMF causation of cancer is, in Berezow & Bloom's words, "pure, unadulterated junk science" is nonsense. What is amazing here is that the U.S. NTP study, published by Wyde et al [122], clearly shows that cell phones do cause cancer but it was completely left out of the Berezow & Bloom statement.

Let's go to their third "major area of scientific knowledge" – Berezow and Bloom [120] state that "the only known health effects from Wi-Fi are due to psychosomatics." That is, "people who believe that something will make them sick will report feeling ill, even if nothing is happening externally." Some of the Wi-Fi studies (Table 1 in [11]) are cell culture studies, some are animal model studies where EMF exposures are compared with sham exposures. While there may be a very weak argument regarding some but not other human studies when they are not done blinded, there is no argument that effects in any of the other studies are caused by "psychosomatics." Berezow and Bloom do not look at any of the 23 studies of Wi-Fi reviewed in [11], each of which showed effects and it is clear that most of them cannot possibly be due to psychosomatics. What is surprising here, is that the trillion dollar set of telecommunication industries, having been working on their propaganda for over a quarter of a century, is unable to produce a more convincing argument.

Have There Been Individual Research Studies Designed to Fail and Therefore Corrupt the Scientific Literature?

The first example, that I am aware of, where false science has been produced to supposedly show that an important EMF observation was unrepeatable also came from the U.S. It was described in Dr. Davis' book [77]. Dr. Allen H. Frey (pronounced Fry) published a paper in 1975 in Annals of the New York Academy of Science showing that low intensity pulsed EMF exposures produced a breakdown of the blood-brain barrier,

the barrier in the blood vessels in the brain and the brain tissue that protects the brain from toxic chemicals and also infectious agents. The methodology that he used was to inject the fluorescent dye fluorescein into the blood (IV) and then use its fluorescence to detect whether and to what extent it penetrates into the brain tissue from the blood. A subsequent paper was published in 1978 [123], using similar methodology *except* that the fluorescein instead of being injected into the blood, was injected by intraperitoneal (IP) injection. When a compound is injected IP, it enters the blood only slowly over a substantial period of time, so that when one does a short term experiment looking at penetration through the blood-brain barrier, essentially nothing is seen. This was a transparent attempt to claim that the studies of Dr. Frey had been repeated with negative results, but the Frey studies had not be replicated.

I am aware of many papers that were flawed like the seven studies of simulated Wi-Fi, discussed near the end of Chapter 5 that were each touted by Foster and Moulder [110]. Let me remind you of what the flaws were in those seven studies. Firstly, each of them used EMFs that were the correct frequency for Wi-Fi but differed in pulsation from genuine Wi-Fi. Each of these studies used a reverberation exposure chamber which is predicted to decrease effects by both decreasing the polarization of the EMFs and increasing the destructive interference of the EMFs. They also used tiny numbers of animals for each study group, such that any statistics would have very low power. Finally, Foster and Moulder claimed each of them showed "no effect" when one can only at best claim there was no statistically significant evidence of an effect. Given the tiny numbers, the lack of statistical significance is of very little importance. I find that this pattern has been followed in a substantial number of additional studies.

What I want to discuss here is a paper that had each of those four properties but had several additional flaws, as well. I am aware of three legal proceedings in the U.S., where the industry side of that case touted the paper to be discussed, as being a particularly strong one. This paper by Ziemann et al [124] is entitled "Absence of genotoxic potential of 902 MHz (GSM) and 1747 MHz (DCS) wireless communication signals: In vivo two-year bioassay in B6C3F1 mice. In other words, the title claims that the 902 MHz frequency, studied and the 1747 MHz frequency also studied in the paper cannot cause DNA damage or other types of genotoxicity."

1. On p. 456 of Ziemann et al [124], the authors make clear that they are studying the effects of simulated cell phone radiation, not actual cell phone radiation. You will recall that Panagopoulos et al [110] found that almost all studies of genuine cell phone radiation found effects whereas less than half of simulated cell phone studies showed effects. This raises an important question about why Ziemann et al [124] opted to study simulated cell phone radiation. Much of the funding of the Ziemann et al paper (see pp.

462-463) came from industry sources. Funding source is not a flaw but it is a reason to look at the paper particularly closely.

2. The Ziemann et al [124] study used a stainless steel exposure chamber similar to the reverberation chambers discussed in Chapter 5 of this document. The chamber is predicted, to produce lower effects because of lowered polarization and increased destructive interference

3. The study is described as being a two year study of radiation effects. However the cells examined for micronuclei (their marker for genotoxicity (cellular DNA damage)), were mouse erythrocytes (red blood cells), and such erythrocytes have a lifespan of only about 30 days; because of the inherent instability of micronuclei in replicating cells, such micronuclei in erythrocytes may possibly be generated over at most a 30 day period. It is misleading to describe this as a two year study when only the last 30 days are relevant to generating the marker being studied.

4. In rats and humans, erythrocytes containing micronuclei are selectively removed from circulation very quickly (see p. 459 of Ziemann et al [124]). While Ziemann et al claim that mice do not have a similar mechanism for selective rapid removal, the only citation that they provide is a study published by Chaubey et al (1993) showing that this was apparently true with Swiss mice; Ziemann et al [124] chose to use B6C3F1/CrlBR mice, a different inbred mouse strain which may well behave quite differently from Swiss mice. It follows from this that we have no idea whether the strain studied is similar to Swiss mice with regard to selective removal of erythrocytes containing micronuclei.

5. Ziemann et al [124] show that male and female mice behave quite differently with regard to levels of micronuclei (Tables I and III in [124]); however in their experimental study (Figure 2), males and females were combined in doing the statistics. What that inevitably does is to produce greater variations in micronuclei levels within different animal groups, making it substantially more difficult to detect any statistical significance among different animal groups in the study. It also means that it is important to use similar ratios of males and females in the experimental groups and we have no idea whether this was done or not.

6. In section A of Figure 2, there were only 8 animals in each group studied. In section B of Figure 2, there are only 5 to 9 animals in each animal group studied. These tiny numbers mean that there is only extremely low statistical power to detect any effects of EMF exposure and therefore these tiny studies make it almost impossible to say anything at all about the results.

7. The Ziemann et al study [124] provide none of their raw data; consequently we are in a situation where we have no way of judging whether their statistical analysis was done properly. We also have no way to use any such data as part of a meta-analysis of multiple studies, which may have much more power than do any single study (particularly such a tiny one). Consequently, the lack of statistical significance they report, cannot be properly assessed by the reader.

8. When one does a study looking at the possible effects of some variables, in this case a couple of simulated cell phone radiation studies, the most you can say about an apparent negative result is that "we did not see any statistically significant effects." When you have tiny studies such a described under 7 above, then the lack of statistical significance tells you almost nothing. But even with a very large study such as with thousands of mice including hundreds in each experimental group, all you can say is that "we did not see any statistically significant effects."

9. What do Ziemann et al conclude? They state in their title that there is an "Absence of genotoxic potential of 902 MHz (GSM) and 1747 (DCS) wireless communication signals." Did they study these EMFs in all organisms and all cell types? No of course not. Did they study all possible pulsation patterns of these two frequency EMFs? No of course not. Did they study all types of genotoxicity found following low-intensity EMF exposures? No, just one, micronuclei in erythrocytes in an inbred strain of mice. This title alone should tell any competent scientist that the paper is deeply flawed, completely apart from the preceding 8 flaws, with each of the 8 adding substantially to the flaws in this paper.

George Carlo Letter

Dr. George Carlo is an interesting and controversial figure who has both a law degree (JD) and a PhD in, I believe, epidemiology. He had worked in the telecommunications industry for years as head of the SAG and then WTR research arms. Dr. Carlo wrote an important letter to the heads of the telecommunications companies on October 7, 1999. The letter he sent to the head of AT&T is available on the internet [125]. In his book [126] Carlo lists all of the people sent the letter and also provides the text of the letter.

Carlo was, at that time the soon to be retiring head of the WTR, which was the CTIA/telecommunications industry research arm. In the letters to the heads of the telecommunications industry companies, Carlo discusses the types of evidence arguing that cell phones do apparently cause cancer and that they do cause DNA damage to our cellular DNA. The DNA damage, suggested that the apparent cancer causation was real. Carlo continues the letter as follows [125]:

> "Today, I sit here extremely frustrated and concerned that appropriate steps have

not been taken by the wireless industry to protect consumers during this time of uncertainty about safety." Continuing further down, Carlo adds:

> "Alarmingly, indications are that some segments of the industry have ignored the scientific findings suggesting potential health effects, have repeatedly and falsely claimed that wireless phones are safe for all consumers including children, and have created an illusion of responsible follow up by calling for and supporting more research. The most important measures of consumer protection are missing: complete and honest factual information to allow informed judgment by consumers about assumption of risk; the direct tracking and monitoring of what happens to consumers who use wireless phones; and, the monitoring of changes in the technology that could impact health.

I am especially concerned about what appear to be actions by a segment of the industry to conscript the FCC, the FDA and WHO with them in following a non-effectual course that will likely result in a regulatory and consumer backlash."

This is an important letter for several reasons. After October 7, 1999 the heads of the telecommunications companies or, for that matter anyone else at those companies, could no longer legitimately claim that they did not know there were serious health concerns with cell phones, with targeting cell phones to young children, or with increasing allowable cell phone exposure radiation. The last of these was done a few years later, as you have already seen.

The concerns Carlo expresses about the FCC (Federal Communications Commission) and the FDA (U.S. Food and Drug Adminstration) are particularly important in the U.S., because both the FCC and the FDA had already been given important regulatory roles when the Carlo letter was written. The FCC had been given the power of regulating the location of cell phone towers by the 1996 telecommunications act, which also *prohibited, as I understand it, any state or local government from protecting their people's health by regulating cell phone tower positioning*. In other words, the 1996 telecommunications act *de facto* stated that the U.S. Federal government valued telecommunication industry profits over every single health impact of microwave frequency radiation, *no matter how serious* it is, to the American people. There have been several subsequent pieces of legislation that have made the situation still worse. The FDA had been given the power to regulate radiation emissions from cell phones and other devices that emit microwave/radiofrequency radiation, with cell phone regulation apparently being shared with the FCC.

What Can We Say About the FCC?

There was a very informative document about the FCC published by the Safra Institute for Ethics at Harvard University [127] entititled "Captured Agency: How the Federal Communications Commission Is Dominated by the Industries It Presumably Regulates." One of the sections in that document shows why both the FCC role and the telecommunications industry role were so important with regard to the 1996 telecommunications act:

Section 332(c)(7)(B)(iv) of the Act remarkably, and that adverb seems inescapably best here, wrests zoning authority from local governments. Specifically, they cannot cite health concerns about the effects of tower radiation to deny tower licenses so long as the towers comply with FCC regulations.

Congress Silences Public

Section 322(c)(7)(B0(iv) of the Communications Act Provides:

No State or local government or instrumentality thereof may regulate the placement, construction of personal wireless service facilities on the basis of environmental effects of radio frequency emissions to the extent that such facilities comply with the Commission's regulations concerning such emissions.

In preempting local zoning authority – along with the public's right to guard its own safety and health, Congress unleashed an orgy of infrastructure build-out. Emboldened by the government green light and the vast consumer appetite for wireless technology, industry has had a free hand in installing more than 300,000 sites. Church steeples, schoolyards, school rooftops, even trees can house these facilities.

What, then are the consequences of all of this? The 17 studies that have been done on people living near cell phone towers show that many people within 300 meters (about 1000 feet) of a cell phone tower are afflicted by six of the health effects found in those many reviews listed in Chapter 1. Two of those effects have not been looked at. According to this literature, people living within 300 meters of cell phone towers suffer from widespread neuropsychiatric effects, cellular DNA damage, cancer, oxidative stress, elevated apoptosis (cell death), and hormonal effects. They also suffer from cardiac effects like those discussed in Chapter 3 and from hypertension and also anemia. The two extremely well documented EMF health effects that have not been looked at are the reproductive effects and the high levels of intracellular calcium. That does not tell us these are not also caused in people living near cell phone towers, just that no one has looked. Roughly 30% of the people in this country live within 300 meters of a cell phone tower so the impact on health is major. But few know about

this and the media and our government, including especially the FCC and FDA are keeping it all a deep dark secret. Not a single one of these 17 studies have been done in the U.S. Consequently, when the U.S. has ensured that we are irradiated by well over 300,000 of these cell phone towers, it has done absolutely nothing to determine what the consequences of exposure are. Of course we are impacted not only by cell phone towers near where we live but also near where we work or go to school and to some extent, when we are driving around town. These high levels of exposure are not necessary. Switzerland has safety guidelines that are 100 times more stringent than ours, Russia has safety guidelines that are 1000 times more stringent than ours. The health effects we see now will no doubt rise much further in the future without any increasing exposure, because many of these effects are cumulative, eventually becoming irreversible.

I would encourage you to look at the whole FCC as a captured agency document [127] – it can be downloaded at no cost from the internet [127]. It is very interesting and adds considerably to my short comments here regarding corruption.

So what does the FCC have to say about EMF effects on its web site [128]? I have copied some relevant sections as follows:

At relatively low levels of exposure to RF radiation, i.e., levels lower than those that would produce significant heating, the evidence for production of harmful biological effects is ambiguous and unproven. Such effects, if they exist, have been referred to as "non-thermal" effects. A number of reports have appeared in the scientific literature describing the observation of a range of biological effects resulting from exposure to low levels of RF energy. However, in most cases, further experimental research has been unable to reproduce these effects. Furthermore, since much of the research is not done on whole bodies (in vivo), there has been no determination that such effects constitute a human health hazard. It is generally agreed that further research is needed to determine the generality of such effects and their possible relevance, if any, to human health. In the meantime, standards-setting organizations and government agencies continue to monitor the latest experimental findings to confirm their validity and determine whether changes in safety limits are needed to protect human health. (Back to Index)

CAN PEOPLE BE EXPOSED TO LEVELS OF RADIOFREQUENCY RADIATION THAT COULD BE HARMFUL?

Studies have shown that environmental levels of RF energy routinely encountered by the general public are typically far below levels necessary to produce significant

heating and increased body temperature. However, there may be situations, particularly in workplace environments near high-powered RF sources, where the recommended limits for safe exposure of human beings to RF energy could be exceeded. In such cases, restrictive measures or mitigation actions may be necessary to ensure the safe use of RF energy. (Back to Index)

CAN RADIOFREQUENCY RADIATION CAUSE CANCER?

Some studies have also examined the possibility of a link between RF exposure and cancer. Results to date have been inconclusive. While some experimental data have suggested a possible link between exposure and tumor formation in animals exposed under certain specific conditions, the results have not been independently replicated. Many other studies have failed to find evidence for a link to cancer or any related condition. The Food and Drug Administration has further information on this topic with respect to RF exposure from mobile phones at the following Web site: FDA Radiation-Emitting Products Page . (Back to Index)

Let's look at the first paragraph. In the third and fourth sentence, they state that there have been non-thermal effects reported but then say that "in most cases they have not been reproduced." Is that true? No. The 79 reviews listed in Chapter 1 have each found repeated studies documenting one or more of the EMF effects. You can't get a review published without multiple studies. And the fact that so many of these effects have been repeatedly reviewed, over many years shows that similar patterns of evidence have been found over long periods of time. *The FCC provides not one iota of evidence on its claims, despite the fact that such a claim of inability to reproduce findings absolutely requires extensive documentation to be scientifically valid. This difference in documentation, means that any one of those 79 reviews listed in Chapter 1 is vastly more scientific in showing the falsity of the FCC statement than is the FCC statement itself, which is completely undocumented.*

Let's go on to the cancer claim at the bottom of the copied section. The FCC states that "A number of reports have appeared in the scientific literature describing the observation of a range of biological effects resulting from exposure to low levels of RF energy. However, in most cases, further experimental research has been unable to reproduce these effects. Furthermore, since much of the research is not done on whole bodies (in vivo), there has been no determination that such effects constitute a human health hazard." You will note here that there are no specifics, nor were there any specifics on the section discussed in the previous paragraph. What we have here are completely undocumented FCC claims, with no specifics whatsoever and claims that are clearly contradicted by each of the 35 reviews on cancer causation by EMF exposure. They are also clearly contradicted by the 21 reviews on cellular DNA damage following

EMF exposures, something that the FCC says nothing about. It has been known for decades, that the process of carcinogenesis (cancer causation) usually starts with one or more mutations in the cellular DNA, mutations that can be caused by each of the three types of cellular DNA damage known to be caused by EMF exposure.

The sort of pattern seen here, where we have gross generalizations followed by no or completely inadequate documentation goes on with the industry propaganda [119,120] as discussed earlier, as well as in the Speit/Schwarz discussion from early in Chapter 5. What you see in each of those cases is everything falls apart when you look carefully at the facts. The situation with the FCC statements is very similar. There can be little doubt that the FCC is acting as a propaganda organization here, as strongly suggested by the George Carlo letter [125,126] and the FCC as a captured agency [127] document.

Three questions: Does the FCC know that these statements that it has made are not factual? Does it know how non-thermal EMF effects actually are produced? Does it know that its safety guidelines do not protect our health? That answer to all three of these questions is yes. How do I know? I know because I did a PowerPoint presentation to the FCC in September 2016 which presented findings in each of these important areas. My account of that presentation, written two days after it occurred, follows:

Professor Emeritus Martin L. Pall presented Powerpoint presentation on the main mechanism of action of non-thermal microwave frequency EMFs to the FCC

I met with Julius Knapp, Chief of OET, Martin Doczkat, Branch Chief, OET/Technical Analysis Branch, and Ed Mantiply Engineer OET/Associate Chief at the Federal Communications Commission on September 21, 2016 to present a Powerpoint presentation and answer questions. The presentation showed that non-thermal microwave and lower frequency EMFs act via voltage-gated calcium channel (VGCC) activation. The most important findings demonstrating this mechanism are that various effects produced by such non-thermal exposures can be blocked or greatly lowered by calcium channel blockers, drugs that are highly specific for blocking VGCCs. The reason why such low intensity non-thermal exposures activate the VGCCs is because the voltage sensor of the VGCCs is exquisitely sensitive to the electrical forces produced by these EMFs. The forces on the voltage sensor are calculated to be about 7.2 million times higher than are the forces on singly charged chemical groups in the aqueous phases of the cell. This very high level sensitivity also predicts that the safety guidelines allow us to be exposed to EMF intensities that are approximately 7.2 million times too high.

The actions produced by such VGCC activation go mainly through the excessive intracellular calcium levels produced by such activation. Excessive calcium acts via

three main pathways to produce effects in the body. Therapeutic effects are produced through the nitric oxide signaling pathway whereas many pathophysiological effects are produced by the peroxynitrite/oxidative stress pathway. Excessive calcium signaling also produces pathophysiological effects. Numerous effects produced following non-thermal EMF exposures can be produced by these pathways including oxidative stress, cellular DNA damage, cancer, widespread neuropsychiatric effects, breakdown of the blood brain barrier, lowered male and female fertility and various endocrine (that is hormonal) changes.

It has long been known that pulsed EMFs are usually much more biologically active than are non-pulsed (or continuous wave) EMFs and this difference appears to be consistent with the VGCC mechanism. Because all wireless communication devices communicate via pulsations, such devices may be of special concern.

Three concerns were expressed with regard to 5G: **1**. The stronger absorption of the very high frequencies involved require the setting up of vast numbers of antennae, making it essentially impossible to avoid damaging exposures. **2**. The stronger absorption suggests that these EMFs may be particularly active in activating the VGCC voltage sensor. **3**. The very high level and complexity of pulsations also may make for much more biological damage via VGCC activation.

There was substantial discussion of the need for biological safety testing. That discussion focused on the using cells in culture that have high densities and different types of VGCCs. Responses can be monitored by either monitoring intracellular calcium levels or by measuring nitric oxide production using a nitric oxide electrode.

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We had what would be considered in diplomatic circles a good and productive meeting, but since that time the FCC has doubled down on their positions, pushed much further on 5G, leading us to the mega-crisis situation which we are faced with now. Instead of actually testing 5G radiation biologically for safety, using the methods that were discussed in that meeting, the FCC has instead opted to put out tens of millions of 5G antennae without any biological safety testing of genuine 5G radiation. That is the insanity that we are in.

What About the FDA?

The Food and Drug Administration (FDA) was given the power to regulate devices that emit microwave frequency EMFs. This was not an unreasonable decision, given that the

FDA was already regulating the safety of medical devices, where one can argue that there are similar challenges involved. The FDA was given this responsibility without any additional funding. So obviously, it was and is distinctly limited in what it can do.

What the FDA did was to issue a Letter of Intent for Proposed Collaboration in Mobile Phone Research between the Food and Drug Administration and the Cellular Telecommunications Industry Association (CTIA), [129] Dated October 20, 1999. This would involve a Cooperative Research and Development Agreement (CRADA). Later in their Letter of Intent, it states under Initial Research Under the CRADA [129]: "The first study to be conducted would follow up on the findings of studies previously conducted by WTR but not yet published using the micronucleus assay, a test which detects structural effects on genetic material. Research data in the literature from RF exposure studies using the micronucleus assay are conflicting, and warrant follow-up study." You will see here that the FDA is accepting the industry claim that these studies are conflicting even though, having been done under different circumstances, they are not.

The basic approach of the CRADA was that the industry would fund any research to be done and decide what research should be done by whom and how and what information would be published subsequently.

You may recall that Dr. George Carlo wrote a very important letter to the heads of the telecommunications companies, described earlier. That letter was dated two weeks before the date of the letter or intent. Carlo's letter stated: "I am especially concerned about what appear to be actions by a segment of the industry to conscript the FCC, the FDA and WHO... ." Carlo who had been up to that point, an industry insider, and apparently had reason to think that the FDA had been corrupted, or what he called conscripted by parts of the telecommunications industry two weeks before the letter of intent was written. I don't think this is definitive evidence that the FDA has been corrupted, and it can even be argued that it is not evidence at all. But it does suggest, however, that we need to look further into this issue.

Let's go on to the results of this CRADA [130]. The FDA reports the following findings from the CRADA: "FDA's cooperative research and development agreement (CRADA) with the Cellular Communication & Internet Association (CTIA) has resulted in research projects focused on two topics - mechanistic studies related to genotoxicity and exposure assessment studies. All studies funded through the CRADA have been completed, and no association was found between exposure to radiofrequency (RF) radiation from cell phones and adverse health effects." I have been unable to get copies of these studies and therefore cannot comment on them.

The CRADA also lead to a National Academy of Sciences (NAS) workshop on EMFs

that lead, in turn, to a 2008 NAS report. That 2008 NAS report can be accessed from [130]. It is a useful report, in my view, albeit one that leaves out much of what was already known in 2008. It does not say that there are no clear non-thermal effects and specifically calls for study of the neurological effects, suggesting that "that neural networks are a sensitive biological target." It also calls for much research on biophysical or biochemical molecular mechanism(s) that may lead to the non-thermal effects. It also calls for much more study on cancer. There has been a large amount of progress in each of these three areas since 2008, including of course the identification of VGCC activation as the most important but not necessarily the only biophysical mechanism. The problem with regard to the FDA is that as far as one can tell, the FDA has paid no attention to either the 2008 report or to the subsequent progress we have had in these several areas.

Let's shift our attention to what the FDA currently says about the impacts of these EMFs? On their web site [131], the FDA states the following:

Is there a connection between certain health problems and exposure to radiofrequency fields via cell phone use?

The results of most studies conducted to date indicate that there is not. In addition, attempts to replicate and confirm the few studies that did show a connection have failed.

According to current data, the FDA believes that the weight of scientific evidence does not show an association between exposure to radiofrequency from cell phones and adverse health outcomes. Still, there is a consensus that additional research is warranted to address gaps in knowledge, such as the effects of cell phone use over the long-term and on pediatric populations.

There was a similar statement made by the FCC, in previous section, and also similar statement was made by Samsung, one of world's largest producers of cell phones which reads a follows [132]:

> Over the past 15 years, scientists have conducted hundreds of studies looking at the biological effects of radio frequency energy emitted by cell phones. While some researchers have reported biological changes associated with RF energy, these studies have failed to be replicated. The majority of studies published have failed to show an association between between exposure to radio frequency from a cell phone and health problems.

Neither the FDA statement nor the Samsung statement give us any idea what possible effects are being considered here, what literature was used for such a consideration.

These statements are completely undocumented and therefore must be viewed as being unscientific. In Chapter 1, 79 reviews were given that each showed the existence of one or more effects. Eignt different of effects were each documented in from 12 to 35 reviews. Such reviews must be extensively documented or one cannot get them published. Any one of those reviews provides, therefore, a much stronger argument for presence of one or more effects than do the FDA, FCC and Samsung statements put together arguing for the opposite. One thing that is strange about the FDA statement is that they are talking specifically about cell phones even though they are tasked with regulating safety on all such microwave/radiofrequency devices. What I have done below is to put together the 16 reviews which are completely or largely focused on cell phone radiation effects so that we can see what specific effects have been found to be caused by cell phone radiation. I will summarize those effects below.

Table 5: Reviews on Cell Phone Effects and the Effects Found in Each

Review on Cell Phone Effects	Effects Found
La Vignera S, Condorelli RA, Vicari E, D'Agata R, Calogero AE. 2012 Effects of the exposure to mobile phones on male reproduction: a review of the literature. J Androl 33:350-356.	Multiple effects on male reproduction
Makker K, Varghese A, Desai NR, Mouradi R, Agarwal A. 2009 Cell phones: modern man's nemesis? Reprod Biomed Online 18:148-157.	Cellular DNA damage, neurological/ neuropsychiatric effects, apoptosis
Yakymenko IL, Sidorik EP, Tsybulin AS. 1999 [Metabolic changes in cells under electromagnetic radiation of mobile communication systems]. Ukr Biokhim Zh (1999), 2011 Mar-Apr:20-28.	Apoptosis, increased oxidative stress, increased intracellular calcium
K Sri N. 2015 Mobile phone radiation: physiological & pathophysiological considerations. Indian J Physiol Pharmacol 59:125-135.	Male infertility, cellular DNA damage, lowered melatonin, increased stress protein expression
Nazıroğlu M, Yüksel M, Köse SA, Özkaya MO. 2013 Recent reports of Wi-Fi and mobile phone-induced radiation on oxidative stress and reproductive signaling pathways in females and males. J Membr Biol 246:869-875.	Oxidative stress, male and female reproductive signaling dysfunction
Yakymenko I, Sidorik E. 2010 Risks of carcinogenesis from electromagnetic radiation and mobile telephony devices. Exp Oncol 32:729-736.	Cancer, cellular DNA damage, apoptosis; higher cancer incidence on ipsilateral side of the head, not contralateral

Review on Cell Phone Effects	Effects Found
Zhang J, Sumich A, Wang GY. 2017 Acute effects of radiofrequency electromagnetic field emitted by mobile phone on brain function. Bioelectromagnetics 38:329-338. doi: 10.1002/bem.22052.	Neurological dysfunction
Kundi M, Mild K, Hardell L, Mattsson M. 2004 Mobile telephones and cancer – a review of the epidemiological evidence. J Toxicol Env Health, Part B 7:351-384.	Cancer – epidemiological review
Hardell L, Carlberg M, Soderqvist F, Hansson Mild K. 2008 Meta-analysis of long-term mobile phone use and the association with brain tumors. Int J Oncol 32:1097-1103.	Cancer – meta-analysis on long-term cell phone use and brain tumors
Hardell L, Carlberg M. 2013 Using the Hill viewpoints from 1965 for evaluating strengths of evidence of the risk for brain tumors associated with use of mobile and cordless phones. Rev Environ Health 28:97-106. doi: 10.1515/reveh-2013-0006.	Mobile and cordless phone radiation caused brain cancer based on the Hill criteria for causation (most important criteria for causation in epidemiology)
Hardell L, Carlberg M, Hansson Mild K. 2013 Use of mobile phones and cordless phones is associated with increased risk for glioma and acoustic neuroma. Pathophysiology 2013;20(2):85-110.	Mobile and cordless phone exposures associated with increased risk of glioma and acoustic neuroma; higher cancer increase on ipsilateral side of the head
Davis DL, Kesari S, Soskolne CL, Miller AB, Stein Y. 2013 Swedish review strengthens grounds for concluding that radiation from cellular and cordless phones is a probable human carcinogen. Pathophysiology 20:123-129.	Cell phone and cordless phone radiation are a probable carcinogens; cancer increase on ipsilateral side of the head, not contralateral side
Morgan LL, Miller AB, Sasco A, Davis DL. 2015 Mobile phone radiation causes brain tumors and should be classified as a probable human carcinogen (2A). Int J Oncol 46(5): 1865-1871.	Mobile phone radiation causes brain tumors and should be classified as a probable human carcinogen
Bielsa-Fernández P, Rodríguez-Martín B. 2017 [Association between radiation from mobile phones and tumour risk in adults]. Gac Sanit. 2017 Apr 12. pii: S0213-9111(17)30083-3. doi: 10.1016/j.gaceta.2016.10.014.	Association between mobile phone risk and tumor risk

Review on Cell Phone Effects	Effects Found
Prasad M, Kathuria P, Nair P, Kumar A, Prasad K. 2017 Mobile phone use and risk of brain tumours: a systematic review of association between study quality, source of funding, and research outcomes. Neurol Sci. 2017 Feb 17. doi: 10.1007/s10072-017-2850-8.	The association between mobile phone use and brain cancer is higher in independently funded studies than in industry funded studies
Miller A. 2017 References on cell phone radiation and cancer. https://ehtrust.org/references-cell-phone-radio-frequency-radiation-cancer/ (Accessed Sept. 9, 2017)	This is a bibliography of studies on cell phone radiation and cancer – most support the view that cell phones do cause cancer

The effects of specifically cell phone radiation that have been found in these reviews (Table 5) include: lowered male reproductive function, lowered female reproductive function, increased cellular DNA damage, neurological/neuropsychiatric effects, increased stress protein synthesis, increased intracellular calcium, apoptosis, lowered melatonin, oxidative stress, cancer (10 reviews) and specifically increased ipsilateral cancer (3 reviews). So there are 11 different cell phone effects where there is substantial enough evidence to warrant publication in one or more review articles. Each of these effects has been shown to occur in response to other microwave frequency EMFs and therefore should be considered to be caused by EMFs more broadly.

> The summary of Table 4, Chapter 5, the genuine cell phone primary literature studies that fell into the 2009-2013 time frame, started as follows: "If you look through the studies described in Table 4, you will see multiple studies in oxidative stress/free radical damage, on changes in tissue structure (sometimes called remodeling), on cellular DNA damage, on male fertility (and also one on female fertility), on behavioral changes and on neurological changes. There is also one study on insulin/type 2 diabetes (hormonal effect). It follows from this that five of the effects that were extensively documented in large numbers of reviews (Chapter 1) are further demonstrated to be produced by cell phone radiation in these studies. In addition the tissue remodeling and proteomic changes discussed in Chapter 3 are also further demonstrated here."

It can be seen from Tables 4 & 5 and the preceding two paragraphs, that there is a vast amount of literature on repeatedly found effects of cell phone radiation, effects which make a mockery of the *completely undocumented and non-specific* FDA claims to the contrary.

Let's look at another part of the FDA statement which also shows similarities to

statements made elsewhere [131]:

The biological effects of radiofrequency energy should not be confused with the effects from other types of electromagnetic energy.

Very high levels of electromagnetic energy, such as is found in X-rays and gamma rays can ionize biological tissues. Ionization is a process where electrons are stripped away from their normal locations in atoms and molecules. It can permanently damage biological tissues including DNA, the genetic material.

The energy levels associated with radiofrequency energy, including both radio waves and microwaves, are not great enough to cause the ionization of atoms and molecules. Therefore, RF energy is a type of non-ionizing radiation. Other types of non-ionizing radiation include visible light, infrared radiation (heat) and other forms of electromagnetic radiation with relatively low frequencies.

This is almost identical to another Samsung statement and also to an FCC statement that I have not copied. Here is the Samsung statement [133]:

The biological effects of RF energy should not be confused with the effects from other types of electromagnetic energy.

Very high levels of electromagnetic energy, such as is found in X-rays and gamma rays, can ionize biological tissues. Ionization is a process where electrons are stripped away from their normal locations in atoms and molecules. It can permanently damage biological tissues including DNA, the genetic material.

The energy levels associated with radio frequency energy, including both radio waves and microwaves, are not great enough to cause ionization of atoms and molecules. Therefore, RF energy is a type of non-ionizing radiation. Other types of non-ionizing radiation include visible light, infrared radiation (heat), and other forms of electromagnetic radiation with relatively low frequencies.

While RF energy does not ionize particles, large amounts can increase body temperatures and cause tissue damage. Two areas of the body, the eyes and the testes, are particularly vulnerable to RF heating because there is relatively little blood flow in them to carry away excess heat.

The three paragraphs from the FDA statement are word for word identical to the first three paragraphs of the Samsung statement. The last paragraph in the Samsung statement was deleted from the FDA statement. It is clear from this that either the FDA statement is derived from the earlier industry statement rather than the other way around or both are derived from a previous statement similar to the Samsung statement.

These types of statements have given rise to shorter statements that are all something like the following:

Non-ionizing radiation consists of photons that do not have enough energy to break chemical bonds including the chemical bonds of DNA.

All of these statements are technically correct. They are also highly misleading. They are often falsely interpreted as meaning that there cannot be any effects of non-ionizing, non-thermal EMF ***exposures including indirect effects***. There are many possible indirect effects that may occur, given the complexity of biology. But our situation goes way beyond that, because we know that most of the effects are produced via VGCC activation which produces, as downstream effects, the free radical breakdown products of peroxynitrite (Fig. 1, Chapter 2). Those free radical breakdown products attack DNA, proteins and other biological constituents in ways that are very similar to the ways in which ionizing radiation attack these same molecules. Ionizing radiation was shown by Arthur Compton, who won the Nobel prize in physics in 1927, for showing that ionizing radiation produces large numbers of free radicals through what has become known as Compton scattering, with those free radicals being responsible for most of the biological effects of ionizing radiation. So the often repeated industry claim that ionizing radiation is dangerous but non-ionizing radiation is not, is wrong – both of them produce similar effects mediated through free radical generation. However the dangers of non-ionizing radiation may eclipse the dangers of ionizing radiation under some conditions because of something that is discussed early in Chapter 5, at the end of the Speit/Schwarz discussion. There are three processes which occur in the sequence by which EMF activation leads to peroxynitrite breakdown product radicals, each of which have high levels of amplification (each discussed on p. 29 in Chapter 5). Thus potentially and I believe actually microwave frequency EMFs can produce under suitable conditions, much more efficient free radical production than occurs from a similar energy level of ionizing radiation.

The FDA may have had a long history of playing fast and loose with the truth. For example, Microwave News article published in 2003, provides this account of what occurred at the FDA in 1993 [134]:

1993 FDA Memo Data "Strongly Suggest" Microwaves Can Promote Cancer.

> In the spring of 1993 at the height of the public concern over cell phone brain tumor risks, the Food and Drug Adminstration (FDA) biologists concluded [134] that the available data **"strongly suggest"** that microwaves can **"accelerate the development of cancer."** This assessment is from an internal agency memo recently obtained by Microwave News under the Freedom of Information Act.

> **"Of approximately eight chronic animal experiments known to us, five resulted in increased numbers of malignancies, accelerated progression of tumors, or both"** wrote Drs. Mays Swicord and Larry Cress of FDA's Center for Devices and Radiological Health (CDRH) in Rockville, MD. They also pointed to other evidence from laboratory (in vitro) studies which supported cancer risk.
>
> Yet in its public statements at that time, the agency played down these findings [134]. For instance in a Talk Paper issued in early February, the FDA stated that there was **"limited evidence that suggests that lower levels (of microwaves) might cause adverse effects."**
>
> **"A few studies suggest that (microwave) levels (from cellular phones) can accelerate the development of cancer in laboratory animals,"** the FDA added [134], "but there is much uncertainty among scientists about whether these results apply to the use of cellular phones."

I have three comments. Firstly, if you look at the 35 citations in the list on cancer causation in Chapter 1, you will see that there are 8 citations (#s 2-7 & 15 & 19) which provide similar evidence of stimulation of tumor promotion, four of which (#s 3-6) were published around 1993, the time of the FDA memo and public statement described above. Therefore, there was a substantial literature including peer-reviewed primary literature and review articles which produced similar conclusions to those of the FDA internal memo. The importance of the memo is that the FDA knew about these findings and opted to cover them up.

Secondly if you compare the rhetoric in the 1993 memo with the first quote from the current FDA web site quoted in this section, you will see some striking similarities. They both first refer to "a few studies" which are not identified, followed by raising uncertainties and then finally raising doubt as to whether these findings apply to cell phone radiation. The pattern of the FDA rhetoric has not changed much in 25 years.

If one includes the middle statement also quoted from the FDA web site, we have three FDA statements each of which downplays any biological effects and each of which are strongly rebutted by extensive peer-reviewed independent scientific literature. I'm not sure we can say the FDA has been corrupted by the industry, but what we can say is that it has been functioning as if it has been corrupted for 25 years.

In mid-2009 Margaret A. Hamburg, the new commissioner of the FDA, and Joshua M. Sharfstein, her principal deputy commissioner, published a commentary article in the New England Journal of Medicine [135] which included the following:

> "One of the greatest challenges facing any public health agency is that of risk

communication. … The FDA's job is to minimize risks through education, regulation, and enforcement. To be credible in all these tasks, the agency must communicate frequently and clearly about risks and benefits—and about what organizations and individuals can do to minimize risk. When, like the FDA, Americans must make choices about medication, devices, foods, or nutrition in the absence of perfect information, the FDA cannot delay in providing reasonable guidance —guidance that informs rather than causes unnecessary anxiety. For these communications to have credibility, the public must trust the agency to base its decisions on science."

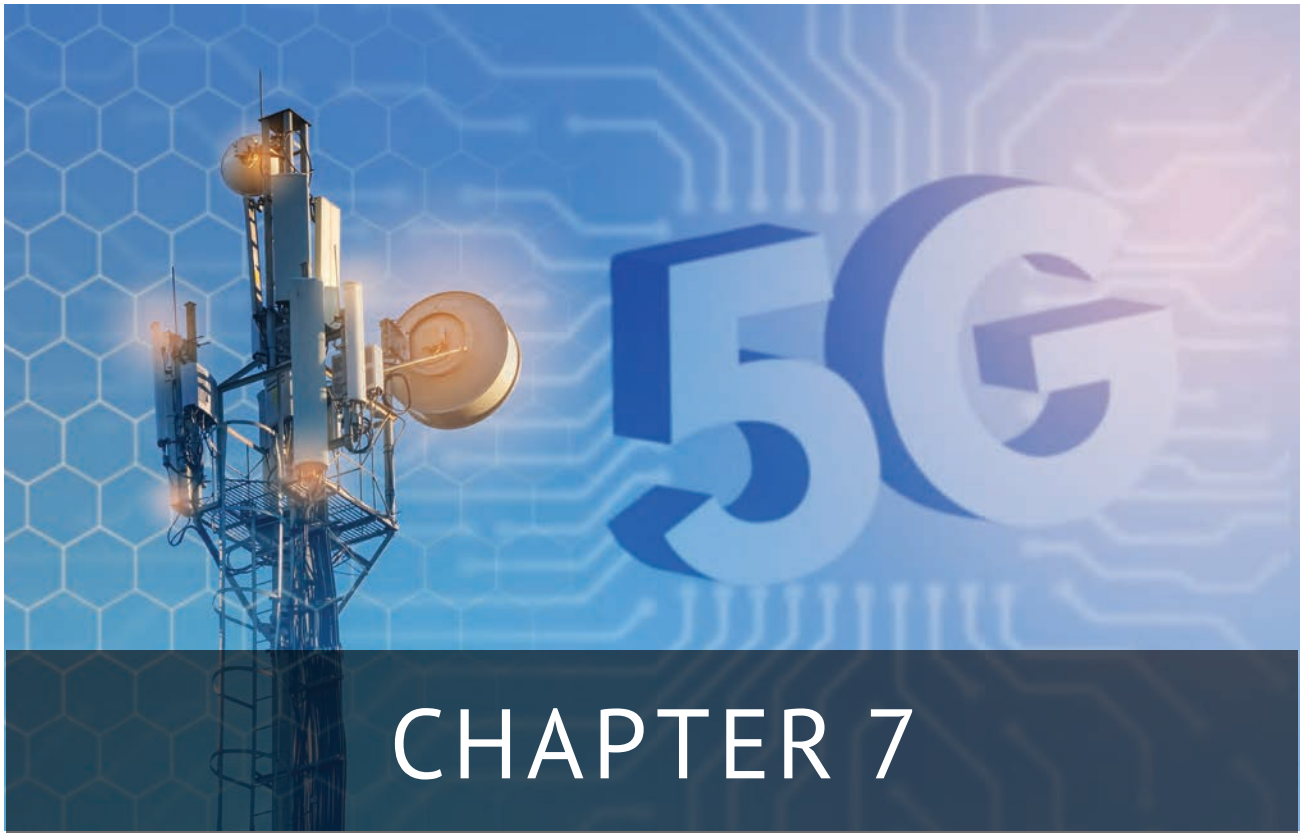
These were and are laudable goals. As far as I can tell, with regard to EMF effects, the FDA has failed to base either its communications or its decisions on science.

SUMMARY OF CHAPTER 6

In the areas discussed in Chapter 6 what used to be the primacy of U.S. science has completely disintegrated. It has disintegrated because of the cessation of U.S. government funding for either experimental studies or epidemiological studies. It has disintegrated due to attacks on U.S. and International scientists, attacks that started in the U.S. with the attacks on Dr. Henry Lai. It has disintegrated because of aggressive industry propaganda, propaganda that has no connection with the real science. It has disintegrated because of the outright corruption of the committee to set standards for radio-frequency exposures and the FCC and the possible and de facto corruption of the FDA. The telecommunications industry has been aware of much of the problems with their approach since the 1999 letter to them from George Carlo. The FCC has been aware of much more of the science since my presentation to them in September 2016. The FDA has been aware of contrary findings since 1993. Each of them has, if anything, doubled down on their fictions since those respective times.

Many of these things are going on internationally; however the U.S. has often been leading the world in these processes. All of the actions we have seen to corrupt the science and public understanding of the science have the effect of making it vastly more difficult for individuals impacted by the EMFs to protect themselves from further harm. We have many effects that are cumulative and become irreversible as they become more severe, effects that impact at a minimum, tens of millions of Americans and hundreds of millions of people elsewhere in the world. Industrial and regulatory organizations make it difficult or impossible for people to have scientifically valid information also make it difficult or impossible for people to protect themselves from the accumulation of these effects, leading to severe irreversible effects. Each of the organizations involved, both U.S. and international that collaborate in this process, have important responsibility for the consequences. I think damage goes way beyond tens

and hundreds of millions of people, because I think we are looking at cumulative severe impact on our brain function, on our reproductive function and on our DNA, and that these, in turn will lead to the crash of every single technologically advanced country on earth, barring a major change in course. That will happen fairly quickly, in my opinion, even without 5G but 5G will greatly speed up the process and perhaps even add new egregious effects.



CHAPTER 7

The Great Risks of 5G: What We Know and What We Don't Know

We have already discussed two issues that are essential to understanding 5G. One is that pulsed EMFs are, in most cases, much more biologically active than are non-pulsed (often called continuous wave) EMFs. A second is that the EMFs act by putting forces on the voltage sensor of the VGCCs, opening these calcium channels and allowing excessive calcium ions to flow into the cell. The voltage sensor is extraordinarily sensitive to those electrical forces, such that the safety guidelines are allowing us to be exposed to EMFs that are something like 7.2 million times too high.

The reason that the industry has decided to go to the extremely high frequencies of 5G is that with such extremely high frequencies, it is possible to carry much more information via much more pulsation than it is possible to carry with lower frequencies even in the microwave range. We can be assured, therefore, that 5G will involve vastly more pulsation than do EMFs that we are currently exposed to. It follows from that, that any biological safety test of 5G must use the very rapid pulsations including whatever very short term spikes may be present, that are to be present in genuine 5G. There is an additional process that is planned to be used in 5G: phased arrays (https://en.wikipedia.org/wiki/Phased_array). Here multiple antenna elements act together to produce highly pulsed fields which are designed for 5G, to produce increased

penetration. 5G will entail particularly powerful pulsations to be used, which may, therefore, be particularly hazardous.

The only data we have, to my knowledge, on millimeter wave frequencies of 5G used non-pulsed EMFs in the millimeter frequency range of 5G, not genuine 5G. Such millimeter waves have been shown to produce a number of downstream effects of VGCC activation. One millimeter wave study showed that it activated both the VGCCs and also the voltage-gated potassium channels, suggesting that it worked via the voltage sensor, as do other EMFs [136]. Any such data tells us almost nothing about how biologically active genuine very highly pulsed 5G will be. I take it that from their statements, that both Mr. Ryan and Dr. Vinciūnas are ready to put out 10s of millions of 5G antennae to afflict every single person in the EU with 5G radiation without even a single biological test of safety of genuine 5G. In the U.S., the FCC has taken a much worse position. The FCC is not only willing to allow such completely untested exposures but has also been has been aggressively pushing to promote installation of 5G antennae, such that antennae are already being installed in parts of the U.S. In a world where shocking behavior has become less and less shocking, I consider EU and U.S. views and actions to be shocking. The U.S. situation is mass insanity. I would have hoped that the Europeans, who think of themselves as being much more thoughtful than Americans, would have been genuinely more thoughtful.

Why does 5G need such high numbers of antennae? It is because the 5G radiation is much more absorbed as it enters various materials. The approach is to use many more antennae with one found every few houses, such that 5G can sufficiently penetrate local walls. Such absorption usually involves the interaction with electrically charged groups, such that such high absorption is likely to involve placing forces on electrically charged groups. Because such forces are the way in which EMFs activate the VGCCs, it seems highly likely, therefore, that 5G radiation will be particularly active in VGCC activation.

In summary, then, 5G is predicted to be particularly dangerous for each of four different reasons:

1. The extraordinarily high numbers of antennae that are planned.
2. The very high energy outputs which will be used to ensure penetration.
3. The extraordinarily high pulsation levels.
4. The apparent high level interactions of the 5G frequency on charged groups presumably including the voltage sensor charged groups.

Now what the telecommunications industry argues is that 5G radiation will be mostly absorbed in the outer 1 or 2 mm of the body, such that they claim that we don't have

to worry about the effects. There is some truth to that, but there are also some caveats that make any conclusions made from that, much more suspect. In any case, these surface effects of 5G will have especially strong impact on organisms with much higher surface to volume ratios. Consequently, I predict that many organisms will be much more impacted than we will. This includes insects and other arthropods, birds and small mammals and amphibia. It includes plants including even large trees, because trees have leaves and reproductive organs that are highly exposed. I predict there will be major ecological disasters as a consequence of 5G. This will include vast conflagrations because EMF exposures make plants much more flammable.

But let's get back to humans. The industry has also made claims that more conventional microwave frequency EMFs are limited in effect to the outer 1 cm of the body. We know that is not true, however because of the effects deep in the human brain, on the heart and on hormone systems. Perhaps the most important two studies demonstrating effects deep within the body are the studies of Professor Hässig and his colleagues in Switzerland on cataract formation in newborn calves [137,138]. These two studies clearly show that when pregnant cows are grazing near mobile phone base stations (also called cell phone towers), the calves are born with very greatly increased incidences of cataracts. It follows from these findings that even though the developing fetuses are very deep in the body of the mother and should be highly protected from the EMF exposures, they are not so protected. And because the EMF safety guidelines in Switzerland are 100 times more stringent than are the safety guidelines in most of the rest of Europe, in the U.S., Canada and most of the rest of the world, the more general safety guidelines allow greatly excessive exposures and penetration of effects. The claims of industry that microwave frequency EMFs only act in the outer centimeter of the body are clearly false.

How then can both conventional microwave frequency EMFs and 5G radiation act deeply within the body? You may correctly observe that the electrical effects of the EMFs activate the voltage sensor and that the direct electrical forces are rapidly attenuated in the body. So how can we get deep effects? I think the answer is that the magnetic parts of the EMFs have been known for decades to penetrate much more deeply than do the electrical parts. The magnetic fields put forces on mobile electrically charged groups dissolved in the aqueous phases of the body and small individual movements of the charged groups can regenerate electric fields that are essentially identical to the electric fields of the original EMFs, carrying the same frequency and same pulsation pattern, although with lower intensity. An example of this is given in the Lu and Ueno [139] study. Because the voltage sensor is so stunningly sensitive to electrical forces and part of the reason for that is the very high

level of amplification of the electrical field across the plasma membrane, we have an almost perfect way in which to produce EMF effects deeply within our bodies.

I am very concerned that 5G may produce effects like those we already see produced from lower frequency EMFs but are much more severe. I am also concerned that we will also see responses that are qualitatively different. Let me give you three possible examples of the latter type and one quantitative example. Each of the four types of blindness, have downstream effects of VGCC activation as causal factors: cataracts, detached retinas, glaucoma and macular degeneration. The aqueous and vitreous humors in the eye may be an ideal environment for the regeneration of the electrical fields within the eye. We may, therefore have a gigantic epidemic of each of the four types of blindness. Another concern focuses on kidney dysfunction, which was shown in Chapter 5 to be impacted by EMFs. The kidneys have much fluid, both blood and also what will become urine, which may allow efficient the regeneration of electrical fields. Such regeneration may be expected to impact both the glomerular filtration and also the reabsorption, both essential to kidney function. Does this mean that 5G will produce very large increases in kidney failure? The only way to find out is to do biological safety testing of genuine 5G radiation. Let me give you a third example. Fetuses and very young babies have much more water in their bodies than do adults. Therefore, they may be a special risk for impacts of 5G, because of great increases in the regeneration of the electrical fields. Here one can think of all kinds of possibilities. Let me suggest two. We may have a gigantic (sorry about using that word again) epidemic of spontaneous abortion due the teratogenic effects. Another possibility is that instead of autism being one birth in 38, however horrendous that is, it could be one out of two, or even a majority of births. I don't know that these will happen, but these are the kinds of risks we are taking and there are many others one can think of. Putting in tens of millions of 5G antennae without a single biological test of safety has got to be about the stupidest idea anyone has had in the history of the world.

This brings us back to the earlier point. The only way to do 5G safety testing is to do genuine 5G biological safety testing. I have published on how this can be done relatively easily at relatively low cost and have, as you saw in the Chapter 6, told the FCC how this can be done. Those tests must be done by organizations completely independent of industry and that leaves out both ICNIRP and SCENIHR and a lot of other organizations.

Now we will get into the precautionary principle which is specially relevant to the EU but may have lessons for all of us.

> Dr. Vinciūnas' last full paragraph reads as follows: "The recourse to the EU's precautionary principle to stop distribution of 5G products appears too drastic a

measure. We need first to see how this technology will be applied and how the scientific evidence will evolve. Please be assured that the Commission will keep abreast of the scientific evidence in view of safeguarding the health of European citizens at the highest level possible and in line with its mandate."

Article 191 defines the Precautionary Principle as follows:

"According to the European Commission the precautionary principle may be invoked when a phenomenon, product or process may have a dangerous effect, identified by a scientific and objective evaluation, if this evaluation does not allow the risk to be determined with sufficient certainty.

Recourse to the principle belongs in the general framework of risk analysis (which, besides risk evaluation, includes risk management and risk communication), and more particularly in the context of risk management which corresponds to the decision-making phase.

The Commission stresses that the precautionary principle may only be invoked in the event of a potential risk and that it can never justify arbitrary decisions.

The precautionary principle may only be invoked when the three preliminary conditions are met:

identification of potentially adverse effects;
evaluation of the scientific data available;
the extent of scientific uncertainty."

The question now is what about 5G? We have with 5G strong suspicions of similar or much more severe risk of effects documented elsewhere in this document. We have no biological safety testing of genuine 5G radiation. Therefore, we have no risk analysis or risk management because we have no risk assessment whatsoever on 5G. So here we have Dr. Vinciūnas arguing that the request for precautionary principle application is premature. But it is not the request for the use of the precautionary principle that is premature, it is the Commission's claim that it has done the required risk analysis and risk assessment. This is the bizarre world that we live in.

The European Commission has done nothing to protect European citizens from the very serious health hazards and the U.S. FDA, EPA and National Cancer Institute have done nothing to protect U.S. citizens. The U.S. FCC has been worse than that, acting in wanton disregard for our health.

LET ME CLOSE, AS FOLLOWS

There have been certain points in our history where people have stood up to strong destructive forces against what often appeared to be insurmountable odds. Those people are THE most honored people in our history. The people who failed to do so are among the most despised people in our history. I am not at all sure we will have historians to record us 100 years from now or even 30 years from now, given the direction in which we are heading. But if we do, rest assured that these are the standards by which we will all be judged.

Citations used in the text:

[1] Levine H, Jorgensen N, Martino-Andrade A, Mendiola J, Weksler-Derri D, Mindlis I, Pinotti R, Swan SH. 2017 Temporal trends in sperm count: a systematic review and meta-analysis. Human Reproduction Update, https://academic.oup.com/humupd/article/23/6/646/4035689

[2] Magras IN, Xenos TD. 1997 RF radiation-induced changes in the prenatal development of mice. Bioelectromagnetics 18:455-461.

[3] Pall ML. 2016 Microwave frequency electromagnetic fields (EMFs) produce widespread neuropsychiatric effects including depression. J Chem Neuroanat 75(Pt B):43-51. doi: 10.1016/j.jchemneu.2015.08.001.

[4] Pall, ML. 2013. Electromagnetic fields act via activation of voltage-gated calcium channels to produce beneficial or adverse effects. J Cell Mol Med 17:958-965. doi: 10.1111/jcmm.12088.

[5] Pall, M. L. 2015 Scientific evidence contradicts findings and assumptions of Canadian Safety Panel 6: microwaves act through voltage-gated calcium channel activation to induce biological impacts at non-thermal levels, supporting a paradigm shift for microwave/lower frequency electromagnetic field action. Rev. Environ. Health 3, 99-116. doi: 10.1515/reveh-2015-0001.

[6] Pall ML. 2016 Electromagnetic fields act similarly in plants as in animals: Probable activation of calcium channels via their voltage sensor. Curr Chem Biol 10: 74-82.

[7] Pall, M. L., 2018. How cancer can be caused by microwave frequency electromagnetic field (EMF) exposures: EMF activation of voltage-gated calcium channels (VGCCs) can cause cancer including tumor promotion, tissue invasion and metastasis via 15 mechanisms. Chapter 7 in Markov, M. S., (Ed.), Mobile Communications and Public Health, CRC Press, Boca Raton, FL, in press.

[8] Belyaev, I., 2005. Non-thermal biological effects of microwaves. Microwave Rev. 11, 13-29.

[9] Belyaev, I., 2015. Biophysical mechanisms for nonthermal microwave effects. In: Markov M.S. (Ed), Electromagnetic Fields in Biology and Medicine, CRC Press, New York, pp 49-67.

[10] Panagopoulos, D. J., Johansson, O., Carlo, G. L., 2015. Polarization: a key difference between man-made and natural electromagnetic fields, in regard to biological activity. Sci. Rep. 2015 Oct 12;5:14914. doi: 10.1038/srep14914.

[11] Pall ML. 2018 Wi-Fi is an important threat to human health. Environ Res 164:405-416. doi: 10.1016/j.envres.2018.01.035.

[12] Pilla, A. A., 2012. Electromagnetic fields instantaneously modulate nitric oxide signaling in challenged biological systems. Biochem. Biophys. Res. Commun. 28, 426:330-333. doi: 10.1016/j.bbrc.2012.08.078.

[13] Lu, X. W., Du, L., Kou, L., Song, N., Zhang, Y. J., Wu, M. K., Shen, J. F., 2015. Effects of moderate static magnetic fields on the voltage-gated sodium and calcium channels currents in trigeminal ganglion neurons. Electromagn. Biol. Med. 34, 285-292. doi: 10.3109/15368378.2014.906448.

[14] Tabor, K. M., Bergeron, S. A., Horstick, E. J., Jordan, D. C., Aho, V., Porkka-Heiskanen, T., Haspel, G, Burgess, H. A., 2014. Direct activation of the Mauthner cell by electric field pulses drives ultrarapid escape responses. J Neurophysiol 112:834-844. doi: 10.1152/jn.00228.2014.

[15] Zhang, J., Li, M., Kang, E. T., Neoh, K. G., 2016. Electrical stimulation of adipose-derived mesenchymal stem cells in conductive scaffolds and the roles of voltage-gated ion channels. Acta Biomater. 32, 46-56. doi: 10.1016/j.actbio.2015.12.024.

[16] Tekieh T, Sasanpour P, Rafii-Tabar H. 2016 Effects of electromagnetic field exposure on conduction and concentration of voltage gated calcium channels: A Brownian dynamics study. Brain Res 1646:560-569.

[17] ICNIRP 2009 International Commission on Non-ionizing Radiation Protection. ICNIRP statement on the "Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (up to 300 GHz). Health Phys 97:257-258.

[18] Bioinitiative Working Group. 2007 BioInitiative Report: A rationale for biologically-based public exposure standard for electromagnetic fields (ELF and RF). Sage C and Carpenter DO (Eds.), Available online: http://www.bioinitiative.org/table-of-contents/ (accessed March 19, 2018)

[19] Sypniewska, R. K., Millenbaugh, N. J., Kiel, J. L., Blystone, R. V., Ringham, H. N., Mason, P. A., Witzmann, F. A., 2010. Protein changes in macrophages induced by plasma from rats exposed to 35 GHz millimeter waves. Bioelectromagnetics 3, 656-663. doi: 0.1002/bem.20598.

[20] Kalns, J., Ryan, K. L., Mason, P. A., Bruno, J. G., Gooden, R., Kiel, J. L., 2000. Oxidative stress precedes circulatory failure induced by 35-GHz microwave heating. Shock 13, 52-59.

[21] Garbuz, D. G., 2017. Regulation of heat shock gene expression in response to stress. Mol. Biol. 51, 352-367. doi: 10.1134/S0026893317020108.

[22] Park, H. K., Lee, J. E., Lim, J. F., Kang, B. H., 2014. Mitochondrial Hsp90s suppress calcium-mediated stress signals propagating from the mitochondria to the ER in cancer cells. Mol. Cancer 13 Article Number: 148 doi: 10.1186/1476-4598-13-148.

[23] Krebs, J., Groenendyk, J., Michalek, M., 2011. Ca2+-signaling, alternative splicing and endoplasmic reticulum stress responses. Neurochem. Res. 36, 1198-1211. doi: 10.1007/s11064-011-0431-4.

[24] Pilla, A. A., 2013. Nonthermal electromagnetic fields: from first messenger to therapeutic applications. Electromagn Biol Med 32, 123-136. doi: 10.3109/15368378.2013.776335.

[25] Pall, M. L., 2014. Electromagnetic field activation of voltage-gated calcium channels: role in therapeutic effects. Electromagn. Biol. Med. 2014 Apr 8 doi: 10.3109/15368378.2014.906447.

[26] Raines JK. 1981. Electromagnetic Field Interactions with the Human Body: Observed Effects and Theories. Greenbelt, Maryland: National Aeronautics and Space Administration 1981; 116 p.

[27] Goldsmith JR. 1997 Epidemiologic evidence relevant to radar (microwave) effects. Env Health Perspect 105(Suppl 6):1579-1587.

[28] Hecht Karl. 2016 Health Implications of Long-Term Exposures to Electrosmog. Brochure 6 of A Brochure Series of the Competence Initiative for the Protection of Humanity, the Environment and Democracy. http://kompetenzinitiative.net/KIT/wp-content/uploads/2016/07/KI_Brochure-6_K_Hecht_web.pdf (accessed Feb. 11, 2018)

[29] Marha K. 1966 Biological Effects of High-Frequency Electromagnetic Fields (Translation). ATD Report 66-92. July 13, 1966 (ATD Work Assignment No. 78, Task 11).

[30] Glaser ZR, PhD. 1971 Naval Medical Research Institute Research Report, June 1971. Bibliography of Reported Biological Phenomena ("Effects") and Clinical Manifestations Attributed to Microwave and Radio-Frequency Radiation. Report No. 2 Revised. https://scholar.google.com/scholar?q=Glaser+naval+medical+microwave+radio-frequency+1972&btnG=&hl=en&as_sdt=0%2C38 (Accessed Sept. 9, 2017)

[31] Bise W. 1978 Low power radio-frequency and microwave effects on human electroencephalogram and behavior. Physiol Chem Phys 10:387-398.

[32] Belyaev I, Dean A, Eger H, Hubmann G, Jandrisovits R, Kern M, Kundi M, Moshammer H, Lercher P, Müller K, Oberfeld G, Ohnsorge P, Pelzmann P, Scheingraber C, Thill R. 2016 EUROPAEM EMF Guideline 2016 for the prevention, diagnosis and treatment of EMF-related health problems and illnesses. Rev Environ Health DOI 10.1515/reveh-2016-0011.j

[33] Hedendahl L, Carlberg M, Hardell L. 2015 Electromagnetic hypersensitivity--an increasing challenge to the medical profession. Rev Environ Health 30:209-215. doi: 10.1515/reveh-2015-0012.

[34] Carpenter DO. 2015 The microwave syndrome or electro-hypersensitivity: historical background. Rev Environ Health 30:217-222. doi: 10.1515/reveh-2015-0016

[34] Havas M. 2013 Radiation from wireless technology affects the blood, the heart and the autonomic nervous system. Rev Environ Health 82:75-84. https://www.degruyter.com/view/j/reveh.2013.28.issue-2-3/reveh-2013-0004/reveh-2013-0004.xml

[35] Havas M, Marrongelle J, Pollmer, Kelley E, Rees C, Tully S. 2010 Provocation study using heart rate variability shows microwave radiation from 2.4 GHz cordless phone affects autonomic nervous system. Eur J Oncol 5:273-300.

[36] Gordon, ZV. 1966 [Problems of industrial hygiene and biological effects of super high frequency electromagne c fields.] Medizina, Moscow (in Russian)

[37] Presman, AS. Electromagnetic fields and life. New York: Plenum Press, 1970.

[38] Tolgskaya MS, Gordon ZV. 1973. Pathological Effects of Radio Waves, Translated from Russian by B Haigh. Consultants Bureau, New York/London, 146 pages.

[39] Siebert DM, Drezner JA. 2018 Sudden cardiac arrest on the field of play: turning tragedy into a survivable event. Neth Heart J 26:115-119. doi: 10.1007/s12471-018-1084-6.

[40] Pall ML. 2013 The NO/ONOO- cycle as the central cause of heart failure. Int J Mol Sci 14:22274-22330. doi: 10.3390/ijms141122274.

[41] Liu YQ, Gao YB, Dong J, Yao BW, Zhao L, Peng RY. 2015 Pathological changes in the sinoatrial node tissues of rats caused by pulsed microwave exposure. Biomed Environ Sci 28:72-75. doi: 10.3967/bes2015.007.

[42] Pritchard C, Mayers A, Baldwin D. 2013 Changing patterns of neurological mortality in the 10 major developed countries--1979-2010. Public Health 127:357-368. doi: 10.1016/j.puhe.2012.12.018.

[43] Pritchard C, Rosenorn-Lanng E. 2015 Neurological deaths of American adults (55-74) and the over 75's by sex compared with 20 Western countries 1989-2010: Cause for concern. Surg Neurol Int 2015 Jul 23;6:123. doi: 10.4103/2152-7806.161420.

[44] Vieira RT, Caixeta L, Machado S, Silva AC, Nardi AE, Arias-Carrión O, Carta MG. 2013 Epidemiology of early-onset dementia: a review of the literature. Clin Pract Epidemiol Ment Health 9:88-95. doi: 10.2174/1745017901309010088.

[45] Hallberg O, Johansson O. 2005 Alzheimer mortality—why does it increase so rapidly in sparsely populated areas? Eur Biol Bioelectromag 1;1-8

[46] [Dossey L. 2014 FOMO, digital dementia, and our dangerous experiment. Explore (NY) 2014 Mar-Apr;10(:69-73. doi: 10.1016/j.explore.2013.12.008.

[47] Moledina S, Khoja A. 2018 Letter to the Editor: Digital Dementia-Is Smart Technology Making Us Dumb? Ochsner J. 2018 Spring;18(1):12.

[48] Spitzer, Manfred. Digitale Demenz. Wie wir uns und unsere Kinder um den Verstand bringen. Droemer Verlag, Munich 2012.

[49] Mattson MP. 2007 Calcium and neurodegeneration. Aging Cell 6:337-350. doi: 10.1111/j.1474-9726.2007.00275.x

[50] Celsi F, Pizzo P, Brini M, Leo S, Fotino C, Pinton P, Rizzuto R. 2009 Mitochondria, calcium and cell death: a deadly triad in neurodegeneration. Biochim Biophys Acta 1787:335-344. doi: 10.1016/j.bbabio.2009.02.021.

[51] Carreiras MC, Mendes E, Perry MJ, Francisco AP, Marco-Contelles J. 2013 The multifactorial nature of Alzheimer's disease for developing potential therapeutics. Curr Top Med Chem 13:1745-1770.

[52] Jiang DP, Li J, Zhang J, Xu SL, Kuang F, Lang HY, Wang YF, An GZ, Li JH, Guo GZ. 2013 Electromagnetic pulse exposure induces overexpression of beta amyloid protein in rats. Arch Med Res 44:178-184. doi: 10.1016/j.arcmed.2013.03.005.

[53] Jiang DP, Li JH, Zhang J, Xu SL, Kuang F, Lang HY, Wang YF, An GZ, Li J, Guo GZ. 2016 Long-term electromagnetic pulse exposure induces Abeta deposition and cognitive dysfunction through oxidative stress and overexpression of APP and BACE1. Brain Res. 2016 Jul 1;1642:10-19. doi: 10.1016/j.brainres.2016.02.053.

[54] Dasdag S, Akdag MZ, Kizil G, Kizil M, Cakir DU, Yokus B. 2012 Effect of 900 MHz radio frequency radiation on beta amyloid protein, protein carbonyl, and malondialdehyde in the brain. Electromagn Biol Med. 2012 Mar;31(1):67-74. doi: 10.3109/15368378.2011.624654.

[55] Dasdag S, Akdag MZ, Erdal ME, Erdal N, Ay OI, Ay ME, Yilmaz SG, Tasdelen B, Yegin K. 2015 Long term and excessive use of 900 MHz radiofrequency radiation alter microRNA expression in brain. Int J Radiat Biol 91:306-311. doi: 10.3109/09553002.2015.997896.

[56] Arendash GW, Mori T, Dorsey M, Gonzalez R, Tajiri N, Borlongan C. 2012 Electromagnetic treatment to old Alzheimer's mice reverses β-amyloid deposition, modifies cerebral blood flow, and provides selected cognitive benefit. PLoS One. 2012;7(4):e35751. doi: 10.1371/journal.pone.0035751.

[57] Arendash GW. 2016 Review of the Evidence that Transcranial Electromagnetic Treatment will be a Safe and Effective Therapeutic Against Alzheimer's Disease. J Alzheimers Dis 53:753-771.

[58] García AM, Sisternas A, Hoyos SP. 2008 Occupational exposure to extremely low frequency electric and magnetic fields and Alzheimer disease: a meta-analysis. Int J Epidemiol 37:329-340. doi: 10.1093/ije/dym295.

[59] Hug K1, Röösli M, Rapp R. 2006 Magnetic field exposure and neurodegenerative diseases--recent epidemiological studies. Soz Praventivmed 51:210-220.

[59A] No author listed. 1997 Stronger evidence for an Alzheimer's EMF connection. Microwave News XVII, Jan/Feb 1997, 1,6,7.

[60] Gandhi OP, Kang G. 2001 Calculation of induced current densities for humans by magnetic fields from electronic article surveillance devices. Phys Med Biol 46:2759-2771.

[61] Gandhi OP, Morgan LL, de Salles AA, Han YY, Herberman RB, Davis DL. 2012 Exposure Limits: The underestimation of absorbed cell phone radiation, especially in children. Electromagn Biol Med 31:34-51. doi: 10.3109/15368378.2011.622827.

[62] Belyaev IY, Markovà E, Hillert L, Malmgren LO, Persson BR. 2009 Microwaves from UMTS/GSM mobile phones induce long-lasting inhibition of 53BP1/gamma-H2AX DNA repair foci in human lymphocytes. Bioelectromagnetics 30:129-141. doi: 10.1002/bem.20445.

[63] Markovà E, Malmgren LO, Belyaev IY. 2010 Microwaves from Mobile Phones Inhibit 53BP1 Focus Formation in Human Stem Cells More Strongly Than in Differentiated Cells: Possible Mechanistic Link to Cancer Risk. Environ Health Perspect 118:394-399. doi: 10.1289/ehp.0900781

[64] Lee SS, Kim HR, Kim MS, Park SH, Kim DW. 2014 Influence of smart phone Wi-Fi signals on adipose-derived stem cells. Ja J Cranofac Surg 25:1902-1907. doi: 10.1097/SCS.0000000000000939.

[65] Czyz J, Guan K, Zeng Q, Nikolova T, Meister A, Schönborn F, Schuderer J, Kuster N, Wobus AM. 2004 High frequency electromagnetic fields (GSM signals) affect gene expression levels in tumor suppressor p53-deficient embryonic stem cells. Bioelectromagnetic 25:296-307. doi:10.1002/bem.10199

[66] Xu F, Bai Q, Zhou K, Ma L, Duan J, Zhuang F, Xie C, Li W, Zou P, Zhu C. 2016 Age-dependent acute interference with stem and progenitor cell proliferation in the hippocampus after exposure to 1800 MHz electromagnetic radiation. Electromagn Biol Med 3:1-9. doi: 10.1080/15368378.2016.

[67] Odaci E, Bas O, Kaplan S. 2008 Effects of prenatal exposure to a 900 MHz electromagnetic field on the dentate gyrus of rats: a stereological and histopathological study. Brain Res 1238:224-229. doi: 10.1016/j.brainres.2008.08.013.

[68] Uchugonova A, Isemann A, Gorjup E, Tempea G, Bückle R, Watanabe W, König K. 2008 Optical knock out of stem cells with extremely ultrashort femtosecond laser pulses. J Biophotonics 1(6):463-469. doi: 10.1002/jbio.200810047.

[69] Wang C, Wang X, Zhou H, Dong G, Guan X, Wang L, Xu X, Wang S, Chen P, Peng R, Hu X. 2015 Effects of pulsed 2.856 GHz microwave exposure on BM-MSCs isolated from C57BL/6 mice. PLoS One. 2015 Feb 6;10(2):e0117550. doi: 10.1371/journal.pone.0117550.

[70] Teven CM, Greives M, Natale RB, Su Y, Luo Q, He BC, Shenaq D, He TC, Reid RR. 2012 Differentiation of osteoprogenitor cells is induced by high-frequency pulsed electromagnetic fields. J Craniofac Surg 23:586-593. doi: 10.1097/SCS.0b013e31824cd6de.

[71] Bhargav H, Srinivasan TM, Varambally S, Gangadhar BN, Koka P. 2015 Effect of Mobile Phone-Induced Electromagnetic Field on Brain Hemodynamics and Human Stem Cell Functioning: Possible Mechanistic Link to Cancer Risk and Early Diagnostic Value of Electronphotonic Imaging. J Stem Cells 10 (4): 287-294.

[72] Redmayne M, Johansson O. 2015 Radiofrequency exposure in young and old: different sensitivities in the light of age-relevant natural differences. Rev Environ Health 30: 323-335. doi: 10.1515/reveh-2015-0030.

[73] SCENIHR, 2015. Health effects of EMF – 2015 Scientific Committee on Emerging and Newly Identified Health Risks SCENIHR: opinion on potential health effects of exposure to electromagnetic fields (EMF). https://ec.europa.eu/health/scientific_committees/emerging/docs/scenihr_o_041.pdf (accessed Sept. 7, 2017)

[74] Speit G, Gminski R, Tauber R. 2013 Genotoxic effects of exposure to radiofrequency electromagnetic fields (RF-EMF) in HL-60 cells are not reproducible. Mutat Res Genet Toxicol Environ Mutagen 755: 163-166.

{75] Schwarz C, Kratochvil E, Pilger A, Kuster N, Adlkofer F, Rüdiger HW. 2008 Radiofrequency electromagnetic fields (UMTS, 1,950 MHz) induce genotoxic effects in vitro in human fibroblasts but not in lymphocytes. Int Arch Occup Environ Health 81: 755-767.

[76] J. Lutz and F. Adlkofer, 2007 Objections against current limits for microwave radiation. Proceedings or the WFMN07, Chemnitz, Germany, pp. 119-123. http://www.mobilfunk-debatte.de/pdf/studien/Lutz_Adlkofer_WFMN07_III_A1.pdf (accessed March 36, 2018).

[77] Davis D. 2010 Disconnect: The Truth about Cell Phone Radiation, What the Industry Is Doing to Hide It, and How to Protect Your Family. Penguin Group, New York.

[78] Khurana VG, Teo C, Kundi M, Hardell L, Carlberg M. 2009 Cell phones and brain tumors: a review including the long-term epidemiologic data. Surg Neurol 72:205-214.

[79] Desai NR, Kesari KK, Agarwal A. 2009 Pathophysiology of cell phone radiation: oxidative stress and carcinogenesis with focus on the male reproductive system. Reproduct Biol Endocrinol 7:114.

[80] Makker K, Varghese A, Desai NR, Mouradi R, Agarwal A. 2009 Cell phones: modern man's nemesis? Reprod Biomed Online 18:148-157.

[81] Ruediger HW. 2009 Genotoxic effects of radiofrequency electromagnetic fields. Pathophysiology. 16:89-102.

[82] Phillips JL, Singh NP, Lai H. 2009 Electromagnetic fields and DNA damage. Pathophysiology 16:79-88.

[83] Davanipour Z, Sobel E. 2009 Long-term exposure to magnetic fields and the risks of Alzheimer's disease and breast cancer: Further biological research. Pathophysiology 16:149-156.

[84] Yakymenko I, Sidorik E. 2010 Risks of carcinogenesis from electromagnetic radiation and mobile telephony devices. Exp Oncol 32:729-736.

[85] Carpenter DO. 2010 Electromagnetic fields and cancer: the cost of doing nothing. Rev Environ Health 25:75-80.

[86] Giuliani L, Soffriti M (Eds). 2010 NON-THERMAL EFFECTS AND MECHANISMS OF INTERACTION BETWEEN ELECTROMAGNETIC FIELDS AND LIVING MATTER, RAMAZZINI INSTITUTE EUR. J. ONCOL. LIBRARY Volume 5, National Institute for the Study and Control of Cancer and Environmental Diseases "Bernardino Ramazzini" Bologna, Italy 2010, 400 page monograph.

[87] Khurana, V. G., Hardell, L., Everaert, J., Bortkiewicz, A., Carlberg, M., Ahonen, M. 2010 Epidemiological evidence for a health risk from mobile phone base stations. Int. J. Occup. Environ. Health 16, 263-267.

[88] Levitt, B. B., Lai, H. 2010. Biological effects from exposure to electromagnetic radiation emitted by cell tower base stations and other antenna arrays. Environ. Rev. 18, 369-395. doi.org/10.1139/A10-018

[89] Kang N, Shang XJ, Huang YF. 2010 [Impact of cell phone radiation on male reproduction]. Zhonghua Nan Ke Xue 16:1027-1030.

[90] Yakymenko, I., Sidorik, E., Kyrylenko, S., Chekhun, V. 2011. Long-term exposure to microwave radiation provokes cancer growth: evidences from radars and mobile communication systems. Exp. Oncol. 33(2), 62-70.

[91] Yakimenko IL, Sidorik EP, Tsybulin AS. 2011 [Metabolic changes in cells under electromagnetic radiation of mobile communication systems]. Ukr Biokhim Zh (1999). 2011 Mar-Apr;83(2):20-28.

[92] Gye MC, Park CJ. 2012 Effect of electromagnetic field exposure on the reproductive system. Clin Exp Reprod Med 39:1-9. doi.org/10.5653/cerm.2012.39.1.1

[93] La Vignera S, Condorelli RA, Vicari E, D'Agata R, Calogero AE. 2012 Effects of the exposure to mobile phones on male reproduction: a review of the literature. J Androl 33:350-356.

[94] Biointiative Working Group, David Carpenter and Cindy Sage (eds). 2012 Bioinitiative 2012: A rationale for biologically-based exposure standards for electromagnetic radiation. http://www.bioinitiative.org/participants/why-we-care/

[95} Nazıroğlu M, Yüksel M, Köse SA, Özkaya MO. 2013 Recent reports of Wi-Fi and mobile phone-induced radiation on oxidative stress and reproductive signaling pathways in females and males. J Membr Biol 246:869-875.

[96] Ledoigt G, Belpomme D. 2013 Cancer induction molecular pathways and HF-EMF irradiation. Adv Biol Chem 3:177-186.

[97] Hardell L, Carlberg M. 2013 Using the Hill viewpoints from 1965 for evaluating strengths of evidence of the risk for brain tumors associated with use of mobile and cordless phones. Rev Environ Health 28:97-106. doi: 10.1515/reveh-2013-0006.

[98] Hardell L, Carlberg M, Hansson Mild K. 2013 Use of mobile phones and cordless phones is associated with increased risk for glioma and acoustic neuroma. Pathophysiology 2013;20(2):85-110.

[99} Davis DL, Kesari S, Soskolne CL, Miller AB, Stein Y. 2013 Swedish review strengthens grounds for concluding that radiation from cellular and cordless phones is a probable human carcinogen. Pathophysiology 20:123-129.

[100] Panagopoulos DJ, Johansson O, Carlo GL. 2015. Real versus simulated mobile phone exposures in experimental studies. BioMed Res Int 2015, article ID 607053, 8 pages. doi: 10.1155/2015/607053.

[101] Meo SA, Alsubaie Y, Almubarak Z, Almutawa H, AlQasem Y, Hasanato RM. 2015 Association of Exposure to Radio-Frequency Electromagnetic Field Radiation (RF-EMFR) Generated by Mobile Phone Base Stations with Glycated Hemoglobin (HbA1c) and Risk of Type 2 Diabetes Mellitus. Int J Environ Res Public Health 13;12:14519-14528. doi: 10.3390/ijerph121114519.

[102] Othman, H., Ammari, M., Rtibi, K., Bensaid, N., Sakly, M., Abdelmelek, H. 2017. Postnatal development and behavior effects of in-utero exposure of rats to radiofrequency waves emitted from conventional WiFi devices. Environ. Toxicol. Pharmacol. 52:239-247. doi: 10.1016/j.etap.2017.04.016.

[103] Bas O, Sönmez OF, Aslan A, Ikinci A, Hanci H, Yildirim M, Kaya H, Akca M, Odaci E. 2013 Pyramidal Cell Loss in the Cornu Ammonis of 32-day-old Female Rats Following Exposure to a 900 Megahertz Electromagnetic Field During Prenatal Days 13-21.

Neuroquantology 11: 591-599.

[104] Kumari K, Koivisto H, Myles C, Jonne N, Matti V, Heikki T, Jukka J. 2017 Behavioural phenotypes in mice after prenatal and early postnatal exposure to intermediate frequency magnetic fields. Environ Res 162: 27-34

[105] Othman H, Ammari M, Sakly M, Abdelmelek H. 2017 Effects of prenatal exposure to WIFI signal (2.45GHz) on postnatal development and behavior in rat: Influence of maternal restraint. Behav Brain Res 326: 291-302.

[106] Stasinopoulou M, Fragopoulou AF, Stamatakis A, Mantziaras G, Skouroliakou K, Papassideri IS, Stylianopoulou F, Lai H, Kostomitsopoulos N, Margaritis LH. 2016 Effects of pre- and postnatal exposure to 1880-1900 MHz DECT base radiation on development in the rat. Reprod Toxicol 2016; 65: 248-262.

[107] Divan HA, Kheifets L, Obel C, Olsen J. 2008 Prenatal and postnatal exposure to cell phone use and behavioral problems in children. Epidemiology 19:523-529. doi: 10.1097/EDE.0b013e318175dd47.

[108] Divan HA, Kheifets L, Obel C, Olsen J. 2012 Cell phone use and behavioural problems in young children. J Epidemiol Community Health. 2012 Jun;66(6):524-9. doi: 10.1136/jech.2010.115402.

[109] Kabir ZD, Martínez-Rivera A, Rajadhyaksha AM. 2017 From Gene to Behavior: L-Type Calcium Channel Mechanisms Underlying Neuropsychiatric Symptoms. Neurotherapeutics. 2017 Jul;14(3):588-613. doi: 10.1007/s13311-017-0532-0.

[110] Foster KR, Moulder JE. 2013 Wi-Fi and health: review of current status of research. Health Phys 105:561-565. doi: 10.1097/HP.0b013e31829b49bb.

[111] Diamond Jared. 2005 Collapse: How Societies Choose to Fail or Succeed. Viking Group, New York.

[112] NCRP Report No. 86. 1986 Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields. Recommendations of the National Council on Radiation Protection and Measurements. 400 pp. Bethesda MD 20814

[113] Motorala, Microwaves and DNA Breaks: "War-Gaming"the Lai-Singh Experiments. Dec. 13, 1994. Reprinted in Microwave News January/February 1997 https://www.rfsafe.com/wp-content/uploads/2014/06/cell-phone-radiation-war-gaming-memo.pdf (Accessed April 4, 2018).

[114] WTR and betrayal of the public trust. Microwave News, March 2005. http://microwavenews.com/docs/MWN.March-05.pdf (accessed April 4, 2018)

[115] Wakeup Call Cover Story. Rob Harrill University of Washington Alumni News, March 2005. http://www.washington.edu/alumni/columns/march05/wakeupcall01.html (Accessed April 4, 2018)

[116] Schneider, Scott. 2008 Book Review of "Doubt is Their Product: How Industry's Assault on Science Threatens Your Health." By David Michaels. https://www.lhsfna.org/index.cfm/lifelines/june-2008/book-review-doubt-is-their-product/ (accessed April 4, 2018).

[117] Interview of Dr. Dietrich Klinghardt by Dr. Joe Mercola, December 28, 2017. https://idocslide.com/the-philosophy-of-money.html?utm_source=interview-klinghardt-emf (Accessed April 6, 2018). Please note: There is also youtube video of this interview.

[118] http://www.newsweek.com/why-does-vladimir-putin-avoid-smartphones-801406 (Accessed April 9, 2018).

[119] Goldberg RB. 1993 The cellular phone controversy: real or contrived? EMF Health Report 1(1): 1993. EPI1793

[120] Berezow A, Bloom A. 2017 Recommendation to limit Md. School Wi-Fi based on 'junk science'. Baltimore Sun op-ed piece, March 12. https://www.baltimoresun.com/opinion/op-ed/bs-ed-wifi-school-20170312-story.html (Accessed June 17, 2017).

[121] NCI, 2016 National Cancer Institute Statement on Electromagnetic Fields and Cancer May 2016. https://www.cancer.gov/about-cancer/causes-prevention/risk/radiation/electromagnetic-fields-fact-sheet (accessed Sept. 7, 2017)

[122] Wyde M, Cesta M, Blystone C, et al. 2016 Report of Partial findings from the National Toxicology Program Carcinogenesis Studies of Cell Phone Radiofrequency Radiation in Hsd: Sprague Dawley® SD rats (Whole Body Exposure). bioRXiv doi.org/10.1101/055699

[123] Merritt, JH, Chamness AF, Allen SJ. 1978 Studies on blood-brain barrier permeability after microwave-radiation. Rad Environ Biophys 15:367-377.

[124] Ziemann C, Brockmeyer H, Reddy SB, Vijayalaxmi, Prihoda TJ, Kuster N, Tillmann T, Dasenbrock C. 2009 Absence of genotoxic potential of 902 MHz (GSM) and 1747 MHz (DCS) wireless communication signals: In vivo two-year bioassay in B6C3F1 mice. Int J Radiat Biol 85:454-464. doi: 10.1080/09553000902818907.

[125] Dr. George L. Carlo Letter To AT&T Chairman on Cell Phone Radiation, October 7, 1999. https://www.rfsafe.com/dr-george-l-carlo-letter-to-att-chairman-on-cell-phone-radiation/ (Accessed April 8, 2018).

[126] Carlo, George and Schram, Martin. 2001 Cell Phones: Invisible Hazards in the Wireless Age: An Insider's Alarming Discoveries about Cancer and Genetic Damage. Carroll and Graf, New York.

[127] Alster, Norm. 2015 Captured Agency: How the Communications Commission Is Dominated by the Industry It Presumably Regulates. Edmund J. Safra Institute for Ethics, Harvard University, Cambridge, MA, USA

[128] FCC Federal Communication RF Safety FAQ. No date given https://www.fcc.gov/engineering-technology/electromagnetic-compatibility-division/radio-frequency-safety/faq/rf-safety#top

[129] FDA Letter of Intent for Collaboration with the CTIA. October 18, 1999. https://www.rfsafe.com/fda-letter-intent-collaboration-ctia/ (Accessed April 14, 2018).

[130] Cooperative Research and Development Agreement (CRADA). Updated on Dec. 4, 2017 https://www.fda.gov/radiation-emitting-products/cell-phones/cooperative-research-and-development-agreement-crada

[131] fda.gov site Cell Phones > Current Research Results. No Date given. https://www.fda.gov/Radiation-EmittingProducts/RadiationEmittingProductsandProcedures/HomeBusinessandEntertainment/CellPhones/ucm116335.htm

[132] Samsung Health and Safety and Warrantee Guide. 2015 https://www.samsung.com/us/Legal/PHONE-HS_GUIDE_English.pdf (Accessed April 15, 2018)

[133] Samsung Gear S Black (AT&T) last updated July 17, 1017. https://www.samsung.com/us/support/service/warranty/SM-R750AZKAATT (Accessed April 15, 2018).

[134] 1993 FDA Memo: Data "Strongly Suggest" Microwaves Can Promote Cancer. Jan/Feb 1993, p. 1, 5. https://pdfs.semanticscholar.org/776f/b8ea63bd5c3c32699e90301af123eea6c6c7.pdf (Accessed Apr 15, 2018)

[135] Hamburg MA, Sharfstein JM. 2009 The FDA as a public health agency. N Engl J Med 360:2493-2495. doi: 10.1056/NEJMp0903764

[136] Alekseev SI, Ziskin MC. 1999 Effects of millimeter waves on ionic currents of Lymnaea neurons. Bioelectromagnetics 20:24-33.

[137] Hässig M, Jud F, Naegeli H, Kupper J, Spiess BM. 2009 Prevalence of nuclear cataract in Swiss veal calves and its possible association with mobile telephone antenna base stations. Schweiz Arch Tierheilkd 151:471-478.

[138] Hässig M, Jud F, Spiess B. 2012 [Increased occurrence of nuclear cataract in the calf after erection of a mobile phone base station]. Schweiz Arch Tierheilkd 154:82-86.

[139] Lu M, Ueno S. 2013 Calculating the induced electromagnetic fields in real human heads by deep transcranial magnetic stimulation. 35th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Book Series. Osaka Japan, pp. 795-798.

Kathy Noel

From: Annemarie Clisby
Sent: Wednesday, August 21, 2019 2:09 PM
To: Roy Sapau
Subject: FW: 2019 5G Injury Reports after 5G installed in neighborhoods

From: Anjali Corinne S <anjalicore2011@gmail.com>
Sent: Wednesday, August 21, 2019 1:43 PM
To: Catherine Blakespear <cblakespear@encinitasca.gov>; Jody Hubbard <jhubbard@encinitasca.gov>; Council Members <council@encinitasca.gov>; Tony Kranz <tkranz@encinitasca.gov>; Joe Mosca <jmosca@encinitasca.gov>; Kellie Shay Hinze <khinze@encinitasca.gov>
Subject: Fwd: 2019 5G Injury Reports after 5G installed in neighborhoods

Dear Encinitas City Council members,

I am deeply concerned about the installation of 5G due to not being tested and certified as safe for health. People are now reporting illnesses where 5G has been installed. See the news articles below. The lack of testing was admitted by all the industry executives at a hearing in Washington D.C. which you can see on YouTube. I urge you to read these news reports coming from people getting ill after the installation of 5G in California and Switzerland. Note in this news report that Swill doctor Dr. Bertrand Buchs, who has also called for a 5G moratorium, states he has seen more and more patients with similar symptoms.

This is from mdsafetech.org Physicians for Safe Technology

The first reported injury of 5G in a news report comes from Switzerland, where 5G has been launched in 102 locations. The weekly French-language Swiss magazine L'Illustré interviewed people living in Geneva after the 5G rollout with alarming details of illness. In their article, With 5G, We Feel Like Guinea Pigs, posted July 18, 2019, they report neighbors met to discuss their many common symptoms and many unanswered questions.

Update 8/15/19

5G: Its Legal but Not Safe

As soon as the antennas were installed, several residents and entire families in the heart of Geneva reported similar unusual symptoms of loud ringing in the ear, intense headaches, unbearable earaches, insomnia, chest pain, fatigue and not feeling well in the house. 29-year-old Geneva resident, Johan Perruchoud, called up Swisscom and was told that indeed the 5G cell towers were activated on the same day he began to feel the symptoms. When others called Swisscom they were told everything is legal and within guidelines.

Swiss Physician Denounces 5G and Calls for a 5G Moratorium

Dr. Bertrand Buchs, who has also called for a 5G moratorium, states he has seen more and more patients with similar symptoms. He notes, "In this case, our authorities are going against common sense … we risk experiencing a

catastrophe in a few years… no serious study exists yet, which is not surprising when we know that this technology was developed in China, then to the United States. In Switzerland, we could open a line for people who feel bad, listen to these complaints and examine them. Our country has the means and the skills. The debate must be launched because the story is not about to end."

Dear Diary: Loud Humming, Lots of Pain, Nausea, No Sleep

These stories parallel that of Anne Mills, author of "All EMF'd Up", who suffered wireless radiation poisoning in Germany when her husband was stationed there for work. She wrote a diary with identical symptoms of those in Geneva. As noted in the Swiss magazine L'Illustré article, her concerns, like those in Geneva, were dismissed. She consulted with German physician, Dr. Horst Eger, to confirm her symptoms were that of microwave illness seen in military radar personnel and those working on microwave towers. All EMF*d Up (*Electromagnetic Fields): My Journey Through Wireless Radiation Poisoning and How You Can Protect Yourself. (2019)Anne Mills

"Mystery Illness" In Cuban and Chinese Diplomats is Microwave Poisoning

The New York Times and CBS reported unexplained symptoms in diplomats living in China and Cuba in 2017 and 2018. The source was found to be microwave radiation. UC San Diego Professor of Medicine, Dr. Beatrice Golomb, published an article in Neural Computation in September 2018, discussing the symptoms of the diplomats living abroad. The symptoms that diplomats and their families experienced, i.e. sleep problems, headaches, strange auditory sounds, anxiety and dizziness were similar to those with microwave illness reported in military studies from pulsed microwave radiation. See Cuban Diplomats Likely Hit by Microwave Weapons.

Residents in Sacramento, California Experiencing Symptoms

After 5G towers were installed in a Sacramento neighborhood, a family began to experience generalized health issues, including headaches. This was such a concern that the father set up a website and petition to gain support for halting 5G expansion. Sacramento was one of the first in the U.S. to permit 5G cell towers, with health concerns being raised well before the towers were in place. The question remains about exactly what frequencies of radiation and what levels of radiation are emitted by these neighborhood 5G cell towers which reportedly will use 4G frequencies as well. Should there be independent testing?

News and Research Articles

- "With 5G, We Feel Like Guinea Pigs" or "Avec la 5G, nous nous sentons comme des cobayes".Translated easily into English with google translator. https://www.illustre.ch/magazine/5g-sentons-cobayes?utm_source=facebook&fbclid=IwAR1kXKK1yWBDKoaZRVOQB7gRvC8o-1a3GyVbQHJPyPkAzzpl73iKYtaiA6Q
- Side Effects of living near 5G towers in Geneva Switzerland – testimonial. Altermedicine.org. https://www.altermedicine.org/sideeffects-of-living-near-5g-towers-in-geneva-switzerland-testimonial/
- Microwave Weapons Are Prime Suspect in Ills of U.S. Embassy Workers. Doctors and scientists say microwave strikes may have caused sonic delusions and very real brain damage among embassy staff and family members. Sept 1, 2018.William J. Broad. https://www.nytimes.com/2018/09/01/science/sonic-attack-cuba-microwave.html?action=click&module=Well&pgtype=Homepage&section=Health
- Diplomats in China report similar brain injuries as Americans in Cuba in 2016 and 2017,25 Americans in the U.S. embassy in Cuba suffered serious, unexplained brain injuries. Now, at least 15 American officials in China are

reporting similar symptoms. 60 Minutes reports. March 15, 2019. https://www.cbsnews.com/news/diplomats-in-china-report-similar-brain-injuries-as-americans-in-cuba-60-minutes/

- Researcher links diplomats' mystery illness to radiofrequency/microwave radiation. Eureka alert. August 29, 2018. American Academy for the Advancement of Science. https://www.eurekalert.org/pub_releases/2018-08/uoc–rld082918.php
- Diplomats' Mystery Illness and Pulsed Radiofrequency/ Microwave Radiation. Golomb BA. Neural Computation. 2018 Sep 5:1-104. https://www.ncbi.nlm.nih.gov/pubmed/30183509
- EUROPAEM EMF Guideline 2016 for the prevention, diagnosis and treatment of EMF-related health problems and illnesses gives an "overview of the current knowledge regarding EMF-related health risks and provides recommendations for the diagnosis, treatment and accessibility measures of EHS to improve and restore individual health outcomes as well as for the development of strategies for preventionor https://www.degruyter.com/view/j/reveh.ahead-of-print/reveh-2016-0011/reveh-2016-0011.xml?format=INTor EMF Guidelines
- 'Are community concerns over the 5G network rollout based on unfounded anxiety or valid evidence?' Guest Blog from Dr. Don Maisch, Australia. Between a Rock and a Hard place. April 25, 2019. https://betweenrockandhardplace.wordpress.com/2019/04/25/guest-blog-from-dr-don-maisch-australia-are-community-concerns-over-the-5g-network-rollout-based-on-unfounded-anxiety-or-valid-evidence/
- The Prevalence of People With Restricted Access to Work in Man-Made Electromagnetic Environments. Bevington M. Journal of Environment and Health Science. January 18, 2019. https://www.ommegaonline.org/article-details/The-Prevalence-of-People-With-Restricted-Access-to-Work-in-Man-Made-Electromagnetic-Environments/2402
- Prevalence of self-reported hypersensitivity to electric or magnetic fields in a population-based questionnaire survey. Hillert L et al. Scand J Work Environ Health. 2002 Feb;28(1):33-41. https://www.ncbi.nlm.nih.gov/pubmed/11871850
- Changes of Clinically Important Neurotransmitters Under the Influence of Modulated RF Fields- A Long-term Study Under Real-life Conditions. (2011) Buchner K and Eger H. https://ecfsapi.fcc.gov/file/7521095891.pdf
- Research articles by Dr. Horst Eger. https://www.researchgate.net/scientific-contributions/2014064959_Horst_Eger

PHYSICIANS FOR SAFE TECHNOLOGY

Digital Technology and Public Health

Our vision is a world where technology serves our needs without undermining our physical, psychosocial or environmental health.

Health Effects of Digital Technology

EXECUTIVE SUMMARY: WIRELESS TECHNOLOGY AND PUBLIC HEALTH

Digital and wireless devices have provided many benefits, however, we are now realizing that the rapid adoption of this novel technology has not been accompanied by adequate regulation, monitoring or safety precautions.

Widespread use of digital media and near constant exposure to wireless devices has caused increasing concern among scientists, health care professionals, psychologists, educators and the public who are now considering this is not only a public health issue but a looming public health crisis. (11,108) It appears that we are at the same point of emerging science similar to early recognition of health impacts associated with tobacco, asbestos, coal dust and lead. (119) These concerns are amplified by industry proposals for a massive expansion of wireless infrastructure and connectivity.

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CHALLENGES FOR PHYSICIANS

It seems impossible to many physicians that non-ionizing radiation from wireless devices would cause physical symptoms or biological harm. Patient reported health concerns are often dismissed as coincidence (e.g. cell phone use and brain cancer), or psychological (e.g. someone reporting electrosensitivity symptoms near devices), or stress related (e.g. a couple that is infertile). There also seems to be endless controversy surrounding adverse health effects from wireless devices. Physicians want to help patients and not give them incorrect advice or fan their fears. After all, one cannot see, hear or feel electromagnetic radiation. People must be "a bit off" to think effects could be caused by electronic gadgets we have used for years, right? Well, as it turns out, there is an abundance of research from credible, unbiased sources which indicates clear harm from microwave radio frequency radiation we are exposed to.

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PSYCHOSOCIAL ISSUES AND DIGITAL TECHNOLOGY USE

Emotional well-being and positive human interaction are crucial for healthy individuals, healthy families, and a healthy society. Researchers are finding that the overuse of interactive devices such as computers, cell phones, video games, and other mobile electronic devices can have a direct effect on our well-being and mental health. (5,19) With excess technology use, mental health experts are reporting psychological and physiological effects on the central nervous system, especially in children, leading to impairment of physical and mental functioning. Psychiatrists and psychologists are seeing a disquieting rise in tech addiction, cyberbullying, depression, insomnia, loss of empathy. and impaired social-emotional learning in their young patients. (1,3,10))
Internet game overuse has been found to have psychological and neural effects similar to other types of impulse control disorders and addictions which are both substance

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S'ABONNER

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«Avec la 5G, nous nous sentons comme des cobayes»

SUISSE

Lecture 7 minutes

Marc David

Publié jeudi 18 juillet 2019 à 12:03

PARTAGER

Depuis que des antennes 5G ont été installées près de leur domicile, en plein Genève, ces habitants du même quartier souffrent de divers problèmes de santé. Sont-ils les victimes d'une technologie dont on n'a pas assez testé les dangers? Un médecin et député dénonce.

Publicité

Réunis dans l'appartement de l'un des deux, au cinquième étage d'un immeuble du centre de Genève, ces habitants du même quartier se regardent. Ils ont pour point commun d'avoir des insomnies, des acouphènes, des maux de tête. Et un monceau de questions sans réponses.

Le plus jeune, Johan Perruchoud, 29 ans, vit là depuis onze ans et n'est pourtant pas du genre à cultiver une quelconque haine contre la technologie envahissante. C'est un garçon en pleine santé, actif et positif, qui revient de quatre ans à New York et réalise des vidéos et des films finement ciselés pour des médias ou des privés, souvent en travaillant dans sa chambre avec son ordinateur.

«Comme dans un micro-onde»

Accueil Photos Vidéos Magazine Planète

Pour lui comme pour son voisin, tout a commencé en avril. «Moi qui vis depuis toujours sans soucis avec le wi-fi et le reste et n'ai jamais eu de problèmes de sommeil, j'ai soudain eu de la peine à m'endormir. Surtout je me sentais chez moi, comment dire, comme dans un micro-onde. Je n'étais pas bien dans la maison, comme si j'étais entouré de fantômes.» Interpellé, il constate sur Facebook et en consultant le site de la Confédération* que trois antennes 5G viennent d'être mises en service à proximité et que d'autres personnes se plaignent de troubles identiques, céphalées, fatigue. «Etait-ce psychologique? Je n'en sais rien. Mais, pour la première fois, alors que je n'ai jamais eu mal aux oreilles en composant ma musique, elles se sont mises à siffler. Cela me réveillait la nuit. Tout cela était inhabituel.»

La sensation désagréable d'être utilisé, pris dans un carcan où il n'a pas choisi de se trouver, l'assaille. Alors il appelle Swisscom. Dix minutes à peine après avoir rempli le formulaire de base, un préposé aux accents ultra-empathiques le rappelle déjà. «Il a été tout de suite sur la défensive. Il m'a expliqué que des tests avaient eu lieu et que tout était en ordre. Tout à la fin, pour la forme, il m'a souhaité une bonne récupération.» Aujourd'hui, Johan va un peu mieux, même s'il a les sinus obstrués depuis deux mois; une affection qu'il n'avait jamais connue.

DARRIN VANSELOW

Elidan Arzoni, 50 ans, à la rue de Coutance, à Genève. «Quand ils ont installé la 5G, je me suis senti mal du jour au lendemain.»

La solution: déménager?

Son voisin Elidan Arzoni, 50 ans, ne va pas mieux, lui. A la même date, des symptômes semblables plus aigus, apparaissent chez cet acteur, metteur en scène et directeur de la Compagnie Métamorphoses. «C'est arrivé du jour au lendemain, raconte-t-il, mes oreilles se sont mises à émettre des sons, très forts, alors que je ne savais même pas ce qu'étaient des acouphènes.» Parallèlement, il ressent des douleurs sur le côté gauche de la tête et à l'arrière du crâne. Et une gêne au cœur si violente qu'il pense à un infarctus et que, deux jours plus tard, il se rend aux urgences. Là-bas, après quelques tests, on le rassure en lui trouvant un «cœur de sportif». Quand il évoque la présence des antennes, l'infirmier lui répond que personne n'est formé pour le renseigner sur les effets potentiels de ces émetteurs. «Le seul conseil qu'on m'a donné, c'est de déménager…» Pour lui, aucun doute, l'irruption des antennes est la cause de ses maux. «C'est une évidence. Même Swisscom me l'a confirmé au niveau du timing. Et je suis en très bonne santé, je ne bois pas, je ne fume pas, je ne vais jamais chez le médecin.» Il constate en outre que sa femme et ses enfants de 9, 16 et 21 ans souffrent eux aussi d'insomnies nouvelles.

Plus virulent que Johan, l'acteur ne cache pas son inquiétude. Il écrit alors au président du conseil d'Etat, Antonio Hodgers (Les Verts), et se voit simplement répondre que tout est légal dans cette nouvelle technologie. Insatisfait, il n'hésite plus à exprimer ses réflexions: «Comment oublier que la Confédération est l'actionnaire majoritaire de Swisscom? Dès qu'on se présente contre les intérêts financiers de ces gens-là, ils sont dans un déni total. Personne ne s'intéresse aux citoyens. Même le rapport en cours (prévu pour l'été 2019 et réalisé par un groupe de travail en collaboration avec l'Office fédéral de la communication, il vient d'être reporté à la fin de l'année, ndlr) ne s'occupera pas de l'aspect de la santé. S'il se passe effectivement une multiplication de leucémies ou de cancers du cerveau, elle mettra des années à être constatée.»

MARTIAL TREZZINI/KEYSTONE

Installées au pas de charge en Suisse, les antennes 5G posent la question des conséquences sanitaires de l'électrosmog.

Hors de question de vivre sous une antenne

Depuis, il compose tant bien que mal avec ses maux d'oreilles, «mais c'est invivable, c'est très fort». Sur Facebook, où il expose volontiers son cas, il doit essuyer des attaques, accepter d'être traité de rétrograde. Cela dit, pas question de déménager: «Pourquoi devrais-je quitter mon logement alors que je suis citoyen genevois, que je paie mes impôts ici? Ce serait totalement antidémocratique. Et où aller, puisqu'il y aura des antennes partout d'ici peu? En attendant, je me sens comme un indésirable. Je ne sais pas où fuir. Mon travail et mes enfants sont là.» Tout aussi troublant: quand il se déplace en France voisine, ses maux s'atténuent. Ils reviennent dès qu'il retrouve la ville.

Johan, lui, dit s'habituer peu à peu. Il s'est cependant promis que, s'il avait des enfants, il était hors de question que sa famille vive près d'une antenne. «A mon avis, ce qui se passe aura un impact sur notre génération quand nous serons plus vieux.» Pire: s'il comprend le progrès que peut apporter la 5G dans certains secteurs spécifiques, le médical, la recherche, il pense que «pour les gens, elle ne sert à peu près à rien».

Les deux voisins se quittent sur la même longueur d'onde: «Nous nous sentons comme des cobayes.» Seront-ils seulement écoutés?

** L'emplacement précis des diverses antennes sur le territoire suisse: www.bakom.admin.ch/bakom/fr/pagedaccueil/frequences-et-antennes/emplacement-des-stationsemettrices.html*

Un médecin accuse «On risque une catastrophe»

Le praticien et député PDC Bertrand Buchs a déposé la motion pour un moratoire sur la 5G à Genève. Il tire la sonnette d'alarme.

PIERRE ABENSUR/TAMEDIA

Votre réaction devant ces témoignages?

J'en rencontre de plus en plus. En l'absence d'études claires, on n'a en tout cas pas le droit de répondre à ces personnes qu'elles sont des malades imaginaires. Avec les ondes plus courtes de la 5G, personne ne sait ce qu'il peut se passer. Sans compter leur potentialisation, c'est-à-dire leur mélange avec la 3G, la 4G, le wi-fi.

Pourquoi avoir déposé cette motion?

On est en train de se moquer de nous. Dans ce dossier, nos autorités vont à rebours du bon sens. Le principe de précaution est clairement violé. Pourquoi en à peine deux mois tant d'antennes (une centaine aujourd'hui en Suisse, pour 90% du territoire couvert à la fin de l'année, ndlr) apparaissent-elles? Alors que pour n'importe quel médicament, on passe des années à évaluer s'il constitue un bien ou un mal? Tout va trop vite. Nous vivons une course au premier opérateur installé, qui se passe dans la précipitation, alors qu'il n'existe aucune urgence objective à installer la 5G. Pour la population, elle ne sert presque à rien. On aurait pu faire comme en Allemagne, où elle est réservée à certaines entreprises, et très surveillée.

Que risque-t-on?

Comme rien ne se voit ou ne se sent, le public croit à du zéro risque, un peu comme dans le domaine du nucléaire. Or on risque de vivre une catastrophe dans quelques années, par exemple en matière de tumeurs. Il faudra que l'Etat l'assume.

Que préconisez-vous?

Je le répète, après avoir essayé de me renseigner dans les bases de données auxquelles j'ai accès en tant que médecin: aucune étude sérieuse n'existe encore, ce qui n'est pas étonnant quand on sait que cette technologie a été développée en Chine, puis aux Etats-Unis. En Suisse, on pourrait ouvrir une ligne pour les gens qui se sentent mal, écouter ces plaintes et les examiner. Notre pays en a les moyens et les compétences. Le débat doit être lancé, car l'histoire n'est pas près de se terminer. Or, chez nous, c'est: «Circulez, il n'y a rien à voir...»

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MIT Press

Neural Comput. 2018 Sep 5:1-104. doi: 10.1162/neco_a_01133. [Epub ahead of print]

Diplomats' Mystery Illness and Pulsed Radiofrequency/Microwave Radiation.

Golomb BA[1].

Author information

Abstract

IMPORTANCE: A mystery illness striking U.S. and Canadian diplomats to Cuba (and now China) "has confounded the FBI, the State Department and US intelligence agencies" (Lederman, Weissenstein, & Lee, 2017). Sonic explanations for the so-called health attacks have long dominated media reports, propelled by peculiar sounds heard and auditory symptoms experienced. Sonic mediation was justly rejected by experts. We assessed whether pulsed radiofrequency/microwave radiation (RF/MW) exposure can accommodate reported facts in diplomats, including unusual ones.

OBSERVATIONS: (1) Noises: Many diplomats heard chirping, ringing or grinding noises at night during episodes reportedly triggering health problems. Some reported that sounds were localized with laser-like precision or said the sounds seemed to follow them (within the territory in which they were perceived). Pulsed RF/MW engenders just these apparent "sounds" via the Frey effect. Perceived "sounds" differ by head dimensions and pulse characteristics and can be perceived as located behind in or above the head. Ability to hear the "sounds" depends on high-frequency hearing and low ambient noise. (2) Signs/symptoms: Hearing loss and tinnitus are prominent in affected diplomats and in RF/MW-affected individuals. Each of the protean symptoms that diplomats report also affect persons reporting symptoms from RF/MW: sleep problems, headaches, and cognitive problems dominate in both groups. Sensations of pressure or vibration figure in each. Both encompass vision, balance, and speech problems and nosebleeds. Brain injury and brain swelling are reported in both. (3) Mechanisms: Oxidative stress provides a documented mechanism of RF/MW injury compatible with reported signs and symptoms; sequelae of endothelial dysfunction (yielding blood flow compromise), membrane damage, blood-brain barrier disruption, mitochondrial injury, apoptosis, and autoimmune triggering afford downstream mechanisms, of varying persistence, that merit investigation. (4) Of note, microwaving of the U.S. embassy in Moscow is historically documented.

CONCLUSIONS AND RELEVANCE: Reported facts appear consistent with RF/MW as the source of injury in diplomats in Cuba. Nondiplomats citing symptoms from RF/MW, often with an inciting pulsed-RF/MW exposure, report compatible health conditions. Under the RF/MW hypothesis, lessons learned for diplomats and for RF/MW-affected civilians may each aid the other.

PMID: 30183509 DOI: 10.1162/neco_a_01133

LinkOut - more resources

PHYSICIANS FOR SAFE TECHNOLOGY

Military and Government Reports

Scientific Literature

Military and Government Reports

While newer scientific literature on biological and physiological effects of microwave radiation is available online, there is a wealth of older and very valuable information from governmental policy organizations on research and health effects of radiofrequency radiation. These include the World Health Organization, the Naval Military Institute and NASA, that were written even before the 1970's, which add thousands of studies to this scientific information base. These reports are long but thorough compendiums that indicate harm from this type of non-ionizing radiation has been known for many decades.

1) NASA Report – Electromagnetic Field Interactions with the Human Body: Observed Effects and Theories. April 1981. Jeremy Raines, PhD. https://ntrs.nasa.gov/search.jsp?R=19810017132

2) Defense Intelligence Agency: Biological Effects of Electromagnetic Radiation (Radiowaves and Microwaves) in Eurasian Communist Countries. October 10, 1975. Prepared by Army Medical Intelligence and the office of the Surgeon General. Defense intelligence Agency Report 1975

3) Naval Military Research Institute. Bibliography of Reported Biologic Phenomenoa("Effects") and Clinical Manifestations to Microwave and Radiofrequency Radiation. October 4, 1971. With supplement 2,300 studies are included. EMFAnalysis Link to Naval Research Naval Research 1971

4) EPA 1992- Electric and Magnetic Fields: An EPA perspective on research needs and priorities for improving health risk assessment. EPA Report Electric and Magnetic Fields Research Priorities

5) EPA 1990- Evaluation of the Potential Carcinogenicity of Electromagnetic Fields. https://ofmpub.**epa**.gov/eims/eimscomm.getfile?p_download_id=437194 EPR Report

6) **US EPA Office of Air and Radiation and Office of Research and Development: Summary of Results of the April 26-27,1993 Radiofrequency Radiation conference**. March 1995. US EPA Office of Air and Radiation 1995

7) A Study of Microwave Standards. U.S. Department of Energy. Office of energy Research. Satellite Power System Project division. August 1980. **https://www.osti.gov/servlets/purl/5021571** Department of Energy Study of Microwave Standards

8) Efforts By The Environmental Protection Agency To Protect The Public From Environmental Non-ionizing Radiation Exposures. United States General Accounting Office. CED-78-79, 1978. Environmental protection Agency Protection from Non-ionizing Radiation 1978

9) Report of the Comptroller of the United States. More Protection from Microwave Radiation Hazards Needed. 1971. Report to House committee on Interstate and Foreign Commerce. **http://www.gao.gov/assets/130/124884.pdf**

10) WHO 1981. Environmental Health Criteria: Radiofrequency and Microwaves. Biologic Effects and Health Hazards of Microwave Radiation: Proceedings on International Symposium 1973. Warsaw, Oct 15-18, 1973. Sponsored by the WHO, US Department of Health, Education and Welfare, and The Scientific Council to the Minister of health and Social Welfare, Poland. Environmental Health Criteria

Or published through International Program on Chemical Safety- WHO Environmental Health Criteria Rdiofrequency and Microwaves. ISBN 92 4 154076 1- http://www.inchem.org/documents/ehc/ehc/ehc016.htmhttp://www.inchem.org/documents/ehc/ehc/ehc016.htm

11) 1969 Annual Report to Congress on the Administration of Radiation Control for Health and Safety Act of 1968. Public Law 90-602. Congressional Report Radiation Control 1969

12) Translations on USSR Science and Technology Biomedical Sciences: Effects of Non-Ionizing Electromagnetic Radiation. USSR Science on Non-ionizing Radiation: Ggovernment Translations

13) **Government Accountability Office (GAO). Report to Congressional Requesters. Telecommunications. Exposure and Testing Requirements for Mobile Phones Should Be Reassessed.** July 2012. https://www.gao.gov/assets/600/592901.pdf

14) **Early research on the biological effects of microwave radiation: 1940–1960. (1980)** Cook HJ et al. Annals of Science. Volume 37, 1980 Issue 3.
https://www.tandfonline.com/doi/abs/10.1080/00033798000200271

PHYSICIANS FOR SAFE TECHNOLOGY

Cuban Diplomats Likely Hit by Microwave Weapons, New York Times Reports

SEPTEMBER 4, 2018

Disturbing and sometimes incapacitating neurologic symptoms have been experienced by American and Canadian diplomats in Cuba since late 2015 and in American diplomats in China more recently this year. A New York Times front page **article** Sept 1, 2018, eerily describes what researchers and physicians have discovered to be the likely cause in this international story that reads like a spy novel. Initially it was felt that these strange and varied symptoms could be due to sonic attacks as people reported hearing clicking and high pitched chirping, as well as feeling symptoms including headaches, nausea and dizziness, during the episodes, with long term effects of hearing loss, ringing in the ears and fatigue. Experts are now pointing to focused beams of targeted man-made pulsed microwave radiation penetrating the walls of the homes and hotels of the 21 diplomats studied. The long term effects are consistent with known cellular and oxidative damage from radiofrequency radiation, as Dr. Beatrice Golomb highlights in her recent article to be published Sept 15, 2018.

Microwave Hearing

Allan Frey, a biologist at Cornell University was the first to discover and publish **papers** on "microwave hearing" while working on radar equipment at General Electric's Advanced Electronics Center. In the 1970's. This sonic hearing was found at levels below what are considered today safe exposure standards. Frey was later invited to the Soviet Union to discuss these effects at the Soviet Academy of Sciences. Not long after, our Defense Intelligence Agency warned that the soviets were developing a new class of psychophysical microwave weapons which could be beamed from afar and temporarily or permanently harm the nervous system. Our own Air Force scientists found they could beam comprehensible speech into a person's brain, and were given a patent in 2002 for this technology destined for "psychological warfare".

In late 2016, following a breakdown in Cuba and U.S. relations, U.S. diplomats and their families began experiencing unusual high pitched sounds in their hotel rooms and homes. This was accompanied by incapacitating headaches, fatigue, and insomnia. The medical team that examined them published a peer reviewed **article** in the Journal of the American Medical Association in March 2018 describing their symptoms. They state, "retrospective case series, persistent cognitive, vestibular, and oculomotor dysfunction, as well as sleep impairment and headaches, were observed among US government

personnel in Havana, Cuba, associated with reports of directional audible and/or sensory phenomena of unclear origin. These individuals appeared to have sustained injury to widespread brain networks without an associated history of head trauma."

Mystery Illness: Microwave Illness

University of California San Diego Professor Dr. Beatrice Golomb, after extensively researching the health effects of microwave radiation has provided the most comprehensive explanation for the diplomat's mystery illness. In an upcoming **article** in the October 2018 issue of Neural Computation, she lays out the case for neurological effects from radiofrequency radiation. She notes the variety of symptoms reported by diplomats is consistent with effects seen in those with microwave illness and radio frequency exposure. This condition is also known as electrosensitivity (ES) or electrohypersensitivity (EHS).

Symptoms and Signs Compatible with Electrosensitivity

According to an American Academy of Advancement of Sciences **press release,** Dr. Golomb stated "The specifics of the varied sounds that the diplomats reported hearing during the apparent inciting episodes, such as chirping, ringing and buzzing, cohere in detail with known properties of so-called 'microwave hearing,' also known as the Frey effect… And the symptoms that emerged fit, including the dominance of sleep problems, headaches and cognitive issues, as well as the distinctive prominence of auditory symptoms. Even objective findings reported on brain imaging fit with what has been reported for persons affected by RF/MW radiation." She adds the toxic reaction is "tied to mitochondrial alteration and oxidative stress".

Dr. Golomb noted that the diplomats symptoms are similar to those of EHS (headache , insomnia, cognitive problems, dizziness, nausea, along with balance, speech and vision impairment and nosebleeds). In addition the rate of symptoms among diplomats is consistent with those of EHS reported in the literature. "Headache 81% vs 81%, Sleep problems 86% vs 76%, Irritability 67% vs 56%, Nervousness/Anxiety 52% vs 56%,

Dizziness 67% vs 64%, Tinnitus 57% vs 63%." In addition, she notes that "the repudiation of psychogenic causation in the evaluation of diplomats, which holds for RF/MW affected persons as well."

NASA Has Reported Symptoms of Microwave Illness in Radar Personnel

A similar complex of variable symptoms was reported decades ago in military personnel occupationally exposed to microwave radar signals. There is robust and expanding literature on the adverse health and environmental effects of microwave radiation we are commonly exposed to in our homes and near cell towers. Manmade electromagnetic radiation affects basic cellular processes of all living organisms via complex non-thermal mechanisms and not surprisingly can be used as a military weapon with higher power.

It is common knowledge that high frequency millimeter wavelengths (95GHz) are used by the military for non-lethal crowd control (active denial system). 5G technology is in the same high frequency group (6GHz-100GHz). Our current 3G and 4G microwave technology uses longer wavelengths. It is not clear what frequencies were used on the diplomats, if this was an attack or for surveillance, nor is it clear who the perpetrators were. What is becoming apparent is that electrosensitivity is a real medical diagnosis with common symptoms. Physicians now have a lightly traveled path of peer reviewed documentation leading to diagnosis and treatment of this condition. The Austrian Medical Association has written the most detailed compendium on this subject as they recognize that "Physicians are increasingly confronted with health problems from unidentified causes". Their EUROPAEM EMF Guideline 2016 for the prevention, diagnosis and treatment of EMF-related health problems and illnesses links electrosensitivity with chemical sensitivity in common mechanisms of harm and biomarkers.

Electrosenstivity in an Expanding Wireless Environment

It is problematic that the rapid and unobstructed deployment of 5G millimeter technology is being pushed by the telecommunications industry in congress (S 3157) without premarket study of health or environmental effects, without provisions for post market study, without precautions and without appropriate public input. We are already saturated with 3G and 4G technology, also without pre or post market study. What happens to those electrosensitive individuals as wireless systems expand? Will we be able to have Wi Fi free and cell tower free zones where they are able to live or shop? What are the long term effects of this wireless radiation on the rest of us who do not sense this radiation? These military revelations prompt more questions and inquiry regarding short and long term effects of wireless technology on public health and the environment. Should we be more thoughtful about how and where we use this technology? There are safer alternatives such as in Reinventing Wires. 5G is poised to appear on a street corner near you. There remain many more questions than answers about this technology. We should all be asking them to our local, state and federal representatives before these blanket our neighborhoods.

Update 3/15/19

Diplomats in China report similar brain injuries as Americans in Cuba: 60 Minutes

The popular show 60 Minutes aired a show on March 15, 2019 “Diplomats in China report similar brain injuries as Americans in Cuba” . Catherine Werner, a US diplomat in China suffered the same symptoms as those in Havana. She reported headaches, nose bleeds, vomiting, ringing in the ears, difficulty recalling words. When her mother came to stay with her for 3 months, she soon developed the same symptoms and severe illness. Even the dogs started vomiting. China Diplomat Suffers Microwave Illness-60 mInutes

Articles

- **Diplomats in China report similar brain injuries as Americans in Cuba:n 2016 and 2017,** 25 Americans in the U.S. embassy in Cuba suffered serious, unexplained brain injuries. Now, at least 15 American officials in China are reporting similar symptoms. 60 Minutes reports. March 15, 2019. https://www.cbsnews.com/news/diplomats-in-china-report-similar-brain-injuries-as-americans-in-cuba-60-minutes/
- **Microwave Weapons Are Prime Suspect in Ills of U.S. Embassy Workers. Doctors and scientists say microwave strikes may have caused sonic delusions and very real brain damage among embassy staff and family members. Sept 1, 2018.** William J. Broad. https://www.nytimes.com/2018/09/01/science/sonic-attack-cuba-microwave.html?action=click&module=Well&pgtype=Homepage&section=Health
- **Researcher links diplomats' mystery illness to radiofrequency/microwave radiation. Eureka alert. August 29, 2018.** American Academy for the Advancement of Science. https://www.eurekalert.org/pub_releases/2018-08/uoc–rld082918.php
- **Diplomats' Mystery Illness and Pulsed Radiofrequency/ Microwave Radiation. Sept 15, 2018**. Beatrice Golomb, MD, PhD. Neural https://mdsafetech.files.wordpress.com/2018/09/12a9d-cuba2018-08-23c-nejm.pdf
- **More Questions Raised by Concussion-like Symptoms Found in US Diplomats Who Served in Havana. March 20, 2018.** https://jamanetwork.com/journals/jama/article-abstract/2673167
- **Neurological Manifestations Among US Government Personnel Reporting Directional Audible and Sensory Phenomena in Havana, Cuba. (2018)** Swanson RL et al. JAMA. 2018 Mar 20;319(11):1125-1133. https://www.ncbi.nlm.nih.gov/pubmed/?term=cuba+diplomats+headaches+jama

- **Strange Reports of Weaponized Sound in Cuba [Health Matters].**IEEE Microwave Magazine. Volume 19. Issue 1, Jan Feb 2018. Dr. James C. Lin. https://ieeexplore.ieee.org/document/8186377/
- **The Sound and the Fury: Inside the Mystery of the Havana Embassy. Feb 2018.** https://www.propublica.org/article/diplomats-in-cuba
- **US Patent. US Air Force. METHODANDDEVICEFOR IMPLEMENTING THE RADIO FREQUENCY HEARNG EFFECT.** October 22, 2002. https://patentimages.storage.googleapis.com/00/24/7c/4cf02f4210343e/US6470214.pdf

- **Auditory System Response to Radio Frequency Energy. 1961.** Allan H.Frey. Aerospace Medicine. https://braincontrolhedge.files.wordpress.com/2013/05/auditory-system-response-to-radio-frequency-energy-technical-note.pdf
- **Active Denial Video. Defense Visual Information Distribution Service.** https://www.dvidshub.net/video/304622/solid-state-active-denial-technology#.Umk9zsvD-pp
- **Non Lethal Weapons Program.** US Department of Defense. Active Denial system FAQs. https://jnlwp.defense.gov/About/Frequently-Asked-Questions/Active-Denial-System-FAQs/

See Also

PST Biological Mechanism Oxidation: https://mdsafetech.org/cellular-mechanisms-oxidation/

PST Blood Brain Barrier Effects: https://mdsafetech.org/blood-brain-barrier/

PST Electrosensitivity: https://mdsafetech.org/science/es-science/

PST Environmental Effects: https://mdsafetech.org/environmental-and-wildlife-effects/

PST Military and Government Literature: https://mdsafetech.org/science/military-studies-and-compendiums/

PST Nervous System Effects: https://mdsafetech.org/nervous-system/

PST NTP Study: https://mdsafetech.org/ntp-study-2016/

PST 5G Telecommunications Scientific Literature: https://mdsafetech.org/5g-telecommunications-science/

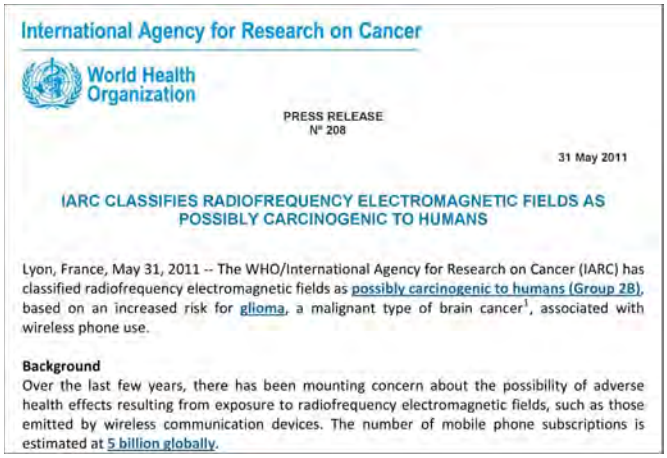
5G Awareness Now

Info from the front lines of the war on 5G

Video of our Sacramento group speaking at city council for the second time. Council refuses to address our concerns about the 5G network currently being installed in our area. Sacramento is one of the first cities in the world to receive this technology. The City of Sacramento signed us up to be guinea pigs with practically ZERO public outreach. Please watch and share this video!

5G will require roughly a million small cell antennas to be installed throughout the U.S. over the next few years. These antennas are being installed on top of light poles without any notice required to be given. These antennas will expose nearby residents to potentially harmful radiation inside their homes all day, every day. They will also decrease property values of nearby homes. If you do not want an antenna near YOUR home, PLEASE SIGN OUR PETITION!

Due to the number of antennas 5G will require, and the proximity to people's homes, 5G will expose us to unprecedented levels of radio frequency radiation on top of the radiation we are currently exposed to. 5G will also utilize a new higher energy frequency of radiation than previous generations of wireless technology. The long term health effects of this exposure are UNKNOWN.



International Agency for Research on Cancer

World Health Organization

PRESS RELEASE
N° 208

31 May 2011

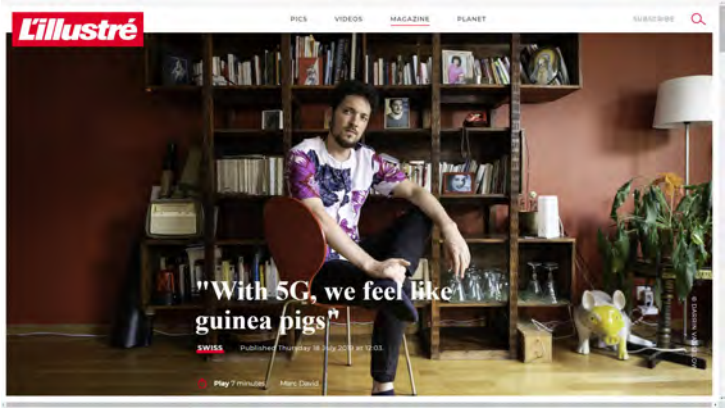
IARC CLASSIFIES RADIOFREQUENCY ELECTROMAGNETIC FIELDS AS POSSIBLY CARCINOGENIC TO HUMANS

Lyon, France, May 31, 2011 -- The WHO/International Agency for Research on Cancer (IARC) has classified radiofrequency electromagnetic fields as possibly carcinogenic to humans (Group 2B), based on an increased risk for glioma, a malignant type of brain cancer[1], associated with wireless phone use.

Background

Over the last few years, there has been mounting concern about the possibility of adverse health effects resulting from exposure to radiofrequency electromagnetic fields, such as those emitted by wireless communication devices. The number of mobile phone subscriptions is estimated at 5 billion globally.

In 2011 The World Health Organization classified radio frequency radiation as a possible carcinogen. In light of more recent research, many researchers have called for the classification to be upgraded to established carcinogenic to humans. **www.sciencedirect.com/science/article/pii/S0013935118303475** Find more research **here**.



Residents of a neighborhood in Geneva, Switzerland began experiencing health problems such as headaches, tinnitus, and insomnia after 5G was installed in their area. Their experience mirrors ours almost precisely. Similar health problems, feeling of victimization inside their own homes, conflicts of interest and a complete lack of response from governing bodies.

While cities all over the world are **taking action to protect their citizens** against the dangers and problems of 5G, the City of Sacramento willingly sold out its' constituents to Verizon WITHOUT OUR PERMISSION! A recent article in the Sacramento Business Journal highlights how Sacramento got hoodwinked in this deal. **Let's hold our representatives accountable.**

ADDITIONAL RESOURCES:

https://5gawarenessnow.com/take-action/

https://ehtrust.org/key-issues/cell-phoneswireless/5g-networks-iot-scientific-overview-human-health-risks/

https://www.saferemr.com/2017/09/5g-wireless-technology-is-5g-harmful-to.html

https://www.saferemr.com/2015/04/cell-tower-health-effects.html

https://www.5gcrisis.com/

https://www.5gspaceappeal.org/the-appeal

5G Awareness Now, Blog at WordPress.com.

Questions Raised About 5G Health Risks Months Before Sacramento Launches Service

May 29, 2018 at 5:24 pm **Filed Under:** 5G, Sacramento News, verizon

SACRAMENTO (CBS13) – Sacramento will be the first city in the country to get 5G cell service later this summer, but health concerns are now being raised about the equipment.

5G uses high frequency waves and is supposed to be 100 times faster than the current cell phone service. However, the 5G waves don't travel as far as current wireless frequencies so instead of large cell phone tower equipment spread far apart, the 5G requires small cell sites closer together.

The FCC does set exposure limits for cell site antennas that transmit signals to phones.

Research has been done on the effects of cell radiation but it has been inconsistent. According to the National Cancer Institute, "A limited number of studies have shown some evidence of statistical association of cell phone use and brain tumor risks, but most studies have found no association."

Firefighters in San Francisco have reported memory problems and confusion after cell phone towers were installed outside of fire stations. The firefighters claim the symptoms stopped when they relocated to stations without equipment nearby.

The wireless industry told CBS13 that decades of research shows no known health risk from this type of energy. In fact, a spokesperson says the occurrence of brain tumors in the United States has actually gone down since cell phones were introduced.

> "The safety of cellphone consumers is important to CTIA and the wireless industry. We follow the guidance of the experts when it comes to antennas and health effects. Following numerous scientific studies conducted over several decades, the FCC, the FDA, the World Health Organization, the American Cancer Society and numerous other international and U.S. organizations and health experts continue to say that the scientific evidence shows no known health risk to humans due to the RF energy emitted by antennas and cellphones. The evidence includes analysis of official federal brain tumor statistics showing that since the introduction of cellphones in the mid-1980s, the rate of brain tumors in the United States has decreased."

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Off-Duty Deputy On Ridealong Shot At Suspects Accused Of Killing Deputy Brian Ishmael

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3 Girls Reported Missing In Oroville Found Safe

The City of Sacramento partnered with Verizon to offer 5G. A spokesperson told CBS13 the City of Sacramento currently has six active 5G sites- all are on SMUD utility poles:

- 1731 E Street
- 1619 E Street
- 421 14TH Street
- 2330 Q Street
- 2019 21ST Street
- 801 16TH Street

Sacramento issued a statement to CBS13- reading in part:

> "Sacramento continues its emergence as a leader and innovator and will be the first scaled commercial practical implementation of 5G in the nation. It is this type of innovation that will enable residents to experience gigabit speeds that were previously only available via costly fiber. Technologies like 5G promise to revolutionize the daily lives of people. The City plays an important role and is actively working to streamline the development processes and effectively and efficiently pave the way for innovators like Verizon to implement technologies that will drive economic vitality, decrease the digital divide, serve our diverse communities, and forward the mission of the City for all.
>
> The City currently has six 5G sites active. The City does not/cannot regulate wireless devices."

AT&T also plans to introduce 5G and says it is comfortable with the technology.

Some cities, including Santa Rosa, have put their 5G plans on hold while health concerns are addressed.

Editor's note: A previous version of the story read that firefighters had "memory problems and confusion after the 5G equipment was installed outside of fire stations." The story has been changed to reflect that the cell towers, not 5G, which isn't in San Francisco, possibly contributed to the firefighters' problems.

Comments (8)

Former KNCI DJ Dan Cheatham Found Dead In His Home
Former KNCI afternoon DJ, Dan Cheatham, died on Tuesday.

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The family of a 12-year-old boy who was put in a spit bag while being detained by Sacramento police is planning to file a complaint against the city.

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Sideeffects of living near 5G towers in Geneva Switzerland – testimonial

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People experiencing health effects after the 5G was turned on in Geneva

I spotted an article on the Swiss website https://www.illustre.ch/magazine/5g-sentons-cobayes where residents suddenly report about strange side effects they have after the 5G towers have been turned on in Geneva Switzerland. These residents of the same neighborhood in Geneva suffer from various health problems. Are they the victims of a 5G technology whose dangers have not been sufficiently tested anywhere in the world? We are being forcibly radiated by 5G microwaves (https://www.altermedicine.org/16-reasons-why-you-should-be-concerned-about-5g-network/).

29-year-old Johan Perruchoud who has been living in Geneva for the past 11 years says that all problems started in April 2019 when the 5G in Geneva was officially turned on. Suddenly he started having problems falling to sleep. He felt at home as being in a microwave. Three antennas 5G (https://www.altermedicine.org/5g-wireless-network-is-just-around-the-corner/) have just been put into service nearby where he lives and other people complained of identical disorders, headaches, fatigue.

He called Swisscom who is responsible for 5G antennas being installed in Geneva and immediately the operator went on defensive mode, how everything is tested and perfectly healthy. He claims he had a 2-month sinus infection he had never known before.

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LIVE CHAT

5G towers health danger Geneva Switzerland

Also, his neighbor, a 50 years old Elidan Arzoni, was no better. On the same date, similar symptoms, more acute, appeared in this actor, who is a director of the Company Metamorphoses in g Geneva. He started to experience strange symptoms like tinnitus, constant ringing in his ears. At the same time, he felt strong pain on the left side of the head and behind the skull. He was also worried he had a heart attack because his heart was beating so fast.

Well, we made an interview with this gentleman from Geneva to try to find out more about the whole 5G problem.

5G INTERVIEW WITH GENEVA RESIDENT Elidan Arzoni

Please introduce yourself.

I work as an actor, in film and theatre. I am also a stage director and artistic director of a theatre company. I'm 50 years old and in good health.

When did you first become concerned about EMF radiation?

A few years ago, I felt burns on my chest and head every time I was in front of a computer screen. I have been looking for solutions for a long time because I needed to be able to work on the computer. Miraculously, while I was very skeptical, a small plate that channels the waves and that I constantly wear around my neck helped me to solve this problem.

LIVE CHAT

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The small plate contains a microcrystalline solution which, activated by the radiation of the device, will generate a very weak signal: this is a compensation signal.

When did you first find out 5G is not safe for humans?

When more than 180 scientists and doctors from 36 countries recommended a moratorium on the expansion of the fifth-generation (5G) of telecommunications in a call letter at the end of September 2017.

You said that you live in Geneva and after they turned on the 5G antenna, the next day you had side effects.

Since the 17th of April 2019. My problems started the next day. The day after the 5G antennas in Geneva started working, I had headaches on my left side, severe chest pain in my heart and very loud and acute whistling in my ears. All this was totally new to me, I've never experienced these pains before.

Two days later, on a Saturday, the chest pain had become so painful that I had to go to the emergency room for fear of having a heart attack. In the emergency room, the doctors did tests and told me that I had the heart of an athlete. When I asked them if there could be a link with the 5G antennas that had just been set up, they told me that they knew nothing about it, that they had not received any training in this area and that the only advice they could give me was to move.

How did other people react?

My wife and children had severe insomnia at the same time. In our neighborhood, I know 2 other people who suffer from problems similar to mine, especially ringing in their ears. I am also in contact with other people in Geneva and the rest of French-speaking Switzerland who have similar problems to mine since the launch of the 5G antennas. In some cases, these problems are even more serious than mine: I am in contact with two people who can no longer sleep at home and who spend their nights in the forests to escape the waves.

LIVE CHAT

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sheila turner on
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Muoi (https://youtu.be) on

Are many Geneva residents concerned about 5g?

From the publications and comments I can read on FB, yes, there is clearly a concern. There are also groups fighting to ensure that there are no 5G antennas in their neighborhoods.

Why did they turn it on, not even one phone supports 5g technology yet.

To my knowledge, there are at least two smartphones on sale in Switzerland that work with 5G.

There were rumors on the internet that the Geneva government stopped 5G cause it was not tested on humans, I have read that in a mobile phone magazine. But I guess that was just propaganda and fake news.

Yes, the canton of Geneva has effectively banned the construction of new antennas on its territory. However, this announcement was made after operators had already installed some 5G antennas. But I don't think it's still relevant because the confederation has informed the cantons that they don't have the right to forbid telephone operators to deploy their antennas. Anyway, there are now more 5G antennas in operation than when the first ones were first put into operation.

What do you think is the future of human health?

With the multiple pesticides, microplastics in water, air and food, as well as this invasion of diverse waves and their over-multiplication linked to the Internet of things to come, unless there is a radical and rapid change, which will probably not happen for economic reasons, the future of human health is not looking bright. But everything will be to the benefit

LIVE CHAT

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Electromagnetic Radiation Health Problems

of telephone operators, the electronics industry and especially the pharmaceutical industry….

How will you protect yourself against it?

I have, for the moment, found no solution to protect myself from 5G waves, my ears are continuously whistling to go crazy as I answer your questions. According to another victim who has done research, it is a problem of microcrystals in the inner ear that (depending on their size) start vibrating in the presence of scalar waves and cause these whistles. So it wouldn't be an electro-magnetic problem but a vibratory one. Hence the difficulty of protecting against it.

Did you see any birds or bees dying under the 5g antennas that saw personally in some videos on youtube

No, I did not approach the 5G antennas. But I heard that 5G is not yet in full frequency in Switzerland. The Swiss government has to change the law for that to become possible.

Is there some movement in Geneva against 5G?

There are several movements in Switzerland that have groups on FB. They post articles, petitions and advice to oppose the installation of new antennas. Unfortunately, for the time being, all this does not prevent operators from pursuing their plan to cover the whole of Switzerland with 5G technology by the end of 2019. In addition, it should be noted that the frequencies used are not yet at their maximum because they are limited by Swiss laws.

There is, therefore, a lot of lobbying work on the part of operators to push politicians to authorize the increase in these frequencies, threatening a massive financial loss and technological backwardness on the part of Switzerland if this were not to be authorized. I have no doubt that the operators will succeed and it is likely that there will be many more victims of the 5G technology.

(https://www.altermedicine.org/electro
radiation-health-problems/)
0.67 views per day

Suicide And Depression Linked With EMF Radiation
(https://www.altermedicine.org/suicide
and-depression-linked-with-emf-
radiation/)
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(https://www.altermedicine.org/this-
is-why-you-should-throw-away-
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(https://www.altermedicine.org/measu
lay-lines-in-clients-home/)
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5G Wireless Network Is Just Around The Corner – Shocking News!
(https://www.altermedicine.org/5g-
wireless-network-is-just-around-the-
corner/)
0.33 views per day

LIVE CHAT

Do you know that the military is using very similar frequency to 5G (https://www.altermedicine.org/military-active-denial-system-5g-wireless-radiation-connection/) for their microwave weapons?

I have heard about it but I don't believe the Swiss army is using this type of weapon. As a Swiss citizen, I am therefore not concerned by this for the moment.

Do you think your symptoms will go away?

I don't know. I hope so because it's unbearable and yet there are cases much more serious than me. I am looking for solutions but I have not yet found any. Above all, I hope that it will not get any worse for me when Switzerland will allow the increase in the intensity of 5G frequencies. If that happens, the authorities will respond to the slightest complaint that "everything is legal", as they already do now.

LIVE CHAT

Also here are links to the position of 5G towers here in Geneva

First is a map of Swisscom (https://scmplc.begasoft.ch/plcapp/pages/gis/netzabdeckung.jsf), the operator of whom the Swiss government has 51% of the shares.

This is another official map of 5G in Geneva (https://map.geo.admin.ch/?topic=funksender&lang=fr&zoom=6&bgLayer=ch.swisstopo.pixelkarte-farbe&layers=ch.bakom.radio-fernsehsender,ch.bakom.mobil-antennenstandorte-gsm,ch.bakom.mobil-antennenstandorte-umts,ch.bakom.mobil-antennenstandorte-lte,ch.bakom.mobil-antennenstandorte-5g&catalogNodes=403,408&layers_visibility=false,false,false,false,true&E=2499263.12&N=1119493.17) :

And here is a map from Sunrise, another operator (dark red is 5G) (https://www.sunrise.ch/de/privatkunden/mobil-abos/mobilnetz/netzabdeckung/netzabdeckungskarte.html)

Thank you Elidan for taking your time to answer these problematic questions for our website altermedicine.org.

LIVE CHAT

Swiss doctor Bertrand Buchs launched the motion for a moratorium on 5G in Geneva

What is your reaction to these testimonials?

I meet more and more with similar problems. In the absence of clear studies, we do not have the right to answer to these people that they are imaginary patients. With the shorter waves of the 5G, no one knows what can happen. Not to mention their potentiation, that is to say, their mixture with 3G, 4G, wi-fi.

Why did you introduce the motion against 5G in Geneva?

Geneva authorities are going against common sense. The precautionary principle is clearly violated. Why in just two months so many antennas (a hundred today in Switzerland) appear? While for any drug, we spend years testing the drug whether it is good or bad? With 5G everything is going too fast. We live a race with the first operator that installed 5G, which happens in a hurry, while there is no objective urgency to install the 5G. For the people, 5G is almost useless. We could copy what Germany did, where %G is reserved for certain companies, and very supervised.

LIVE CHAT

What is the risk of installing 5G antennas in the near vicinity where people live in Geneva?

5g (https://www.altermedicine.org/high-radio-frequency-fields/) can't be seen or felt, the public believes there is no risk, a bit like in the nuclear field. But we risk experiencing a catastrophe in a few years, sudden increase of tumors.

What do you recommend?

I have access to databases as a licensed doctor and I found out there was no serious study done on health effects of 5G technology. This is not shocking to me while we know that 5G technology was developed in China, then transferred to the United States. In Switzerland, we could open a line for people who feel bad, listen to these complaints and examine them. Our country has the means and skills to do that. The debate must be launched because the story is not about to end.

Conclusion on this topic by Dr Bob

Morr

5G is coming. It will not replace the 4G and 3G at all. It will work with 4G and 3G creating even more radiation and EMF pollution. 5G will have hard time penetrating objects. 5G signal will be blocked by the walls, windows, trees. That is a good thing. You can bulletproof your house against 3G, 4G and 5G completely with EMF shielding that you can find here https://www.altermedicine.org/shop (https://www.altermedicine.org/shop)/.

The problem will be with new devices that will emit 5G radiation inside our home. For example new phones, fridges, home appliances, even WIFI. That will be the biggest problem with 5G. And of course, we will be bombarded with 5G waves outside of our homes, in our cars, offices etc. The future is not bright. My recommendation is to remove all devices from our home that emit high-frequency fields and use shielding paints or mesh to protect your home. That is what we can do.

LIVE CHAT

Comments 6

linda

AUGUST 12, 2019 AT 12:02 AM (HTTPS://WWW.ALTERMEDICINE.ORG/SIDEEFFECTS-OF-LIVING-NEAR-5G-TOWERS-IN-GENEVA-SWITZERLAND-TESTIMONIAL/#COMMENT-30901)

Great info Dr, I shared it to all my subscribers…

Reply

Ronnie

AUGUST 12, 2019 AT 4:36 AM (HTTPS://WWW.ALTERMEDICINE.ORG/SIDEEFFECTS-OF-LIVING-NEAR-5G-TOWERS-IN-GENEVA-SWITZERLAND-TESTIMONIAL/#COMMENT-30927)

Dr Morr thank you for spreading the truth, you are a godsend

Reply

eni1977

AUGUST 12, 2019 AT 9:43 PM (HTTPS://WWW.ALTERMEDICINE.ORG/SIDEEFFECTS-OF-LIVING-NEAR-5G-TOWERS-IN-GENEVA-SWITZERLAND-TESTIMONIAL/#COMMENT-31033)

My friend send me your article Dr Bob. Thank you for writing such good article on 5G problem. Good job.

Reply

Truscani

AUGUST 13, 2019 AT 5:21 AM (HTTPS://WWW.ALTERMEDICINE.ORG/SIDEEFFECTS-OF-LIVING-NEAR-5G-TOWERS-IN-GENEVA-SWITZERLAND-TESTIMONIAL/#COMMENT-31078)

Love this. We are getting 5G soon too, I am very concerned about health of my family….

Reply

Marilynne Martin

AUGUST 14, 2019 AT 9:04 PM (HTTPS://WWW.ALTERMEDICINE.ORG/SIDEEFFECTS-OF-LIVING-NEAR-5G-TOWERS-IN-GENEVA-SWITZERLAND-TESTIMONIAL/#COMMENT-31311)

Regarding noises in the ear (microwave hearing) – understand that the authorities are aware of this effect but don't consider it "harmful".
See ICNIRP official explain at the 10 min mark – https://youtu.be/i7rTumGdxlw (https://youtu.be/i7rTumGdxlw)

"So what evidence do we have of harm. Well unfortunately, curiously, we have still the effects of elevated temperature. We knew this very early on and we still know that. There is this phenomenon of microwave hearing, this hissing and popping sound that you can sometimes hear with pulsed fields. And we know at the lower end of the RF frequencies you can have actually stimulation of nerves and muscles. And also you can have very high fields electroporation. So there, as far as we are concerned, are the four intraction mechanisms that we have to deal with. Now I am going to take them almost in reverse order and do the last of those three first because we don't think we are actually going to base the guidelines on them. We have talked about guidelines, we have already talked about microwave hearing in our guidelines before, we now actually feel that having a hissing or popping sound actually does require very very quiet conditions to hear it and is clearly a very localized thermal effect. As far as we can tell it is the fields are absorbed by tissues close to or in the inner ear and it sets up a pressure wave which is interpreted by the brain as actually being a sound. So again you hear this hissing clicking popping noise. But what we don't consider is its harmful. So we are not going to have any specific restrictions based upon the avoidance of that noise."
Zenon Sienkiewicz, ICNIRP: A long and winding road: update of the ICNIRP draft HF guidelines, ITU Workshop on Human Exposure to Electromagnetic Fields (EMF), December 5, 2017, Warsaw, Poland.

Regarding headaches, they know that too:

Consider this quote from Dr. Gro Harlem Brundtland, former Prime Minister of Norway, Former Director of the World Health Agency, and a medical doctor to boot:

"There is unfortunately no doubt in the research on this. There are definitely negative aspects to the radiation that affects us humans as a consequence of all the new devices we are using. "Are we underestimating it? Well I guess we have to have hope and I do hope.. That this doesn't turn out too seriously… "I could not hold the phone next to my head. Never, … I can't have the radiation close to my head. If I do, I immediately get a headache. …"Well this technology has had such an enormous breakthrough in society everywhere it is almost unthinkable that one could stop it for health reasons".
https://youtu.be/ISsQSwiWI2E (https://youtu.be/ISsQSwiWI2E)

They know, they don't care. Their definition of "harmful" is clearly quite different than ours.

Reply

sheila turner

AUGUST 18, 2019 AT 7:38 PM (HTTPS://WWW.ALTERMEDICINE.ORG/SIDEEFFECTS-OF-LIVING-NEAR-5G-TOWERS-IN-GENEVA-SWITZERLAND-TESTIMONIAL/#COMMENT-31937)

This is extremely interesting. My sleep has been disturbed every night (for past two years) by a popping sound in both ears. I waited 9 months to see an ENT Consultant, then another 9 months for a 2nd opinion. They could find no physical problem

LIVE CHAT

whatsoever. Additionally I know I am very sensitive to EMF as I avoid using the mobile phone due to feeling unwell if I use it for a call in excess of 5 minutes. My head & face heat up and my face colours with the heat of it. Landline phones not on leads also affect me, though not as strongly. There must be others out there similarly affected?

Reply

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Your email address will not be published. Required fields are marked *

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Your Name *

Email*

Your Email *

Website

Your Website

Submit

LIVE CHAT

EMF questions 1

- is it safe living under power lines
- is my house to close to a power lines
- safe distance from the house to power lines
- cancer risk living under powerlines
- house value near power lines
- physical mental damage from powerlines
- how to measure electromagnetic fields from power lines
- living near power lines
- what if my home is near power lines
- recommended safe distance from power lines
- how far need my home to be from power lines

EMF questions 2

- how to protect myself against electromagnetic fields
- how to protect my whole house against EMF fields
- emf protection cell phones
- why emf protection pendants are a scam
- why emf protection jewelry is a scam
- don't fall for the EMF scams
- complete emf protection for your home
- how to avoid high EMF fields
- emf neutralizers for your home
- all about electromagnetic fields shielding paint
- how to protect your with EMF paint
- do emf blockers work

how to use electromagnetic fields meter to measure power lines emissions

the danger of high-voltage power lines

working near power lines

safe distance from electric transformer

electricity transformer displaced near my house

what is the safe distance from electrical transformer

should I buy a house near electrical transformer

transformer box health risk

electricity transformer near house

is transformer box in my backyard dangerous

what is the safe distance from electrical transformer to my house

what are the health risks living near electrical transformer substation

damage to body from electrical transformers

physical and mental side effects living near electrical transformers

what are the health hazards from electrical substation

what if my house is near electrical substation

what if my kids go to school near electrical substation

what if my kids play near electrical substation

will my house be worth less if it's under power lines

how many people think powerlines are dangerous

power lines on my property

long-term health side effects from power lines

how long is it safe to be near power lines

electrical transformer is near my house what to do

electrical substation hazards

electric substation is near me

Then check my emf survival guide (https://www.altermedicine.org/dvd-emf-protection-guide/)

home emf shielding

how much does aluminum foil protect against EMF fields

a detailed guide on how to protect yourself from electromagnetic radiation

beware of buying scam EMF pendants

how to block emf radiation with few simple steps

protection fabric against EMF fields

emf home protection system

homemade EMF shielding

EMF pendants never work

emf protection bracelet

why crystals cannot protect you against EMF fields

the biggest EMF scams on Internet

electromagnetic fields room protection

electromagnetic fields apartment protection

check out my EMF protection guide (https://www.altermedicine.org/dvd-emf-protection-guide/) to get all the answers to questions

how to block your smart meter emissions

why you should never have smart meter in your house

smart meter shielding

smart meter homemade shielding

how dangerous are smart meters

DIY smart meter home protection

how strong is smart meter relation

what is the safe distance from smart meters

smart meter radiation distance

how to stop a smart meter from transmitting

gas meter homemade guard

how to protect against gas meter emissions

gas meter EMF blocker

LIVE CHAT

(https://www.facebook.com/altermedicine.org/) (https://twitter.com/highlowfields) (https://www.youtube.com/user/Altermedicine)

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The New York Times

Microwave Weapons Are Prime Suspect in Ills of U.S. Embassy Workers

Doctors and scientists say microwave strikes may have caused sonic delusions and very real brain damage among embassy staff and family members.

By William J. Broad

Sept. 1, 2018

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During the Cold War, Washington feared that Moscow was seeking to turn microwave radiation into covert weapons of mind control.

More recently, the American military itself sought to develop microwave arms that could invisibly beam painfully loud booms and even spoken words into people's heads. The aims were to disable attackers and wage psychological warfare.

Now, doctors and scientists say such unconventional weapons may have caused the baffling symptoms and ailments that, starting in late 2016, hit more than three dozen American diplomats and family members in Cuba and China. The Cuban incidents resulted in a diplomatic rupture between Havana and Washington.

The medical team that examined 21 affected diplomats from Cuba made no mention of microwaves in its detailed report published in JAMA in March. But Douglas H. Smith, the study's lead author and director of the Center for Brain Injury and Repair at the University of Pennsylvania, said in a recent interview that microwaves were now considered a main suspect and that the team was increasingly sure the diplomats had suffered brain injury.

"Everybody was relatively skeptical at first," he said, "and everyone now agrees there's something there." Dr. Smith remarked that the diplomats and doctors jokingly refer to the trauma as the immaculate concussion.

Strikes with microwaves, some experts now argue, more plausibly explain reports of painful sounds, ills and traumas than do other possible culprits — sonic attacks, viral infections and contagious anxiety.

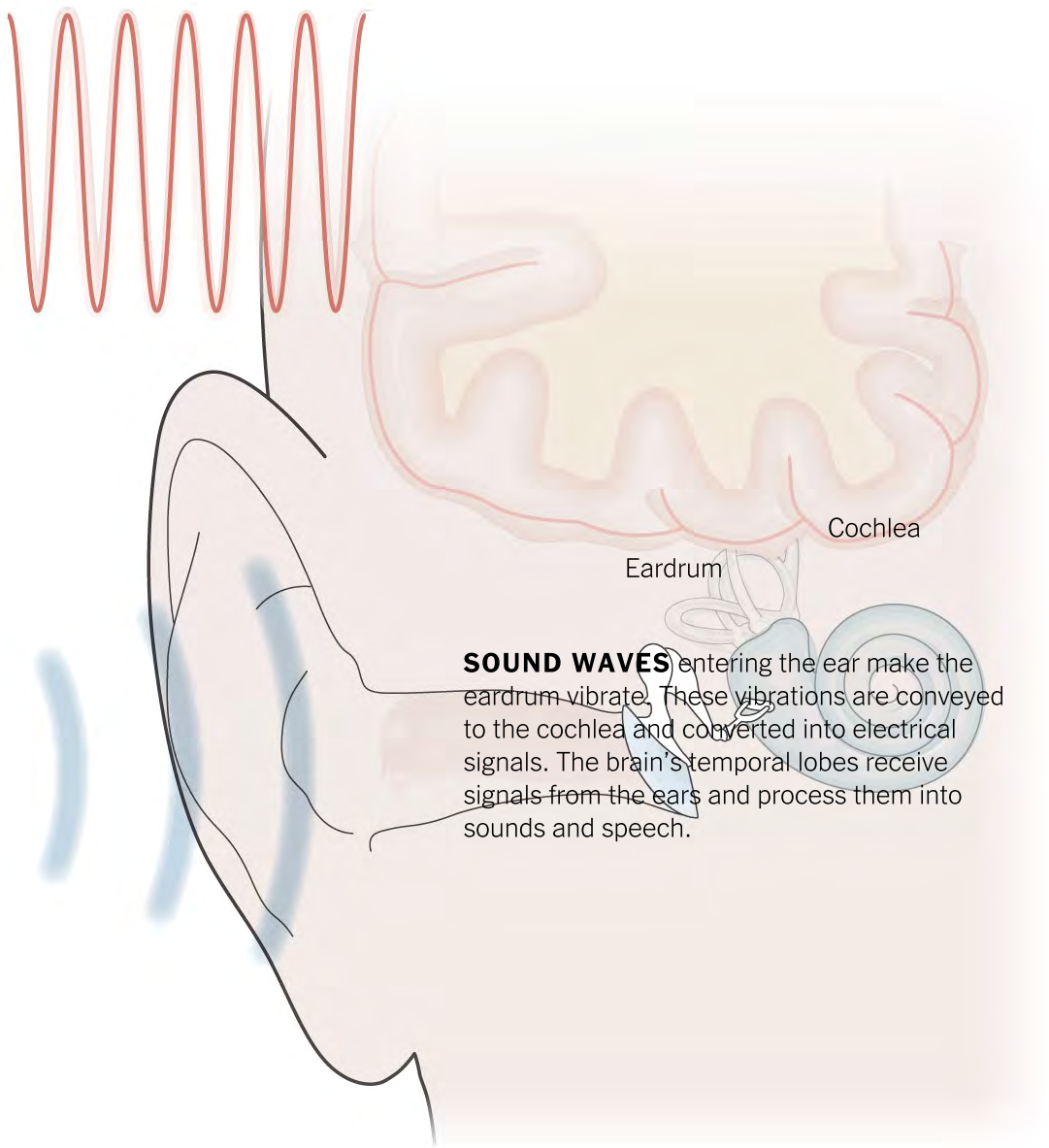
In particular, a growing number of analysts cite an eerie phenomenon known as the Frey effect, named after Allan H. Frey, an American scientist. Long ago, he found that microwaves can trick the brain into perceiving what seem to be ordinary sounds.

Hearing Microwaves

Scientists have known for decades that the brain can perceive some microwaves as sound.

MICROWAVES hitting the head in the area around the temporal lobe were perceived as sound in a 1962 experiment. Several theories have sought to explain the exact mechanism but it remains in dispute.

TEMPORAL LOBE



By The New York Times | Sources: Allan H. Frey; Centers for Disease Control and Prevention

The false sensations, the experts say, may account for a defining symptom of the diplomatic incidents — the perception of loud noises, including ringing, buzzing and grinding. Initially, experts cited those symptoms as evidence of stealthy attacks with sonic weapons.

Members of Jason, a secretive group of elite scientists that helps the federal government assess new threats to national security, say it has been scrutinizing the diplomatic mystery this summer and weighing possible explanations, including microwaves.

Asked about the microwave theory of the case, the State Department said the investigation had yet to identify the cause or source of the attacks. And the F.B.I. declined to comment on the status of the investigation or any theories.

The microwave idea teems with unanswered questions. Who fired the beams? The Russian government? The Cuban government? A rogue Cuban faction sympathetic to Moscow? And, if so, where did the attackers get the unconventional arms?

At his home outside Washington, Mr. Frey, the scientist who uncovered the neural phenomenon, said federal investigators have questioned him on the diplomatic riddle and that microwave radiation is considered a possible cause.

Mr. Frey, now 83, has traveled widely and long served as a contractor and a consultant to a number of federal agencies. He speculated that Cubans aligned with Russia, the nation's longtime ally, might have launched microwave strikes in attempts to undermine developing ties between Cuba and the United States.

"It's a possibility," he said at his kitchen table. "In dictatorships, you often have factions that think nothing of going against the general policy if it suits their needs. I think that's a perfectly viable explanation."

Developing a new class of weapons

Microwaves are ubiquitous in modern life. The short radio waves power radars, cook foods, relay messages and link cellphones to antenna towers. They're a form of electromagnetic radiation on the same spectrum as light and X-rays, only at the opposite end.

While radio broadcasting can employ waves a mile or more in length, microwaves range in size from roughly a foot to a tiny fraction of an inch. They're seen as harmless in such everyday uses as microwaving foods. But their diminutive size also enables tight focusing, as when dish antennas turn disorganized rays into concentrated beams.

The dimensions of the human head, scientists say, make it a fairly good antenna for picking up microwave signals.

Mr. Frey, a biologist, said he stumbled on the acoustic effect in 1960 while working for General Electric's Advanced Electronics Center at Cornell University. A man who measured radar signals at a nearby G.E. facility came up to him at a meeting and confided that he could hear the beam's pulses — *zip, zip, zip*.

Intrigued, Mr. Frey traveled to the man's workplace in Syracuse and positioned himself in a radar beam. "Lo," he recalled, "I could hear it, too."

Mr. Frey's resulting papers — reporting that even deaf people could hear the false sounds — founded a new field of study on radiation's neural impacts. Mr. Frey's first paper, in 1961, reported that power densities 160 times lower than "the standard maximum safe level for continuous exposure" could induce the sonic delusions.

His second paper, in 1962, pinpointed the brain's receptor site as the temporal lobes, which extend beneath the temples. Each lobe bears a small region — the auditory cortex — that processes nerve signals from the outer and inner ears.

Investigators raced to confirm and extend Mr. Frey's findings. At first they named the phenomenon after him, but eventually called it the microwave auditory effect and, in time, more generally, radio-frequency hearing.

The Soviets took notice. Not long after his initial discoveries, Mr. Frey said, he was invited by the Soviet Academy of Sciences to visit and lecture. Toward the end, in a surprise, he was taken outside Moscow to a military base surrounded by armed guards and barbed-wire fences.

"They had me visiting the various labs and discussing the problems," including the neural impacts of microwaves, Mr. Frey recalled. "I got an inside look at their classified program."

Moscow was so intrigued by the prospect of mind control that it adopted a special terminology for the overall class of envisioned arms, calling them psychophysical and psychotronic.

Soviet research on microwaves for "internal sound perception," the Defense Intelligence Agency warned in 1976, showed great promise for "disrupting the behavior patterns of military or diplomatic personnel."

Furtively, globally, the threat grew.

The National Security Agency gave Mark S. Zaid, a Washington lawyer who routinely gets security clearances to discuss classified matters, a statement on how a foreign power built a weapon “designed to bathe a target’s living quarters in microwaves, causing numerous physical effects, including a damaged nervous system.”

Mr. Zaid said a N.S.A. client of his who traveled there watched in disbelief as his nervous system later unraveled, starting with control of his fingers.

Washington, too, foresaw new kinds of arms.

In Albuquerque, N.M., Air Force scientists sought to beam comprehensible speech into the heads of adversaries. Their novel approach won a patent in 2002, and an update in 2003. Both were assigned to the Air Force secretary, helping limit the idea’s dissemination.

The lead inventor said the research team had “experimentally demonstrated” that the “signal is intelligible.” As for the invention’s uses, an Air Force disclosure form listed the first application as “Psychological Warfare.”

The Navy sought to paralyze. The Frey effect was to induce sounds powerful enough to cause painful discomfort and, if needed, leave targets unable to move. The weapon, the Navy noted, would have a “low probability of fatalities or permanent injuries.”

In a twist, the 2003 contract was awarded to microwave experts who had emigrated to the United States from Russia and Ukraine.

It is unknown if Washington deploys such arms. But the Pentagon built a related weapon known as the Active Denial System, hailing it in a video. It fires an invisible beam meant to deter mobs and attackers with fiery sensations.

Russia, China and many European states are seen as having the know-how to make basic microwave weapons that can debilitate, sow noise or even kill. Advanced powers, experts say, might accomplish more nuanced aims such as beaming spoken words into people’s heads. Only intelligence agencies know which nations actually possess and use such unfamiliar arms.

The basic weapon might look like a satellite dish. In theory, such a device might be hand-held or mounted in a van, car, boat or helicopter. Microwave arms are seen as typically working over relatively short distances — across the length of a few rooms or blocks. High-powered ones might be able to fire beams across several football fields, or even for several miles.

The episode in Cuba

The Soviet collapse in 1991 cut Russia's main ties to Cuba, a longtime ally just 90 miles from the United States. The shaky economy forced Moscow to stop providing Havana with large amounts of oil and other aid.

Vladimir Putin, as Russia's president and prime minister, sought to recover the economic, political and strategic clout that the Soviets had lost. In December 2000, months after the start of his first presidential term, Mr. Putin flew to the island nation. It was the first visit by a Soviet or Russian leader since the Cold War.

He also sought to resurrect Soviet work on psychoactive arms. In 2012, he declared that Russia would pursue "new instruments for achieving political and strategic goals," including psychophysical weapons.

In July 2014, Mr. Putin again visited Cuba. This time he brought a gift — the cancellation of some $30 billion in Cuban debt. The two nations signed a dozen accords.

A Russian spy ship, Viktor Leonov, docked in Havana on the eve of the beginning of reconciliation talks between Cuba and the United States in early 2015, and did so again in subsequent years. Moscow and Havana grew so close that in late 2016, the two nations signed a sweeping pact on defense and technology cooperation.

Raul Castro, president of Cuba, with Vladimir Putin, Russia's president, at a welcoming ceremony for Mr. Putin in Havana in 2014. Ismael Francisco/Associated Press

In Havana's harbor, men fishing near the Russian warship, Viktor Leonov, in 2015.
Ramon Espinosa/Associated Press

As a candidate, Donald Trump faulted the Obama administration's normalization policy as "a very weak agreement" and threatened to scrap it on reaching the White House. Weeks after he won the election, in late November 2016, the American embassy in Havana found itself battling a mysterious crisis.

Diplomats and their families recounted high-pitched sounds in homes and hotel rooms at times intense enough to incapacitate. Long-term, the symptoms included nausea, crushing headaches, fatigue, dizziness, sleep problems and hearing loss.

The State Department filed diplomatic protests, and the Cuban government denied involvement. In May, the F.B.I. opened an investigation and its agents began visiting Havana a half year after the incidents began. The last major one hit that summer, in August, giving the agents relatively little time to gather clues.

In September 2017, the Trump administration warned travelers away from Cuba and ordered home roughly half the diplomatic personnel.

Rex W. Tillerson, who was then the secretary of state, said the embassy's staff had been targeted deliberately. But he refrained from blaming Cuba, and federal officials held out the possibility that a third party may have been responsible.

In early October, President Trump expelled 15 Cuban diplomats, producing a chill between the nations. Administration critics said the White House was using the health issue as a pretext to end President Barack Obama's reconciliation policy.

The day after the expulsions, the Senate Foreign Relations Committee held a closed, top secret hearing on the Cuba situation. Three State Department officials testified, as did an unnamed senior official of the Central Intelligence Agency.

The Hypothesis

Early this year, in January, the spooky impact of microwaves on the human brain never came up during an open Senate hearing on the Cuba crisis.

But in a scientific paper that same month, James C. Lin of the University of Illinois, a leading investigator of the Frey effect, described the diplomatic ills as plausibly arising from microwave beams. Dr. Lin is the editor-in-chief of Bio Electro Magnetics, a peer-reviewed journal that explores the effects of radio waves and electromagnetic fields on living things.

In his paper, he said high-intensity beams of microwaves could have caused the diplomats to experience not just loud noises but nausea, headaches and vertigo, as well as possible brain-tissue injury. The beams, he added, could be fired covertly, hitting "only the intended target."

In February, ProPublica in a lengthy investigation mentioned that federal investigators were weighing the microwave theory. Separately, it told of an intriguing find. The wife of a member of the embassy staff, it reported, had looked outside her home after hearing the disturbing sounds and seen a van speeding away.

A dish antenna could fit easily into a small van.

The medical team that studied the Cuba diplomats ascribed the symptoms in the March JAMA study to “an unknown energy source” that was highly directional. Some personnel, it noted, had covered their ears and heads but experienced no sound reduction. The team said the diplomats appeared to have developed signs of concussion without having received any blows to the head.

In May, reports emerged that American diplomats in China had suffered similar traumas. Secretary of State Mike Pompeo called the medical details of the two groups "very similar” and “entirely consistent" with one another. By late June, the State Department had evacuated at least 11 Americans from China.

To date, the most detailed medical case for microwave strikes has been made by Beatrice A. Golomb, a medical doctor and professor of medicine at the University of California, San Diego. In a forthcoming paper to be published in October in Neural Computation, a peer-reviewed journal of the MIT Press, she lays out potential medical evidence for Cuban microwave strikes.

She compared the symptoms of the diplomats in Cuba to those reported for individuals said to be suffering from radio-frequency sickness. The health responses of the two groups, Dr. Golomb wrote, “conform closely.”

In closing, she argued that “numerous highly specific features” of the diplomatic incidents “fit the hypothesis” of a microwave attack, including the Frey-type production of disturbing sounds.

Scientists still disagree over what hit the diplomats. Last month, JAMA ran four letters critical of the March study, some faulting the report for ruling out mass hysteria.

But Mr. Zaid, the Washington lawyer, who represents eight of the diplomats and family members, said microwave attacks may have injured his clients.

"It's sort of naïve to think this just started now," he said. Globally, he added, covert strikes with the potent beams appear to have been going on for decades.

Francisco Palmieri, a State Department official, was asked during the open Senate hearing if "attacks against U.S. personnel in Cuba" had been raised with Moscow.

"That is a very good question," Mr. Palmieri replied. But addressing it, he added, would require "a classified setting."

For his part, Mr. Frey says he doubts the case will be solved anytime soon. The novelty of the crisis, its sporadic nature and the foreign setting made it hard for federal investigators to gather clues and draw conclusions, he said, much less file charges.

"Based on what I know," he remarked, "it will remain a mystery."

William J. Broad is a science journalist and senior writer. He joined The Times in 1983, and has shared two Pulitzer Prizes with his colleagues, as well as an Emmy Award and a DuPont Award. @WilliamJBroad

A version of this article appears in print on , Section A, Page 1 of the New York edition with the headline: Invisible Strike May Be Cause Of Envoys' Ills

BRAIN TRAUMA SUFFERED BY U.S. DIPLOMATS ABROAD COULD BE WORK OF HOSTILE FOREIGN GOVERNMENT

Since 2016, dozens of American officials have come home from Cuba and China with unexplained brain trauma. Evidence shows it may be the work of another government using a weapon that leaves no trace

2019 MAR 17 CORRESPONDENT SCOTT PELLEY FACEBOOK TWITTER REDDIT FLIPBOARD

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In 2016 and '17, 25 Americans, including CIA agents, who worked in the U.S. Embassy in Cuba suffered serious brain injuries causing impaired vision and memory loss among other persistent symptoms. Now, we've learned that at least 15 American officials in China suffered unexplained brain trauma soon after. The FBI is now investigating whether these Americans were attacked by a mysterious weapon that leaves no trace. Over many months we have been collecting evidence of what appears to be a hostile foreign government's plan to target americans serving abroad and their families.

60 Minutes Overtime: Is an invisible weapon targeting U.S. diplomats?

Mark Lenzi: For me it was November of 2017, when I started to feel lightheaded a lot. I was getting more headaches, my wife was getting headaches too.

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What kee Hong Ko protests

Mark Lenzi

Mark Lenzi is a State Department security officer who worked in the U.S. Consulate in Guangzhou, China. He says that he and his wife began to suffer after hearing strange sounds in their apartment.

Mark Lenzi: Picture holding a marble. Then, picture if you had like a six foot in diameter funnel, metal funnel. The sound that marble would make as it goes around and it progressively gets faster as it gets, goes down towards the hole at the end. It's a sound like I've never heard before.

Scott Pelley: Was this subtle? Like, "Did I hear that?"

Mark Lenzi: No. It was, it was actually somewhat loud. I heard it about three or four times. Always in the same spot. Always over my son's crib and always right before we would go to bed.

"THIS WAS A DIRECTED, STANDOFF ATTACK AGAINST MY APARTMENT."

Lenzi wears prescribed glasses because sensitivity to light is among his persistent symptoms.

Mark Lenzi: The symptoms were progressively getting worse with me. My headaches were getting worse. The most concerning symptom for me was memory loss, especially short-term memory loss.

Mark Lenzi believes he was targeted because of his work. He uses top secret equipment to analyze electronic threats to diplomatic missions.

Mark Lenzi: There is no shadow of a doubt in my mind that this was a directed attack against my neighbor and I.

His neighbor was Catherine Werner, who lived one floor up. She's a U.S. Commerce Department trade officer who promoted American business from the Guangzhou Consulate.

Catherine Werner

Catherine Werner: I woke up in the middle of the night. I could feel this sound in my head. Um, it was intense pressure on both of my temples. At the same time, I heard this low humming sound, and it was oscillating. And I remember looking around for where this sound was coming from, because it was painful.

Scott Pelley: When did you first notice that you weren't feeling well?

Catherine Werner: October of 2017, I started to get hives all over my body. Really bad hives. I woke up with headaches every day. Um, I started to feel tired. The simplest things would just make me very, very tired.

Scott Pelley: Were these symptoms growing worse over time?

Catherine Werner: They were. Yes. My symptoms would get so bad that I would throw up, or I would wake up with nosebleeds.

She says even her dogs were throwing up blood. Werner assumed her illness was connected to China's toxic smog. She didn't know it at the time but her symptoms were the same that American officials in Havana had suffered since 2016. The U.S. Embassy there is all but closed as a result.

The U.S. Embassy in Havana, now all but closed

Catherine Werner: We hadn't heard about what happened in Cuba. I mean, there were headlines in the news about hearing loss and um, attacks to our diplomats, but we didn't know the details.

Catherine Werner became so ill, her mother traveled from the U.S. to live with her.

Catherine Werner: She spent almost three months with me. During that time she also got very ill. Um, and she and I shared the same symptoms.

Scott Pelley: What sort of symptoms did your mother have?

Catherine Werner: Headaches and um, ringing in our ears. Um, we also started to both um, have difficulty recalling words.

After reporting her experiences, Werner was medically evacuated to the U.S. for treatment. U.S. agencies are investigating, but Mark Lenzi has a theory.

Mark Lenzi: This was a directed standoff attack against my apartment.

Scott Pelley: It was a weapon?

Mark Lenzi: Oh, of course it was a weapon.

Scott Pelley: An energy weapon--

Mark Lenzi: Absolutely.

Scott Pelley: What sort of energy is this that we're talking about?

Mark Lenzi: I believe it's RF, radio frequency energy, in the microwave range.

A clue that supports that theory was revealed by the National Security Agency in 2014. This NSA statement describes such a weapon as a "high-powered microwave system weapon that may have the ability to weaken, intimidate, or kill an enemy over time without leaving evidence." The statement goes on to say "...this weapon is designed to bathe a target's living quarters in microwaves." The NSA disclosed this in a worker's compensation case filed by former NSA employee Mike Beck.

Scott Pelley: When you look back across your career is there any incident that leads you to believe that it could be responsible for your Parkinson's disease?

Mike Beck: Yes.

Mike Beck

In the 1990's Beck and an NSA co-worker were on assignment overseas. Years later, he says they developed Parkinson's Disease at the same time.

Mike Beck: In 1996 a colleague of mine, Chuck Gubete, and I traveled to a hostile country and worked there for about a week. And um, I can't say where the hostile country-- the identity of it.

Scott Pelley: Because it's still classified?

Mike Beck: Yes.

But it was not Cuba or China.

Scott Pelley: You believe that you and Chuck Gubete were attacked with this microwave weapon?

Mike Beck: Yes. I had a pretty good working knowledge of the hostile country's intelligence services, what they do to people, what they have done, what their modus operandi is.

Mike Beck says more intelligence has come in recently which he shared in a classified briefing with congressional investigators.

Scott Pelley: Mike, you can't discuss any of these details because they're all classified. But in your opinion, does the new information that you briefed the House and Senate Intelligence Committee staff on in any way relate to what happened in Cuba and China?

Mike Beck: It's relevant to the Cuba and China cases.

No one has officially confirmed that what Beck says happened to him is related to at least 40 Americans injured in China and Cuba. While Beck suffers from Parkinson's the recent patients are being treated for the same kind of symptoms that doctors would expect from a concussion. Dr. Teena Shetty is Mark Lenzi's neurologist.

Dr. Teena Shetty: So Mark initially came to me reporting symptoms of headache, memory loss, sleep difficulties, emotionality, and irritability.

Scott Pelley: And what did you make of that in the early days?

Dr. Teena Shetty: I was very surprised. He did not have any history of any trauma or blow to his head, but he reported a constellation of neurologic symptoms which are characteristic of mild traumatic brain injury, without any history of associated head trauma.

Exactly how their brains were injured is the subject of a study at the University of Pennsylvania Center for Brain Injury and Repair. Dr. Shetty is not part of that study, but her patient, Mark Lenzi, is.

Dr. Teena Shetty: The presumption is that something happened which caused a functional brain injury of widespread brain networks because he has symptoms to reflect a multitude of brain networks.

What Dr. Shetty describes mirrors the findings published so far by the University of Pennsylvania study.

Robyn Garfield: They have said that our symptoms are exactly what they saw in Cuba, and that we have the full suite of findings that they had there.

Robyn and Britta Garfield

Robyn and Britta Garfield are among the 40 patients enrolled in the University of Pennsylvania study. Like Catherine Werner, Robyn Garfield is a trade officer with the Commerce Department. He was posted with his wife and two young children in Shanghai.

Robyn Garfield: I don't know when the sound started. Um, I do know that it was for months on end.

Britta Garfield: I was sitting next to Robyn and something I felt like hit me from the left side. Um, and at first it felt like an electric shock um, and then it paralyzed me, so I was not able to move or speak.

Scott Pelley: It hit you so hard you felt like you were in danger in the room?

Britta Garfield: Yes.

They say the children suffered blurred vision and loss of balance.

Scott Pelley: Your daughter was literally falling down?

Robyn Garfield: Yes. She fell down multiple times that day.

Britta Garfield: We went on a walk and she just fell on her face. It was very abnormal. She never does that. And then a second time she completely lost her balance and just fell to the side.

Last spring the secretary of state, Mike Pompeo, confirmed the case of Catherine Werner. U-Penn found her brain injuries matched the Cuba victims.

Mike Pompeop on May 23, 2018: We had an incident in Guangzhou that the medical indications are very similar and entirely consistent with the medical indications that have taken place to Americans working in Cuba.

But for reasons that are unclear, the State Department is raising doubt about the other 14 China cases. The State Department's medical office sent Mark Lenzi this note that says, "We have reached the decision that your symptoms and findings do not correlate with the Havana cohort."

Mark Lenzi: They tried to deny it. They tried to cover it up. They tried to minimize it.

Scott Pelley: Why would the State Department minimize this?

Mark Lenzi: Because it's China, because we have such a large trade relationship with them. You can push around Cuba. Their trade, you know, relations are minimal. With China, that's a different beast. Right?

State Department doctors told Robyn Garfield his illness stems from a baseball injury 17 years ago, which does not explain his wife and children.

Robyn Garfield: It is a very complicated geopolitical relationship between the U.S. and China. So that, to me, feels like why this determination's being made.

Scott Pelley: What does it mean for your benefits today that the State Department is refusing to call this an attack?

Robyn Garfield: It has significant impact on our, our life. Our finances. My career as well, likely. I have not been afforded time for my rehabilitation. Being classified as a preexisting injury means that I don't have access to paid leave. It also means that after one year my medical bills will not be covered currently.

The China patients have the attention of at least one member of the Senate Foreign Relations Committee. Jeanne Shaheen wrote Secretary Pompeo, "The group from China is increasingly feeling isolated and left behind by... the State Department."

Feb. 1, 2019 letter from Sen. Shaheen to State about attacks

The State Department declined an interview, but in a statement to 60 Minutes it said, "We will continue to provide our colleagues the care they need, regardless of their diagnosis or the location of their medical evacuation." A State Department official told us that the Cuba patients are victims of an attack. But State hasn't made the same determination for the China patients. The department has asked the National Academies of Science to assist in the medical investigation.

State Department statement in response to questions from 60 Minutes for this report

The FBI is also investigating. Intelligence sources told us that in addition to Cuba and China, Russia is a suspect. But if microwaves were used, the technology is not rare. It could be more than one country is using it. U.S. Intelligence is still debating what caused the injuries.

Scott Pelley: You were in harm's way and you didn't know it.

Catherine Werner: Exactly. I didn't know it, and I'm afraid that others may be in harm's way and may not know it. I don't know what the future looks like for me. But I would do anything in my power to prevent this from happening to somebody else serving their country.

Americans are not the only ones who have been attacked. According to the Canadian government, 15 Canadians were injured in Cuba, including diplomats and their families.

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Researcher links diplomats' mystery illness to radiofrequency/microwave radiation

UNIVERSITY OF CALIFORNIA - SAN DIEGO

Writing in advance of the September 15 issue of *Neural Computation*, Beatrice Golomb, MD, PhD, professor of medicine at University of California San Diego School of Medicine, says publicly reported symptoms and experiences of a "mystery illness" afflicting American and Canadian diplomats in Cuba and China strongly match known effects of pulsed radiofrequency/microwave electromagnetic (RF/MW) radiation.

IMAGE: THIS IS BEATRICE GOLOMB, MD, PHD, PROFESSOR OF MEDICINE AT UC SAN DIEGO SCHOOL OF MEDICINE. **view more** ›

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Her conclusions, she said, may aid in the treatment of the diplomats (and affected family members) and assist U.S. government agencies seeking to determine the precise cause. More broadly, Golomb said her research draws attention to a larger population of people who are affected by similar health problems.

"I looked at what's known about pulsed RF/MW in relation to diplomats' experiences," said Golomb. "Everything fits. The specifics of the varied sounds that the diplomats reported hearing during the apparent inciting episodes, such as chirping, ringing and buzzing, cohere in detail with known properties of so-called 'microwave hearing,' also known as the Frey effect.

"And the symptoms that emerged fit, including the dominance of sleep problems, headaches and cognitive issues, as well as the distinctive prominence of auditory symptoms. Even objective findings reported on brain imaging fit with what has been reported for persons affected by RF/MW radiation."

Beginning in 2016, personnel at the U.S. Embassy in Havana, Cuba (as well as Canadian diplomats and family members) described hearing strange sounds, followed by development of an array of symptoms. The source of the health problems has not been determined. Though some officials and

media have described the events as "sonic attacks," some experts on sound have rejected this explanation. In May of this year, the State Department reported that U.S. government employees in Guangzhou, China had also experienced similar sounds and health problems.

Affected diplomats and family members from both locations were medically evacuated to the U.S. for treatment, but despite multiple government investigations, an official explanation of events and subsequent illnesses has not been announced. At least two early published studies examining available data were inconclusive.

In her paper, scheduled to be published September 15 in *Neural Computation*, Golomb compared rates of described symptoms among diplomats with a published 2012 study of symptoms reported by people affected by electromagnetic radiation in Japan. By and large, she said the cited symptoms -- headache, cognitive problems, sleep issues, irritability, nervousness or anxiety, dizziness and tinnitus (ringing in the ears) -- occurred at strikingly similar rates.

Some diplomats reported hearing loss. That symptom was not assessed in both studies so rates could not be compared, but Golomb said it is widely reported in both conditions. She also noted that previous brain imaging research in persons affected by RF/ EMR "showed evidence of traumatic brain injury, paralleling reports in diplomats."

David O. Carpenter, MD, is director of the Institute for Health and the Environment at the University of Albany, part of the State University of New York. He was not involved in Golomb's study. He said evidence cited by Golomb illustrates "microwave hearing," which results "from heating induced in tissue, which causes 'waves' in the ear and results in clicks and other sounds." Reported symptoms, he said, characterize the syndrome of electrohypersensitivity (EHS), in which unusual exposure to radiofrequency radiation can trigger symptoms in vulnerable persons that may be permanent and disabling.

"We have seen this before when the Soviets irradiated the U.S. Embassy in Moscow in the days of the Cold War," he said.

Golomb, whose undergraduate degree was in physics, conducts research investigating the relationship of oxidative stress and mitochondrial function -- mechanisms shown to be involved with RF/EMR injury -- to health, aging, behavior and illness. Her work is wide-ranging, with published studies on Gulf War illness, statins, antibiotic toxicity, ALS, autism and the health effects of chocolate and trans fats, with a secondary interest in research methods, including placebos.

Golomb said an analysis of 100 studies examining whether low-level RF produced oxidative injury found that 93 studies concluded that it did. Oxidative injury or stress arises when there is an imbalance between the production of reactive oxygen species (free radicals) and the body's detoxifying antioxidant defenses. Oxidative stress has been linked to a range of diseases and

conditions, from Alzheimer's disease, autism and depression to cancer and chronic fatigue syndrome, as well as toxic effects linked to certain drugs and chemicals. More to the point, Golomb said, oxidative injury has been linked to the symptoms and conditions reported in diplomats.

The health consequences of RF/MW exposure is a matter of on-going debate. Some government agencies, such as the National Institute of Environmental Health Sciences and the National Cancer Institute, publicly assert that low- to mid-frequency, non-ionizing radiation like those from microwaves and RF is generally harmless. They cite studies that have found no conclusive link between exposure and harm.

But others, including researchers like Golomb, dispute that conclusion, noting that many of the no-harm studies were funded by vested industries or had other conflicts of interest. She said independent studies over decades have reported biological effects and harms to health from nonionizing radiation, specifically RF/MW radiation, including via oxidative stress and downstream mechanisms, such as inflammation, autoimmune activation and mitochondrial injury.

Golomb compared the situation to persons with peanut allergies: Most people do not experience any adverse effect from peanut exposure, but for a vulnerable subgroup, exposure produces negative, even life-threatening, consequences.

In her analysis, Golomb concludes that "of hypotheses tendered to date, (RF/MW exposure) alone fits the facts, including the peculiar ones" regarding events in Cuba and China. She said her findings advocate for more robust attention to pulsed RF/MW and associated adverse health effects.

"The focus must be on research by parties free from ties to vested interests. Such research is needed not only to explain and address the symptoms in diplomats, but also for the benefit of the small fraction - but large number -- of persons outside the diplomatic corps, who are beset by similar problems."

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This study was unfunded.

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Diplomats' Mystery Illness and Pulsed Radiofrequency/Microwave Radiation.

Golomb BA[1].

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Abstract

IMPORTANCE: A mystery illness striking U.S. and Canadian diplomats to Cuba (and now China) "has confounded the FBI, the State Department and US intelligence agencies" (Lederman, Weissenstein, & Lee, 2017). Sonic explanations for the so-called health attacks have long dominated media reports, propelled by peculiar sounds heard and auditory symptoms experienced. Sonic mediation was justly rejected by experts. We assessed whether pulsed radiofrequency/microwave radiation (RF/MW) exposure can accommodate reported facts in diplomats, including unusual ones.

OBSERVATIONS: (1) Noises: Many diplomats heard chirping, ringing or grinding noises at night during episodes reportedly triggering health problems. Some reported that sounds were localized with laser-like precision or said the sounds seemed to follow them (within the territory in which they were perceived). Pulsed RF/MW engenders just these apparent "sounds" via the Frey effect. Perceived "sounds" differ by head dimensions and pulse characteristics and can be perceived as located behind in or above the head. Ability to hear the "sounds" depends on high-frequency hearing and low ambient noise. (2) Signs/symptoms: Hearing loss and tinnitus are prominent in affected diplomats and in RF/MW-affected individuals. Each of the protean symptoms that diplomats report also affect persons reporting symptoms from RF/MW: sleep problems, headaches, and cognitive problems dominate in both groups. Sensations of pressure or vibration figure in each. Both encompass vision, balance, and speech problems and nosebleeds. Brain injury and brain swelling are reported in both. (3) Mechanisms: Oxidative stress provides a documented mechanism of RF/MW injury compatible with reported signs and symptoms; sequelae of endothelial dysfunction (yielding blood flow compromise), membrane damage, blood-brain barrier disruption, mitochondrial injury, apoptosis, and autoimmune triggering afford

downstream mechanisms, of varying persistence, that merit investigation. (4) Of note, microwaving of the U.S. embassy in Moscow is historically documented.

CONCLUSIONS AND RELEVANCE: Reported facts appear consistent with RF/MW as the source of injury in diplomats in Cuba. Nondiplomats citing symptoms from RF/MW, often with an inciting pulsed-RF/MW exposure, report compatible health conditions. Under the RF/MW hypothesis, lessons learned for diplomats and for RF/MW-affected civilians may each aid the other.

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EUROPAEM EMF Guideline 2016 for the prevention, diagnosis and treatment of EMF-related health problems and illnesses

Igor Belyaev / Amy Dean / Horst Eger / Gerhard Hubmann / Reinhold Jandrisovits / Markus Kern / Michael Kundi / Hanns Moshammer / Piero Lercher / Kurt Müller / Gerd Oberfeld / Peter Ohnsorge / Peter Pelzmann / Claus Scheingraber / Roby Thill

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Citations 24

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Abstract

Chronic diseases and illnesses associated with non-specific symptoms are on the rise. In addition to chronic stress in social and work environments, physical and chemical exposures at home, at work, and during leisure activities are causal or contributing environmental stressors that deserve attention by the general practitioner as well as by all other members of the health care community. It seems necessary now to take “new exposures” like electromagnetic fields (EMF) into account. Physicians are increasingly confronted with health problems from unidentified causes. Studies, empirical observations, and patient reports clearly indicate interactions between EMF exposure and health problems. Individual susceptibility and environmental factors are frequently neglected. New wireless technologies and applications have been introduced without any certainty about their health effects, raising new challenges for medicine and society. For instance, the issue of so-called non-thermal effects and potential long-term effects of low-dose exposure were scarcely investigated prior to the introduction of these technologies. Common electromagnetic field or EMF sources: Radio-frequency radiation (RF) (3 MHz to 300 GHz) is emitted from radio and TV broadcast antennas, Wi-Fi access points, routers, and clients (e.g. smartphones, tablets), cordless and mobile phones including their base stations, and Bluetooth devices. Extremely low frequency electric (ELF EF) and magnetic fields (ELF MF) (3 Hz to 3 kHz) are emitted from electrical wiring, lamps, and appliances. Very low frequency electric (VLF EF) and magnetic fields (VLF MF) (3 kHz to 3 MHz) are emitted, due to harmonic voltage and current distortions, from electrical wiring, lamps (e.g. compact fluorescent lamps), and electronic devices. On the one hand, there is strong evidence that long-term exposure to certain EMFs is a risk factor for diseases such as certain cancers, Alzheimer’s disease, and male infertility. On the other hand, the emerging electromagnetic hypersensitivity (EHS) is more and more recognized by health authorities, disability administrators and case workers, politicians, as well as courts of law. We recommend treating EHS clinically as part of the group of chronic multisystem illnesses (CMI), but still recognizing that the underlying cause remains the environment. In the beginning, EHS

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symptoms occur only occasionally, but over time they may increase in frequency and severity. Common EHS symptoms include headaches, concentration difficulties, sleep problems, depression, a lack of energy, fatigue, and flu-like symptoms. A comprehensive medical history, which should include all symptoms and their occurrences in spatial and temporal terms and in the context of EMF exposures, is the key to making the diagnosis. The EMF exposure is usually assessed by EMF measurements at home and at work. Certain types of EMF exposure can be assessed by asking about common EMF sources. It is very important to take the individual susceptibility into account. The primary method of treatment should mainly focus on the prevention or reduction of EMF exposure, that is, reducing or eliminating all sources of high EMF exposure at home and at the workplace. The reduction of EMF exposure should also be extended to public spaces such as schools, hospitals, public transport, and libraries to enable persons with EHS an unhindered use (accessibility measure). If a detrimental EMF exposure is reduced sufficiently, the body has a chance to recover and EHS symptoms will be reduced or even disappear. Many examples have shown that such measures can prove effective. To increase the effectiveness of the treatment, the broad range of other environmental factors that contribute to the total body burden should also be addressed. Anything that supports homeostasis will increase a person's resilience against disease and thus against the adverse effects of EMF exposure. There is increasing evidence that EMF exposure has a major impact on the oxidative and nitrosative regulation capacity in affected individuals. This concept also may explain why the level of susceptibility to EMF can change and why the range of symptoms reported in the context of EMF exposures is so large. Based on our current understanding, a treatment approach that minimizes the adverse effects of peroxynitrite – as has been increasingly used in the treatment of multisystem illnesses – works best. This EMF Guideline gives an overview of the current knowledge regarding EMF-related health risks and provides recommendations for the diagnosis, treatment and accessibility measures of EHS to improve and restore individual health outcomes as well as for the development of strategies for prevention.

This article offers supplementary material which is provided at the end of the article.

Keywords: accessibility measures; Alzheimer's disease; cancer; chronic multisystem illnesses (CMI); diagnosis; electric; electromagnetic field (EMF); electromagnetic hypersensitivity (EHS); infertility; leukemia; magnetic; medical guideline; nitrosative stress; non-ionizing; oxidative stress; peroxynitrite; prevention; radiation; static; therapy; treatment

Current state of the scientific and political debate about EMF-related health problems from a medical perspective

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- **EMF and infertility and reproduction**
- **Electromagnetic hypersensitivity (EHS)**
- **Other diseases that require attention with respect to EMF**

Recommendations for action

References

1. Hanninen O, Knol AB, Jantunen M, Lim TA, Conrad A, et al. Environmental burden of disease in Europe: assessing nine risk factors in six countries. Environ Health Perspect 2014;122(5):439–46.
   Google Scholar

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2. Bundespsychotherapeutenkammer. BPtK-Studie zur Arbeitsunfähigkeit – Psychische Erkrankungen und Burnout [Internet]. Berlin (DE): Bundespsychotherapeutenkammer, 2012:29. Report 2012. Available at: http://www.bptk.de/uploads/media/20120606_AU-Studie-2012.pdf. ↑

3. Bundespsychotherapeutenkammer. BPtK-Studie zur Arbeits- und Erwerbsunfähigkeit – Psychische Erkrankungen und gesundheitsbedingte Frühverrentung [Internet]. Berlin (DE): Bundespsychotherapeutenkammer, 2013:66. Report 2013. Available at: http://www.bptk.de/uploads/media/20140128_BPtK-Studie_zur_Arbeits-und_Erwerbsunfaehigkeit_2013_1.pdf. ↑

4. Fritze J. Psychopharmaka-Verordnungen: Ergebnisse und Kommentare zum Arzneiverordnungsreport 2011. Psychopharmakotherapie 2011;18:245–56. ↑
Google Scholar

5. Bundesinstitut für Arzneimittel und Medizinprodukte. Erstmals seit 20 Jahren kein Anstieg beim Methylphenidat-Verbrauch [Internet]. Bonn (DE): Bundesinstitut für Arzneimittel und Medizinprodukte, 2014 Apr 1. Pressemitteilung Nummer 05/14; Available at: https://www.bfarm.de/SharedDocs/Pressemitteilungen/DE/mitteil2014/pm05-2014.html. ↑

6. Badura B, Ducki A, Schroder H, Klose J, Meyer M, editors. Fehlzeiten-Report 2012. Berlin, Heidelberg (DE): Springer Verlag, 2012:528pp. ↑
Google Scholar

7. OECD. Health at a Glance 2013: OECD Indicators [Internet]. Paris (FR): OECD Publishing, 2013:212 p. . Available at: http://dx.DOI.org/10.1787/health_glance-2013-en. ↑
Crossref

8. Pawankar R, Canonica GW, Holgate ST, Lockey RF, editors. WAO White book on Allergy 2011–2012 [Internet]. Milwaukee, WI (US): World Allergy Organization, 2013:228. Available at: http://www.worldallergy.org/UserFiles/file/WAO-White-Book-on-Allergy.pdf. ↑

9. BioInitiative Working Group, Sage C, Carpenter DO, editors. BioInitiative Report: A Rationale for a Biologically-based Public Exposure Standard for Electromagnetic Fields (ELF and RF) at www.bioinitiative.org, August 31, 2007. ↑

10. BioInitiative Working Group, Sage C, Carpenter DO, editors. BioInitiative Report: A Rationale for a Biologically-based Public Exposure Standard for Electromagnetic Radiation at www.bioinitiative.org, December 31, 2012. ↑

11. Levitt B, Lai H. Biological effects from exposure to electromagnetic radiation emitted by cell tower base stations and other antenna arrays. Environ Rev 2010;18:369–95. ↑
Google Scholar

12. Pall ML. Scientific evidence contradicts findings and assumptions of Canadian safety panel 6: microwaves act through voltage-gated calcium channel activation to induce biological impacts at non-thermal levels, supporting a paradigm shift for microwave/lower frequency electromagnetic field action. Rev Environ Health 2015;30 (2):99–116. ↑
Google Scholar

13. Binhi VN. Magnetobiology: Underlying Physical Problems. San Diego: Academic Press, 2002:1–473. ↑
Google Scholar

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14. Binhi VN. Principles of electromagnetic biophysics (in Russian). Moscow (RU): Fizmatlit; 2011. p. 571. ↑
Google Scholar

15. Georgiou CD. Oxidative stress-induced biological damage by low-level EMFs: mechanism of free radical pair electron spin-polarization and biochemical amplification. In: Giuliani L, Soffritti M, editors. Non-thermal effects and mechanisms of interaction between electromagnetic fields and living matter. Bologna (IT): Ramazzini institute, 2010. European Journal of Oncology – Library Vol. 5. pp 63–113. Available at: http://www.icems.eu/papers.htm?f=/c/a/2009/12/15/MNHJ1B49KH.DTL. ↑

16. Pall ML. Electromagnetic fields act via activation of voltage-gated calcium channels to produce beneficial or adverse effects. J Cell Mol Med 2013;17(8):958–65. ↑
Google Scholar

17. Blank M, Goodman R. Electromagnetic fields stress living cells. Pathophysiology 2009;16(2–3):71–8. ↑
Google Scholar

18. Blackman C. Cell phone radiation: evidence from ELF and RF studies supporting more inclusive risk identification and assessment. Pathophysiology 2009;16(2–3):205–16. ↑
Google Scholar

19. Hedendahl L, Carlberg M, Hardell L. Electromagnetic hypersensitivity – an increasing challenge to the medical profession. Rev Environ Health 2015;30(4):209–15. ↑
Google Scholar

20. International Commission on Non-Ionizing Radiation Protection. Guidelines for limiting exposure to time-varying electric, magnetic, and electromagnetic fields (up to 300 GHz). Health Physics 1998;74(4):494–522. ↑
Google Scholar

21. International Commission on Non-Ionizing Radiation Protection. Guidelines for limiting exposure to time-varying electric and magnetic fields (1 Hz to 100 kHz). Health Phys 2010;99(6):818–36. ↑
Google Scholar

22. Belyaev I. Biophysical mechanisms for nonthermal microwave effects. In: Markov M, editor. Electromagnetic fields in biology and medicine. Boca Raton, London, New York: CRC Press 2015:49–68. ↑
Google Scholar

23. Belyaev I. Electromagnetic field effects on cells and cancer risks from mobile communication. In: Rosch PJ, editor. Bioelectromagnetic and subtle energy medicine, 2nd ed. Boca Raton, London, New York: CRC Press, 2015:517–39. ↑
Google Scholar

24. IARC Working Group on the Evaluation of Carcinogenic Risks to Humans. Non-Ionizing Radiation, Part 2: Radiofrequency Electromagnetic Fields. Lyon (FR): International Agency for Research on Cancer (IARC), 2013:480. IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, Vol 102. Available at: http://monographs.iarc.fr/ENG/Monographs/vol102/. ↑

25. Vecchia P. ICNIRP and international standards. London (GB): Conference EMF and Health, 2008:28. Available at: http://archive.radiationresearch.org/conference/downloads/021145_vecchia.pdf. ↑

26.

degruyter.com uses cookies to store information that enables us to optimize our website and make browsing more comfortable for you. To learn more about the use of cookies, please read our privacy policy.

Panagopoulos DJ, Johansson O, Carlo GL. Evaluation of specific absorption rate as a dosimetric quantity for electromagnetic fields bioeffects. PLoS One 2013;8 (6):e62663. ↑
Google Scholar

27. Belyaev I. Dependence of non-thermal biological effects of microwaves on physical and biological variables: implications for reproducibility and safety standards [Internet]. In: Giuliani L, Soffritti M, editors. Non-thermal effects and mechanisms of interaction between electromagnetic fields and living matter. Bologna (IT): Ramazzini institute, 2010. European Journal of Oncology – Library Vol. 5. pp 187–218. Available at: http://www.icems.eu/papers.htm?f=/c/a/2009/12/15/MNHJ1B49KH.DTL. ↑

28. Grigoriev YG, Stepanov VS, Nikitina VN, Rubtcova NB, Shafirkin AV, et al. ISTC Report. Biological effects of radiofrequency electromagnetic fields and the radiation guidelines. Results of experiments performed in Russia/Soviet Union. Moscow: Institute of Biophysics, Ministry of Health, Russian Federation, 2003. ↑
Google Scholar

29. SanPiN 2.2.4/2.1.8. Radiofrequency electromagnetic radiation (RF EMR) under occupational and living conditions. Moscow: Minzdrav. [2.2.4/2.1.8.055-96] 1996. ↑
Google Scholar

30. IARC Working Group on the Evaluation of Carcinogenic Risks to Humans. Non-Ionizing Radiation, Part 1: Static and Extremely Low-Frequency (ELF) Electric and Magnetic Fields. Lyon (FR): International Agency for Research on Cancer (IARC), 2002:445. IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, VOL 80. Available at: http://monographs.iarc.fr/ENG/Monographs/vol80/. ↑

31. Oberfeld G. Precaution in Action – Global Public Health Advice Following BioInitiative 2007. In Sage C, Carpenter DO, editors. BioInitiative Report 2012: A Rationale for a Biologically based Public Exposure Standard for Electromagnetic Fields (ELF and RF), 2012. Available at: http://www.bioinitiative.org. ↑

32. International Commission for electromagnetic safety (ICEMS), Resolutions. Available at: http://www.icems.eu/resolution.htm. ↑

33. Radiofrequency electromagnetic radiation and the health of Canadians. Report of the S Committee on Health, JUNE 2015, Parliament of Canada, Ottawa, Ontario. Available a http://www.parl.gc.ca/content/hoc/Committee/412/HESA/Reports/RP8041315/hesarp13

34. Havas M. International expert's Perspective on the Health Effects of Electromagnetic Fields (EMF) and Electromagnetic Radiation (EMR) [Internet]. Peterborough, ON, (CD): 2011 June 11 (updated 2014 July). Available at: http://www.magdahavas.com/international-experts-perspective-on-the-health-effects-of-electromagnetic-fields-emf-and-electromagnetic-radiation-emr/. ↑

35. European Environmental Agency. Radiation risk from everyday devices assessed [Internet]. Copenhagen (DK): 2007 Sept 17. Available at: http://www.eea.europa.eu/highlights/radiation-risk-from-everyday-devices-assessed. ↑

36. European Environmental Agency. Health risks from mobile phone radiation – why the experts disagree [Internet]. Copenhagen (DK): 2011 Oct 12. Available at: http://www.eea.europa.eu/highlights/health-risks-from-mobile-phone. ↑

37. European Environmental Agency. Late lessons from early warnings: science, precaution, innovation [Internet]. Copenhagen (DK): 2013 Jan 23. EEA Report No 1/2013. Available at: http://www.eea.europa.eu/publications/late-lessons-2. ↑

38.

degruyter.com uses cookies to store information that enables us to optimize our website and make browsing more comfortable for you. To learn more about the use of cookies, please see our Cookie Policy.

EU Parliament. Report on health concerns associated with electromagnetic fields. Brussels (BE): Committee on the Environment, Public Health and Food Safety of the European Parliament. Rapporteur: Frederique Ries (2008/2211(INI) [Internet]. Available at: http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//NONSGML+REPORT+A6-2009-0089+0+DOC+PDF+V0//EN. ↑

39. EU Parliament. European Parliament resolution of 2 April 2009 on health concerns associated with electromagnetic fields [Internet]). Brussels (BE): European Parliament, 2009 Apr 2. Available at: http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//TEXT+TA+P6-TA-2009-0216+0+DOC+XML+V0//EN. ↑

40. Fragopoulou A, Grigoriev Y, Johansson O, Margaritis LH, Morgan L, et al. Scientific panel on electromagnetic field health risks: consensus points, recommendations, and rationales. Environ Health 2010;25(4):307–17. ↑
Google Scholar

41. Gesichtspunkte zur aktuellen gesundheitlichen Bewertung des Mobilfunks. Empfehlung Ausgabe 05/14; Bundesministerium für Gesundheit. Vienna (AT). Available at: http://www.bmg.gv.at/cms/home/attachments/1/9/2/CH1238/CMS1202111739767/mob

42. Council of Europe – Parliamentary Assembly. The potential dangers of electromagnetic fields and their effect on the environment. Resolution, Doc. 1815, Text adopted by the Standing Committee, acting on behalf of the Assembly, on 27 May 2011 [Internet]. Available at: http://assembly.coe.int/nw/xml/XRef/Xref-XML2HTML-en.asp?fileid=17994&lang=en. ↑

43. Dean AL, Rea WJ. American Academy of Environmental Medicine Recommendations Regarding Electromagnetic and Radiofrequency Exposure [Internet]. Wichita, KS (US): Executive Committee of the American Academy of Environmental Medicine, 2012 July 12. Available at: https://www.aaemonline.org/pdf/AAEMEMFmedicalconditions.pdf. ↑

44. Federal Public Service (FPS) Health, Food Chain Safety and Environment. Mobile phones and children-New regulation for the sale of mobile phones as of 2014 [Internet]. Brussels (BE): Federal Public Service (FPS) Health, Food Chain Safety and Environment, 2016 Jan 12. Available at: http://www.health.belgium.be/en/mobile-phones-and-children. ↑

45. Assemblée Nationale. PROPOSITION DE LOI relative a la sobriete, a la transparence, a l'information et a la concertation en matiere d'exposition aux ondes electromagnetiques. Paris (FR): Assemblée Nationale, France, 2015 Jan 29. Available at: http://www.assemblee-nationale.fr/14/pdf/ta/ta0468.pdf. ↑

46. Blank M, Havas M, Kelley E, Lai H, Moskowitz JM. International EMF Scientist Appeal [Internet]. 2015 May 11. Available at: https://www.emfscientist.org/index.php/emf-scientist-appeal. ↑

47. International Scientific Declaration on Electromagnetic Hypersensitivity and Multiple Chemical Sensitivity. Following the 5th Paris Appeal Congress that took place on the 18th of May, 2015 at the Royal Academy of Medicine, Brussels, Belgium. Available at: http://appel-de-paris.com/wp-content/uploads/2015/09/Statement-EN.pdf. ↑

48. Wertheimer N, Leeper E. Electrical wiring configurations and childhood cancer. Am J Epidemiol 1979;109(3):273–84. ↑
Google Scholar

49. Robinette CD, Silverman C, Jablon S. Effects upon health of occupational exposure to microwave radiation (radar). Am J Epidemiol 1980;112:39–53. ↑
Google Scholar

degruyter.com uses cookies to store information that enables us to optimize our website and improve your browsing experience. Please read our cookies, please read our privacy policy.
OK

50. Ahlbom A, Day N, Feychting M, Roman E, Skinner J, et al. A pooled analysis of magnetic fields and childhood leukaemia. Br J Cancer 2000;83(5):692–8.
Google Scholar

51. Greenland S, Sheppard AR, Kaune WT, Poole C, Kelsh MA. A pooled analysis of magnetic fields, wire codes, and childhood leukemia. Childhood Leukemia-EMF Study Group. Epidemiology 2000;11(6):624–34.
Google Scholar

52. Kheifets L, Ahlbom A, Crespi CM, Draper G, Hagihara J, et al. Pooled analysis of recent studies on magnetic fields and childhood leukaemia. Br J Cancer 2010;103 (7):1128–35.
Google Scholar

53. Zhao L, Liu X, Wang C, Yan K, Lin X, et al. Magnetic fields exposure and childhood leukemia risk: a meta-analysis based on 11,699 cases and 13,194 controls. Leuk Res 2014;38(3):269–74.
Google Scholar

54. Yang Y, Jin X, Yan C, Tian Y, Tang J, et al. Case-only study of interactions between DNA repair genes and low-frequency electromagnetic fields in childhood acute leukemia. Leuk Lymphoma 2008;29(12):2344.
Google Scholar

55. Kundi M. Evidence for childhood cancers (Leukemia). In: Sage C, Carpenter DO, editors. The BioInitiative Report 2012. A Rationale for a Biologically-based Public Exposure Standard for Electromagnetic Fields (ELF and RF), 2012, http://www.bioinitiative.org/.

56. Sage C. Summary for the public. In: Sage C, Carpenter DO, editors. The BioInitiative Report 2012. A Rationale for a Biologically-based Public Exposure Standard for Electromagnetic Fields (ELF and RF), 2012. Available at: http://www.bioinitiative.org.

57. Hardell L, Nasman A, Pahlson A, Hallquist A, Hansson Mild K. Use of cellular telephones and the risk for brain tumours: a case-control study. Int J Oncol 1999;15 (1):113–6.
Google Scholar

58. Coureau G, Bouvier G, Lebailly P, Fabbro-Peray P, Gruber A, et al. Mobile phone use and brain tumours in the CERENAT case-control study. Occup Environ Med 2014;71 (7):514–22.
Google Scholar

59. Hardell L, Carlberg M, Soderqvist F, Mild KH. Case-control study of the association between malignant brain tumours diagnosed between 2007 and 2009 and mobile and cordless phone use. Int J Oncol 2013;43(6):1833–45.
Google Scholar

60. Hardell L, Carlberg M, Soderqvist F, Mild KH. Pooled analysis of case-control studies on acoustic neuroma diagnosed 1997–2003 and 2007–2009 and use of mobile and cordless phones. Int J Oncol 2013;43(4):1036–44.
Google Scholar

61. Hardell L, Carlberg M. Using the Hill viewpoints from 1965 for evaluating strengths of evidence of the risk for brain tumors associated with use of mobile and cordless phones. Rev Environ Health 2013;28:97–106.
Google Scholar

62.

degruyter.com uses cookies to store information that enables us to optimize our website and make browsing more comfortable for you. To learn more about the use of cookies, please see our privacy policy.

62. Carlberg M, Hardell L. Decreased survival of glioma patients with astrocytoma grade IV (glioblastoma multiforme) associated with long-term use of mobile and cordless phones. Int J Environ Res Public Health 2014;11(10):10790–805. ↑
Google Scholar

63. Hardell L, Carlberg M. Mobile phone and cordless phone use and the risk for glioma – Analysis of pooled case-control studies in Sweden, 1997–2003 and 2007–2009. Pathophysiology 2015;22(1):1–13. ↑
Google Scholar

64. West JG, Kapoor NS, Liao SY, Chen JW, Bailey L, et al. Multifocal breast cancer in young women with prolonged contact between their breasts and their cellular phones. Case Rep Med 2013;2013:354682. ↑
Google Scholar

65. Levis AG, Gennaro V, Garbisa S. Business bias as usual: the case of electromagnetic pollution. In: Elsner W, Frigato P, Ramazzotti P, editors. Social Costs Today. Institutional Economics and Contemporary Crises. London and New York: Routledge (Taylor & Francis Group), 2012:225–68. ↑
Google Scholar

66. Lai H. Genetic Effects of Non-Ionizing Electromagnetic Fields Bioinitiative 2012: A Rationale for a Biologically based Public Exposure Standard for Electromagnetic Fields (ELF and RF). Sage C and Carpenter DO. http://www.bioinitiative.org/: 1-59. ↑

67. Huss A, Egger M, Hug K, Huwiler-Müntener K, Röösli M. Source of funding and results of studies of health effects of mobile phone use: systematic review of experimental studies. Cien Saude Colet 2008;13(3):1005–12. ↑
Google Scholar

68. Apollonio F, Liberti M, Paffi A, Merla C, Marracino P, et al. Feasibility for microwaves energy to affect biological systems via nonthermal mechanisms: a systematic approach. IEEE Trans Microw Theory Tech 2013;61(5):2031–45. ↑
Google Scholar

69. Cucurachi S, Tamis WL, Vijver MG, Peijnenburg WJ, Bolte JF, et al. A review of the ecological effects of radiofrequency electromagnetic fields (RF-EMF). Environ Int 2013;51:116–40. ↑
Google Scholar

70. Belyaev IY, Alipov YD, Harms-Ringdahl M. Effects of weak ELF on E-coli cells and human lymphocytes: role of genetic, physiological, and physical parameters. In: Bersani F, editor. Electricity and magnetism in biology and medicine. New York: Kluwer Academic/Plenum Publ, 1999:481–4. ↑
Google Scholar

71. Belyaev IY, Alipov ED. Frequency-dependent effects of ELF magnetic field on chromatin conformation in Escherichia coli cells and human lymphocytes. Biochim Biophys Acta 2001;1526(3):269–76. ↑
Google Scholar

72. Sarimov R, Alipov ED, Belyaev IY. Fifty hertz magnetic fields individually affect chromatin conformation in human lymphocytes: dependence on amplitude, temperature, and initial chromatin state. Bioelectromagnetics 2011;32(7):570–9. ↑
Google Scholar

73. Belyaev IY, Hillert L, Protopopova M, Tamm C, Malmgren LO, et al. 915 MHz microwaves and 50 Hz magnetic field affect chromatin conformation and 53BP1 foci in

degruyter.com uses cookies to store information that enables us to optimize our website and make browsing more comfortable for you. To learn more about the use of cookies, please see our privacy policy.

human lymphocytes from hypersensitive and healthy persons. Bioelectromagnetics 2005;26(8):178–84.
Google Scholar

74. Markovà E, Hillert L, Malmgren L, Persson BR, Belyaev IY. Microwaves from GSM Mobile Telephones Affect 53BP1 and gamma-H2AX Foci in Human Lymphocytes from Hypersensitive and Healthy Persons. Environ Health Perspect 2005;113(9):1172–7.
Google Scholar

75. Belyaev IY, Markovà E, Hillert L, Malmgren LO, Persson BR. Microwaves from UMTS/GSM mobile phones induce long-lasting inhibition of 53BP1/g-H2AX DNA repair foci in human lymphocytes. Bioelectromagnetics 2009;30(2):129–41.
Google Scholar

76. Sarimov R, Malmgren LO, Markova E, Persson BR, Belyaev IY. Nonthermal GSM microwaves affect chromatin conformation in human lymphocytes similar to heat shock. IEEE Trans Plasma Sci 2004;32(4):1600–8.
Google Scholar

77. Markovà E, Malmgren LOG, Belyae IY. Microwaves from mobile phones inhibit 53BP1 focus formation in human stem cells more strongly than in differentiated cells: possible mechanistic link to cancer risk. Environ Health Perspect 2010;118(3):394–9.
Google Scholar

78. World Health Organization (WHO). Radiofrequency and microwaves. Environmental Health Criteria 16, Geneva (CH): WHO, 1981. Available at: http://www.inchem.org/documents/ehc/ehc/ehc016.htm.

79. World Health Organization (WHO). Extremely low frequency (ELF) fields. Environmental Health Criteria 35, Geneva (CH): WHO, 1984. Available at: http://www.inchem.org/documents/ehc/ehc/ehc35.htm.

80. Haynal A, Regli F. Zusammenhang der amyotrophischen Lateralsklerose mit gehäuften Elektrotraumata [Amyotrophic lateral sclerosis associated with accumulated electric injury]. Confin Neurol 1964;24:189–98.
Google Scholar

81. Şahin A, Aslan A, Baş O, İkinci A, Özyılmaz C, et al. Deleterious impacts of a 900-MHz electromagnetic field on hippocampal pyramidal neurons of 8-week-old Sprague Dawley male rats. Brain Res 2015;1624:232–8.
Google Scholar

82. Schliephake E. Arbeitsergebnisse auf dem Kurzwellengebiet [Work results in the area of short waves]. Dtsch Med Wochenschr 1932;58(32):1235–41.
Google Scholar

83. Sadchikova MN. State of the nervous system under the influence of UHF. In: Letavet AA, Gordon ZV, editors. The biological action of ultrahigh frequencies. Moscow: Academy of Medical Sciences, 1960:25–9.
Google Scholar

84. Von Klitzing L. Low-frequency pulsed electromagnetic fields influence EEG of man. Phys Medica 1995;11:77–80.
Google Scholar

85. Reiser H, Dimpfel W, Schober F. The influence of electromagnetic fields on human brain activity. Eur J Med Res 1995;1(1):27–32.
Google Scholar

86.

degruyter.com uses cookies to store information that enables us to optimize our website and make browsing more comfortable for you. To learn more about the use of cookies, please read our Privacy Policy.

Röschke J, Mann K. No short-term effects of digital mobile radio telephone on the awake human electroencephalogram. Bioelectromagnetics 1997;18(2):172–6.
Google Scholar

87. Hietanen M, Kovala T, Hamalainen AM. Human brain activity during exposure to radiofrequency fields emitted by cellular phones. Scand J Work Environ Health 2000;26(2):87–92.
Google Scholar

88. Croft R, Chandler J, Burgess A, Barry R, Williams J, et al. Acute mobile phone operation affects neural function in humans. Clin Neurophysiol 2002;113(10):1623–32.
Google Scholar

89. Kramarenko AV, Tan U. Effects of high-frequency electromagnetic fields on human EEG: a brain mapping study. Int J Neurosci 2003;113(7):1007–19.
Google Scholar

90. Vecchio F, Babiloni C, Ferreri F, Curcio G, Fini R, et al. Mobile phone emission modulates interhemispheric functional coupling of EEG alpha rhythms. Eur J Neurosci 2007;25(6):1908–13.
Google Scholar

91. Vecchio F, Babiloni C, Ferreri F, Buffo P, Cibelli G, et al. Mobile phone emission modulates inter-hemispheric functional coupling of EEG alpha rhythms in elderly compared to young subjects. Clin Neurophysiol 2010;121(2):163–71.
Google Scholar

92. Vecchio F, Buffo P, Sergio S, Iacoviello D, Rossini PM, et al. Mobile phone emission modulates event-related desynchronization of α rhythms and cognitive-motor performance in healthy humans. Clin Neurophysiol 2012;123(1):121–8.
Google Scholar

93. Perentos N, Croft RJ, McKenzie RJ, Cvetkovic D, Cosic I. The effect of GSM-like ELF radiation on the alpha band of the human resting EEG. Conf Proc IEEE Eng Med Biol Soc 2008;1:5680–3.
Google Scholar

94. Trunk A, Stefanics G, Zentai N, Kovács-Bálint Z, Thuróczy G, et al. No effects of a single 3G UMTS mobile phone exposure on spontaneous EEG activity, ERP correlates, and automatic deviance detection. Bioelectromagnetics 2013;34(1):31–42.
Google Scholar

95. Ghosn R, Yahia-Cherif L, Hugueville L, Ducorps A, Lemarechal JD, et al. Radiofrequency signal affects alpha band in resting electroencephalogram. J Neurophysiol 2015;113(7):2753–9.
Google Scholar

96. Roggeveen S, van Os J, Viechtbauer W, Lousberg R. EEG changes due to experimentally induced 3G mobile phone radiation. PLoS One 2015;10(6):e0129496.
Google Scholar

97. Freude G, Ullsperger P, Eggert S, Ruppe I. Effects of microwaves emitted by cellular phones on human slow brain potentials. Bioelectromagnetics 1998;19(6):384–7.
Google Scholar

98.

degruyter.com uses cookies to store information that enables us to optimize our website and make browsing more comfortable for you. To learn more about the used cookies, please read our Cookie Policy.

Freude G, Ullsperger P, Eggert S, Ruppe I. Microwaves emitted by cellular telephones affect human slow brain potentials. Eur J Appl Physiol 2000;81(1–2):18–27.
Google Scholar

99. Hladky A, Musil J, Roth Z, Urban P, Blazkova V. Acute effects of using a mobile phone on CNS functions. Cent Eur J Public Health 1999;7(4):165–7.
Google Scholar

100. Hamblin DL, Wood AW, Croft RJ, Stough C. Examining the effects of electromagnetic fields emitted by GSM mobile phones on human event-related potentials and performance during an auditory task. Clin Neurophysiol 2004;115 (1):171–8.
Google Scholar

101. Yuasa K, Arai N, Okabe S, Tarusawa Y, Nojima T, et al. Effects of thirty minutes mobile phone use on the human sensory cortex. Clin Neurophysiol 2006;117:900 –5.
Google Scholar

102. Bak M, Dudarewicz A, Zmyślony M, Sliwinska-Kowalska M. Effects of GSM signals during exposure to event related potentials (ERPs). Int J Occup Med Environ Health 2010;23(2):191–9.
Google Scholar

103. Maganioti AE, Hountala CD, Papageorgiou CC, Kyprianou MA, Rabavilas AD, et al. Principal component analysis of the P600 waveform: RF and gender effects. Neurosci Lett 2010;478(1):19–23.
Google Scholar

104. Trunk A, Stefanics G, Zentai N, Bacskay I, Felinger A, et al. Lack of interaction between concurrent caffeine and mobile phone exposure on visual target detection: an ERP study. Pharmacol Biochem Behav 2014;124:412–20.
Google Scholar

105. Mann K, Röschke J. 1996. Effects of pulsed high-frequency electromagnetic fields on human sleep. Neuropsychobiology 1996;33(1):41–7.
Google Scholar

106. Borbely AA, Huber R, Graf T, Fuchs B, Gallmann E, et al. Pulsed high-frequency electromagnetic field affects human sleep and sleep electroencephalogram. Neurosci Lett 1999;275(3):207–10.
Google Scholar

107. Huber R, Graf T, Cote KA, Wittmann L, Gallmann E, et al. Exposure to pulsed high-frequency electromagnetic field during waking affects human sleep EEG. Neuroreport 2000;11(15):3321–5.
Google Scholar

108. Huber R, Treyer V, Borbély AA, Schuderer J, Gottselig JM, et al. Electromagnetic fields, such as those from mobile phones, alter regional cerebral blood flow and sleep and waking EEG. J Sleep Res 2002;11:289–95.
Google Scholar

109. Huber R, Schuderer J, Graf T, Jutz K, Borbely AA, et al. Radio frequency electromagnetic field exposure in humans: Estimation of SAR distribution in the brain, effects on sleep and heart rate. Bioelectromagnetics 2003;24(4):262–76.
Google Scholar

110.

degruyter.com uses cookies to store information that enables us to optimize our website and make browsing more comfortable for you. To learn more about the use of cookies, please read our Cookie Policy. Accept Cookies

Regel SJ, Tinguely G, Schuderer J, Adam M, Kuster N, et al. Pulsed radio-frequency electromagnetic fields: dose-dependent effects on sleep, the sleep EEG and cognitive performance. J Sleep Res 2007;16(3):253–8.
Google Scholar

111. Fritzer G, Göder R, Friege L, Wachter J, Hansen V, et al. Effects of short- and long-term pulsed radiofrequency electromagnetic fields on night sleep and cognitive functions in healthy subjects. Bioelectromagnetics 2007;28(4):316–25.
Google Scholar

112. Lowden A, Akerstedt T, Ingre M, Wiholm C, Hillert L, et al. Sleep after mobile phone exposure in subjects with mobile phone-related symptoms. Bioelectromagnetics 2011;32(1):4–14.
Google Scholar

113. Loughran SP, McKenzie RJ, Jackson ML, Howard ME, Croft RJ. Individual differences in the effects of mobile phone exposure on human sleep: rethinking the problem. Bioelectromagnetics 2012;33(1):86–93.
Google Scholar

114. Schmid MR, Loughran SP, Regel SJ, Murbach M, Bratic Grunauer A, et al. Sleep EEG alterations: effects of different pulse-modulated radio frequency electromagnetic fields. J Sleep Res 2012;21(1):50–58.
Google Scholar

115. Schmid MR, Murbach M, Lustenberger C, Maire M, Kuster N, et al. Sleep EEG alterations: effects of pulsed magnetic fields versus pulse-modulated radio frequency electromagnetic fields. J Sleep Res 2012;21(6):620–9.
Google Scholar

116. Nakatani-Enomoto S, Furubayashi T, Ushiyama A, Groiss SJ, Ueshima K, et al. Effects of electromagnetic fields emitted from W-CDMA-like mobile phones on sleep in humans. Bioelectromagnetics 2013;34(8):589–8.
Google Scholar

117. Lustenberger C, Murbach M, Durr R, Schmid MR, Kuster N, et al. Stimulation of the brain with radiofrequency electromagnetic field pulses affects sleep-dependent performance improvement. Brain Stimul 2013;6(5):805–11.
Google Scholar

118. Lustenberger C, Murbach M, Tüshaus L, Wehrle F, Kuster N, et al. Inter-individual and intra-individual variation of the effects of pulsed RF EMF exposure on the human sleep EEG. Bioelectromagnetics 2015;36(3):169–77.
Google Scholar

119. Danker-Hopfe H, Dorn H, Bolz T, Peter A, Hansen ML, et al. Effects of mobile phone exposure (GSM 900 and WCDMA/UMTS) on polysomnography based sleep quality: An intra- and inter-individual perspective. Environ Res 2015;145:50–60.
Google Scholar

120. Preece AW, Iwi G, Davies-Smith A, Wesnes K, Butler S, et al. Effect of a 915-MHz simulated mobile phone signal on cognitive function in man. Int J Radiat Biol 1999;75 (4):447–56.
Google Scholar

121. Koivisto M, Revonsuo A, Krause C, Haarala C, Sillanmaki L, et al. Effects of 902 MHz electromagnetic field emitted by cellular telephones on response times in humans. Neuroreport 2000;11(2):413–5.
Google Scholar

degruyter.com uses cookies to store information that enables us to optimize the website. By using this website, you agree to our use of cookies. To learn more about our cookies, please read our privacy policy.
OK

122. Edelstyn N, Oldershaw A. The acute effects of exposure to the electromagnetic field emitted by mobile phones on human attention. Neuroreport 2002;13(1):119–21. ↑
Google Scholar

123. Lee TM, Lam PK, Yee LT, Chan CC. The effect of the duration of exposure to the electromagnetic field emitted by mobile phones on human attention. Neuroreport 2003;14(10):1361–4. ↑
Google Scholar

124. Curcio G, Ferrara M, De Gennaro L, Cristiani R, D'Inzeo G, et al. Time-course of electromagnetic field effects on human performance and tympanic temperature. Neuroreport 2004; 15(1):161–4. ↑
Google Scholar

125. Schmid G, Sauter C, Stepansky R, Lobentanz IS, Zeitlhofer J. No influence on selected parameters of human visual perception of 1970 MHz UMTS-like exposure. Bioelectromagnetics 2005;26(4):243–50. ↑
Google Scholar

126. Cinel C, Boldini A, Russo R, Fox E. Effects of mobile phone electromagnetic fields on an auditory order threshold task. Bioelectromagnetics 2007;28(6):493–6. ↑
Google Scholar

127. Luria R, Eliyahu I, Hareuveny R, Margaliot M, Meiran N. Cognitive effects of radiation emitted by cellular phones: the influence of exposure side and time. Bioelectromagnetics 2009;30(3):198–204. ↑
Google Scholar

128. Leung S, Croft RJ, McKenzie RJ, Iskra S, Silber B, et al. Effects of 2G and 3G mobile phones on performance and electrophysiology in adolescents, young adults and older adults. Clin Neurophysiol 2011;122(11):2203–16. ↑
Google Scholar

129. Mortazavi SM, Rouintan MS, Taeb S, Dehghan N, Ghaffarpanah AA, et al. Human short-term exposure to electromagnetic fields emitted by mobile phones decreases computer-assisted visual reaction time. Acta Neurol Belg 2012;112(2):171–5. ↑
Google Scholar

130. Wallace D, Eltiti S, Ridgewell A, Garner K, Russo R, et al. Cognitive and physiological responses in humans exposed to a TETRA base station signal in relation to perceived electromagnetic hypersensitivity. Bioelectromagnetics 2012;33 (1):23–39. ↑
Google Scholar

131. Sauter C, Eggert T, Dorn H, Schmid G, Bolz T, et al. Do signals of a hand-held TETRA transmitter affect cognitive performance, well-being, mood or somatic complaints in healthy young men? Results of a randomized double-blind cross-over provocation study. Environ Res 2015;140:85–94. ↑
Google Scholar

132. Volkow ND, Tomasi D, Wang GJ, Vaska P, Fowler JS, et al. Effects of cell phone radiofrequency signal exposure on brain glucose metabolism. JAMA 2011;305(8):808 –13. ↑
Google Scholar

133. Kwon MS, Vorobyev V, Kännälä S, Laine M, Rinne JO, et al. GSM mobile phone radiation suppresses brain glucose metabolism. J Cereb Blood Flow Metab 2011;31 (12):2293–301. ↑
Google Scholar

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OK

134. Huber R, Treyer V, Schuderer J, Berdoz J, Hell G, Buck A, et al. Exposure to pulse modulated radio frequency electromagnetic fields affects regional cerebral blood flow. Eur J Neurosci 2005;21(4):1000–6. ↑
Google Scholar

135. Aalto S, Haarala C, Brück A, Sipilä H, Hämäläinen H, et al. Mobile phone affects cerebral blood flow in humans. J Cereb Blood Flow Metab 2006;26(7):885–90. ↑
Google Scholar

136. Sienkiewicz ZJ, Blackwell RP, Haylock RG, Saunders RD, Cobb BL. Low-level exposure to pulsed 900 MHz microwave radiation does not cause deficits in the performance of a spatial learning task in mice. Bioelectromagnetics 2000;21(3):151–8. ↑
Google Scholar

137. Fragopoulou AF, Miltiadous P, Stamatakis A, Stylianopoulou F, Koussoulakos SL, et al. Whole body exposure with GSM 900 MHz affects spatial memory in mice. Pathophysiology 2010;17(3):179–87. ↑
Google Scholar

138. Aldad TS, Gan G, Gao XB, Taylor HS. Fetal radiofrequency radiation exposure from 800–1900 MHz-rated cellular telephones affects neurodevelopment and behavior in mice. Sci Re 2012;2:312. ↑
Google Scholar

139. Sharma A, Sisodia R, Bhatnagar D, Saxena VK. Spatial memory and learning performance and its relationship to protein synthesis of Swiss albino mice exposed to 10 GHz microwaves. Int J Radiat Biol 2013;90(1):29–35. ↑
Google Scholar

140. Shirai T, Imai N, Wang J, Takahashi S, Kawabe M, et al. Multigenerational effects of whole body exposure to 2.14-GHz W-CDMA cellular phone signals on brain function in rats. Bioelectromagnetics 2014;35(7):497–511. ↑
Google Scholar

141. Hu S, Peng R, Wang C, Wang S, Gao Y, et al. Neuroprotective effects of dietary supplement Kang-fu-ling against high-power microwave through antioxidant action. Food Funct 2014;5(9):2243–51. ↑
Google Scholar

142. Sokolovic D, Djordjevic B, Kocic G, Babovic P, Ristic G, et al. The effect of melatonin on body mass and behaviour of rats during an exposure to microwave radiation from mobile phone. Bratisl Lek Listy 2012;113(5):265–9. ↑
Google Scholar

143. Lai H. Neurological effects of non-ionizing electromagnetic fields. In: Sage C, Carpenter DO, editors. The bioinitiative report 2012, a rationale for a biologically-based public exposure standard for electromagnetic fields (ELF and RF), 2012. Available at: http://www.bioinitiative.org. ↑

144. Adey WR. Evidence for cooperative mechanisms in the susceptibility of cerebral tissue to environmental and intrinsic electric fields. In: Schmitt FO, Schneider DN, Crothers DM, editors. Functional linkage in biomolecular systems. New York: Raven Press, 1975:325–42. ↑
Google Scholar

145. Bawin SM, Sheppard AR, Adey WR. Possible mechanisms of weak electromagnetic field coupling in brain tissue. Bioelectrochem Bioenerg 1978;5:67–76. ↑
Google Scholar

degruyter.com uses cookies to store information that enables us to optimize our site, and provide you with a better browsing experience. By using this site, you agree to our use of cookies, please read our privacy policy.
OK

146. Blackman CF, Benane SG, Kinney LS, Joines WT, House DE. Effects of ELF fields on calcium ion efflux from brain tissue in vitro. Radiat Res 1982;92:510–20. ↑
Google Scholar

147. Adey WR. Tissue interactions with nonionizing electromagnetic fields. Physiol Rev 1981;61(2):435–514. ↑
Google Scholar

148. Shin EJ, Jeong JH, Kim HJ, Jang CG, Yamada K, et al. Exposure to extremely low frequency magnetic fields enhances locomotor activity via activation of dopamine D1-like receptors in mice. J Pharmacol Sci 2007;105(4):367–71. ↑
Google Scholar

149. Shin EJ, Nguyen XK, Nguyen TT, Pham DT, Kim HC. Exposure to extremely low frequency magnetic fields induces fos-related antigen-immunoreactivity via activation of dopaminergic D1 receptor. Exp Neurobiol 2011;20(3):130–6. ↑
Google Scholar

150. Wang LF, Li X, Gao YB, Wang SM, Zhao L, et al. Activation of VEGF/Flk-1-ERK pathway induced blood-brain barrier injury after microwave exposure. Mol Neurobiol 2015;52(1): 478–91. ↑
Google Scholar

151. Ravera S, Bianco B, Cugnoli C, Panfoli I, Calzia D, et al. Sinusoidal ELF magnetic fields affect acetylcholinesterase activity in cerebellum synaptosomal membranes. Bioelectromagnetics 2010;31(4):270–6. ↑
Google Scholar

152. Fournier NM, Mach QH, Whissell PD, Persinger MA. Neurodevelopmental anomalies of the hippocampus in rats exposed to weak intensity complex magnetic fields throughout gestation. Int J Dev Neurosci 2012;30(6):427–33. ↑
Google Scholar

153. Gavalas RJ, Walter DO, Hamner J, Adey WR. Effect of low-level, low-frequency electric fields on EEG and behavior in Macaca nemestrina. Brain Res 1970;18:491–501. ↑
Google Scholar

154. Anderson LE, Phillips ED. Biological effects of electric fields: an overview. In: Gandolfo M, Michaelson S, Rindi A, editors. Biological effects and dosimetry of static and ELF electromagnetic fields. New York: Plenum Press, 1984. ↑
Google Scholar

155. Balassa T, Szemerszky R, Bárdos G. Effect of short-term 50 Hz electromagnetic field exposure on the behavior of rats. Acta Physiol Hung 2009;96(4):437–48. ↑
Google Scholar

156. Dimitrijević D, Savić T, Anđelković M, Prolić Z, Janać B. Extremely low frequency magnetic field (50 Hz, 0.5 mT) modifies fitness components and locomotor activity of Drosophila subobscura. Int J Radiat Biol 2014;90(5):337–43. ↑
Google Scholar

157. He LH, Shi HM, Liu TT, Xu YC, Ye KP, et al. Effects of extremely low frequency magnetic field on anxiety level and spatial memory of adult rats. Chin Med J (Engl) 2011;124(20):3362–6. ↑
Google Scholar

158. Korpinar MA, Kalkan MT, Tuncel H. The 50 Hz (10 mT) sinusoidal magnetic field: effects on stress-related behavior of rats. Bratisl Lek Listy 2012;113(9):521–4. ↑

degruyter.com uses cookies to store information that enables us to optimize our website and make browsing more comfortable for you. To learn more about the use of cookies, please read our privacy policy.
OK

Google Scholar

159. Salunke BP, Umathe SN, Chavan JG. Involvement of NMDA receptor in low-frequency magnetic field-induced anxiety in mice. Electromagn Biol Med 2014;33 (4):312–26.
Google Scholar

160. Szemerszky R, Zelena D, Barna I, Bárdos G. Stress-related endocrinological and psychopathological effects of short- and long-term 50Hz electromagnetic field exposure in rats. Brain Res Bull 2010;81(1):92–9.
Google Scholar

161. Kitaoka K, Kitamura M, Aoi S, Shimizu N, Yoshizaki K. Chronic exposure to an extremely low-frequency magnetic field induces depression-like behavior and corticosterone secretion without enhancement of the hypothalamic-pituitary-adrenal axis in mice. Bioelectromagnetics 2013;34(1):43–51.
Google Scholar

162. Stevens P. Affective response to 5 microT ELF magnetic field-induced physiological changes. Bioelectromagnetics 2007;28(2):109–14.
Google Scholar

163. Ross ML, Koren SA, Persinger MA. Physiologically patterned weak magnetic fields applied over left frontal lobe increase acceptance of false statements as true. Electromagn Biol Med 2008;27(4):365–71.
Google Scholar

164. Nishimura T, Tada H, Guo X, Murayama T, Teramukai S, et al. A 1-μT extremely low-frequency electromagnetic field vs. sham control for mild-to-moderate hypertension: a double-blind, randomized study. Hypertens Res 2011;34(3):372–7.
Google Scholar

165. Huss A, Koeman T, Kromhout H, Vermeulen R. Extremely low frequency magnetic field exposure and parkinson's disease–a systematic review and meta-analysis of the data. Int J Environ Res Public Health 2015;12(7):7348–56.
Google Scholar

166. Zhou H, Chen G, Chen C, Yu Y, Xu Z. Association between extremely low-frequency electromagnetic fields occupations and amyotrophic lateral sclerosis: a meta-analysis. PLoS One 2012;7(11):e48354.
Google Scholar

167. Vergara X, Kheifets L, Greenland S, Oksuzyan S, Cho YS, et al. Occupational exposure to extremely low-frequency magnetic fields and neurodegenerative disease: a meta-analysis. J Occup Environ Med 2013;55(2):135–46.
Google Scholar

168. Kundi M, Hutter HP. Umwelthygienische Bewertung des Berichtes zur Bestimmung der Feldstarken niederfrequenter magnetischer Wechselfelder im Bereich der 110 kV Hochspannungsleitung im Siedlungsbereich der Gemeinde Kottingbrunn von Dr.-Ing. Dietrich Moldan vom 20.8.2014 [Internet]. Kottingbrunn(AT): Gemeinde Kottinbrunn, 2014:69–104. Available at: www.kottingbrunn.or.at/system/web/GetDocument.ashx?fileid=972861.

169. Stam R. Electromagnetic fields and the blood-brain barrier. Brain Res Rev 2010;65 (1):80–97.
Google Scholar

170.

degruyter.com uses cookies to store information that enables us to optimize our website and make browsing more comfortable for you. To learn more about the use of cookies, please read our Privacy policy. OK

Nittby H, Brun A, Strömblad S, Moghadam MK, Sun W, et al. Nonthermal GSM RF and ELF EMF effects upon rat BBB permeability. Environmentalist 2011; 31(2):140–8.
Google Scholar

171. Salford LG, Nittby H, Persson BRR. Effects of electromagnetic fields from wireless communication upon the blood-brain barrier. In: Sage C, Carpenter DO. The BioInitiative Report 2012: A Rationale for a Biologically based Public Exposure Standard for Electromagnetic Fields (ELF and RF). Available at: http://www.bioinitiative.org/: 1–52.

172. Zhou JX, Ding GR, Zhang J, Zhou YC, Zhang YJ, et al. Detrimental effect of electromagnetic pulse exposure on permeability of in vitro blood-brain-barrier model. Biomed Environ Sci 2013;26(2):128–37.
Google Scholar

173. Tang J, Zhang Y, Yang L, Chen Q, Tan L, et al. Exposure to 900 MHz electromagnetic fields activates the mkp-1/ERK pathway and causes blood-brain barrier damage and cognitive impairment in rats. Brain Res 2015;1601:92–101.
Google Scholar

174. Masuda H, Hirota S, Ushiyama A, Hirata A, Arima T, et al. No dynamic changes in blood-brain barrier permeability occur in developing rats during local cortex exposure to microwaves. In Vivo 2015;29(3):351–7.
Google Scholar

175. Sage C. Summary table 1-1. In: Sage C, DO Carpenter (editors.), The BioInitiative Report 2012: a rationale for a biologically-based public exposure standard for electromagnetic fields (ELF and RF), 2012. Available at: http://www.bioinitiative.org/.

176. Agarwal A, Deepinder F, Sharma RK, Ranga G, Li J. Effect of cell phone usage on semen analysis in men attending infertility clinic: an observational study. Fertil Steril 2008;89(1):124–8.
Google Scholar

177. Agarwal A, Desai NR, Makker K, Varghese A, Mouradi R, et al. Effect of radiofrequency electromagnetic waves (RF-EMF) from cellular phones on human ejaculated semen: an in vitro study. Fertil Steril 2009;92(4):1318–25.
Google Scholar

178. Wdowiak A, Wdowiak L, Wiktor H. Evaluation of the effect of using mobile phones on male fertility. Ann Agric Environ Med 2007;14(1):169–72.
Google Scholar

179. De Iuliis GN, Newey RJ, King BV, Aitken RJ. Mobile phone radiation induces reactive oxygen species production and DNA damage in human spermatozoa in vitro. PLoS One 2009;4(7):e6446.
Google Scholar

180. Fejes I, Zavacki Z, Szollosi J, Koloszar Daru J, Kovacs L, et al. Is there a relationship between cell phone use and semen quality? Arch Androl 2005;51(5):385–93.
Google Scholar

181. Aitken RJ, Bennetts LE, Sawyer D, Wiklendt AM, King BV. Impact of radio frequency electromagnetic radiation on DNA integrity in the male germline. Int J Androl 2005;28(3):171–9.
Google Scholar

degruyter.com uses cookies to store information that enables us to optimize our website and make browsing more comfortable for you. To learn more about the use of cookies, please read our Privacy Policy.

182. Kumar S, Behari J, Sisodia R. Impact of Microwave at X-Band in the aetiology of male infertility. Electromagnetic Electromagn Biol Med 2012;31(3):223–32. ↑
Google Scholar

183. Aitken RJ, Koopman P, Lewis SEM. Seeds of concern. Nature 2004;432(7013):48–52. ↑
Google Scholar

184. Erogul O, Oztas E, Yildirim I, Kir T, Aydur E, et al. Effects of electromagnetic radiation from a cellular phone on human sperm motility:an in vitro study. Arch Med Res 2006;37(7):840–3. ↑
Google Scholar

185. Dasdag S. Whole-body microwave exposure emitted by cellular phones and testicular function of rats. Urol Res 1999;27(3):219–23. ↑
Google Scholar

186. Yan JG, Agresti M, Bruce T, Yan YH, Granlund A, et al. Effects of cellular phone emissions on sperm motility in rats. Fertil Steril 2007;88(4):957–64. ↑
Google Scholar

187. Otitoloju AA, Obe IA, Adewale OA, Otubanjo OA, Osunkalu VO. Preliminary study on the reduction of sperm head abnormalities in mice, Mus musculus, exposed to radiofrequency radiations from global system for mobile communication base stations. Bull Environ Contam Toxicol 2010;84(1):51–4. ↑
Google Scholar

188. Behari J, Kesari KK. Effects of microwave radiations on reproductive system of male rats. Embryo Talk 2006;1(Suppl 1):81–5. ↑
Google Scholar

189. Neutra RR, Hristova L, Yost M, Hiatt RA. A nested case-control study of residential and personal magnetic field measures and miscarriages. Epidemiology 2002;13(1):21–31. ↑
Google Scholar

190. Li DK, Odouli R, Wi S, Janevic T, Golditch I, et al. A population-based prospective cohort study of personal exposure to magnetic fields during pregnancy and the risk of miscarriage. Epidemiology 2002;13(1):9–20. ↑
Google Scholar

191. Roosli M, Moser M, Baldinini Y, Meier M, Braun-Fahrlander C. Symptoms of ill health ascribed to electromagnetic field exposure – a questionnaire survey. Int J Hyg Environ Health 2004;207(2):141–50. ↑
Google Scholar

192. Huss A, Kuchenhoff J, Bircher A, Heller P, Kuster H, et al. Symptoms attributed to the environment-a systematic interdisciplinary assessment. Int J Hyg Environ Health 2004;207(3):245–54. ↑
Google Scholar

193. Huss A, Kuchenhoff J, Bircher A, Niederer M, Tremp J, et al. Elektromagnetische Felder und Gesundheitsbelastungen – Interdisziplinare Fallabklärungen im Rahmen eines umweltmediznischen Beratungsprojektes. Umweltmed Forsch Prax 2005;10(1):21–8. ↑
Google Scholar

194.

degruyter.com uses cookies to store information that enables us to optimize our website and make browsing more comfortable for you. To learn more about the use of cookies, please read our cookie policy.

Hagstrom M, Auranen J, Ekman R. Electromagnetic hypersensitive Finns: symptoms, perceived sources and treatments, a questionnaire study. Pathophysiology 2013;20 (2):117–22.
Google Scholar

195. Schreier N, Huss A, Roosli M. The prevalence of symptoms attributed to electromagnetic field exposure: a cross-sectional representative survey in Switzerland. Soz Praventivmed 2006;51(4):202–9.
Google Scholar

196. Huss A, Roosli M. Consultations in primary care for symptoms attributed to electromagnetic fields–a survey among general practitioners. BMC Public Health 2006;6:267.
Google Scholar

197. Ausfeld-Hafter B, Manser R, Kempf D, Brandli I. Komplementärmedizin. Eine Fragebogenerhebung in schweizerischen Arztpraxen mit komplementärmedizinischem Diagnostik- und Therapieangebot. Studie im Auftrag vom Bundesamt für Umwelt. Universitat Bern. Kollegiale Instanz für Komplementärmedizin (KIKOM) [Internet]. Bern (CH): Bundesamt für Umwelt. 2006 Oct 5. Available at: https://www.diagnose-funk.org/publikationen/artikel/detail&newsid=720.

198. Leitgeb N, Schrottner J, Bohm M. Does “electromagnetic pollution” cause illness? An inquiry among Austrian general practitioners. Wien Med Wochenschr 2005;155(9–10):237–41.
Google Scholar

199. Kato Y, Johansson O. Reported functional impairments of electrohypersensitive Japanese: a questionnaire survey. Pathophysiology 2012;19(2):95–100.
Google Scholar

200. Khurana VG, Hardell L, Everaert J, Bortkiewicz A, Carlberg M, et al. Epidemiological evidence for a health risk from mobile phone base stations. Int J Occup Environ Health 2010;16(3):263–7.
Google Scholar

201. Carpenter DO. The microwave syndrome or electro-hypersensitivity: historical background. Rev Environ Health 2015;30(4):217–22.
Google Scholar

202. World Health Organization. Factsheet Nr. 296, Elektromagnetische Felder und Öffentliche Gesundheit – Elektromagnetische Hypersensitivität (Elektrosensibilität) [Internet]. Genf (CH): WHO, 2005 Dec. Available at: http://www.who.int/peh-emf/publications/facts/ehs_fs_296_german.pdf.

203. Tresidder A, Bevington M. Electrosensitivity: sources, symptoms, and solutions. In: Rosch PJ, editor. Bioelectromagnetic and subtle energy medicine, 2nd ed. Boca Raton, FL, (USA): CRC Press, Taylor & Francis Group Version Date: 20141107, ISBN-13: 978-1-4822-3320-9 (eBook – PDF).
Google Scholar

204. Genuis SJ, Lipp CT. Electromagnetic hypersensitivity: fact or fiction? Sci Total Environ 2012;414:103–12.
Google Scholar

205. Johansson O, Liu P-Y. “Electrosensitivity”, “electrosupersensitivity” and “screen dermatitis”: preliminary observations from on-going studies in the human skin. In: Simunic D, editor. Proceedings of the COST 244: Biomedical Effects of

degruyter.com uses cookies to store information that enables us to optimize our website and make browsing more comfortable for you. To learn more about the use of cookies, please read our Cookie Policy. OK

Electromagnetic Fields – Workshop on Electromagnetic Hypersensitivity, Brussels/Graz. EU/EC (DG XIII) 1995:52–57.
Google Scholar

206. Johansson O, Gangi S, Liang Y, Yoshimura K, Jing C, et al. Cutaneous mast cells are altered in normal healthy volunteers sitting in front of ordinary TVs/PCs – results from open-field provocation experiments. J Cutan Pathol 2001;28(10):513–9.
Google Scholar

207. Belpomme D, Campagnac C, Irigaray P. Reliable disease biomarkers characterizing and identifying electrohypersensitivity and multiple chemical sensitivity as two etiopathogenic aspects of a unique pathological disorder. Rev Environ Health 2015;30(4):251–71.
Google Scholar

208. Regel SJ, Negovetic S, Roosli M, Berdinas V, Schuderer J, et al. UMTS base station-like exposure, well-being, and cognitive performance. Environ Health Perspect 2006;114(8):1270–5.
Google Scholar

209. Zwamborn APM, Vossen SHJA, van Leersum BJAM, Ouwens MA, Makel WN. Effects of global communication system radio-frequency fields on well being and cognitive functions of human subjects with and without subjective complaints. The Hague (NL): TNO Physics and Electronics Laboratory, 2003 Sept, 86p. TNO-report FEL-03-C148. Available at: https://www.salzburg.gv.at/gesundheit_/Documents/tno-fel_report_03148_definitief.pdf.

210. Eltiti S, Wallace D, Ridgewell A, Zougkou K, Russo R, et al. Does short-term exposure to mobile phone base station signals increase symptoms in individuals who report sensitivity to electromagnetic fields? A double-blind randomized provocation study. Environ Health Perspect 2007;115(11):1603–8.
Google Scholar

211. McCarty DE, Carrubba S, Chesson AL, Frilot C, Gonzalez-Toledo E, et al. Electromagnetic hypersensitivity: evidence for a novel neurological syndrome. Int J Neurosci 2011;121(12):670–6.
Google Scholar

212. Havas M, Marrongelle J, Pollner B, Kelley E, Rees CR, et al. Provocation study using heart rate variability shows microwave radiation from 2.4 GHz cordless phone affects autonomic nervous system [Internet]. In: Giuliani L, Soffritti M, editors. Non-thermal effects and mechanisms of interaction between electromagnetic fields and living matter. Bologna (IT): Ramazzini institute, 2010. European Journal of Oncology – Library Vol. 5. pp 187–218. Available at: http://www.icems.eu/papers.htm?f=/c/a/2009/12/15/MNHJ1B49KH.DTL.

213. Havas M. Radiation from wireless technology affects the blood, the heart, and the autonomic nervous system. Rev Environ Health 2013;28(2–3):75–84.
Google Scholar

214. Tuengler A, von Klitzing L. Hypothesis on how to measure electromagnetic hypersensitivity. Electromagn Biol Med 2013;32(3):281–90.
Google Scholar

215. Klitzing L. Einfluss elektromagnetischer Felder auf kardiovaskulare Erkrankungen. umwelt medizin gesellschaft 2014;27(1):17–21.
Google Scholar

216.

degruyter.com uses cookies to store information that enables us to optimize our website and make browsing more comfortable for you. To learn more about the use of cookies, please read our Cookie Policy.

Santini R, Santini P, Danze JM, Le Ruz P, Seigne M. Investigation on the health of people living near mobile telephone relay stations: I/Incidence according to distance and sex. Pathol Biol (Paris) 2002;50(6):369–73. ↑
Google Scholar

217. Navarro EA, Segura J, Portoles M, Gomez-Perretta de Mateo C. The microwave syndrome: a preliminary study in Spain. Electromagn Biol Med 2003;22(2–3):161–9. ↑
Google Scholar

218. Hutter HP, Moshammer H, Wallner P, Kundi M. Subjective symptoms, sleeping problems, and cognitive performance in subjects living near mobile phone base stations. Occup Environ Med 2006;63(5):307–13. ↑
Google Scholar

219. Abdel-Rassoul G, El-Fateh OA, Salem MA, Michael A, Farahat F, et al. Neurobehavioral effects among inhabitants around mobile phone base stations. Neurotoxicology 2007;28(2):434–40. ↑
Google Scholar

220. Blettner M, Schlehofer B, Breckenkamp J, Kowall B, Schmiedel S, et al. Mobile phone base stations and adverse health effects: phase 1 of a population-based, cross-sectional study in Germany. Occup Environ Med 2009;66(2):118–23. ↑
Google Scholar

221. Molla-Djafari H, Witke J, Poinstingl G, Brezansky A, Hutter HP, et al. Leitfaden Senderbau -Vorsorgeprinzip bei Errichtung, Betrieb, Um- und Ausbau von ortsfesten Sendeanlagen. Wien (AT): Ärztinnen und Ärzte für eine gesunde Umwelt e.V. (Hrsg.), 2014 Oct. 2. Auflage, 42 p, Available at: www.aegu.net/pdf/Leitfaden.pdf. ↑

222. Milham S, Stetzer D. Dirty electricity, chronic stress, neurotransmitters and disease. Electromagn Biol Med 2013;32(4):500–7. ↑
Google Scholar

223. Blackman C. Evidence for disruption by the modulating signal. In: Sage C, Carpenter DO, editors. The bioInitiative report 2007: a rationale for a biologically-based public exposure standard for electromagnetic fields (ELF and RF), 2007. Available at: http://www.bioinitiative.org/. ↑

224. Belyaev I. Evidence for disruption by modulation: role of physical and biological variables in bioeffects of non-thermal microwaves for reproducibility, cancer risk and safety standards. In: Sage C, Carpenter DO, editors. BioInitiative report 2012: a rationale for a biologically based public exposure standard for electromagnetic fields (ELF and RF), 2012, Available at: http://www.bioinitiative.org/. ↑

225. Matronchik AI, Belyaev IY. Mechanism for combined action of microwaves and static magnetic field: slow non uniform rotation of charged nucleoid. Electromagn Biol Med 2008;27:340–54. ↑
Google Scholar

226. Binhi VN, Alipov YD, Belyaev IY. Effect of static magnetic field on E. coli cells and individual rotations of ion-protein complexes. Bioelectromagnetics 2001;22(2):79–86. ↑
Google Scholar

227. Première reconnaissance d'un handicap dû à l'électrosensibilité en France. Le Monde fr avec AFP | 25.08.2015. Available at: http://www.lemonde.fr/planete/article/2015/08/25/premiere-reconnaissance-en-justice-d-un-handicap-du-a-l-electrosensibilite_4736299_3244.html. ↑

degruyter.com uses cookies to store information that enables us to optimize the website and improve your experience. By using this website you agree to our use of cookies, please read our privacy policy.

228. Abelous D. France has its first radiation-free refuge in The Drome [Internet]. EURE/D (FR). Agence France Presse (AFP), 2009 Oct 9. Available at: http://www.next-up.org/pdf/AFP_France_has_its_first_radiation_free_refuge_in_the_Drome_09_10_2(↑

229. Ecoforma. Mit einem schadstofffreiem Haus gegen Schlafprobleme [Internet]. Sarleinsbach (AT): Ecoforma, 2014 Sept 9. Available at: http://www.ecoforma.co.at/holzbau-ecobau-lehrbaustelle/. ↑

230. Friedmann J, Kraus S, Hauptmann Y, Schiff Y, Seger R. Mechanism of short-term ERK activation by electromagnetic fields at mobile phone frequencies. Biochem J 2007;405(3):559–68. ↑
Google Scholar

231. Simko M. Cell type specific redox status is responsible for diverse electromagnetic field effects. Curr Med Chem 2007;14(10):1141–52. ↑
Google Scholar

232. Pall ML. Explaining “Unexplained Illnesses”: disease paradigm for chronic fatigue syndrome, multiple chemical sensitivity, fibromyalgia, post-traumatic stress disorder, Gulf War Syndrome, and others. New York, NY (US), London (GB): Harrington Park Press/Haworth Press, 2007, ISBN 978-0-7890-2388-9. ↑
Google Scholar

233. Bedard K, Krause KH. The NOX Family of ROS-Generating NADPH oxidases: physiology and pathophysiology. Physiol Rev 2007;87(1):245–313. ↑
Google Scholar

234. Pacher P, Beckman JS, Liaudet L. Nitric oxide and peroxynitrite in health and disease. Physiol Rev 2007;87(1):315–424. ↑
Google Scholar

235. Desai NR, Kesari KK, Agarwal A. Pathophysiology of cell phone radiation: oxidative stress and carcinogenesis with focus on male reproductive system. Reprod Biol Endocrinol 2009;7:114. ↑
Google Scholar

236. Straub RH, Cutolo M, Buttgereit F, Pongratz G. Energy regulation and neuroendocrine-immune control in chronic inflammatory diseases. J Intern Med 2010;267(6):543–60. ↑
Google Scholar

237. Gye MC, Park CJ. Effect of electromagnetic field exposure on the reproductive system. Clin Exp Reprod Med 2012;39(1):1–9. ↑
Google Scholar

238. Yakymenko I, Tsybulin O, Sidorik E, Henshel D, Kyrylenko O, et al. Oxidative mechanisms of biological activity of lowintensity radiofrequency radiation. Electromagn Biol Med 2015;19:1–16. ↑
Google Scholar

239. Consales C, Merla C, Marino C, Benassi B. Electromagnetic fields, oxidative stress, and neurodegeneration. Int J Cell Biol 2012;2012:683897. ↑
Google Scholar

240. Pall ML. Microwave frequency electromagnetic fields (EMFs) produce widespread neuropsychiatric effects including depression. J Chem Neuroanat 2015. pii: S0891-0618(15)00059-9. . [Epub ahead of print]. ↑
Crossref Google Scholar

241.

degruyter.com uses cookies to store information that enables us to optimize our website and make browsing more comfortable for you. To learn more about the use of cookies, please read our Privacy Policy. Close

Erdal N, Gurgul S, Tamer L, Ayaz L. Effects of long-term exposure of extremely low frequency magnetic field on oxidative/nitrosative stress in rat liver. J Radiat Res 2008;49(2):181–7.
Google Scholar

242. De Luca C, Thai JC, Raskovic D, Cesareo E, Caccamo D, et al. Metabolic and genetic screening of electromagnetic hypersensitive subjects as a feasible tool for diagnostics and intervention. Mediat Inflamm 2014;2014:924184.
Google Scholar

243. Myhill S, Booth NE, McLaren-Howard J. Chronic fatigue syndrome and mitochondrial dysfunction. Int J Clin Exp Med 2009;2(1):1–16.
Google Scholar

244. Müller KE. Stressregulation und Mitochondrienfunktion. Zs f Orthomol Med 2012;1:1–13.
Google Scholar

245. Buchner K, Eger H. Veränderung klinisch bedeutsamer Neurotransmitter unter dem Einfluss modulierter hochfrequenter Felder – Eine Langzeiterhebung unter lebensnahen Bedingungen. umwelt medizin gesellschaft 2011;24(1):44–57.
Google Scholar

246. Hill HU, Huber W, Müller KE. Multiple-Chemikalien-Sensitivität (MCS) – Ein Krankheitsbild der chronischen Multisystemerkrankungen, umweltmedizinische, toxikologische und sozialpolitische Aspekte. Aachen (DE): Shaker-Verlag, 2010 Apr, 3rd edition, 500p. ISBN: 978-3-8322-9046-7.
Google Scholar

247. Redmayne M, Johansson O. Could myelin damage from radiofrequency electromagnetic field exposure help explain the functional impairment electrohypersensitivity? A review of the evidence. J Toxicol Environ Health B Crit Rev 2014;17(5):247–58.
Google Scholar

248. Von Baehr V. Rationelle Labordiagnostik bei chronisch entzündlichen Systemerkrankungen. umwelt medizin gesellschaft 2012;25(4):244–7.
Google Scholar

249. Warnke U, Hensinger P. Steigende. “Burn-out“-Inzidenz durch technisch erzeugte magnetische und elektromagnetische Felder des Mobil- und Kommunikationsfunks. umwelt-medizin-gesellschaft 2013;26(1):31–8.
Google Scholar

250. Havas M. Dirty electricity elevates blood sugar among electrically sensitive diabetics and may explain brittle diabetes. Electromagn Biol Med 2008;27(2):135–46.
Google Scholar

251. Herbert MR, Sage C. Autism and EMF? Plausibility of a pathophysiological link – Part I. Pathophysiology 2013;20(3):191–209.
Google Scholar

252. Herbert MR, Sage C. Autism and EMF? Plausibility of a pathophysiological link part II. Pathophysiology 2013;20(3):211–34.
Google Scholar

253. Eskander EF, Estefan SF, Abd-Rabou AA. How does long term exposure to base stations and mobile phones affect human hormone profiles? Clin Biochem 2012;45(1–2):157–61.

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Google Scholar

254. Steiner E, Aufdereggen B, Bhend H, Gilli Y, Kalin P, et al. Erfahrungen des Pilotprojektes „Umweltmedizinisches Beratungsnetz“ des Vereins Aerztinnen und Aerzte für Umweltschutz (AefU). Therapeutische Umschau 2013;70(12):739–45.
Google Scholar

255. Hagstrom M, Auranen J, Johansson O, Ekman R. Reducing electromagnetic irradiation and fields alleviates experienced health hazards of VDU work. Pathophysiology 2012;19(2):81–7.
Google Scholar

256. Oberfeld G. Die Veränderung des EMF Spektrums und ihre Folgen. In: Baubiologische EMF-Messtechnik. München, Heidelberg (DE): Hüthig and Pflaum Verlag, 2012. ISBN 1438-8707.
Google Scholar

257. Berufsverband Deutscher Baubiologen. VDB-Richtlinien, Physikalische Untersuchungen, Band 1: Fürth (DE): Verlag AnBUS eV, 2006. 2nd edition. ISBN 3-9808428-6-X.
Google Scholar

258. Virnich M. Gutachten über die messtechnische Untersuchung der Charakteristik von Funksignalen [Internet]. Salzburg (AT): Land Salzburg, 2015 Jun 26, 141p. Available at: https://www.salzburg.gv.at/gesundheit_/Seiten/technik.aspx.

259. Bundesamt für Umwelt. Orte mit empfindlicher Nutzung (OMEN) [Internet]. Bern (CH): Bundesamt für Umwelt, 2010 Mar 4. Available at: http://www.bafu.admin.ch/elektrosmog/13893/15175/15257/index.html?lang=de.

260. Kundi M, Hutter HP. Mobile phone base stations – Effects on wellbeing and health. Pathophysiology 2009;16(2–3):123–35.
Google Scholar

261. National Council on Radiation Protection and Measurements (NCRP). Draft Report of Extremely Low Frequency Electric and Magnetic Fields [Internet]. 1995 Jun 13. Availa
https://www.salzburg.gv.at/gesundheit_/Documents/ncrp_draft_recommendations_on

262. Oberfeld G. Prüfkatalog des Fachbereiches Umweltmedizin für das Vorhaben 380kV Freileitung von St. Peter a. H. zum Umspannwerk Salzach Neu (Salzburgleitung) der Verbund-Austrian Power Grid AG. [Internet] Salzburg (AT): Land Salzburg, 2006 Feb 27. Available at: https://www.salzburg.gv.at/gesundheit_/Documents/Umweltmedizin-Sbg.pdf.

263. Baubiologie Maes/Institut für Baubiologie + Nachhaltigkeit (IBN). Building Biology Evaluation Guidelines for Sleeping Areas (SBM-2015). Neuss, Rosenheim (DE): Baubiologie Maes, IBN., 2015 May, 3p. Available at: http://www.baubiologie.de/site/wp-content/uploads/richtwerte-2015-englisch.pdf.

264. Der Schweizerische Bundesrat. Verordnung über den Schutz vor nichtionisierender Strahlung (NISV) vom 23. Dezember 1999 [Internet]. Bern (CH): Der Schweizerische Bundesrat, 2012 Jul 1. Available at: https://www.admin.ch/opc/de/classified-compilation/19996141/index.html.

265. TCO Certified Displays 7.0-11 November 2015 [Internet]. TCO Development. Available at: http://tcodevelopment.com/files/2015/11/TCO-Certified-Displays-7.0.pdf.

266. Vignati M, Giuliani L. Radiofrequency exposure near high-voltage lines. Environ Health Perspect 1997;105(Suppl 6): 1569–73.

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Google Scholar

267. Margaritis LH, Manta AK, Kokkaliaris KD, Schiza D, Alimisis K et al. Drosophila oogenesis as a bio-marker responding to EMF sources. Electromagn Biol Med 2014;33(3):165–89.
Google Scholar

268. Gustavs K. Options to minimize non-ionizing electromagnetic radiation exposures (EMF/RF/Static fields) in office environments [Internet]. Victoria, BC (CA): Katharina Consulting, 2008 Nov 14. Available at: http://www.katharinaconsulting.com/s/2008_Gustavs_Low_EMF_Office_Environment.

269. Oberfeld G, Gutbier J. Elektrosmog im Alltag [Internet]. Stuttgart (DE): Diagnose Funk, 2013 Nov 10, 44p. Available at: https://www.salzburg.gv.at/gesundheit_/Seiten/infoblaetter.aspx.

270. Virnich M. Baubiologische EMF-Messtechnik – Grundlagen der Feldtheorie, Praxis der Feldmesstechnik. München, Heidelberg (DE): Hüthig & Pflaum Verlag, 2012. ISBN 1438-8707.
Google Scholar

271. Pauli P, Moldan D. Reduzierung hochfrequenter Strahlung im Bauwesen: Baustoffe und Abschirmmaterialien. Fürth (DE): Hrsg. Berufsverband Deutscher Baubiologen VDB e.V., Verlag AnBUS e.V. 2015. ISBN 978-3-9814025-9-9.
Google Scholar

272. Levy F, Wannag A, editors. Nordic adaptation of classification of occupationally related disorders (diseases and symptoms) to ICD-10 [Internet]. Oslo (NO): Nordic council of ministers, 2000, 53p. DIVS: 2000:839, ISBN: 92-893-0559-2. Available at: http://www.nordclass.se/ICD-10_Nordic%20Occupational_2000.pdf.

273. Bansal M, Kaushal N. Oxidative stress mechanisms and their modulation. New Delhi (IN): Springer, 2014:167.
Google Scholar

274. Brostoff J, Challacombe S. Food allergy and intolerance. London (GB): Balliere Tindall, 1987.
Google Scholar

275. Andre CM, Larondelle Y, Eners D. Dietary antioxidants and oxidative stress from a human and plant perspective, a review. Curr Nutr Food Sci 2010;6(1):2–12.
Google Scholar

276. Bouayed J, Bohn T. Exogenous antioxidants-double edged swords in cellular redox state; health beneficial effects at physiological doses versus deleterious effects at high doses. Oxid Med Cell Longev 2010;3(4):228–37.
Google Scholar

277. Hoffmann W, Staller B. Prävention durch richtige Ernährung. umwelt medizin gesellschaft 2012;25(2):115–7.
Google Scholar

278. Suzuki YJ, Packer L. Inhibition of NFkB activation by vitamin E derivates. Biochem Biophys Res Commun 1993;193(1):277–83.
Google Scholar

279. Zingg JM. Modulation of signal transduction by vitamin E. Mol Aspects Med 2007;28 (5–6):481–506.
Google Scholar

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280. Yeh SL, Wang HM, Chen PY, Wu TC. Interaction of β-Carotin and flavonoids on the secretion of inflammatory mediators in an in vitro system. Chem Biol Interact 2009;179(2–3): 386–93.
Google Scholar

281. Carcamo JM, Pedraza A, Borquez-Ojeda O, Golde DW. Vitamin C suppresses TNF alpha-induced NF kappa B activation by inhibiting I kappa B alpha phosphorylation. Biochemistry 2002;41(43):12995–3002.
Google Scholar

282. Carcamo JM, Pedraza A, Borquez-Ojeda O, Zhang B, Sanchez R, et al. Vitamin C is a kinase inhibitor: dehydroascorbic acid inhibits IkappaBalphakinase beta. Mol Cell Biol 2004; 24(15):6645–52.
Google Scholar

283. Kyaw M, Yoshizumi M, Tsuchya K, Suzaki Y, Abe S, et al. Antioxidants inhibit endothelin-1 (1-31)-induced proliferation of vascular smooth muscle cells via the inhibition of mitogenactivated protein (MAP) kinase and activator protein-1 (AP-1). Biochem Pharmacol 2002;64(10):1521–31.
Google Scholar

284. Lubbad A, Oriowo MA, Khan I. Curcumin attenuates inflammation through inhibition of TLR-4 receptor in experimental Colitis. Mol Cell Biochem 2009;322(1–2): 127–35.
Google Scholar

285. Woo JH, Lim JH, Kim YH, Soh SI, Min DS, et al. Resveratrol inhibits phorbol myristate acetate-induced matrix metalloproteinase-9 expression by inhibiting JNK and PKC delta signal transduction. Oncogene 2004;23(10):1845–53.
Google Scholar

286. Nonn L, Duong D, Pechl DM. Chemopreventive anti-inflammatory activities of curcumin and other phytochemicals mediated by MAP kinase phosphatase-5 in prostata cells. Carcinogenesis 2007;28(6):1188–96.
Google Scholar

287. Khan N, Mukhtar H. Multitargeted therapy of cancer by green tee polyphenols. Cancer Lett 2008;269(2):269–80.
Google Scholar

288. Roskoski R. Biochemistry. Philadelphia, PA, USA: W.B. Saunders Company, 1996:530pp.
Google Scholar

289. Devlin TM, editor. Textbook of Biochemistry with Clinical Correlations, 5th ed. New York, NY (US): Wiley-Liss, 2002.
Google Scholar

290. Rassow J, Hauser K, Netzker, Deutzmann R. Biochemie. 2nd ed. Stuttgart (DE): Thieme, 2008:872pp.
Google Scholar

291. Müller KE. Genetische Polymorphismen der Catechol-O-Methyltransferase (COMT). umwelt medizin gesellschaft 2007;20(4):282–8.
Google Scholar

292. Rea WJ. Chemical Sensitivity, Vol. 2: Sources of Total Body Load, 1st ed. Boca Raton, FL (US): CRC Press/Lewis Publishers, 1994:569pp.
Google Scholar

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293. Schäfer SG, Eisenhaas B, Forth W, Schumann K. Metalle. In: Marquardt H, Schäfer SG, editors. Lehrbuch der Toxikologie. Heidelberg (DE): Spektrum Akademischer Verlag, 1997:504–49pp. ↑
Google Scholar

294. Goyer RA, Cherian GM, editors. Toxicology of Metals. Berlin, Heidelberg (DE): Springer-Verlag, 1995:467pp. ↑
Google Scholar

295. Müller KE. Immuntoxikologie der Metalle. umwelt medizin gesellschaft 2004;17 (4):299–301. ↑
Google Scholar

296. Aposian HV, Malorino RM, Gonzales-Ramirez D, Zuniga-Charles M, Xu Z, et al. Mobilization of heavy metals by newer, therapeutically useful chelating agents. Toxicology 1995;97(1–3):23–38. ↑
Google Scholar

297. Flora SJ, Pachauri V. Chelation in Metal Intoxication. Int J Environ Res Public Health 2010;7(7):2745–88. ↑
Google Scholar

298. Jennrich P. Detoxifikation von Schwermetallen. umwelt medizin gesellschaft 2012;25 (4):24–7. ↑
Google Scholar

299. Pall ML. Do sauna therapy and exercise act by raising the availability of tetrahydrobiopterin? Med Hypotheses 2009;73(4):610–3. ↑
Google Scholar

300. Rozanowska M, Jarvis-Evans J, Korytowski W, Boulton ME, Burke JM, et al. Blue-light induced reactivity of retinal age pigment. In vitro generation of oxygen-reactive species. J Biol Chem 1995;270(32):18825–30. ↑
Google Scholar

301. Tolentino M, Morgan G. Popularity of electronic devices, “greener” light bulbes increases blue light exposure. Pri Care Optometry News 2012;18–9. ↑
Google Scholar

302. van der Lely S, Frey S, Garbazza C, Wirz-Justice A, Jenni OG, et al. Blue blocker glasses as a countermeasure for alerting effects of evening light-emitting diode screen exposure in male teenagers. J Adolesc Health 2015;56(1):113–9. ↑
Google Scholar

303. Narimatsu T, Negishi K, Miyake S, Hirasawa M, Osada H, et al. Blue light-induced inflammatory marker expression in the retinal pigment epithelium-choroid of mice and the protective effect of a yellow intraocular lens material in vivo. Exp Eye Res 2015;132:48–51. ↑
Google Scholar

304. Nishi T, Saeki K, Obayashi K, Miyata K, Tone N, et al. The effect of blue-blocking intraocular lenses on circadian biological rhythm: protocol for a randomised controlled trial (CLOCK-IOL colour study). BMJ Open 2015;5(5):e007930. ↑
Google Scholar

305. Mutter J, Naumann J, Schneider R, Walach H, Haley B. Mercury and autism: accelerating evidence? Neuro Endocrinol Lett 2005;26(5):439–46. ↑
Google Scholar

306.

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Mutter J, Naumann J, Guethlin C. Comments on the article "the toxicology of mercury and its chemical compounds" by Clarkson and Magos (2006). Crit Rev Toxicol 2007;37(6):537–49; discussion 551–2.
Google Scholar

307. Mutter J, Curth A, Naumann J, Deth R, Walach H. Does inorganic mercury play a role in Alzheimer's disease? A systematic review and an integrated molecular mechanism. J Alzheimers Dis 2010;22(2):357–74.
Google Scholar

308. Geier DA, King PG, Sykes LK, Geier MR. A comprehensive review of mercury provoked autism. Indian J Med Res 2008;128(4):383–411.
Google Scholar

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Guest Blog from Dr. Don Maisch, Australia: ‘Are community concerns over the 5G network rollout based on unfounded anxiety or valid evidence?’

GALLERY

Posted on **April 25, 2019**

*Below is the next in a series of Guest Blogs on BRHP. The opinions expressed in this Guest Blog are of **Don Maisch** himself. Publication of these opinions in BRHP does not imply that BRHP automatically agrees with or endorses these opinions. Publication of this, and other Guest Blogs, facilitates an open debate and free exchange of opinions on wireless technology and health.*

Don Maisch is the publisher of the **EMFacts Consultancy**

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Are community concerns over the 5G network rollout based on unfounded anxiety or valid evidence?

by Don Maisch PhD

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Overview

5th generation (5G) wireless technology, as the name indicates, is the next generation wireless communication network from 4G and 4G LTE. Once fully implemented it will predominantly operate in the millimetre (mm) radiofrequency band which will allow much higher data transfer necessary for driverless vehicles, the Internet of Things (IoT), faster video downloads as well as other applications, including military. The downside of 5G mmWave, however, is that the signals do not penetrate objects readily such as buildings and foliage, in comparison to the lower frequencies. This necessitates a far denser network of 5G small cell antennas which will be mounted on power poles, light poles, street furniture, bus shelters, etc. which in many cases will be close to homes, workplaces and public areas. In some cases internal antennas in buildings will also be used. This will result in higher chronic radiofrequency exposures to humans in these areas. The high number of small cells needed for an effective 5G network is causing community disquiet and that, combined with many scientific unknowns about the possible biological effects of prolonged exposure to mm waves, is resulting in increasing community opposition in Australia and internationally. As community opposition is most likely going to increase as 5G infrastructure continues to be rolled out nationally, the question arises: Is this opposition to 5G warranted or not?

5G community concerns in Australia

The Blue Mountains

On January 29, 2019, the Katoomba Council in the Blue Mountains, NSW, voted unanimously to acknowledge serious community concerns over the coming rollout of 5G technology and to investigate these 5G concerns further. Mayor Mark Greenhill said after the meeting that there was "significant community concern" (1) and that the council would be writing to various government ministers in order to help clarify the issue (2).

In response to this, Professor Simon Chapman from the University of Sydney, used a very 'broad brush' in dismissing community 5G concerns by bringing in other contentious issues in attempting to picture 5G concerns as just another example of anti-technology risk-phobic alarmism.

> *The most elementary test of the hypothesis that mobile phone and other electronic appliances like WiFi may give you brain cancer has repeatedly fallen at the first and most obvious hurdle. If they cause brain cancer, where are all the bodies? Ever since the nineteenth century we have seen pockets of anxiety about health from train travel, ordinary phones, radio, computer screens, electric blankets, power lines, WiFi, smart meters and wind turbines. Meanwhile, life expectancy is longer than it has ever been in history. (3)*

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And quoting from Chapman’s blog:

> *Mobile phone alarmists are a relentless (small) lobby group who are risk-phobic about almost every new form of communication. Every time there’s a new generation of cell phone or electronic technology, they crank out the same fear-mongering stuff. Cult-like, they wake every morning, to spread the word about the deadly rays they believe are being foisted on the world by the evil telecommunications industry. They follow in the hallowed footsteps of those in history who raised health alarms about railway travel, electric light, ordinary phones, radio, TV, electric blankets, computers, microwave ovens, wind turbines and solar roof cells etc. Some are also anti-vaccination (e.g.: this is one of their US queen bees). (4)*

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In early January 2019, a group of over 100 residents of the suburb of Ryde signed a petition to have small cell 4G antennas (which will later be upgraded to accommodate 5G *infrastructure*) removed from the Ryde residential area. Unlike larger towers, small cell antennas do not need planning approval under the Federal telecommunications act. Sue Cappadonna, spokesperson for the group, said *"We don't want it here, it causes us great anxiety that this thing is going to be running 24/7". (5)*

In response, Dr. Geza Benke from Monash University's Department of Occupational and Environmental Health said that residents living near small cell boxes (antennas) had nothing to worry about. He then made a rather surprising statement that:

> *The exposure which people get from these antenna* (small cells*) is no more than you would get from a large antenna. . . over the next two years the small cell boxes would become commonplace, as they are considered a critical component of "filling in the gaps" for the high-speed 5G network…*" (6)

As "*these antenna*" can be erected without local authority and community permission on bus shelters, light poles, power poles, etc. close to homes in residential areas, it is questionable whether concerned residents would be put at ease by Benke's statement.

Responding to the above ABC News item about the Ryde community 5G concerns, Adam Verrender, a PhD Student, under the supervision of Rodney Croft at the Australian Centre for Electromagnetic Bioeffects Research (ACEBR), wrote a reply for the ABC News on January 9, 2019. His article started out with his claim that:

> *Decades of scientific research has found no evidence of any adverse health effects* [from mobile phones] *but still the public remains concerned. Even studies looking at long-term damage, such as brain cancer, have not found evidence of increased harm. (7)*

Such a *disingenuous* claim of *"no evidence"* is at odds with the decision of the International Agency for Research on Cancer (IARC) which, in 2011*, classified* radiofrequency emissions from mobile phones as a possible human carcinogen, based on the 13 nation Interphone study on mobile phone use (8).

Verrender also claimed in his article that the continuing debate over adverse health effects from "phone tower anxiety" is being *"fuelled by misinformation, scepticism and a complex psychological phenomenon known as the nocebo effect"*. As a result of this according to Verrender *"it's little wonder this contentious issue persists, particularly given wireless technologies are so pervasive"*. (9)

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As for evidence that any adverse effects from radiofrequency exposure, such as electro-hyper-sensitivity (EHS) are purely psychological, Verrender mentions in his article the provocation study designed by ACEBR which supported the view that a complex psychological phenomenon, the nocebo effect, could explain the condition (EHS). What he failed to mention was that the ACEBR study finding was based only on three subjects and therefore lacked sufficient statistical significance to back up his claim (10, 11).

As for the scientific validity of the ACEBR provocation study, in 2013 CSIRO scientist and statistician, Dr. David McDonald conducted an analysis of the proposed ACEBR provocation study. He concluded in part:

> *As it stands the proposed experimental design and statistical analysis cannot be used to achieve the stated aim. The scientific and statistical shortcomings of the proposed [study] are each serious flaws in themselves and their cumulative impact and interaction render the proposal scientifically indefensible. All of them need to be corrected in a major revision of the proposal. (12)*

According to Dariusz Leszczynski (13) who has studied McDonald's full critique and later versions of the ACEBR test protocol, he saw no changes and considered it as an exact repetition of the earlier design (14). Leszczynski has written extensively about the many weaknesses on provocation testing, including that designed by ACEBR, and has published an open letter on the weaknesses of EHS provocation research (15).

A sampler of growing international opposition to 5G network rollouts

In 2017 an international 5G Appeal was launched by scientists and doctors who are calling for the EU to halt the roll out of 5G due to serious potential health effects from the technology. As of April 24, 2019, 231 scientists and medical doctors have signed the appeal (16).

- **March 24**, 2019: Portland Oregon city officials in the US stated their opposition to the installation of 5G networks around the city, supported by the mayor and two commissioners. The city officials considered that 5G health risks were not well enough understood to warrant installations (17).
- **March 28**, 2019: Florence, Italy, applied the precautionary principle by refusing permission for 5G infrastructure and referring to "the ambiguity and the uncertainty of supranational bodies and private bodies (like ICNIRP)", which "have very different positions from each other, despite the huge evidence of published studies"(18).
- **March 28**, 2019: The Roman district "XII Municipality of Rome" voted against allowing 5G trials, with other districts expected to follow. Other motions to stop 5G

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are expected in the four regional councils, one provincial council and other municipal councils of Italy (19).

- **April 1**, 2019: Plans for a pilot project to provide high-speed 5G wireless internet in Brussels have been halted due to fears for the health of citizens, Environment Minister Céline Fremault said that "The people of Brussels are not guinea pigs whose health I can sell at a profit. We cannot leave anything to doubt" (20).
- **April 4**, 2019: The House of Representatives of the Netherlands expressed its concern over the possible health risks of radiation from the new 5G network. Political parties want to know as a matter of urgency what the dangers are before 5G is rolled out on a large scale (21).
- **April 5**, 2019: The California Supreme Court Justices unanimously upheld a 2011 San Francisco ordinance requiring telecommunications companies to get permits before placing small cell antennas on city infrastructure (22).
- **April 8**, 2019: A petition asking the German Parliament to stop the award of 5G frequencies has reached 54,643 signatures, surpassing the quorum, according to an environmental campaign group called 'Diagnose: Funk'. The German Parliament may decide to suspend the procedure to award 5G frequencies based on "scientifically justified doubts about the safety of this technology", according to the petition (23).
- **April 9**, 2019: Switzerland's 3rd largest region, Canton of Vaud adopted a resolution calling for a moratorium on 5G antennas until the publication of a report on 5G by the Swiss Federal Office for the Environment (24). Other cantons may follow with further moratoriums (25).
- **April 11**, 2019: Geneva adopted a motion for a moratorium on 5G, calling on the Council of State to request WHO to monitor independent scientific studies to determine any possible harmful effects of 5G.(26)
- **April 20**, 2019: Switzerland announced that it will monitor 5G health risks as a result of a pushback from citizens who claim that 5G emissions present dire health risks (27). Four cantons have now stopped 5G networks, Jura, Geneva, Vaud and Neuchâtel. Comprising 1.5 million people. However, the majority state-owned Swisscom defied these cantons by activating 5G stations in 102 locations by upgrading existing antennas installed for previous generations of wireless technology (28, 29).

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So, what are we to make of all this. Are there valid concerns over the rollout of 5G technology, or is this all needless worry from a misled public, as suggested by those connected with ACEBR and Prof. Simon Chapman?

Validating community concerns

In early 2019 the Policy Department for Economic, Scientific and Quality of Life Policies Directorate-General for Internal Policies (European Commission), was commissioned by the EC’s *Committee* on Industry, Research and Energy (*ITRE*) to prepare an in-depth analysis on the deployment of 5G technology in the EU, the USA, China, Japan, the Republic of Korea, Singapore and Taiwan.

This report, titled *5G Deployment: State of Play in Europe, USA and Asia*, was published in April 2019. The authors point out that the global roll out of 5G is not a short-term race and that “*5G is more complex than previous wireless technologies and should be considered as a long-term project to solve technical challenges and develop a clear business case*”.

As for those “technical challenges” this is mentioned in the executive summary (excerpt):

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> *As 5G is driven by the telecoms supply industry, and its long tail of component manufacturers, a major campaign is under way to convince governments that the economy and jobs will be strongly stimulated by 5G deployment. However, we are yet to see significant "demand-pull" that could assure sales. These campaign efforts are also aimed at the MNOs but they have limited capacity to invest in the new technology and infrastructure as their returns from investment in 3G and 4G are still being recouped. The notion of a "race" is part of the campaign but it is becoming clear that the technology will take much longer than earlier generations to perfect. China, for instance, sees 5G as at least a ten-year programme to become fully working and completely rolled out nationally. This is because the technologies involved with 5G are much more complex. One aspect, for example, that is not well understood today is the unpredictable propagation patterns that could result in unacceptable levels of human exposure to electromagnetic radiation.* (30)

Unpredictable propagation patterns

To visually understand what is meant by those unpredictable propagation patterns mentioned in the EC 5G report it is worthwhile examining an Ericsson PowerPoint presentation, titled *Impact of EMF limits on 5G network roll-out*.

The presentation was prepared by Christer Törnevik, Senior Expert, EMF and Health, Ericsson Research, Stockholm Sweden. The presentation was given at The International Telecommunications Union's (ITU) Workshop on 5G, EMF & Health, Warsaw, Poland on December 5, 2017.

In part, the presentation concluded that with increased human exposure levels from 5G antennas, EMF exposure compliance in some nations will be difficult. To quote: "In countries with EMF limits significantly below the international science-based ICNIRP limits the roll-out of 5G networks will be a major problem"(31).

The 5th Asian and Oceanic IRPA Regional Congress on Radiation Protection (AOCRP-5) Melbourne, Australia, May 20 – 23, 2018

At a recent scientific conference by the Australian Radiation Protection and Nuclear Safety Agency two expert presentations gave reason to pause in the rapid roll out of 5G millimetre waves. The first was by Dr. Dariusz Leszczynski, adjunct professor of biochemistry, University of Helsinki, Finland and chief editor of Frontiers in Radiation & Health, Lausanne, Switzerland. In his presentation, titled *5G Millimetre-Waves Health & Environment*, Leszczynski examined the serious limitations of biomedical research on millimetre waves but from what studies that are available, it should cause great concern.

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He specifically called for the urgent need for research on 5G millimetre waves because of the rapidly ongoing deployment of 5G technology (32).

Another presentation was by Dr. Andrew Wood, School of Health Sciences, Swinburne University of Technology, Melbourne. Titled ‘*What is the current status of research on mm-Wave frequencies’*, Wood mentioned two areas of uncertainty with 5G radiation:

- *Skin and eyes are regions of concern in regard to 5G frequencies (6-60 GHz) and beyond.*
- *Could be resonant enhancement absorption due to skin structures.*(33)

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Possible effects on trees and foliage

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Another possible problem specific to 5G millimeter emissions is that they can be disrupted or blocked by trees and foliage, especially after rain. This creates a potential

problem for suburban streetscapes. Will residents have to choose whether they prefer a pleasant green environment or great download speeds (34)?

The potential problem of trees and 5G reception has not escaped Telstra's notice. To quote from Mike Wright, Telstra's managing director of networks:

> *"Telstra is also funding research into whether uniquely Australian obstacles – including flora – will disrupt 5G signals, which occupy a higher frequency and don't travel as far as other mobile signals. "Something that seems to be unique to Australia, and we found with earlier standards, is how gumtrees impact those radio signals and the way they get from the radio tower to the end user". (35)*

In a September 2018 New Zealand court case the judge ruled, in relation to a property owner's trees blocking a neighbour's wi-fi reception, that *"undue interference with a wi-fi signal caused by trees could constitute an undue interference with the reasonable use and enjoyment of an applicant's land for the purposes of s335 (1)(vi) of the {property law} Act.*" Lawyer and IT specialist Rick Shera said of the case: *"This decision is interesting because it finds that, in some circumstances, neighbour A can require tree trimming, or removal, repair or alteration of a structure, on neighbour B's land, where the trees or structure unduly interfere with the neighbour A's wireless connectivity." (36)*

As 5G transmissions may be more prone to being blocked by trees than wi-fi signals what will be the legal implications if this turns out to be an issue?

An *important question*: Can 5G phased array antennas generate Brillouin precursors?

In early 2002 the New York based technical publication, *Microwave News* published an examination of a rather arcane topic: Brillouin Precursors. The issue at that time was non-ionising radiation from the phased array PAVE PAWS radar facility at Cape Cod, Massachusetts, USA. A Brillouin precursor is a very fast pulse of radiation, which when it enters the human body, may generate a burst of energy that can travel much deeper than predicted by conventional models.

In a *Microwave News* interview with Professor Kurt Oughstun (37), he explained how Brillouin precursors are generated by phased array radar antennas. When asked, "Are Brillouin precursors unique to PAVE PAWS radiation?", Oughstun replied:

> *"No – not at all. As data transmission rates continue to increase, wireless communication systems will approach closer to and may, at some time in the not-too-distant future, exceed the conditions necessary to produce Brillouin precursors in living tissue. (38)*

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It must be pointed out that it is not known if Brillouin precursors would be created by 5G phased array antennas as no research has been done – so this is hypothetical. However, considering the uncertainties mentioned in the recent EC report on 5G, mentioned earlier, this possibility should be investigated:

> *One aspect, for example, that is not well understood today is the unpredictable propagation patterns that could result in unacceptable levels of human exposure to electromagnetic radiation.*

Concluding thoughts

What is apparent in this controversy is that the public's perception of risk and that of some experts defending the technology is at wide variance. The assurances of a complete absence of risk from 5G networks coming from these experts is not reflected in what is known about the many uncertainties which exist with 5G technology and speaks more about their own ignorance than that of concerned communities.

What we are seeing here is an example of what has been defined as *technological fundamentalism*. To quote from Robert Jensen:

> *Technological fundamentalists believe that the increasing use of evermore sophisticated high-energy, advanced technology is always a good thing and that any problems caused by the unintended consequences of such technology eventually can be remedied by more technology. Those who question such declarations are often said to be "anti-technology," which is a meaningless insult. All human beings use technology of some kind, whether stone tools or computers. An anti-fundamentalist position is not that all technology is bad, but that the introduction of new technology should be evaluated carefully on the basis of its effects—predictable and unpredictable—on human communities and the non-human world, with an understanding of the limits of our knowledge.(39)*

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References

1. No 5G in the Blue Mountains, https://www.no5gbluemountains.org/
2. Lewis B.C., “No 5G in the Blue Mountains packs council chamber”, *The Blue Mountains Gazette*, January 31, 2019, https://www.bluemountainsgazette.com.au/story/5878465/move-to-stop-5g-in-the-mountains/
3. ibid.
4. Chapman S., Whack-a-mole: Knocking the “mobile phones cause cancer” claim on the head, January 23, 2019, https://simonchapman6.com/2019/01/23/whack-a-mole-knocking-the-mobile-phones-cause-cancer-claim-on-the-head/
5. Raper A., Sas N., “Huawei-made ‘small cell’ boxes hit suburban Sydney, as residents raise health concerns”, *ABC News*, https://www.abc.net.au/news/2019-01-07/huawei-small-cell-network-comes-to-sydney/10688124
6. ibid.
7. Verrender A., “Phone tower anxiety is real and we’re worrying ourselves sick”, ABC News, January 9, 2019, https://www.abc.net.au/news/2019-01-09/huawei-small-cell-boxes-fuelling-phone-radiation-anxiety/10701856
8. WHO, Interphone study on mobile phone use and brain cancer risk, July, 2010, http://www.euro.who.int/en/health-topics/noncommunicable-diseases/cancer/news/news/2010/7/interphone-study-on-mobile-phone-use-and-brain-cancer-risk
9. Verrender A., “Phone tower anxiety is real and we’re worrying ourselves sick”, *ABC News*, Jan 8, 2019, https://www.abc.net.au/news/2019-01-09/huawei-small-cell-boxes-fuelling-phone-radiation-anxiety/10701856

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10. Maisch D., The sad state of affairs with Bioelectromagnetics Research in Australia, https://www.emfacts.com/2016/11/the-sad-state-of-affairs-with-bioelectromagnetics-research-in-australia/
11. Leszczynski D., Open Letter on the Electromagnetic Hypersensitivity Research, February 4, 2018, https://betweenrockandhardplace.wordpress.com/2018/02/04/open-letter-on-the-electromagnetic-hyper-sensitivity-research/
12. Maisch D., "A historical revisit to ACEBR's questionable provocation testing", March 27, 2019, https://www.emfacts.com/2019/03/a-historical-revisit-to-acebrs-very-questionable-provocation-testing/
13. Adjunct Professor of Biochemistry, University of Helsinki Finland (retired), and Chief Editor of "Radiation and Health" specialty, Frontiers in Public Health, Lausanne, Switzerland.
14. Maisch D., as above.
15. Leszczynski D. ibid.
16. The 5G Appeal, http://www.5gappeal.eu/scientists-and-doctors-warn-of-potential-serious-health-effects-of-5g/
17. Satney J., "Portland Official's Attempt To Block 5G Network Installation Over Health Risks", *PrepForThat* , March 24, 2019, https://prepforthat.com/portland-blocking-5g-networks-over- health-risks/
18. *Oasi Sana*, "Florence brakes on 5G and applies the Precautionary Principle". 28 March 2019, https://oasisana.com/2019/04/05/provoca-danni-al-corpo-firenze-frena-sul-5g-e-applica-il-principio-di-precauzione-approvata-con-voto-quasi-unanime-la-mozione-in-difesa-della-salute-notizia-esclusiva-oasi-sana/
19. *Terra Nuova Italy*, "A Municipality of Rome votes against 5G: what will the Giunta do?",https://www.terranuova.it/News/Attualita/Un-Municipio-di-Roma-vota-contro-il-5G-cosa-fara- la-Giunta
20. *The Brussels Times*, "Radiation concerns halt Brussels 5G development, for now", 01 April 2019, http://www.brusselstimes.com/brussels/14753/radiation-concerns-halt-brussels-5g-for- now
21. *AD Netherlands*, "Chamber wants radiation research first, then 5G network", 4 April 2019,https://www.ad.nl/tech/kamer-wil-eerst-stralingsonderzoek-dan-pas-5g-netwerk~ab567cd6/
22. Egelko B., "California Supreme Court Sides with Cities in Small Cell Faceoff", *San Francisco Chronicle*, April 5, 2019, https://zero5g.com/2019/california-supreme-court-sides-with-cities- in-small-cell-faceoff/
23. *Telecompaper*, "Germans petition Parliament to stop 5G auction on health grounds",https://www.telecompaper.com/news/germans-petition-parliament-to-stop-5g-auction-on-health-grounds–1287962
24. del sol Beaulieu J., "5G moratorium in Switzerland", *Take Back Your Power*, 9 April 2019,https://takebackyourpower.net/5g-vaud-switzerland-adopts-moratorium/

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25. *LE TEMPS*, "5G: after the Vaud moratorium, the storm", 9 April 2019, https://translate.google.com/translate?sl=fr&tl=en&u=https%3A%2F%2Fwww.letemps.ch%2Fsuisse%2F5g-apres-moratoire-vaudois-tempete
26. *LE TEMPS*, " Geneva adopts motion for a moratorium on 5G, 11 April, 2019, https://www.letemps.ch/suisse/geneve-adopte-une-motion-un-moratoire-5g
27. Satney J., "Switzerland Says It Will Monitor 5G Health Risks" April 20, 2019, *Prefotthat.com*, https://prepforthat.com/switzerland-to-monitor-5g-health-risks/
28. Hardell L., "Deployment of 5G stopped in Switzerland, Lennart Hardell's blog, https://lennarthardellenglish.wordpress.com/2019/04/24/deployment-of-5g-stopped-in-switzerland/
29. del sol Beaulieu J., "5G: Swiss Telcos Ignore Official Laws and Launch 5G; Rule Of Law Under Attack", *Tale Back Your Power*, 23 April 2019, https://takebackyourpower.net/5g- swiss-telcos-ignore-laws-and-launch-5g-rule-of-law-under-attack/
30. Blackman C., Forge S., "5G Deployment –State of Play in Europe, USA and ASIA' *European Parliament*, April 2019, http://www.europarl.europa.eu/RegData/etudes/IDAN/2019/631060/IPOL_IDA(2019)631060_EN.pdf
31. Tornevik C.,"Impact of EMF limits on 5G network roll-out, *ITU Workshop on 5G, EMF & Health* Ericsson Research, Stockholm, December 5, 2017, https://www.itu.int/en/ITU-T/Workshops-and-Seminars/20171205/Documents/S3_Christer_Tornevik.pdf
32. Leszczynski D., Report from the AOCRP-5, May 20-23, 2018, https://betweenrockandhardplace.files.wordpress.com/2018/07/leszczynski-report-from-the-aocrp-5.pdf
33. Wood A., "What is the current status of research on mm-wave frequencies?-in relation to health". May 18, 2018, https://betweenrockandhardplace.files.wordpress.com/2018/06/emerg_may18_wood_wide_no-pics.pptx
34. Wooding D., "5G TREE THREAT, New 5G phone system could face reception problems from trees with too many leaves, *The Sun*, March 18, 2018, https://www.thesun.co.uk/news/5838497/5g-phone-system-reception-problems-trees/
35. Hatch P., 'Telstra pushes for 5G that Works in Australia, *The Sydney Morning Herald*, January 9, 2017, https://www.smh.com.au/business/telstra-pushes-for-5g-that-works-in-australia-20170109-gto0gz.html
36. Keall C., Property owner can be forced to cut trees if they interfere with a neighbour's Wi-Fi, judge says, *New Zealand Herald*, September 18, https://www.nzherald.co.nz/business/news/article.cfm?c_id=3&objectid=12127228
37. Dr. Kurt Oughstun is a professor of electrical engineering and mathematics at the University of Vermont, Burlington. He has done extensive work on the propagation of extremely short electromagnetic pulses through different types of materials, and

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is the author of more than 50 published papers, as well as the textbook *Electromagnetic Pulse Propagation in Causal Dielectrics* with G.C. Sherman (Berlin: Springer-Verlag, 1994).

38. Slesin, L., Brillouin Precursors 101 with Professor Kurt Oughstun, *Microwave News*, Vol 22, No. 2, March/April 2002, pp. 10-11, https://microwavenews.com/news/backissues/m- a02issue.pdf
39. Jensen R., "Technological Fundamentalism", *Counterpunch*, January 28, 2011, https://www.counterpunch.org/2011/01/28/technological-fundamentalism-2/

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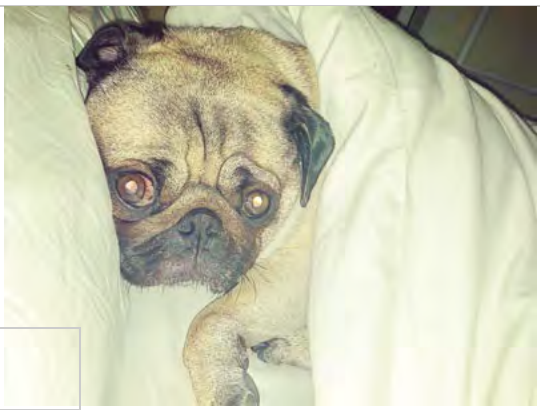

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Misleading opinion on 5G small cells presented by the ABC News in Australia
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Leszczynski: Summary of the forthcoming Opening Lecture at the EMF Symposium in Mainz, Germany
In "Mobile phones and health"

Guest Blog: "Can 5G phased array antennas generate Brillouin precursors?" by Don Maisch
In "Mobile phones and health"

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This entry was posted in **Mobile phones and health**, **Science journalism and blogging** and tagged **2011**, **4G**, **4G/LTE**, **5G**, **5G Appeal**, **ABC News**, **ACEBR**, **Adam**

Verrender, **alarmism**, **Andrew Wood**, **AOCRP-5**, **ARPANSA**, **Australia**, **Australian Centre for Electromagnetic Bioeffects Research**, **Blue Mountains**, **Brillouin precursors**, **cell phone**, **cell phone radiation**, **Christer Tornevik**, **CSIRO**, **Dariusz Leszczynski**, **David McDonald**, **Don Maisch**, **EHS**, **electomagnetic sensitivity**, **electromagnetic hyper-sensitivity**, **foliage**, **Geza Benke**, **health effects**, **IARC**, **ICNIRP**, **Interphone**, **IoT**, **IRPA**, **Katoomba**, **Kurt Oughstun**, **Louis Slesin**, **Mark Greenhill**, **Melbourne**, **Microwave News**, **Mike Wright**, **millimeter waves**, **millimetre waves**, **mobile phone**, **Monash University**, **nocebo**, **PAVE PAWS**, **safety limits**, **safety standards**, **Simon Chapman**, **streetscapes**, **Sue Cappadonna**, **Swinburne University of Technology**, **Sydney**, **Sydney University**, **telecoms**, **Telstra**, **trees**, **wifi** by **dariuszleszczynski**. Bookmark the **permalink [https://betweenrockandhardplace.wordpress.com/2019/04/25/guest-blog-from-dr-don-maisch-australia-are-community-concerns-over-the-5g-network-rollout-based-on-unfounded-anxiety-or-valid-evidence/]** .

5 THOUGHTS ON “GUEST BLOG FROM DR. DON MAISCH, AUSTRALIA: ‘ARE COMMUNITY CONCERNS OVER THE 5G NETWORK ROLLOUT BASED ON UNFOUNDED ANXIETY OR VALID EVIDENCE?’”

Pingback: The first report of 5G injury from Switzerland | i am a malaysian

Pingback: Guest Blog from Dr. Don Maisch, Australia: ‘Are community concerns over the 5G network rollout based on unfounded anxiety or valid evidence?’ – EMRSA

Tom Whitney
on **April 27, 2019 at 04:02** said:

Corrigendum: The 4th sentence of my Ryde paragraph should read – “The trend of replacing macro cells with small cells is analogous to the trend to replace high-wattage centre of the room light fixtures with multiple low-wattage pot lights.”

Tom Whitney
on **April 27, 2019 at 00:19** said:

“Are community concerns over the 5G network rollout based on unfounded anxiety or valid evidence?” This is not a binary question that can be answered with a simple yes or no

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No scientific data supports definitive answers to questions about the existence or nonexistence of health risks related to electromagnetic fields. More research to produce more reliable information is needed before any firm conclusions can be drawn. However, it can be said is that many scientists on both sides of the question agree we are dealing at most with rare diseases and an increased risk that is very small, especially compared with life’s other everyday risks.

In the case of the concerns of the Blue Mountain community, they are probably unfounded anxiety. I say this because the 3.5 GHz frequency band falls between the two Wi-Fi bands and has been used in WiMAX applications for a few decades. There is no mystery as to what it can and cannot do; and there is no reason to find it any scarier than existing 3G & 4G exposure.

As for the Ryde, Sydney concerns of increased exposures from small cells: probably unfounded! As Dariusz and others have pointed out, a lot of the exposure to people comes from their own wireless device close to the body – and the amount of this exposure is controlled by the quality of the base station signal. A strong signal from a nearby transmitter means that the mobile output power will be reduced. And many small cells provide a more homogenous distribution of the signal. The trend of replacing small cells with macro cells is analogous to the trend to replace high-wattage centre of the room light fixtures with multiple low-wattage pot lights. There is every reason to believe that multiple small cells will lead to lower personal exposure.

And your “important question: Can 5G phased array antennas generate Brillouin precursors?”
Firstly, as frequency is increased the absorption is reduced. At mmWave frequencies almost all of the signal will be reflected, with only a tiny amount absorbed by the outermost layer of skin – and any resulting heat will be dissipated as fast as it is absorbed. Furthermore, 5G signals are not pulse-modulated. So, this concern is also based on unfounded anxiety.

By the way, all panel and patch antennas are ‘phased array’ antennas. This not not a new thing for 5G!

dave
on **April 26, 2019 at 21:04** said:

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Why is it so hard to understand that emf at certain frequencies can cause harm… we are bio electric beings and even micro volts can have an effect on the human (and animal) nervous system?Anyone overlooking possibilities of damage is very suspicious (are they punting for the industry?)

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The Prevalence of People With Restricted Access to Work in Man-Made Electromagnetic Environments

Michael Bevington
Michael Bevington

Article information

Abstract

Some surveys have identified people who have restricted access to work in environments with man-made electromagnetic exposures. This study attempts to determine their prevalence, an aspect not previously investigated in its own right. It is based on analyses of the two different types of surveys of people with Idiopathic Environmental Intolerance attributed to Electromagnetic Fields (IEI-EMF), or Electromagnetic Hyper-Sensitivity (EHS), either of the general population or of people with IEI-EMF/EHS. In addition, there are different definitions of IEI-EMF/EHS, with a range of subconscious, mild, moderate or severe symptoms, potentially leading in three stages to hyper-sensitivity. The current evidence is assessed as indicating that, in addition to subconscious sensitivity, the prevalence of IEI-EMF/EHS is between about 5.0 and 30 per cent of the general population for mild cases, 1.5 and 5.0 per cent for moderate cases and < 1.5 per cent for severe cases. The prevalence of people restricted in their access to work in a man-made electromagnetic environment is estimated at 0.65 per cent of the general population, at about 18% of the general population with moderate IEI-EMF/EHS. The estimate of 0.65% equates to 435,500 people in the UK's population of 67 million. Some reasons for possible under-reporting are discussed. Adjustments can enable some people with this disability to remain in employment, suggesting that rates of restriction in access to work may fall as employers become aware of what adjustments are needed.

Introduction

Some surveys have tried to assess the prevalence of employment among people affected by man-made electromagnetic environments. This condition is known as Idiopathic Environmental Intolerance attributed to Electromagnetic Fields (IEI-EMF), or Electromagnetic Hyper-Sensitivity (EHS), and also as Radio Wave Sickness or Intolerance, Microwave Sickness, or Electrosensitivity. There are two types of surveys, either large-scale of the general population, or small-scale and limited to people with IEI-EMF/EHS. Both depend on a method of identifying people with IEI-EMF/EHS.

The differences between the two types of survey are not necessarily a problem. Once the percentage of the general population with IEI-EMF/EHS is known, surveys limited to people with IEI-EMF/EHS can be evaluated in the light of this percentage. Some surveys of the general population are here estimated to show that about 18% of people classified as having IEI-EMF/EHS with moderate symptoms are restricted in access to work.

The criteria for the diagnosis of IEI-EMF/EHS are a greater problem. Many surveys have relied on self-diagnosis, without external objective analysis. The World Health Organization Backgrounder (WHO 296, 2005) did not provide a clear diagnostic test. Only recently have multi-systemic tests been proposed as suitable for diagnosis (Belpomme, et al. 2015).

The two proposed aetiologies of IEI-EMF/EHS are not an issue, since either aetiology could lead to restricted access to work. The psychological aetiology is based on failures to find a comprehensive association between exposure and conscious symptoms, suggesting instead a nocebo effect or electrophobia during sham sessions (Eltiti, et al. 2018; Rubin, et al. 2010), dependent on media reports, which can vary between countries (Tseng, et al. 2013), and related to personality traits (Boehmert, et al. 2018;Johansson A, et al. 2010;Withoff, et al. 2018).The alternative, physiological, aetiology, possibly characterising an essentially different condition (Bogers, et al. 2018; Dieudonné, 2016) is based on individual provocation cases (McCarty et al, 2011; Rea, et al. 1991), cerebral blood scans (Irigaray, Lebar, et al. 2018), 3d fMRI (Heuser, et al. 2017) and genetics (De Luca et al, 2014), dependent on mechanisms such as voltage-gated calcium channels (Pall, 2013), cryptochromes (Sherrard, et al. 2018) and oxidative stress (Irigaray, Caccamo, et al. 2018).

There is a growing awareness of the issues concerning people with IEI-EMF/EHS and the duties of society towards them (Johansson, 2015). The analysis presented here is the first to be concerned primarily with restricted access to work.

Two types of surveys of people unable to access work

Surveys of the general population: Most epidemiological surveys have assessed the prevalence of IEI-EMF/EHS in the general population according to their own criteria, by questions on conscious symptoms. Although all humans are naturally sensitive to electromagnetic fields in the form of, for instance, solar radiation, these surveys have concerned only conscious and adverse symptoms of sensitivity, from man-made technology. They have necessarily included people with mild, moderate and severe symptoms of IEI-EMF/EHS. This wide range of sensitivity has age-related differences (Redmayne et al. 2015).

The estimated proportion of the general population with IEI-EMF/EHS has varied considerably, depending on a survey's minimum requirements in terms of the number and extent of the symptoms needed to classify a person with IEI-EMF/EHS. Where the classification is looser, including a wider a range of people with IEI-EMF/EHS, the proportion of the general population with IEI-EMF/EHS may be higher. These cases are likely to include many mild ones, where the condition is less disabling and therefore a smaller subsection is likely to be restricted in access to work. The converse also applies, where a more demanding range of symptoms gives a smaller proportion of the general population, but the cases are likely to be more severe, with a larger subsection identified as restricted in access to work.

The validity of this analysis is apparent from some of the literature. In population-based surveys the prevalence of IEI-EMF/EHS has ranged from 1.5% in Sweden (Hillert et al. 2002), at a low level, to over 30% in Austria (Schröttner, et al. 2008), with an average value for some surveys at 3.6% (Table 1). The comparatively high value of 4.6% (Huang, et al. 2018) was for a survey in Taiwan which did "not find a higher risk of being unable to work in participants with IEI-EMF". In fact the survey asked only whether the person was employed, and not about any restriction on access to work, and its combined percentage of out of work and unable to work was, unusually, lower for people with IEI-EMF/EHS than others, despite its finding that 0.58% of the general population had impairment of daily activities because of their IEI-EMF/EHS.

Table 1: Surveys of the general population showing the prevalence of people with IEI-EMF/EHS with restricted access to work.

Study	Number of general population surveyed	Percentage (and number) of general population classified with
Tseng, et al. 2011	1,197	13.3 (104)
Carlsson, et al. 2005	13,381	2.7 (367)[1] 13.5 (1812)[2]
Eltiti, et al. 2007	3,633	4.0 (145)
Huang, Li, et al. 2018	3,303	4.6 (155)
Hojo, et al. 2016	1,306	4.59 (60)
Levallois, et al. 2002	2,072	3.2 (68)
Baliatsas, et al. 2014	5,073	3.5 (202)
Hillert, et al. 2002	10,439	1.5 (166)
Mean (with Tseng and Carlsson)		6.4
Mean (without Tseng and Carlsson) [5]		3.6

[1]'Other (non-lighting) electrical equipment': some or much annoyance.

[2] Visual display unit (VDU) and Fluorescent tube lighting (FTL): some or much annoyance.

[3] The differential of the combined percentage for out of work and unable to work, for IEI-EMF compared with non IEI-EMF. This negative figure implies proportionately more people with IEI-EMF than non IEI-EMF were working.

[4] The difference in the per centage unemployed, excluding students, between controls identified by screening as EHS and all controls; the differential for homeworking was 12%.

[5] The figures from Tseng, et al. 2011, and Carlsson, et al. 2005, appear to be outliers. Therefore, they are omitted from the averages.

[6] Excluding Huang, Li, et al. 2018, where the anomalous value of -0.63 [see note 3] does not appear to relate to the final column recording severe symptoms, unless Taiwanese employers had already made the necessary adjustments for people with severe cases of IEI-EMF/EHS. The survey's contacts were made by telephone; severe cases of IEI-EMF/EHS often cannot tolerate EMFs from a corded or especially a wireless telephone.

In contrast, a survey which found a relatively lower percentage, identifying 3.2% as having IEI-EMF/EHS in California (Levallois et al. 2002), concluded that "being unable to work might be a consequence of the disorder for the more severe cases". Extrapolated figures give 0.52% of the general population as facing restrictions in accessing work because of IEI-EMF/EHS, similar to the Taiwan figure of 0.58% with impairment of daily activities. In the Swedish survey which found 1.5% with IEI-EMF/EHS (Hillert et al. 2002), rates of unemployment, sick leave and early retirement were higher for those identified as having IEI-EMF/EHS compared with others without IEI-EMF/EHS, by up to 2.7 times. It concluded that those with IEI-EMF/EHS "appeared to have a lower capacity for work", based on 51.8% of those with IEI-EMF/EHS working (compared with 61.1% of others), 12.1% unemployed (4.4% others), 2.5% on sick leave (1.6% others), and 7.7% on early retirement or disability pension (3.8% others). This gives 12.5% of the people classified as having IEI-EMF/EHS as restricted in access to work. In terms of the general population, this is equivalent to 0.19%.

Surveys of people with IEI-EMF/EHS: Where a study is restricted to people with IEI-EMF/EHS, and especially where they are people with a severe rather than mild form of IEI-EMF/EHS, it is likely that a higher proportion will be found to have no, or restricted, access to work. The few studies of this type so far have been limited in scale but half those listed have found between 50% and 67% of their respondents with no, or restricted, access to work (Table 2).

Table 2: Surveys of people with IEI-EMF/EHS showing the prevalence of people with IEI-EMF/EHS with restricted access to work

Study	Funding: Government Agency (GA), or Independent (Ind.) and various	Number of IEI-EMF/EHS referents
Gibson, et al. 2015	Ind.	465 (IEI)
UK, 2019 current[3]	Ind.	36
Kato, et al. 2012	Ind.	75
Johansson A, et al. 2010	Center for Env. Res., Umeå	71
Levallois, et al. 2002	GA: PUC	68
IDEA, 2005	Ind.	16
Arnetz, et al. 1997	GA: NIRP	116 [4]
Hojo, et al. 2016	Ind.	82
Kjellqvist, et al. 2016	Center for Env. Res., Umeå	114
Johansson A, et al. 2010	Center for Env. Res., Umeå	0
Andrianome, et al. 2018	GA: ANSES	52
Blomkvist, et al. 1993	GA: Swed. Found. for Occup. H&S	1,650

[1] Restricted access to work, including: decreased income,disability pension, early retirement, reduced work, sick leave, unable to work, unemployed, work transfer.

[2] Of the 34% in work, 15% worked full or part time from or inside the home, compared with 18% who worked full or part time outside the home. 31% held university degrees. 22 % were recorded as homeless at some time, and 4% were currently homeless. IEI was called environmental sensitivity, comprising chemical and electrical sensitivity.

[3] Analysis of 36 cases of IEI-EMF/EHS reported in UK printed media 2006-2017, including access to work (unpaid) categorized as applicable to one parent-carer, one university student, and two school pupils. Of the 9 remaining in work, 6 had adjustments made for them to continue in work.

[4]A 1993 study of 133 visual display unit (VDU) workers in Sweden, of whom 87% (116) reported sensitivity to health symptoms and 10% (13) hyper-sensitivity (EHS). 35% (47) were unable to use a VDU for more than 3 hours per day without experiencing symptoms.

[5] The aggregated difference between the combined totals for unemployed and homeworker compared with controls.

[6]'Mobile Phone' symptoms, as opposed to 'general EHS'.

A survey of 16 people with IEI-EMF/EHS in Ireland found that 50% were unable to work (IDEA, 2005). A survey of 75 people with IEI-EMF/EHS in Japan found that 50% of 40 had lost their jobs and that, overall, 65% had lost work or experienced a decrease in income after the onset of IEI-EMF/EHS (Kato, et al. 2012). A study in the USA concerned with only severe cases of environmental sensitivities, including IEI-EMF/EHS, reported 67% unemployed out of 465 subjects (Gibson et al. 2015), where it was stated: "We consistently find in my lab that (unless we request working participants), two-thirds of study participants are unemployed" (Gibson, 2017).A similar proportion of unemployment was found among 71 subjects with EHS in Sweden, where only 16% were employed (compared with 73% among 106 controls), 60% were on sick leave or disability pension (16% controls), and 17% were unemployed or retired (11% controls) (Johansson A, et al. 2010).

To help validate these findings, which relied on online, paper or telephone questionnaires among self-help groups, relevant media reports were analyzed on 36 individuals or groups with IEI-EMF/EHS published in the U.K. between 2006 and 2017 (UK Survey, 2019, Table 2, Supplementary Data). These reports often involved a personal interview by a skeptical journalist, who could more objectively assess how far the subject could access work or needed adjustments. Of the 32 relevant cases of people with IEI-EMF/EHS who started as paid workers, 24 (75%) had been employed and 8 (25%) had been self-employed. Four others comprised of one parent child-career, one university student, and two school pupils. Of the 36 cases, 24 (67%) stopped working, retired early, or left their place of education, 3 (8%) died, one from a brain tumor and two by suicide, and only 9 (25%) continued in work. Of the nine who continued working, five cases were in or before 2006 when the amount of man-made radiation was lower than now. Six were able to continue work after adjustments were made to their electromagnetic environment by the employer or the self-employed person. The overall result of 67% of people with severe IEI-EMF/EHS being unable to continue work or find work is comparable with the range of 60% to 67% listed above among similar groups in Japan, Sweden, the USA and elsewhere.

Discussion

Numerical relationship between the two types of studies of the prevalence of people restricted in access to work

The percentage of the general population unable to access of work because of IEI-EMF/EHS deduced from surveys of the general population varies from 0.19% to 2.4% (Table 1). It is here argued that 0.65%, the mean of four lower figures, can be considered a valid average, given the nature of the evidence.

The low figure of 0.19% of the general population with restricted access to work comes from the detailed survey in Sweden of 10,439 respondents in the general population (Hillert, et al. 2002). This found 1.5% of the population with IEI-EMF/EHS, with a differential for restrictions on work of 12.5%, giving 0.19% of the general population restricted in access to work. A survey in 2007 of 1,197 people in Taiwan gave an extrapolation of 2.4% as having restricted access to work, but this survey identified 13.3 % as having IEI-EMF/EHS, a figure later reduced for Taiwan to 4.6% (Huang, et al. 2018). The latter's finding of +0.58% for impairment of daily activities from IEI-EMF/EHS did not match the -0.63% restrictions on work. In other words, more people with IEI-EMF/EHS, despite their impairments, were in work than the controls, which from other surveys seem unlikely. In addition, this survey did not ask about disability pensions, part-time work or early retirement, and was conducted by telephone, whereas severe cases of IEI-EMF/EHS cannot use telephones. Another study found 4.0% of 3,633 members of the UK general population had IEI-EMF/EHS (Eltiti, et al. 2007). In study 2 it found that 74% of people with IEI-EMF/EHS, or 1.8% of the general population, were classified as having severe symptoms, and these people may be considered most likely to suffer restrictions on access to work. However, since there was no direct assessment of access to work, this figure must be treated cautiously and preference given to other lower figures.

Another approach for assessing the relationship between the two types of surveys, of the general population (Table 1) and of people with IEI-EMF/EHS (Table 2), where the referents are often accessed via self-help groups, is to estimate the number of people with an environmental health condition typically in contact with specialised national self-help groups. Allergy UK in 2017 had 11,383 contacts through its helpline, webchat and by email out of 21 million people with an allergy, at 0.054% (The British Allergy Foundation, 2017). Asthma UK in 2017 had 93,000 downloads of online Action Plans out of 5.4 million people with asthma, at 1.7% (Asthma UK, 2017). Applying these proportions of 0.054% - 1.7% to Electrosensitivity, UK's distribution of 710 printed newsletters in September 2018 (Electrosensitivity UK, 2018) would produce a national prevalence of 0.062% - 1.94%, meaning that the general population with restricted work, based on 67% of people with IEI-EMF/EHS, would be 0.042 - 1.3%, with a midpoint of 0.67%.

These figures show some overlap with the figures of 0.19–2.4 % deduced from general population surveys and the figures of 0.58-2.3% of people with severe symptoms from IEI-EMF/EHS. The mean figure of 0.65 %, suggested here from extrapolations from general population surveys, is close to the average of 0.67% based on UK charity contacts. It is only half of the 1.2% for severe symptoms, but these are less reliable guides to restricted access to work for people with IEI-EMF/EHS than actual surveys. Three of the general population surveys appeared reasonably consistent in giving an average rate of about 15.9% (range 12.5 – 22.1%) for people with IEI-EMF/EHS having restrictions on access to work. For the UK's population of 67 million, the survey mean of 0.65% gives 435,500 people affected in this way.

Prevalence of restricted works in terms of (i) symptom severity and (ii) stages in the progress of IEI-EMF/EHS, and (iii) compared with visual impairment

(i) Subconscious, mild, moderate and severe symptoms: some of the wide variety of the reported prevalence of IEI-EMF/EHS can be explained by the wide variety of definitions typically used. This especially applies to the four ranges of severity in symptoms among the general population, here estimated at: subconscious 30 – 80 %, mild 5 –30 %, moderate 1.5 – 5 %, and severe < 1.5 %.

Subconscious symptoms from man-made electromagnetic exposure cover most of the general population, just as all people are affected by, for instance, natural electromagnetic exposure in the form of solar radiation. Although the effects may include conscious ones, they depend on chronic subconscious exposures, usually in a dose-response relationship, as in a study of 180 respondents near a phone mast (Eger, et al. 2010). A study of 217 students at two schools found an association with a general decrease in motor skills, spatial working memory and attention in the school with higher levels of radiation from base stations (Meo, et al. 2018). This dose-response sensitivity was also evident near base stations in Austria, where, of 336 residents, in the highest exposure category 79% reported headaches and 76% concentration difficulties (Hutter, et al. 2006); these and five other health effects, cold hands or feet (62%), sweating (40%), palpitations (38%), vertigo (32%) and loss of appetite (24%), all showed increased incidence for each higher exposure level. The difficulty of attributing effects may explain how 70% of 587 students complained of headaches whereas only 6.8% related these directly to mobile phone use (Szyjkowska, et al. 2005). Another study implied that up to 40% of adults may have subconscious sensitivity owing to their chronic inflammatory or immune conditions, based on responses by 90% of 64 subjects (Marshall, et al. 2017). For long-term occupational exposure 51% reported cardiovascular impairments (Bortkiewicz, et al. 2012).Cancer, which can be considered as a symptom of IEI-EMF/EHS, increased from 0.00313 to 0.00767 % incidence for 967 persons within 400m of a phone mast after 5 years' exposure, and elsewhere to 0.0129 % within 350m, with a 10.5 relative risk for women but only 1.4 for men (Kundi, et al. 2009) perhaps reflecting greater female IEI-EMF/EHS sensitivity. Since it is difficult for an individual to identify the exposure source when symptoms are triggered subconsciously, most surveys based on self-diagnosis do not cover these effects.

Mild forms of self-reported IEI-EMF/EHS are often characterized as specific sensitivities and intolerances to specific EMF devices, typically up to about 30% of the general population. A survey of 2,048 of the general population found 29.3 % who were "slightly disturbed" (Schröttner, et al. 2008). Of 1,375 respondents "20.9% of our study population was electrohypersensitive according to our definition" (Mohler, et al. 2010), although other authors would define "hypersensitive" more narrowly. Some studies in this range overlap the previous, subconscious, category. A study of inhabitants near a base station found a prevalence of 28.2% for the most common symptom associated with exposure and over 20% for 5 other symptoms, compared with none among controls (Abdel-Rassoul, et al. 2007). At this level IEI-EMF/EHS is usually seen in a dose-response relationship to the EMFs and is often called 'intolerance' or 'sensitivity', but not 'hyper-sensitivity'.

Moderate levels of conscious reactions are more often described as 'hyper-sensitivity' or IEI-EMF/EHS. These are typically found in about 5% or under of the population. Among 2,048 Swiss respondents, 5% were classified as 'EHS' (Schreier, et al. 2006). "Intolerance" to EMFs was used for 2.7% of 3,406 Swedish and 1.6% of 1,535

Finnish respondents (Karvala, et al. 2017).Moderate and severe forms of IEI-EMF/EHS can be non-linear in the relationship of the severity of symptoms and the exposure, rather than dose-response as in mild and subconscious forms.

Severe forms of IEI-EMF/EHS, below the 1.5 - 5.0% of the general population with moderate symptoms, are most likely to lead to restrictions on access to work. Here it is suggested that these severe symptoms are found in about 1.2 % of the general population, based on a mean from the range 0.58 - 2.3 % (Table 1), or 33% of people with moderate IEI-EMF/EHS, averaged at 3.6%, as having a severe form. One study argued that "The results show that very electrosensitive people do exist and are more common in groups reporting EHS", and that while 2% of the general population were "very sensitive individuals", "more than 11% of the EHS persons were classified as very sensitive" (Schröttner, et al. 2007). Here it is also suggested that about a half the people with severe IEI-EMF/EHS, at 0.65% of the general population, based on a mean for the range 0.19 – 1.44% (with 2.4% as an outlier) face restrictions in access to work(Table 1).

(ii) Three stages in the progress of IEI-EMF/EHS: the condition of IEI-EMF/EHS often develops over the years, starting with mild and occasional sensitivity to a single device, but moving into moderate or severe hyper-sensitivity to many sources of EMFs. IEI-EMF/EHS was divided into three stages by A.G. Panov and N.V. Tyagin in 1966 (Petrov, 1970). Its progression is considered non-linear, since adaptive immunological reactions can restore a limited degree of homeostasis in mild forms of IEI-EMF/EHS, as shown in markers for chronic stress reactions (Buchner, et al. 2011), where cumulative effects of Wifi and cordless phones were sometimes seen as reinforcing the phone mast effects. The term 'electromagnetic hyper-sensitivity' is usually reserved for the final and most severe stage, with more frequent and more intense reactions (Hecht, 2012). Only a few surveys have attempted to differentiate the three stages of IEI-EMF/EHS, but some have distinguished between the lengths of EMF exposure (Baliatsas, et al. 2012), or found that most people with IEI-EMF/EHS reported that their "hyper-sensitivity started after high-dose or long-term EMF exposure" (Gruber, et al. 2018).

(iii) The prevalence and severity of IEI-EMF/EHS compared with visual impairment: the variations in prevalence and severity of IEI-EMF/EHS can be paralleled in some respects with visual impairment and loss (Table 3). About 25% of children suffer visual impairment in the form of myopia, usually corrected with glasses (Williams. et al. 2015), while some 30% of the population has limited sensitivity to a specific EMF device, which they may be able to avoid. About 3.0% of the population suffers visual loss, while a mean of about 3.6% of the population suffers IEI-EMF/EHS with moderate severity. About 0.54% of the population is registered blind or partially sighted (UK NHS, 2018), while 0.65% of the population is estimated here as restricted in access to work because of IEI-EMF/EHS(Table 1).

Table 3. Comparison of the prevalence and severity of (a) IEI-EMF/EHS and (b) Visual Impairment and Visual Loss

	(a) IEI-EMF/EHS Sub-conscious effects[1]	IEI-EMF/EHS Mild symptoms[2]	IEI-EMF/EHS Moderate symptoms (estimated mean)[3]	IEI-EMF/EHS Severe symptoms (estimated mean)[4]	IEI-EMF/EHS Restricted work (estimated mean)[5]	(b)Visual Impair-ment: Myopia (children)[6]	Visual Loss [7]	Visual Loss: Registered blind or partially sighted [8]
Percentage (general population)	79	29	3.6	1.2	0.65	25	3	0.54
Number (UK, 67 million)	52,930,000	19,430,000	2,412,000	804,000	435,500	16,750,000	2,000,000	360,000

[1]Long-term exposure at high levels > 0.5 mW/m^2 [= > 500microW/m^2] (Hutter, et al. 2006).

[2](Schröttner, et al. 2008).
[3,4,5]Table 1.
[6](Williams, et al. 2015).
[7](UK NHS, 2018).
[8](UK NHS, 2018).

Temporal changes in the prevalence of (i) IEI-EMF/EHS and (ii) restrictions in access to work

(i) Temporal changes in the prevalence of IEI-EMF/EHS: A temporal change in prevalence with a reduction in perceived symptoms of sensitivity is evident from the two Taiwan surveys, unless it depends on different definitions: from 13.3% in 2007 (Hedendahl, Let al. 2015), it fell to 4.6% by 2012 (Huang, et al. 2018). This was also true in the UK, where it fell from 11% of 3,600 respondents with "some sensitivity" in 2004 (Mild, 2004) to 4% in 2007 (Eltiti, et al. 2007). In contrast, Swedish prevalence remained at 3.1 or 3.2% from 1999 to 2007 (The Swedish National Board of Health. 2009. p.192), although another Swedish survey gave 1.5% in between in 2002 (Hillert, et al. 2002).

If correct, a fall may reflect a variety of factors, such as societal attitudes to wireless radiation, including dependence on, and addiction to, devices, as well as possible psychological or physiological adaptation over the time between surveys, along with differences in the surveys themselves. It does not appear that conscious sensitivity has developed to the 50% extrapolated for 2017 (Hallberg, et al. 2006). However, a fall may also reflect an increased acceptance among the general population of ill health as normal, for instance, frequent insomnia, tinnitus or headache. A survey of 526 of the Austrian general population found that 24% would accept a higher health risk from new technologies for the "increased comfort they provided" (Schröttner, et al. 2008). Since the symptoms are also seen as results of aging, this evidence of general worsening health has led IEI-EMF/EHS to be described as the "Rapid Aging Syndrome" (Havas, 2013).

(ii) Temporal changes in the prevalence of restrictions in access to work for people with IEI-EMF/EHS: t
There is limited evidence at present whether the prevalence in restrictions in access to work for people with IEI-EMF/EHS is changing. In the UK survey of 36 cases of people with IEI-EMF/EHS, there appeared to be an increase in numbers of cases after 2004, where cases triggered in each quinquennial period were: 1991-95: 3; 1996-2000: 6; 2001-05: 4; 2006-10: 11; 2011-15: 12 (Supplementary Data). This could reflect the growing use of mobile phones and Wifi from about 2004, but may be an artefact. a 2009-15 general survey (Hojo, et al. 2016) showed people with IEI-EMF/EHS facing work restrictions about 7.5 times higher than a survey in 1997 (Hillert, et al. 2002), and a prevalence of IEI-EMF/EHS of 4.59% compared with a similar survey from 2004 of 4.0% (Eltiti, et al. 2007). On the other hand, if more employers make the necessary adjustments, then restrictions on access to work may be decreasing. This could be offset, however, by more people suffering from IEI-EMF/EHS. Countries adopting long-term exposure guidelines like EUROPAEM 2016 (Belyaev, et al, 2016) could also see a reduction in both IEI-EMF/EHS and restrictions to work. Among 145 Finns unable to work because of IEI-EMF/EHS, avoidance of EMFs removed or lessened symptoms, whereas psychotherapy was useful in only 42% of cases (Hagström, et al. 2013).

Factors behind possible under-reporting of the prevalence of restrictions in access to work

A number of socio-economic factors may help explain why this area of public health has not received greater attention in the literature so far. In addition to any temporal changes, the following factors may be relevant to under-reporting.

(i) Gender difference: a gender difference was found with a factor of 0.77 in sensitivity to ELF currents, where 4.2% women and 1.7% men were very sensible, and 0.6% women and 1.2% men very insensible, and women also had a larger range for perception thresholds than men, 15 times below the mean, compared with 8 for men

(Leitgeb, et al. 2003). Where IEI-EMF/EHS was found to be 3.2% in Sweden in 2007, the gender differential was 1.2%, based on 3.8 % women and 2.6 % men (The Swedish National Board of Health. 2009. p.192). Since in some cultures female employment has in the past been socially less the norm than male, unemployment in severe cases may have been under-reported where women predominated.

(ii) Difficulty in diagnosing adults with IEI-EMF/EHS: It is often difficult to identify IEI-EMF/EHS and to link EMF exposure with health effects which restrict access to work. In one case a physician with 25 years' experience spent nine months researching before he discovered that he had developed IEI-EMF/EHS (Eberle, 2014). Three out of the four cases in another study showed that it took from 3 to 17 years to identify EMF exposure as a cause of symptoms (Genuis, 2008). Another case (#3, UK survey 2019; Supplementary Data) took 14 years to discover that the cause of her varied symptoms was probably IEI-EMF/EHS; in fact, of the 34 individual adults in this survey, 7 (21%) were graduates of Oxford or Cambridge universities, an unusually high proportion given that these graduates form under 1% of the UK's adult population. In another study 50% of people considered IEI-EMF/EHS had the equivalent of university education compared with 11% of others (Schröttner, et al. 2008), while of 107 with IEI-EMF/EHS, 27.3% were classified as having 'high' education compared with 12.2% as 'low' (Schreier, et al. 2006). No known psychological or neurological factors explain this preponderance towards higher education. Instead, it may reflect the intellectual challenge of linking unseen radiation with ill health, especially given the shortage of information about IEI-EMF/EHS in some medical literature and in some official sources. In Japan it was reported that in 2012 only 1% of the general population had heard of IEI-EMF/EHS (Hojo, et al. 2016). This difficulty of diagnosis may also explain under-reporting in some studies on IEI-EMF/EHS based on self-diagnosis.

(iii) Difficulty in diagnosing children with IEI-EMF/EHS: It can be especially difficult to diagnose IEI-EMF/EHS as the cause of symptoms among children. In one case it took 10 years for physicians and therapists to establish that the child had IEI-EMF/EHS (case 1, Hedendahl, et al. 2015), suggesting that there may be significant under-reporting for children, who need adjustments to prevent restriction or exclusion from their school work situations.

(iv) Difficulty in differential diagnosis of IEI-EMF/EHS and MCS: During the ten years before a survey in 2012-15, IEI-EMF/EHS became the second most common trigger for Multiple Chemical Sensitivity at 26.9%, with 17.1% affected at home and 11.7% at work or school, after construction and renovation (35.1%), whereas it did not feature at all in a survey of 1999-2003 (Hojo, et al. 2018). This link between IEI-EMF/EHS and MCS matches earlier findings (Rea, et al. 1991; Belpomme, et al. 2015), but can make diagnosis difficult, where MCS is a better known and more prevalent environmental intolerance.

(v) Difficulty in differential diagnosis of IEI-EMF/EHS and cancer: markers for some cases of IEI-EMF/EHS, such as genetic haplotypes (De Luca, et al, 2014) and chronic inflammation and oxidative stress (Irigaray, Caccamo, et al. 2018), are also linked with cancers, a common health outcome among many people with IEI-EMF/EHS, related by dose-response to exposures (Kundi, et al. 2009) and supported by WHO's IARC 2B possible human carcinogen classification, making a differential diagnosis often problematical.

(vi) Enforced relocation: some people with IEI-EMF/EHS have felt forced to move to remote areas (Evans, 2017), or even emigrate from their country of birth to seek an environment with less wireless radiation. This makes it difficult to document their removal from a particular employment.

(vii) Perceived shame: people with IEI-EMF/EHS often feel shame and are reluctant to admit their situation, especially when they have been made redundant or dismissed from employment (Eberle, 2017). They see themselves as failing their family by being unable to earn money to support them and also by preventing their family from having the same wireless environment as other people. As a result they are often unwilling to complete surveys and thus they remain hidden from statistics.

(viii) Denial because of ridicule, dismissal, and the fear of involuntary incarceration: where the person with IEI-EMF/EHS has been verbally ridiculed by their employers and peers, or dismissed unsympathetically by their physician, or detained against their will in a psychiatric unit, the perceived danger of further ridicule, dismissal, and involuntary incarceration can lead to a state of denial (Crumpler, 2017). This can make them refuse to admit their actual health condition to themselves or to others. Such people often actively avoid all surveys in their refusal to be labelled as having IEI-EMF/EHS.

(ix) Helplessness syndrome: people with severe cases of IEI-EMF/EHS are prone to developing helplessness (Hecht, 2012). Because they cannot change their situation, they develop depression and other psycho neuroimmunological disorders. This can lead to under-reporting of the original condition which triggered their helplessness.

(x) Mortality ending work: in cases where death was concurrent with, or subsequent to, IEI-EMF/EHS, the referent may not be recorded as losing employment or 'work' because of their IEI-EMF/EHS. In one survey, three people with IEI-EMF/EHS died, one from a brain tumour and two from suicide (UK survey, 2019, Table 2; Supplementary Data), but such cases are not always recorded as relating to work.

(xi) Financial reward and legal 'gagging' clauses to end employment of people with IEI-EMF/EHS: some employers have paid employees with IEI-EMF/EHS to terminate their work (Aschermann, 2011). According to verbal reports, some people with IEI-EMF/EHS in the UK have been subject to "gagging" clauses requiring secrecy in the financial settlement ending employment because of their IEI-EMF/EHS. Such cases cannot, by their nature, appear in published surveys.

(xii) Secondary unemployment: few if any surveys include secondary unemployment caused by IEI-EMF/EHS. In such cases people are kept from employment because they are required to care full time for the needs of a close relative or friend suffering from IEI-EMF/EHS (Granlund-Lind, et al. 2004).

Adjustments enabling access to work

In some countries it appears that people disabled by IEI-EMF/EHS experience a higher rate of restrictions on access to work than people with other disabilities. In 2012 in the UK there were 30.1% fewer disabled people in work compared with non-disabled (UK Government, 2014). A Swedish survey (Hillert, et al. 2002) found that 175% more people with IEI-EMF/EHS were unemployed compared with others, 103% more on early retirement or disability pension, and 56% more on sick leave.

One factor behind this higher rate may be that, for people with IEI-EMF/EHS, there is a greater range in the severity of functional impairment between mild and severe cases than in some other disability groups. Therefore, within the overall figure of people with IEI-EMF/EHS, the proportion of very severe cases is likely to be higher. This matches the small surveys limited to often severe cases of IEI-EMF/EHS, where half gave 50-67% out of work (Table 2).

Some countries recognise IEI-EMF/EHS as a specific functional impairment, such as Sweden from 2000, Canada, and the USA under its Americans with Disabilities Act. Governments, local authorities and employers are required to ensure health and equality of access to workplaces, in addition to accommodation and transport (Johansson O, 2015). Some countries have suggested ideas for accommodation to enable people with IEI-EMF/EHS to continue working (US Department of Labour, 2015). Biological guidelines, such as EUROPAEM EMF Guidelines 2016 (Belyaev, et al. 2016), are applicable to workplaces with people suffering from IEI-EMF/EHS, who need low-level and long-term limits. Where an employee suffers initial symptoms of IEI-EMF/EHS, however, lengthy delay in making adjustments can worsen the condition, as in one case where it took the employer two years to make the necessary adjustments, during which time the employee developed hyper-sensitivity, something which might have been avoided if the employer had reacted promptly (case 3, Hedendahl, et al. 2015).

Conclusion

There is a variety of evidence, both from surveys of the general population and from surveys limited to people with IEI-EMF/EHS, establishing that people with IEI-EMF/EHS, especially in a severe form, can face restrictions in access to work. Surveys have shown that, in addition to subconscious symptoms for up to 79% of the general population, the numbers of people with IEI-EMF/EHS typically range between 5.0 and 30 per cent of the general population for mild cases, 1.5 and 5.0 per cent for moderate cases, and under 1.5 per cent for severe cases. From such surveys it can be deduced that the average prevalence of people with severe IEI-EMF/EHS who are restricted in access to work is in the region of 0.65% of the general population, at about 18% of the general population having moderate IEI-EMF/EHS. The estimate of 0.65% equates to 435,500 people in the UK's population of 67 million. Further surveys and more accurate diagnosis are necessary to confirm these numbers, but over 150 subjects in the general population are needed to ensure that a survey is likely to identify at least one such person. When the necessary adjustments are made, some people even with severe IEI-EMF/EHS can continue to work, suggesting that the percentage facing restrictions could fall once employers are aware of what is needed.

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Supplementary Data: Survey ofpeople with IEI-EMF/EHS facing restrictions in access to work in the UK (n = 36).

Case Number; Source	Demographics: M/F; <18, 18-65, >65	Original Work Status: Employed, Self-employed, School/Student/Carer	Work Outcome: Continued, Adjustments, Left/Retired early	Graduate of Oxford or Cambridge	Year
1 a	M 18-65	Self-Employed	Left/Retired		1990s
2 b	M 18-65	Employed	Continued	Yes	1993
3 c	F 18-65	Self-Employed	Left/Retired		1994
4 d	F 18-65	Employed	Left/Retired		1999
5 e	F 18-65	Employed	Left/Retired		1990s
6 f	F 18-65	Employed	Left/Retired		c.2000s
7 g	M 18-65	Employed	Adjustments		2000
8 h	F 18-65	Employed	Left/Retired		2000
9 i	18-65	Employed	(Continued)		2000
10 j	F 18-65	Employed	Left/Retired		2003
11 k	M 18-65	Student	Left/Retired		2004
12 d	M 18-65	Employed	Left/Retired		2004
13 l	M 18-65	Employed	Left/Retired		2004
14 m	M 18-65	Employed	Adjustments	Yes	c.2006
15 n	M 18-65	Employed	Adjustments	Yes	2006
16 o	F 18-65	Employed	Left/Retired		2007
17 p	F 18-65	Employed	Left/Retired		2007
18 q	M 18-65	Employed	Left/Retired		c.2007
19 d	M 18-65	Employed	Left/Retired		2008
20 b	F 18-65	Self-Employed	Adjustments		2008
21 r	F 18-65	Employed	(Left/Retired)	Yes	c.2008
22 s	M 18-65	Employed	Left/Retired		2009
23 t	M 18-65	Self-Employed	Adjustments		c.2009
24 u	F 18-65	Parent-carer	(Continued)	Yes	c.2010
25 j	F 18-65	Employed	Left/Retired		2011
26 a	F 18-65	Employed	Left/Retired		2011
27 v	F <18	School pupil	Left/Retired		2011
28 d	M 18-65	Self-Employed	Adjustments		c.2012
29 w	M 18-65	Self-Employed	Suicide	Yes	2012

30 a	F 18-65	(Employed)	(Left/Retired)	Yes	2012
31 x	F <18	School pupil	Suicide		2012
32 y	M 18-65	Employed	Left/Retired		c.2012
33 z	M 18-65	Self-Employed	Left/Retired		2013
34 aa	M 18-65	Employed	brain tumour		<2016
35 bb	M >65	Self-Employed	(Left/Retired)		2015
36 cc	F 18-65	Employed	Left/Retired		2015
Totals	F: 17	Employed: 24	Continued: 3	Oxbridge: 7	1991-95: 3
	M: 18	Self-Employed: 8	Adjustments: 6	(21% of 34)	1996-2000: 6
	<18: 2	School pupil: 2	Left/Retired: 24		2001-05: 4
	18-65: 33	Student: 1	Brain tumour: 1		2006-10: 11
	>65: 1	Parent-carer: 1	Suicide: 2		2011-15: 12

(a) Polly Dunbar: "Could Wifi be harming your health?" Daily Mail, November 24 2014;other (https://www.dailymail.co.uk/femail/article-2846494/Could-Wifi-harming-health-Thats-growing-number-people-believe-triggering-headaches-nausea-crippling-pain.html) (b) Nicholas Blincoe: "Electrosensitivity: is technology killing us?" The Guardian, March 29 2013; other (https://www.theguardian.com/society/2013/mar/29/electrosensitivity-is-technology-killing-us)(c) Claire Campbell: "It happened to me ... I'm allergic to modern life" Mail on Sunday, June 28 2009; other (https://www.dailymail.co.uk/health/article-1195551/It-happened--Im-allergic-modern-life.html)(d) Thomas Ball: "Electrosensitivity: is technology killing us? - in pictures" The Guardian, March 29 2013; other (https://www.theguardian.com/society/gallery/2013/mar/29/electrosensitivity-technology-killing-us-photographs)(e) Josh Fordham: "Electro-magnetic waves have made this Chard woman unable to leave the house" Somerset Live, December 20 2016; other (http://emrabc.ca/?page_id=720)(f) Yao Lan: "Trapped in a cage by electromagnetic hypersensitivity" ecns, April 12 2017; other (http://www.ecns.cn/visual/hd/2017/04-12/126750.shtml#nextpage)(g) Joani Walsh: "Using Wifi has cost me my life" Sunday Express, August 5 2007; other (https://www.buergerwelle.de/assets/files/using_wifi_cost_me_my_life.pdf?cultureKey=&q=pdf/using_wifi_cost_me_my_life.pdf); (h) Rebecca Cain: "Welsh Newton woman voices concerns about phone masts after she developed severe skin rash" Hereford Times, March 21 2016; other (https://www.elettrosensibili.it/tag/stazioni-radio-base/page/8/)(i) Jonathan Milne "Mystery headaches reboot Wifi fears" Times Educational Supplement, March 30 2007; other (https://www.emfacts.com/2007/04/693-mystery-headaches-reboot-wifi-fears/)(j) Angela Epstein: "The women who say they are allergic to modern life: Blinding headaches. Violent sickness. Even blackouts. So could Wifi, mobile phones and TV screens be to blame?" Daily Mail, May 26 2013; other (https://www.dailymail.co.uk/femail/article-2331369/The-women-say-allergic-modern-life-Blinding-headaches-Violent-sickness-Even-blackouts-So-wi-fi-mobile-phones-TV-screens-blame.html)(k) Annette McIntyre: "New technology blamed for Ilkley student's living nightmare" Ilkley Gazette, July 10 2008;other (https://www.ilkleygazette.co.uk/news/2388395.new_technology_blamed_for_ilkley_students_living_nightmare/?act=login) (l) Juliette Maxam: "Computer network forced man to quit job" East Anglian Daily Times, July 10 2006;other (https://www.eadt.co.uk/news/computer-network-forced-man-to-quit-job-1-76154) (m) Jonathan Milne: "Wifi fears hang in the air" Times Educational Supplement, December 15 2006;other (https://www.mast-victims.org/index.php?content=news&action=view&type=newsitem&id=1290) (n) Joanna Bale: "Health fears lead schools to dismantle wireless networks: Radiation levels blamed for sickness; teacher became too sick to work" The Times, November 20 2006;other (https://www.thetimes.co.uk/article/health-fears-lead-schools-to-dismantle-wireless-networks-cz3d6m2h898) (o) Jo Smith: "The Invisible Threat" Plymouth Herald, May 23 2012; (p) Faith Eckersall: "No car, TV, laptop, lights or trips to the shops: meet the woman who says she's allergic to electronics" Bournemouth Echo, June 14 2015; other (https://www.bournemouthecho.co.uk/news/13321046.No_car__TV__laptop__lights_or_trips_to_the_shops__meet_the_woma Davies: "The woman 'allergic to electricity': 50-year-old dons protective suit and veil to go outside as she claims Wifi could kill her" Daily Mail, July 3 2015; other (https://www.dailymail.co.uk/health/article-3148311/The-lady-allergic-ELECTRICITY-Woman-50-dons-protective-suit-veil-outside-claims-Wi-Fi-kill-her.html)(q) Joani Walsh: "Using Wifi has cost me my life" Sunday Express, August 5 2007; other (https://www.buergerwelle.de/assets/files/using_wifi_cost_me_my_life.pdf?cultureKey=&q=pdf/using_wifi_cost_me_my_life.pdf)(r) Youle R: "How gadgets and gizmos make life miserable" The South Wales Post, March 18 2009;(s) Catherine Frompovich: "Are You Impacted By Electrosmog?"

Activist Post, June 24 2017; other (https://www.activistpost.com/2017/06/are-you-impacted-by-electrosmog.html)(t) Heidi Blake: "The man who is 'allergic' to Wifi" Daily Telegraph, July 24 2009; other (https://www.independent.ie/business/technology/the-man-who-is-allergic-to-wifi-26553298.html)(u) Guy Hudson: "The doctor who diagnosed her own electrosensitivity" What Doctors Don't Tell You, April 2014; other (https://www.emfanalysis.com/wp-content/uploads/2014/09/ehs_doctor.pdf)(v) Florence Waters: "Is Wifi making your child ill?" Daily Telegraph, May 9 2015;other (https://www.telegraph.co.uk/health-fitness/body/wifi-internet-family-dangerous-health/) (w) "Tormented musician killed himself because he was 'allergic to mobile phones'" The Sun, November 6 2012;other (https://www.thesun.co.uk/archives/news/1028485/tormented-musician-killed-himself-because-he-was-allergic-to-mobile-phones/) (x) Vivien Mason, "Parents of schoolgirl Jenny Fry are campaigning to have Wifi restricted in schools following her death" Cotswold Journal, November 25 2015; other (https://www.cotswoldjournal.co.uk/news/14102769.parents-of-schoolgirl-jenny-fry-are-campaigning-to-have-wifi-restricted-in-schools-following-her-death/)(y) Laura Page: "The man living alone in the woods to escape Wifi and mobile phones" The Guardian, July 20 2012; other (https://www.theguardian.com/lifeandstyle/2012/jul/20/man-living-alone-woods-escape-wifi-mobiles)(z) Tom Davis: "Wifi allergy known as EHS has forced me to close my computer repair shop – Kidderminster boss" Evesham Journal, July 1 2016; other (https://www.kidderminstershuttle.co.uk/news/14592349.wi-fi-forced-me-to-close-my-computer-repair-shop-kidderminster-boss/)(aa) Anna Hodgekiss and Madlen Davies: "Business executive who claimed spending six hours a day on his mobile gave him brain cancer dies aged 44" Daily Mail, May 20 2016. other (https://www.dailymail.co.uk/health/article-3600739/Business-executive-claimed-spending-six-hours-day-mobile-gave-cancer-dies-aged-44.html)(bb) Anna Hodgekiss: "Grandfather claims he suffers bizarre allergy to Electricity which gives him 'sunburn' every time he watches TV" Daily Mail, April 25 2016;other (https://www.dailymail.co.uk/health/article-3557466/Grandfather-claims-suffers-bizarre-allergy-ELECTRICITY-gives-sunburn-time-watches-TV.html) (cc) Adam Bennett: "Woman forced to give up home and job to live in a shed as she's allergic to WiFi" Mirror, January 19 2017; other (https://www.mirror.co.uk/news/weird-news/woman-forced-give-up-home-9653483).

References

Abdel-Rassoul, G., El-Fateh, O.A., Salem, M.A. et al. Neurobehavioral effects among inhabitants around mobile phone base stations. (2007) Neurotoxicology 28(2): 434-440.
PubMed (https://www.ncbi.nlm.nih.gov/pubmed/16962663)│Crossref (https://doi.org/10.1016/j.neuro.2006.07.012)│ Other (https://www.sciencedirect.com/science/article/pii/S0161813X06001835?via%3Dihub)

Andrianome, S., Seze, R., Braun, A., et al. Descriptive self-reporting survey of people with idiopathic environmental intolerance attributed to electromagnetic fields (IEI-EMF): similarities and comparisons with previous studies. (2018) J Public Health 26(4): 461-473.
PubMed│CrossRef (https://doi.org/10.1007/s10389-017-0886-0) │Other (https://link.springer.com/article/10.1007/s10389-017-0886-0)

Arnetz, B.B., Berg, M., Arnetz, J. Mental strain and physical symptoms among employees in modern offices. (1997) Arch Environ Health 52(1): 63-67.
PubMed (https://www.ncbi.nlm.nih.gov/pubmed/9039860) │ Crossref (https://doi.org/10.1080/00039899709603802) │ other (https://www.tandfonline.com/doi/abs/10.1080/00039899709603802)

Aschermann, C. Electrosensitivity: A patient with Burn-like Skin Manifestations. (2011) Umwelt-Medizin-Gesellschaft 24(2): 141-146.
PubMed│Crossref│Other (http://media.withtank.com/71ada80e9b/aschermann_electrosensitivity_final_20111.pdf)

Asthma U.K. Annual Report & Accounts for the year to 30 September 2017. p.11.
PubMed│Crossref│Other (https://www.asthma.org.uk/globalassets/about/asthma-uk-annual-report-2016-17.pdf)

Baliatsas, C., van Kamp, I., Hooiveld, M., et al. Comparing non-specific physical symptoms in environmentally sensitive patients: prevalence, duration, functional status and illness behavior. (2014) J Psychosom Res 76(5): 405-413.

PubMed (https://www.ncbi.nlm.nih.gov/pubmed/24745783) | Crossref (https://doi.org/10.1016/j.jpsychores.2014.02.008) | Other (https://www.sciencedirect.com/science/article/pii/S0022399914000506?via%3Dihub)

Belpomme, D., Campagnac, C., Irigaray, P. Reliable disease biomarkers characterizing and identifying electrohypersensitivity and multiple chemical sensitivity as two etiopathogenic aspects of a unique pathological disorder. (2015) Rev Environ Health 30(4): 251-271.

PubMed (https://www.ncbi.nlm.nih.gov/pubmed/26613326)| Crossref (https://doi.org/doi:%2010.1515/reveh-2015-0027.)| Other (https://www.degruyter.com/view/j/reveh.2015.30.issue-4/reveh-2015-0027/reveh-2015-0027.xml)

Belyaev, I., Dean, A., Eger, H., et al. EUROPAEM EMF Guideline 2016 for the prevention, diagnosis and treatment of EMF-related health problems and illnesses. (2016) Rev Environ Health 31(3): 363-397.

PubMed (https://www.ncbi.nlm.nih.gov/pubmed/27454111)| Crossref (https://doi.org/10.1515/reveh-2016-0011) | Other (https://www.degruyter.com/view/j/reveh.2016.31.issue-3/reveh-2016-0011/reveh-2016-0011.xml)

Boehmert, C., Verrender, A., Pauli, M., et al. Does precautionary information about electromagnetic fields trigger nocebo responses? An experimental risk communication study. (2018) Environ Health 17(1): 36.

PubMed (https://www.ncbi.nlm.nih.gov/pubmed/29650009)| Crossref (https://doi.org/10.1186/s12940-018-0377-y) | Other (https://ehjournal.biomedcentral.com/articles/10.1186/s12940-018-0377-y)

Bogers, R.P., van Gils, A., Clahsen, S.C.S., et al. Individual variation in temporal relationships between exposure to radiofrequency electromagnetic fields and non-specific physical symptoms: A new approach in studying 'electrosensitivity'. (2018) Environ Int 121(Pt 1): 297-307.

PubMed (https://www.ncbi.nlm.nih.gov/pubmed/30227317)| Crossref (https://doi.org/10.1016/j.envint.2018.08.064) | Other (https://www.sciencedirect.com/science/article/pii/S0160412018303088?via%3Dihub)

Bortkiewicz, A., Gadzicka, E., Szymczak, W. et al. Heart rate variability (HRV) analysis in radio and TV broadcasting stations workers. (2012) Int J Occup Med Environ Health 25(4): 446-455.

PubMed (https://www.ncbi.nlm.nih.gov/pubmed/23224733) | Crossref (https://doi.org/10.2478/s13382-012-0059-x) | Other (http://ijomeh.eu/Heart-rate-variability-hrv-analysis-in-radio-and-tv-broadcasting-stations-workers,2236,0,2.html)

Buchner, K., Eger, H. Changes of Clinically Important Neurotransmitters under the Influence of Modulated RF Fields - A Long-term Study under Real-life Conditions. (2011) Umwelt-Medizin-Gesellschaft 24(1): 44-57.

PubMed| Crossref| Other (https://www.avaate.org/IMG/pdf/Rimbach-Study-20112.pdf)

Carlsson, F., Karlson, B., Orbaek, P. et al. Prevalence of annoyance attributed to electrical equipment and smells in a Swedish population, and relationship with subjective health and daily functioning. (2005) Public Health 119(7): 568-577.

PubMed (https://www.ncbi.nlm.nih.gov/pubmed/15925670) | Crossref (https://doi.org/10.1016/j.puhe.2004.07.011) | Other (https://linkinghub.elsevier.com/retrieve/pii/S0033-3506(04)00229-X)

Crumpler, S. MCS and EHS: An Australian Perspective. (2017) Ecopsychology 9(2): 112-116.

PubMed| Crossref (https://doi.org/10.1089/eco.2016.0041)| other (https://www.liebertpub.com/doi/abs/10.1089/eco.2016.0041)

De Luca, C., Thai, J.C., Raskovic, D., et al. Metabolic and genetic screening of electromagnetic hypersensitivity subjects as a feasible tool for diagnostics and intervention. (2014) Mediators Inflamm 2014: 924184.

PubMed (https://www.ncbi.nlm.nih.gov/pubmed/24812443)| Crossref (https://doi.org/10.1155/2014/924184)| Other (https://www.hindawi.com/journals/mi/2014/924184/)

Dieudonné, M. Does electromagnetic hypersensitivity originate from nocebo responses? Indications from a qualitative study. (2016) Bioelectromagnetics 37(1): 14-24.

PubMed (http://www.ncbi.nlm.nih.gov/pubmed/26369906)| Crossref (https://doi.org/10.1002/bem.21937)| Other (https://onlinelibrary.wiley.com/doi/abs/10.1002/bem.21937)

Eberle, S. What's the diagnosis, doctor? (2014) Sonoma Medicine 65: 27–32.

PubMed| CrossRef| Other (http://www.cqlpe.ca/pdf/What'stheDiagnosisDoctorSept2014.pdf)

Eberle, S. An Underworld Journey: Learning to Cope with Electromagnetic Hypersensitivity. (2017) Ecopsychology 9(2): 106-111.

PubMed| Crossref (https://doi.org/10.1089/eco.2016.0036)| Other

(https://www.liebertpub.com/doi/abs/10.1089/eco.2016.0036)
Eger, H., Jahn, M. Specific Health Symptoms and Cell Phone Radiation in Selbitz, Bavaria, Germany: Evidence of a Dose-Response Relationship. (2010) Um Medizin Gesellschaft 23(2): 130-139.
PubMed | CrossRef | Other (http://www.next-up.org/pdf/Horst_Eger_Manfred_Jahn_Scientific_Health_Symptoms_and_Cell_Phone_Radiation_in_Selbitz_Germany_2010.p
Electrosensitivity UK, personal communication, September 2018.
PubMed | CrossRef | Others
Eltiti, S., Wallace, D., Zougkou, K., et al. Development and evaluation of the electromagnetic hypersensitivity questionnaire. (2007) Bioelectromagnetics 28(2): 137-151.
PubMed (https://www.ncbi.nlm.nih.gov/pubmed/17013888) | Crossref (https://doi.org/10.1002/bem.20279) | Other (https://onlinelibrary.wiley.com/doi/abs/10.1002/bem.20279)
Eltiti, S., Wallace, D., Russo, R., et al. Symptom Presentation in Idiopathic Environmental Intolerance With Attribution to Electromagnetic Fields: Evidence for a Nocebo Effect Based on Data Re-Analyzed From Two Previous Provocation Studies. (2018) Front Psychol 28(9): 1563.
PubMed (https://www.ncbi.nlm.nih.gov/pubmed/30210397) | Crossref (https://doi.org/10.3389/fpsyg.2018.01563) | Other (https://www.frontiersin.org/articles/10.3389/fpsyg.2018.01563/full)
Evans, J. Displaced by Chemical and Electrical Hypersensitivities. (2017) Ecopsychology 9(2): 80-82.
PubMed | Crossref (https://doi.org/10.1089/eco.2017.0010) | Other (https://www.liebertpub.com/doi/full/10.1089/eco.2017.0010)
Genuis, S.J. Fielding a current idea: exploring the public health impact of electromagnetic radiation. (2008) Public Health 122(2): 113-124.
PubMed (https://www.ncbi.nlm.nih.gov/pubmed/17572456) | Crossref (https://doi.org/10.1016/j.puhe.2007.04.008) | Other (https://www.sciencedirect.com/science/article/pii/S0033350607001394?via%3Dihub)
Gibson, P.R., Kovach, S., Lupfer, A. Unmet health care needs for persons with environmental sensitivity. (2015) J Multidiscip Healthc 8: 59-66.
PubMed (https://www.ncbi.nlm.nih.gov/pubmed/25670904) | Crossref (https://doi.org/10.2147/JMDH.S61723) | Other (https://www.dovepress.com/unmet-health-care-needs-for-persons-with-environmental-sensitivity-peer-reviewed-article-JMDH)
Gibson, P.R., Introduction to the Special Issue on Environmental Sensitivities: Living on the Margins with Access Denied. (2017) Ecopsychology 9(2): 53-59.
PubMed | Crossref (https://doi.org/10.1089/eco.2017.0017) | Other (https://www.liebertpub.com/doi/full/10.1089/eco.2017.0017)
Granlund-Lind, R., Lind, J. Black on White: Voices and Witnesses about Electro-Hypersensitivity: The Swedish Experience: 2004 2nd edition. Translation, Svartpåvitt - Rösterochvittnesmål om elöverkänslighet. (2002).
PubMed | CrossRef | Other
Gruber, M.J., Palmquist, E., Nordin, S. Characteristics of perceived electromagnetic hypersensitivity in the general population. (2018) Scand J Psychol 59(4): 422-427.
PubMed (https://www.ncbi.nlm.nih.gov/pubmed/29741795) | Crossref (https://doi.org/10.1111/sjop.12449) | Other (https://onlinelibrary.wiley.com/doi/abs/10.1111/sjop.12449)
Hagström, M., Auranen, J., Ekman, R. Electromagnetic hypersensitive Finns: Symptoms, perceived sources and treatments, a questionnaire study. (2013) Pathophysiology 20(2): 117-1122.
PubMed (https://www.ncbi.nlm.nih.gov/pubmed/23557856) | Crossref (https://doi.org/10.1016/j.pathophys.2013.02.001) | Other (https://linkinghub.elsevier.com/retrieve/pii/S0928-4680(13)00002-3)
Hallberg, O., Oberfeld, G. Letter to the editor: will we all become electrosensitive? (2006) Electromagn Biol Med 25 (3): 189-91.
PubMed (https://www.ncbi.nlm.nih.gov/pubmed/16954121) | Crossref (https://doi.org/10.1080/15368370600873377) | Other (https://www.tandfonline.com/doi/abs/10.1080/15368370600873377?journalCode=iebm20)

Havas, M. Radiation from wireless technology affects the blood, the heart, and the autonomic nervous system. (2013) Rev Environ Health 28(2-3): 75-84.
PubMed (https://www.ncbi.nlm.nih.gov/pubmed/24192494)│Crossref (https://doi.org/10.1515/reveh-2013-0004) │Other (https://www.degruyter.com/view/j/reveh.2013.28.issue-2-3/reveh-2013-0004/reveh-2013-0004.xml)
Hecht, K. Health Implications of Long-term Exposure to Electrosmog. (2012) Effects of Wireless Communication Technologies: A Brochure Series of the Competence Initiative for the Protection of Humanity, the Environment and Democracy e.V. Brochure 6. Translated (2016) Katharina Gustavs .
PubMed│Crossref│Other (http://kompetenzinitiative.net/KIT/wp-content/uploads/2016/07/KI_Brochure-6_K_Hecht_web.pdf)
Hedendahl, L., Carlberg, M., Hardell, L. Electromagnetic hypersensitivity - an increasing challenge to the medical profession. (2015) Rev Environ Health 30(4): 209-215.
PubMed (https://www.ncbi.nlm.nih.gov/pubmed/26372109)│Crossref (https://doi.org/10.1515/reveh-2015-0012) │Other (https://www.degruyter.com/view/j/reveh.2015.30.issue-4/reveh-2015-0012/reveh-2015-0012.xml)
Heuser, G., Heuser, S.A. Functional brain MRI in patients complaining of electrohypersensitivity after long term exposure to electromagnetic fields. (2017) Rev Environ Health 32(3): 291-299.
PubMed (https://www.ncbi.nlm.nih.gov/pubmed/28678737)│Crossref (https://doi.org/10.1515/reveh-2017-0014) │Other (https://www.degruyter.com/view/j/reveh.2017.32.issue-3/reveh-2017-0014/reveh-2017-0014.xml)
Hillert, L., Berglind, N., Arnetz, B.B., et al. Prevalence of self-reported hypersensitivity to electric or magnetic fields in a population-based questionnaire survey. (2002) Scand J Work Environ Health 28(1): 33-41.
PubMed (https://www.ncbi.nlm.nih.gov/pubmed/11871850)│Crossref (https://doi.org/10.5271/sjweh.644)│Other (http://www.sjweh.fi/show_abstract.php?abstract_id=644)
Hojo, S., Tokiya, M., Mizuki, M., et al. Development and evaluation of an electromagnetic hypersensitivity questionnaire for Japanese people. (2016) Bioelectromagnetics 37(6): 353-372.
PubMed (https://www.ncbi.nlm.nih.gov/pubmed/27324106) │Crossref (https://doi.org/10.1002/bem.21987) │Other (https://onlinelibrary.wiley.com/doi/full/10.1002/bem.21987)
Hojo, S., Mizukoshi, A., Azuma, K. et al. Survey on changes in subjective symptoms, onset/trigger factors, allergic diseases, and chemical exposures in the past decade of Japanese patients with multiple chemical sensitivity. (2018) Int J Hyg Environ Health 221(8):1085-1096.
PubMed (https://www.ncbi.nlm.nih.gov/pubmed/30115513) │ Crossref (https://doi.org/10.1016/j.ijheh.2018.08.001) │Other (https://www.sciencedirect.com/science/article/pii/S1438463918302712?via%3Dihub)
Huang, P.C., Cheng, M.T., Guo, H.R. Representative survey on idiopathic environmental intolerance attributed to electromagnetic fields in Taiwan and comparison with the international literature. (2018) Environ Health 17(1): 5.
PubMed (https://www.ncbi.nlm.nih.gov/pubmed/29334987)│Crossref (https://doi.org/10.1186/s12940-018-0351-8) │Other (https://ehjournal.biomedcentral.com/articles/10.1186/s12940-018-0351-8)
Hutter, H.P., Moshammer, H., Wallner, P., et al. Subjective symptoms, sleeping problems, and cognitive performance in subjects living near mobile phone base stations. (2006) Occup Environ Med 63(5): 307-313.
PubMed (https://www.ncbi.nlm.nih.gov/pubmed/16621850) │ Crossref (https://doi.org/10.1136/oem.2005.020784) │ Other (https://oem.bmj.com/content/63/5/307.long)
Sensitivity to non-ionising radiation in Ireland. Position Paper on Electro Magnetic Radiation. (2005) Irish Doctors' Environmental Association (IDEA).
PubMed│CrossRef│Other (http://www.peccem.org/DocumentacionDescarga/ElectroHiperSensibilidad/abstract_Irelan.pdf)
Irigaray, P., Lebar, P., Belpomme, D. How Ultrasonic Cerebral Tomosphygmography can contribute to the Diagnosis of Electrohypersensitivity. (2018) J Clin Diagn Res 6: 143.
PubMed│Crossref (https://doi.org/%2010.4172/2376-0311.1000142)│Other (H://Irigaray%20P/Irigaray-2018-ultrasonic-cerebral-tomosphygmography-UCTS-EHS.pdf)
Irigaray, P., Caccamo, D., Belpomme, D. Oxidative stress in electrohypersensitivity self-reporting patients: Results of a prospective in vivo investigation with comprehensive molecular analysis. (2018) Int J Mol Med 42(4): 1885-1898.
PubMed (https://www.ncbi.nlm.nih.gov/pubmed/30015864)│Crossref (https://doi.org/10.3892/ijmm.2018.3774)

│Other (https://www.spandidos-publications.com/10.3892/ijmm.2018.3774)
Johansson, A., Nordin, S., Heiden, M. et al. Symptoms, personality traits, and stress in people with mobile phone-related symptoms and electromagnetic hypersensitivity. (2010) J Psychosom Res 68(1): 37-45.
PubMed (https://www.ncbi.nlm.nih.gov/pubmed/20004299)│Crossref (https://doi.org/10.1016/j.jpsychores.2009.06.009)│Other (https://www.sciencedirect.com/science/article/pii/S0022399909002633?via%3Dihub)
Johansson, O. Electrohypersensitivity: a functional impairment due to an inaccessible environment. (2015) Rev Environ Health 30(4): 311-321.
PubMed (https://www.ncbi.nlm.nih.gov/pubmed/26613327)│Crossref (https://doi.org/10.1515/reveh-2015-0018)│Other (https://www.degruyter.com/view/j/reveh.2015.30.issue-4/reveh-2015-0018/reveh-2015-0018.xml)
Karvala, K., Sainio, M., Palmquist, E., et al. Prevalence of various environmental intolerances in a Swedish and Finnish general population. (2017) Environ Res 161: 220-228.
PubMed (https://www.ncbi.nlm.nih.gov/pubmed/29161654)│Crossref (https://doi.org/10.1016/j.envres.2017.11.014)│Other (https://www.sciencedirect.com/science/article/pii/S001393511731263X?via%3Dihub)
Kato, Y., Johansson, O. Reported functional impairments of electrohypersensitive Japanese: A questionnaire survey. (2012) Pathophysiology 19(2): 95-100.
PubMed (https://www.ncbi.nlm.nih.gov/pubmed/22458999)│Crossref (https://doi.org/10.1016/j.pathophys.2012.02.002)│Other (https://linkinghub.elsevier.com/retrieve/pii/S0928468012000442)
Kjellqvist, A., Palmquist, E., Nordin, S. Psychological symptoms and health-related quality of life in idiopathic environmental intolerance attributed to electromagnetic fields. (2016) J Psychosom Res 84: 8–12.
PubMed (https://www.ncbi.nlm.nih.gov/pubmed/27095153)│Crossref (https://doi.org/10.1016/j.jpsychores.2016.03.006)│Other (https://www.sciencedirect.com/science/article/pii/S0022399916300423?via%3Dihub)
Kundi, M., Hutter, H.P. Mobile phone base stations – Effects on wellbeing and health. (2009) Pathophysiology 16 (2-3): 123-135.
PubMed (https://www.ncbi.nlm.nih.gov/pubmed/19261451)│Crossref (https://doi.org/10.1016/j.pathophys.2009.01.008)│Other (https://www.pathophysiologyjournal.com/article/S0928-4680(09)00011-X/fulltext)
Leitgeb, N., Schröttner, J. Electrosensibility and electromagnetic hypersensitivity. (2003) Bioelectromagnetics 24 (6): 387-394.
PubMed (http://www.ncbi.nlm.nih.gov/pubmed/12929157)│Crossref (https://doi.org/10.1002/bem.10138)│Other (https://onlinelibrary.wiley.com/doi/abs/10.1002/bem.10138)
Levallois, P., Neutra, R., Lee, G. et al. Study of self-reported hypersensitivity to electromagnetic fields in California. (2002) Environ Health Perspect 110(Suppl 4): 619-623.
PubMed (https://www.ncbi.nlm.nih.gov/pubmed/12194896)│Crossref (https://doi.org/10.1289/ehp.02110s4619)│Other (https://doi.org/10.1289/ehp.02110s4619)
Marshall, T.G., Heil, T.J.R. Electrosmog and autoimmune disease. (2017) Immunol Res 65(1): 129-135.
PubMed (https://www.ncbi.nlm.nih.gov/pubmed/27412293)│Crossref (https://doi.org/10.1007/s12026-016-8825-7)│Other (https://link.springer.com/article/10.1007%2Fs12026-016-8825-7)
McCarty, D.E., Carrubba, S., Chesson, Jr. A.L., et al. Electromagnetic Hypersensitivity: evidence for a novel neurological syndrome. (2011) Int J Neurosci 121(12): 670-676.
PubMed (https://www.ncbi.nlm.nih.gov/pubmed/21793784)│Crossref (https://doi.org/10.3109/00207454.2011.608139)│Other (https://www.tandfonline.com/doi/abs/10.3109/00207454.2011.608139?journalCode=ines20)
Meg Tseng, M.C., Lin, Y.P., Cheng, T.J. Prevalence and psychiatric comorbidity of self-reported electromagnetic field sensitivity in Taiwan: a population-based study. (2011) J Formos Med Assoc 110(10): 634-641.

PubMed (https://www.ncbi.nlm.nih.gov/pubmed/21982467)│Crossref (https://doi.org/10.1016/j.jfma.2011.08.005) │Other (https://ac.els-cdn.com/S0929664611000283/1-s2.0-S0929664611000283-main.pdf?_tid=4b7caa1f-9368-4e3a-9ea2-0c660d07308a&acdnat=1545823896_1ef1cf7eb64cf275139f7e6455bddedb)

Meo, S.A., Almahmoud, M., Alsultan, Q., et al. Mobile Phone Base Station Tower Settings Adjacent to School Buildings: Impact on Students' Cognitive Health. (2018) Am J Mens Health 7: 1557988318816914.
PubMed (https://www.ncbi.nlm.nih.gov/pubmed/30526242) │ Crossref (https://doi.org/10.1177/1557988318816914) │ Other (https://journals.sagepub.com/doi/full/10.1177/1557988318816914?url_ver=Z39.88-2003&rfr_id=ori%3Arid%3Acrossref.org&rfr_dat=cr_pub%3Dpubmed)

Mild, K.H. Rapporteur's Report. (2004) WHO Workshop on Electrical Hypersensitivity 25–27.
PubMed│CrossRef│Other (https://www.who.int/peh-emf/meetings/hypersens_rapporteur_rep_oct04.pdf)

Mohler, E., Frei, P., Braun-Fahrländer, C., Fröhlich, J., et al. Effects of everyday radiofrequency electromagnetic-field exposure on sleep quality: a cross-sectional study. (2010) Radiat Res 174(3): 347-356.
PubMed (https://www.ncbi.nlm.nih.gov/pubmed/20726726)│Crossref (https://doi.org/10.1667/RR2153.1)│Other (http://www.bioone.org/doi/10.1667/RR2153.1?url_ver=Z39.88-2003&rfr_id=ori:rid:crossref.org&rfr_dat=cr_pub%3dpubmed)

Pall, M.L. Electromagnetic fields act via activation of voltage-gated calcium channels to produce beneficial or adverse effects. (2013) J Cell Mol Med 17(8): 958-965.
PubMed (https://www.ncbi.nlm.nih.gov/pubmed/23802593) │Crossref (https://doi.org/10.1111/jcmm.12088) │Other (https://onlinelibrary.wiley.com/doi/full/10.1111/jcmm.12088)

Petrov, I.R. Influence of microwave radiation on the organism of man and animals. Translation of Vliyaniye SVCh-Izlucheniyana Organizm Chelovekai Zhivotnykh. (1970) Meditsina Press, Leningrad. NASA TT F-708.
PubMed│CrossRef│Other (http://www.stralskyddsstiftelsen.se/wp-content/uploads/2014/08/Influence_of_Microwave_Radiation_on_the_Organism_of_Man_and_Animals.pdf)

Rea, W.J., Pan, Y., Yenyves, E.J. et al. Electromagnetic field sensitivity. (1991) J Bioelectricity 10(1-2): 241-256.
PubMed│Crossref (https://doi.org/10.3109/15368379109031410)│Other (https://www.tandfonline.com/doi/abs/10.3109/15368379109031410)

Redmayne, M., Johansson, O. Radiofrequency exposure in young and old: different sensitivities in light of age-relevant natural differences. (2015) Rev Environ Health 30(4): 323-335.
PubMed (https://www.ncbi.nlm.nih.gov/pubmed/26613328)│Crossref (https://doi.org/10.1515/reveh-2015-0030) │Other (https://www.degruyter.com/view/j/reveh.2015.30.issue-4/reveh-2015-0030/reveh-2015-0030.xml)

Rubin, G.J., Nieto-Hernandez, R., Wessely, S. Idiopathic environmental intolerance attributed to electromagnetic fields (formerly 'electromagnetic hypersensitivity'): An updated systematic review of provocation studies. (2010) Bioelectromagnetics 31(1): 1-11.
PubMed (https://www.ncbi.nlm.nih.gov/pubmed/19681059)│Crossref (https://doi.org/10.1002/bem.20536)│Other (https://onlinelibrary.wiley.com/doi/abs/10.1002/bem.20536)

Schreier, N., Huss, A., Röösli, M. The prevalence of symptoms attributed to electromagnetic field exposure: a cross-sectional representative survey in Switzerland. (2006) Soz Praventivmed 51(4): 202-209.
PubMed (https://www.ncbi.nlm.nih.gov/pubmed/17193782)│Crossref (https://doi.org/10.1371/journal.pbio.2006229)│Other (http://doc.rero.ch/record/310885/files/38_2006_Article_5061.pdf)

Schröttner, J., Leitgeb, N., Hillert, L. Investigation of electric current perception thresholds of different EHS groups. (2007) Bioelectromagnetics 28(3): 208-213.
PubMed (https://www.ncbi.nlm.nih.gov/pubmed/17080457)│Crossref (https://doi.org/10.1002/bem.20294)│Other (https://onlinelibrary.wiley.com/doi/abs/10.1002/bem.20294)

Schröttner, J., Leitgeb, N. Sensitivity to electricity--temporal changes in Austria. (2008) BMC Public Health 12(8): 310.
PubMed (https://www.ncbi.nlm.nih.gov/pubmed/18789137)│Crossref (https://doi.org/10.1186/1471-2458-8-310) │Other (https://bmcpublichealth.biomedcentral.com/articles/10.1186/1471-2458-8-310)

Sherrard, R.M., Morellini, N., Jourdan, N. et al. Low-intensity electromagnetic fields induce human cryptochrome to modulate intracellular reactive oxygen species. (2018) PLoS Biol 16(10): e2006229.
PubMed (https://www.ncbi.nlm.nih.gov/pubmed/30278045)│Crossref (https://doi.org/10.1371/journal.pbio.2006229)│Other (https://journals.plos.org/plosbiology/article?id=10.1371/journal.pbio.2006229)
Szyjkowska, A., Bortkiewicz, A., Szymczak, W. et al. Subjective symptoms related to mobile phone use--a pilot study. (2005) Pol Merkur Lekarski 19(112): 529-532.
PubMed (https://www.ncbi.nlm.nih.gov/pubmed/16379318)│CrossRef│Other
Tseng, M.C. (see also under Meg Tseng, M.C.), Lin, Y.P., Hu, F.C., et al. Risks perception of electromagnetic fields in Taiwan: the influence of psychopathology and the degree of sensitivity to electromagnetic fields. (2013) Risk Anal 33(11): 2002-2012.
PubMed (https://www.ncbi.nlm.nih.gov/pubmed/23551091) │ Crossref (https://doi.org/10.1111/risa.12041) │Other (https://onlinelibrary.wiley.com/doi/abs/10.1111/risa.12041)
The British Allergy Foundation. Trustees' Annual Report (Including Directors' Report), Year Ended 31 March 2017. (2017)
PubMed│CrossRef│Other (https://www.allergyuk.org/assets/000/001/640/The_Trustees_Report_2017V3_email_original.pdf?1518107876)
The Swedish National Board of Health. Miljöhälsorapport [Environmental Health Report] 2009. (2009) Socialstyrelsen, Karolinska Institutet.
PubMed│CrossRef│Other (https://ki.se/sites/default/files/mhr2009_0.pdf)
UK Government. Official Statistics: Disability facts and figures, January 16, 2014. (2014).
PubMed│CrossRef│Other (https://www.gov.uk/government/publications/disability-facts-and-figures/disability-facts-and-figures)
UK NHS (National Health Service). Blindness and Vision Loss. (2018). Revised 08/06/2018.
PubMed│CrossRef│Other (https://www.nhs.uk/conditions/vision-loss/).
US Department of Labor. The Office for Disability Employment Policy (ODEP), Job Accommodation Network (JAN). (2015) Job Accommodations for People with Electrical Sensitivity.
PubMed│CrossRef│Other (https://ehtrust.org/wp-content/uploads/JAN-EHS-1.pdf)
Williams, K.M., Bertelsen, G., Cumberland, P. et al. Increasing Prevalence of Myopia in Europe and the Impact of Education. (2015) Ophthalmology 122: 1489–1497.
PubMed (https://www.ncbi.nlm.nih.gov/pubmed/25983215) | Crossref (https://doi.org/10.1016/j.ophtha.2015.03.018) | Other (https://www.aaojournal.org/article/S0161-6420(15)00280-8/fulltext)
Witthöft, M., Freitag, I., Nußbaum, C., et al. On the origin of worries about modern health hazards: Experimental evidence for a conjoint influence of media reports and personality traits. (2018) Psychol Health 33(3): 361-380.
PubMed (https://www.ncbi.nlm.nih.gov/pubmed/28758796)│Crossref (https://doi.org/10.1080/08870446.2017.1357814)│Other (https://www.sciencedirect.com/science/article/pii/S0022399912003352?via%3Dihub)
World Health Organization. Electromagnetic fields and public health: Electromagnetic hypersensitivity. (2005) Backgrounder 296.
PubMed│CrossRef│Other (http://www.who.int/peh-emf/publications/facts/fs296/en/)

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Prevalence of self-reported hypersensitivity to electric or magnetic fields in a population-based questionnaire survey.

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Abstract

OBJECTIVES: The prevalence of medically unexplained symptoms attributed to exposure to electromagnetic fields is still largely unknown. Previous studies have investigated reported hypersensitivity to electricity in selected groups recruited from workplaces or outpatient clinics. The aim of this study was to estimate the prevalence of self-reported hypersensitivity to electric or magnetic fields in the general population and to describe characteristics of the group reporting such hypersensitivity with regard to demographics, other complaints, hypersensitivities, and traditional allergies.

METHODS: A cross-sectional questionnaire survey was conducted in 1997 among 15,000 men and women between 19 and 80 years of age in Stockholm County. The response rate was 73%.

RESULTS: One and a half percent of the respondents reported hypersensitivity to electric or magnetic fields. Prevalence was highest among women and in the 60- to 69-year age group. The hypersensitive group reported all symptoms, allergies, and other types of hypersensitivities included in the survey (as well as being disturbed by various factors in the home) to a significantly greater extent than the rest of the respondents. No specific symptom profile set off the hypersensitive group from the rest of the respondents.

CONCLUSIONS: The results should be interpreted with caution. But they suggest that there is widespread concern among the general population about risks to health posed by electric and magnetic fields. More research is warranted to explore ill health among people reporting hypersensitivity to electric or magnetic fields.

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Changes of Clinically Important Neurotransmitters under the Influence of Modulated RF Fields—A Long-term Study under Real-life Conditions

Klaus Buchner and Horst Eger

This follow-up of 60 participants over one and a half years shows a significant effect on the adrenergic system after the installation of a new cell phone base station in the village of Rimbach (Bavaria).
After the activation of the GSM base station, the levels of the stress hormones adrenaline and noradrenaline increased significantly during the first six months; the levels of the precursor dopamine decreased substantially. The initial levels were not restored even after one and a half years. As an indicator of the dysregulated chronic imbalance of the stress system, the phenylethylamine (PEA) levels dropped significantly until the end of the study period.
The effects showed a dose-response relationship and occurred well below current limits for technical RF radiation exposures. Chronic dysregulation of the catecholamine system has great relevance for health and is well known to damage human health in the long run.

Keywords: cell phone base station, long-term study, stress hormones, radiofrequency radiation, GSM transmitter, far-field radiation

Introduction

Despite the distribution of numerous wireless transmitters, especially those of cell phone networks, there are only very few real-life field studies about health effects available. In 2003, the Commission on Radiation Protection was still noticing that there are no reliable data available concerning the public's exposure to UMTS radiation near UMTS base stations (1).

Since the 1960s, occupational studies on workers with continuous microwave radiation exposures (radar, manufacturing, communications) in the Soviet Union have shown that RF radiation exposures below current limits represent a considerable risk potential. A comprehensive overview is given in the review of 878 scientific studies by Prof. Hecht, which he conducted on behalf of the German Federal Institute of Telecommunications (contract no. 4231/630402) (2, 3).
As early as the 1980s, US research projects also demonstrated in long-term studies that rats raised under sterile conditions and exposed to "low-level" RF radiation showed signs of stress by increased incidences of endocrine tumors (4, 5).

Concerned by this "scientific uncertainty" about how radiofrequency "cell tower radiation" affects public health, 60 volunteers from Rimbach village in the Bavarian Forest decided to participate in a long-term, controlled study extending about one and a half years, which was carried out by INUS Medical Center GmbH and Lab4more GmbH in

Original study in German: BUCHNER K, EGER H (2011) Umwelt-Medizin-Gesellschaft 24(1): 44-57.

Zusammenfassung

Veränderung klinisch bedeutsamer Neurotransmitter unter dem Einfluss modulierter hochfrequenter Felder - Eine Langzeiterhebung unter lebensnahen Bedingungen

Die vorliegende Langzeitstudie über einen Zeitraum von eineinhalb Jahren zeigt bei den 60 Teilnehmern eine signifikante Aktivierung des adrenergenen Systems nach Installation einer örtlichen Mobilfunksendeanlage in Rimbach (Bayern).

Die Werte der Stresshormone Adrenalin und Noradrenalin steigen in den ersten sechs Monaten nach dem Einschalten des GSM-Senders signifikant; die Werte der Vorläufersubstanz Dopamin sinken nach Beginn der Bestrahlung erheblich ab. Der Ausgangszustand wird auch nach eineinhalb Jahren nicht wieder hergestellt. Als Hinweis auf die nicht regulierbare chronische Schieflage des Stresshaushalts sinken die Werte des Phenylethylamins (PEA) bis zum Ende des Untersuchungszeitraums signifikant ab. Die Effekte unterliegen einem Dosis-Wirkungs-Zusammenhang und zeigen sich weit unterhalb gültiger Grenzwerte für technische Hochfrequenzbelastung. Chronische Dysregulationen des Katecholaminsystems sind von erheblicher gesundheitlicher Relevanz und führen erfahrungsgemäß langfristig zu Gesundheitsschäden.

Schlüsselwörter: Mobilfunk-Basisstationen, Langzeituntersuchung, Stresshormone, Mobilfunkstrahlung, Fernfeld

in cooperation with Dr. Kellermann from Neuroscience Inc.[1].

Common risk factors such as external toxic agents, parameters of the catecholamine system (6) were determined prior to the activation of the GSM transmitter and followed up in three additional tests for a period of more than 18 months. The informed consent of all participants included the condition that the data were to be published anonymously.

---------- Materials and Methods

Study Setting and Selection of Study Subjects

In spring 2004, a combined GSMD1 and GSMD2 cell transmitter (900 MHz band) was installed on Buchberg mountain in D-93485 Rimbach (Lower Bavaria) with two sets of antenna groups each. The installation height of the antennas for both systems is 7.9 m; the horizontal safety distance along the main beam direction is 6.3 or 4.3 m, respectively. At the same tower, there is also a directional antenna at 7.2 m (7).

1) INUS Medical Center, Dr. Adam-Voll Str. 1, 93437 Furth im Wald, Tel.: 09973/500 5412, www.inus.de; Lab4more GmbH, Prof. Dr. W. Bieger, Paul-Heyse-Straße 6, 80336 München, Tel.: 089/54321 730, info@lab4more.de; NeuroScience Inc., Dr. Kellermann, 373 280th Street - Osceola, WI 54020 - USA, Tel.: +1/715/294-2144, www.neuroscienceinc.com.

Shortly after it had become known that the wireless transmitters were to be installed, all inhabitants of Rimbach had been asked to participate in a mass screening. The municipality has approximately 2,000 inhabitants. In 60 volunteers (27 male, 33 female) aged between 2 and 68, the levels of adrenaline, noradrenaline, dopamine, and PEA (phenylethylamine)—which cannot be consciously regulated—were determined in their urine at the end of January/beginning of February 2004 (shortly before the activation of the antennas and the RF emissions beginning) as well as in July 2004, in January 2005, and in July 2005.

Most of these study participants signed up immediately after an informational gathering in late January 2004, at which the course of action by the cell phone service providers was criticized. Others signed up following a call for participation in the local paper. Since Rimbach is a small municipality, mouth-to-mouth propaganda also played a role. Participation was made attractive to the volunteers because a lab test that usually would be very expensive was offered for a small fee. Since the study required to show the status of the biological parameters over a given time period, only those study subjects participating in all four tests are included.

The data presented below come primarily from volunteers who have a certain interest in the life of their community and their health. Other persons joined the stress hormone investigation because of the recommendation of, or request by, their fellow citizens. This does not meet the requirements for a random sample. The result of this study, however, is hardly affected because Rimbach is a very small municipality. Therefore, the social contacts that lead to participation are very important. Most probably they do not affect the blood parameters. Furthermore, numerous large families participated as a whole whereby the health status of the individual family members did not play any role. For this reason, but especially because of the population structure, the study includes many children but only a few adolescents and young adults: there are hardly any opportunities for occupational training in Rimbach. In contrast, the municipality is attractive to young families with many children.

Sample Collection

The second morning urine was collected at INUS Medical Center on Mondays between 9:00 and 11:00 a.m. We made sure that each participant's appointment was always scheduled for the same time and that the time of breakfast or the state of fasting was the same for each participant at all tests. On the same day, the samples were sent by express to *Labor Dr. Bieger* in Munich where they were processed. In addition, samples were also sent to a laboratory in Seattle for control analyses (8-11).

Medical History

Medical doctors of the INUS Medical Center took a thorough medical history of each participant. At the initial test, the following data were also gathered: exact address, average time spent at home, indoor toxins, stress due to heavy-traffic roads, and the number of amalgam fillings. The latter number also included fillings that had already been removed. A nine-year-old child was noted to be electro-

sensitive to the effects of household wiring and connected appliances. All other study participants declared themselves to be not electrosensitive.

When taking their medical history, participants were also questioned about subjective symptoms and chronic diseases at the start of the study and during its course; if overweight, this was also noted. In this study, overweight in adults is defined as a weight greater than the "body height in cm minus 100 plus 5 kg tolerance."

Consistency checks for the parameter "overweight," however, indicate that—especially with regard to children—different criteria have been applied during the taking of the medical history. These data, therefore, can only serve as a reference point. They are listed here anyhow since they can provide suggestions for further studies.

All atopic disorders such as:

1. Hay fever, neurodermatitis, allergies, asthma, eczema are referred to as "chronic disorders;" as well as
2. All chronic inflammations such as interleukin- or COX-2-mediated problems;
3. All autoimmune diseases such as rheumatism, multiple sclerosis (MS);
4. All chronic metabolic disorders such as diabetes, liver diseases, intestinal diseases, kidney diseases.

Out of the 16 chronically affected participants 12 had allergies.

It was also asked whether there were DECT, Wi-Fi, or Bluetooth devices in the house or apartment during the study period from late January 2004 until July 2005. Also included were those devices present only for part of the study period, but not those turned off at night.

Exposure Level Measurements

For the most part, Rimbach municipality is located at one side of a narrow V-shaped valley. The cell phone base station is situated almost right across from the village center on the other side. RF radiation levels were measured at the outside of the residences of all study participants, wherever possible with direct line of sight of the transmitter. Because the municipality is located on a slope, great differences were noted inside homes—depending on whether or not a line of sight to the transmitter existed. In three cases, it was possible to measure the exposure levels at the head end of the bed. In these cases, the peak value of the power density was lower by a factor of 3.5 to 14 compared to measurements in front of the house with direct line of sight to the transmitter. The exact location of DECT, Wi-Fi, and Bluetooth base stations (if present) as well as possible occupational exposures, etc. were not determined by most participants.

At first, the measurements were taken with a broadband RF meter HF38B of Gigahertz Solutions, for which the manufacturer guarantees an error margin of max. ±6 dB (+ 7 decimal places; but this error can be mostly eliminated by selecting the appropriate measurement range). However, an inspection revealed that the error margin was less than ±3 dB. In addition, the broadband RF meter

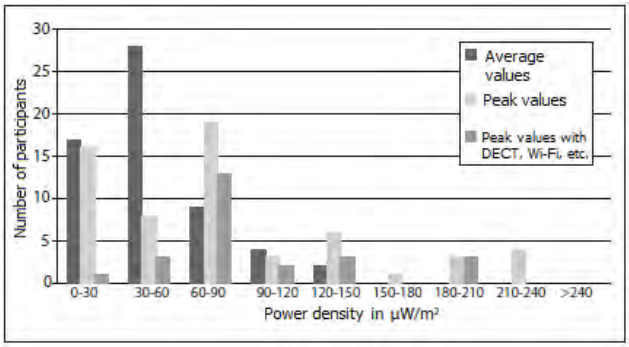

Fig. 1: Classification of participants based on average or peak value of the GSM power density level

HF59B (±3 dB, ±5 decimal places) was used at several points. With this RF meter, relevant frequencies can be analyzed with variable filters, the ELF modulation frequencies via fast Fourier analysis.

By using broadband RF meters, the testing effort and expense are reduced compared to spectrum analyzers. Thus, it was possible to take measurements at a greater number of points, and as a result, it was easier to determine the maxima and minima of the power density levels. Furthermore, the accuracy of high-quality broadband RF meters is similar to that of spectrum analyzers.

In this study, only cell phone signals are considered: not DECT, Wi-Fi, or Bluetooth devices inside homes or emissions from broadcast or TV stations at *Hohenbogen*, a mountain above Rimbach. For the most part, the emissions from the latter transmitters remained stable during the study period, whereas the focus of this study is on changes in exposure levels. For almost all sample measurements, the portion of the exposure due to the transmitter at *Hohenbogen* was at maximum 35 µW/m^2 (peak value). It was higher in the residences of only two study participants: 270 µW/m^2 (average) or 320 µW/m^2 (peak), respectively. At these residences, the GSM exposure was approximately 10 µW/m^2.

For the assessment, the peak values of the signals are used because, in the case of GSM radiation, they are less dependent on the usage level than average values. The peak value of the power density for all study participants from Rimbach was on average 76.9 µW/m^2 (Tab. 1).

In Figure 1 the exposure of the participants is given as power density levels in increments of 30 µW/m^2.

Classification of Participant Group and Exposure Levels

Sixty persons participated in the study; their age distribution is shown in Figure 2 according to year groups. In order to capture the effect of the cell phone base station, other environmental factors must be excluded as much as possible. It is vitally important to ensure that no major differences between high-exposure and low-exposure persons influenced the results.

Original study in German: BUCHNER K, EGER H (2011) Umwelt-Medizin-Gesellschaft 24(1): 44-57.

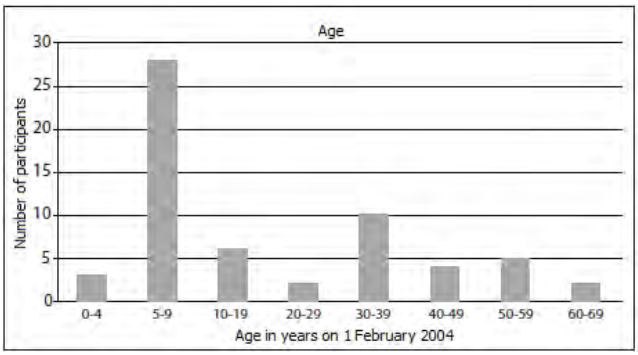

Fig. 2: Age distribution of study participants on 1 February 2004

	All	<=60 µW/m²	60-100 µW/m²	>100 µW/m²
Participants	60	24	20	16
Power density, avg (µW/m²)	76.9	21.7	68.1	170.7
Healthy adults	20	9	5	6
Sick adults	9	6	2	1
Healthy children	24	9	7	8
Sick children	7	0	6	1
Overweight	14	7	3	4
Amalgam number	12	5	3	4
Evaluation of amalgam/person	120	76.4	32.7	240
Street	8	0	8	0
Indoor toxins	17	7	6	4
DECT, Wi-Fi, Bluetooth	25	4	14	7

Tab. 1: Data on the 60 study participants who are classified into exposure groups 0 - 60 µW/m², 60 - 100 W/m², and above 100 µW/m², based on relevant peak values of GSM exposure in front of their residence.

Additional information:

Power density, avg (µW/m²) means: average peak value of GSM exposure level in the relevant category;
Healthy adults: adults without chronic diseases. Participants who were born after 1 February 1994 are referred to as children, all others as adults;
Sick adults: adults with chronic diseases;
Healthy children: children without chronic diseases;
Sick children: children with chronic diseases;
Overweight: see text;
Amalgam number: number of participants who had at least one amalgam filling (which may have been removed prior to the study period);
Evaluation of amalgam/person: For each tooth with an amalgam filling of a participant, the size of the filling (values from 1 to 3) is multiplied with the number of years this filling has been placed prior to the date of the initial test of this study (rounded up to the nearest whole number). The value in the table is the sum of these numbers for all amalgam fillings of a person in the respective category divided by the number of participants with amalgam fillings (= "amalgam number");
Street: number of participants who live at a busy street;
Indoor toxins: number of participants who have had contact with toxins, varnishes, preservatives, etc. at home or at work;
DECT, Wi-Fi: number of persons who had DECT, Wi-Fi, Bluetooth or the like at home at the end of January 2004 or later.

As shown in Table 1, the group with exposure levels greater than 100 µW/m² included fewer chronically ill persons and fewer residences at heavy-traffic roads, but considerably higher amalgam exposures by dental fillings compared to the average of the participants. These differences, however, cannot explain the observed development of the blood parameters as will be shown further below. It should also be noted that the number of children in the group of <= 60 µW/m² is considerably lower than in the other two groups.

Statistics

Because of the large individual differences in blood values, their asymmetrical distribution, and because of the many "outliers," the assessment presented here focuses on the following problem: "Did the level of a given substance predominantly increase (or decrease, respectively) in the test subjects?" For this problem, the so-called signed-rank paired Wilcoxon test (12) is applied. How to determine the confidence intervals of medians is described in an easy-to-understand form in (13).

Due to the rather large differences in individual values, we refrained from carrying out additional statistical analyses, especially those with parametric methods.

---------- Results

1 Clinical Findings

Adrenaline, noradrenaline, and dopamine as well as phenylethylamine (PEA) levels were determined at the time when the medical history was taken at INUS Medical Center. Out of the 60 participants, eleven had sleep problems until the end of 2004. During the study period (until July 2005), eight additional cases with these problems were reported. At the end of January 2004, only two participants complained about headaches; eight additional cases were reported thereafter. For allergies, there were eleven cases in the beginning and 16 later; for dizziness five and eight; and for concentration problems ten and fourteen. Due to the limited number of participants, no meaningful statements can be made about changes during the study period regarding the conditions tinnitus, depression, high blood pressure, autoimmune diseases, rheumatism, hyperkinetic syndrome, attention deficit hyperactivity disorder (ADHD), tachycardia, and malignant tumors. (Tab. 2)

Symptoms	Before activation of transmitter	After activation of transmitter
Sleep problems	11	19
Headache	2	10
Allergy	11	16
Dizziness	5	8
Concentration problems	10	14

Tab. 2: Clinical symptoms before and after activation of transmitter

2 Adrenaline

The adrenaline level trends are shown in Figure 3. After the activation of the transmitter from January until July 2004, a clear increase is followed by a decrease. In participants in the exposure category above 100 µW/m^2, the decrease is delayed.

Since the distribution of the adrenaline levels is very asymmetrical as shown in Figure 4, the median values are better suited for evaluation than the average values. However, there is no significant difference between the trend of the median and the trend of the average values (Tab. 3). But it stands out that, in the lowest exposure group with a power density below 60 µW/m^2, median values do not decrease between July 2004 and January 2005.

The statement "The adrenaline values of study subjects increased after the activation of the transmitter, i.e. between January and July 2004" is statistically confirmed ($p<0.002$), as well as the statement "The adrenaline level of the study participants decreased from July 2004 to July 2005" ($p<0.005$). In the lowest exposure group, the increase is the smallest. Until the end of the study period, these values do not drop.

A certain dose-response relationship can be observed for the increase in adrenaline levels from January 2004 until July 2004. The increase in medians was 2.3 µg/g creatinine for all subjects. At an RF radiation level up to 60 µW/m^2, creatinine was 1.0 µg/g, and by contrast, for power density levels between 60-100 µW/m^2 it was 2.6 µg/g.

For subjects in the exposure group above 100 µW/m^2, creatinine levels were found to be 2.7 µg/g, i.e. this value did not increase. We refrain from any additional statistical analysis because, as shown further below, the increase in adrenaline levels was mainly observed in children and chronically ill participants whose numbers were not sufficient to be broken down into further subgroups.

		January 2004	July 2004	January 2005	July 2005
All	Average	8.56	10.79	8.84	9.14
	Median	7.44	9.75	8.40	7.45
	CI	5.9 - 8.4	6.6 - 11.7	6.1 - 10.0	6.5 - 9.6
0-60 µW/m^2	Average	8.9	10.3	7.7	9.0
	Median	6.4	7.4	7.8	7.4
	CI	3.8 - 10.3	4.6 - 13.2	3.4 - 9.4	5.5 - 11.1
60-100 µW/m^2	Average	7.9	10.4	8.4	9.0
	Median	7.4	10.2	8.1	7.2
	CI	5.3 - 10.0	6.6 - 12.8	5.0 - 11.2	6.4 - 9.7
>100 µW/m^2	Average	8.9	12.0	11.1	9.6
	Median	8.2	10.9	10.6	8.6
	CI	5.3 - 10.9	5.7 - 19.6	5.8 - 15.2	4.9 - 13.4

Tab. 3: Results for adrenaline levels in µg/g creatinine
CI = 95% confidence interval of median

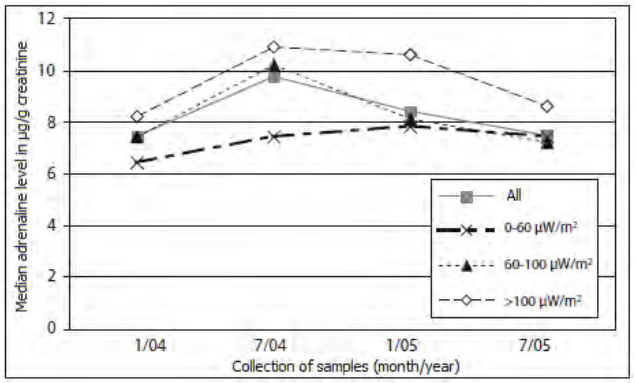

Fig. 3: Median adrenaline levels for all participating citizens of Rimbach whose cell phone base station exposure was above 100 µW/m^2, between 60 and 100 µW/m^2, or up to 60 µW/m^2. The power density levels refer to peak values of the GSM radiation exposure in front of a given residence.

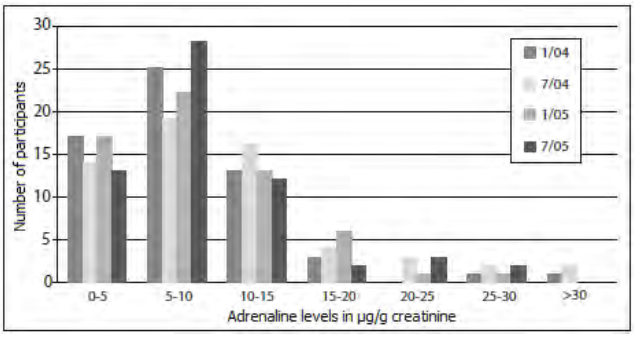

Fig. 4: Distribution of adrenaline levels in µg/g creatinine

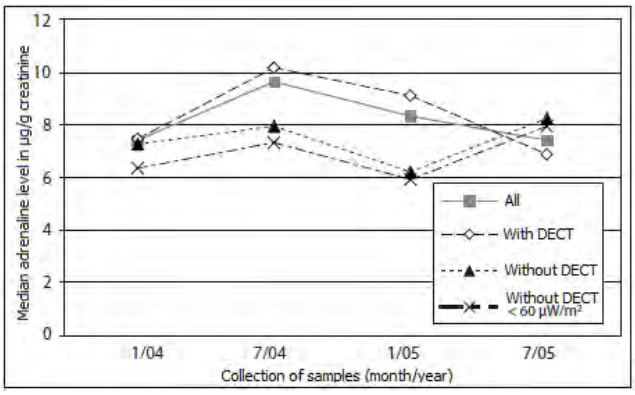

Fig. 5: Median adrenaline levels for all participating citizens of Rimbach who have a DECT phone, Wi-Fi, Bluetooth, or similar device, for those who do not have such wireless devices, and for the lowest exposure group without indoor wireless transmitters and with a GSM power density level up to 60 µW/m^2.

The impact of indoor wireless devices such as DECT, Wi-Fi, and Bluetooth (the latter are not specifically mentioned in the graphs) are shown in Fig. 5. Within the first year after the activation of the GSM transmitter, i.e. until and including January 2005, the group with indoor wireless devices shows the strongest responses.

It is possible that in the less exposed subjects seasonal fluctuations or other factors such as "overshooting" of the values could have played a role.
It should be noted here that both the average as well as the median adrenaline values increased after the activation of the transmitter and decreased again after one year. This, however, only applies to exposure levels >60 µW/m^2. Chronically ill subjects and children showed especially strong responses; except for some "outliers," no effect was observed in healthy adults.

The adrenaline level of overweight subjects and those with an amalgam burden hardly changed during the study period (Fig. 6). In contrast, chronically ill subjects showed especially strong responses above average. In fact, the increase in the median values between January and July 2004 for all study subjects was predominantly caused by children and chronically ill subjects; adults without any chronic disease show a flat curve. During this period, an increased adrenaline level between 5 and 10.3 was measured in three healthy adults. Because of these "outliers," the average values for healthy adults clearly increased in contrast to the median values.

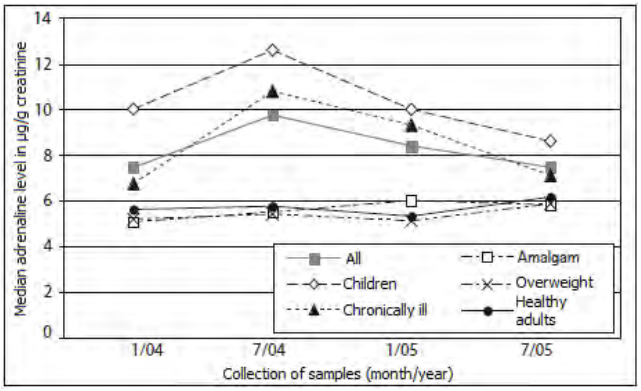

Fig. 6: Median adrenaline levels for participating children, for chronically ill subjects, for those with amalgam burden, and overweight subjects in Rimbach in comparison to the median levels of all study subjects and adults without chronic disease

The lower sensitivity of subjects with an amalgam burden can be explained by the fact that the effect occurs more often in children and that children according to our definition are younger than 10 years. They have hardly any fillings with amalgam.

3 Noradrenaline

The results for noradrenaline are similar to those for adrenaline (Tab. 4, Fig. 7). The statement that individual noradrenaline levels from January to July 2004 increased is statistically well supported with $p<0.001$. The fact that the levels dropped between July 2004 and July 2005 is also well supported with $p<0.0005$. Like in the case of adrenaline, the period under investigation is July 2004 to July 2005 to take the delayed decrease in the high exposure group into consideration. According to Table 4, the median of all noradrenaline levels increased from January to July 2004 for 11.2 µg/g creatinine; for exposures up to 60 µW/m^2, there were 2.2 µg/g creatinine, at 60-100 µW/m^2 12.4 µg/g creatinine, and above 100 µW/m^2 12.3 µg/g creatinine. As in the case of adrenaline, the increase for the last two groups is almost the same. Again, it is not possible to statistically verify a dose-response relationship. In Figure 7, a dose-response relationship

		January 2004	July 2004	January 2005	July 2005
All	Average	55.8	64.9	57.7	55.7
	Median	49.8	61.0	52.2	53.5
	CI	44.3-59.1	53.3-72.2	45.0-60.3	41.9 -60.5
0-60	Average	54.7	59.3	56.5	53.5
µW/m^2	Median	45.2	47.4	48.7	48.1
	CI	35.1-67.8	36.3-75.6	40.1-60.0	36.3-65.6
60-100	Average	51.4	63.6	49.1	55.9
µW/m^2	Median	47.5	59.9	45.8	54.8
	CI	38.0-59.1	53.1-74.8	40.5-58.4	34.9-66.5
>100	Average	62.9	74.9	70.1	58.8
µW/m^2	Median	58.8	71.1	71.6	56.3
	CI	49.9-87.3	54.9-91.6	48.7-89.1	36.9-81.6

Tab. 4: Results for the noradrenaline levels in µg/g creatinine
CI = 95% confidence interval of the median

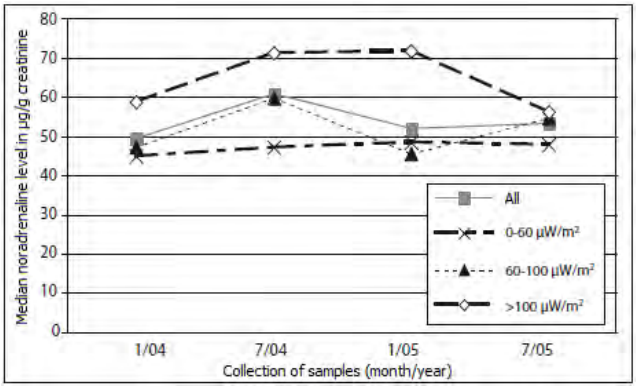

Fig. 7: Median noradrenaline levels in all participating citizens of Rimbach as a function of GSM power density levels (peak values)

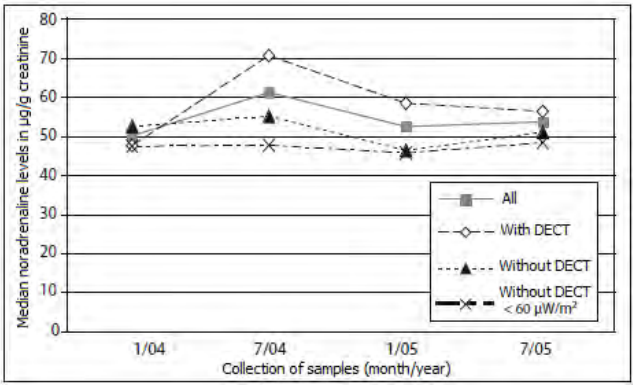

Fig. 8: Median noradrenaline values for subjects who had a DECT phone or other wireless devices at home, for those without indoor wireless devices, as well as for subjects without indoor wireless devices and with a GSM radiation exposure up to 60 µW/m^2 (peak value measured in front of residence)

is seen, whereby the dot-dashed line serves as reference for persons with very low exposures. It stands out that the "recovery period," i.e. the decrease in values in 2005, drags on for longer in subjects in the exposure group with GSM radiation levels above 100 µW/m^2. This also corresponds with the behavior of the adrenaline levels.

In comparison with adrenaline, noradrenaline plays a somewhat greater role in residences where wireless devices existed before the beginning of this study (Fig. 8).

The trend in Figure 9 shows that children and chronically ill subjects in contrast to overweight subjects express strong responses to cell tower radiation. The ratios, however, are not as clearly visible as with adrenaline. Especially in overweight subjects, they indicate a slow response to GSM radiation.

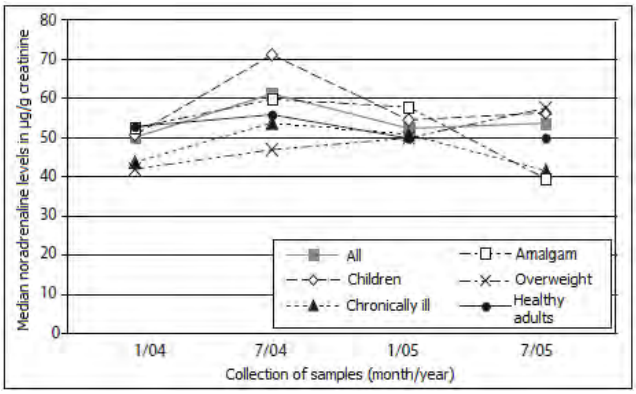

Fig. 9: Median noradrenaline levels of children, chronically ill subjects, those with amalgam burden and overweight subjects in Rimbach in comparison to the median values of all study subjects and healthy adults

Noradrenaline and adrenaline, however, responded very similarly.

4 Dopamine

For dopamine, inverse effects to those for adrenaline and noradrenaline were observed. The median dopamine levels decreased from 199 to 115 µg/g creatinine between January and July 2004 (Tab. 5). The fact that the dopamine levels of the study subjects decreased during this period is highly significant ($p<0.0002$). Thereafter, the median increased again: In January 2005, it was at 131 µg/g creatinine, in July of this year 156. This increase is also significant (for increase between July 2004 and July 2005 $p<0.05$).

This, too, is a dose-response relationship: from January to July 2004, the median for all subjects decreased for 84 µg/g creatinine, in the exposure group up to 60 µW/m^2 for 81, in the exposure group above 100 µW/m^2 even 153 µg/g (see Tab. 5 and Fig. 10). This dose-response relationship is statistically significant based on the signed-rank Wilcoxon test (12) with $p<0.025$. The following statement applies: "The decrease in dopamine levels for exposure levels up to 100 µW/m^2 is smaller than at exposure levels above 125 µW/m^2."

In subsequent laboratory tests, the dopamine levels do not return to the same level as in January 2004. From Figure 11, it is obvious that the correlation with prior exposures to indoor wireless devices is small.

		January 2004	July 2004	January 2005	July 2005
All	Average	233	158	138	164
	Median	199	115	131	156
	CI	168-273	86-160	111-153	145-175
0-60 µW/m^2	Average	217	183	130	148
	Median	189	108	116	147
	CI	142-273	80-254	90-157	129-167
60-100 µW/m^2	Average	242	161	140	178
	Median	223	150	131	175
	CI	137-335	94-168	93-164	126-207
>100 µW/m^2	Average	244	115	147	170
	Median	244	91	151	156
	CI	139-316	48-202	117-169	138-209

Tab. 5: Results for dopamine levels in µg/g creatinine
CI = 95% confidence interval of median

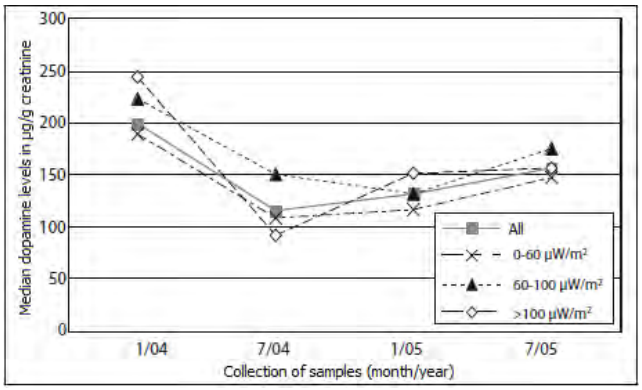

Fig. 10: Median dopamine levels for different GSM power density levels

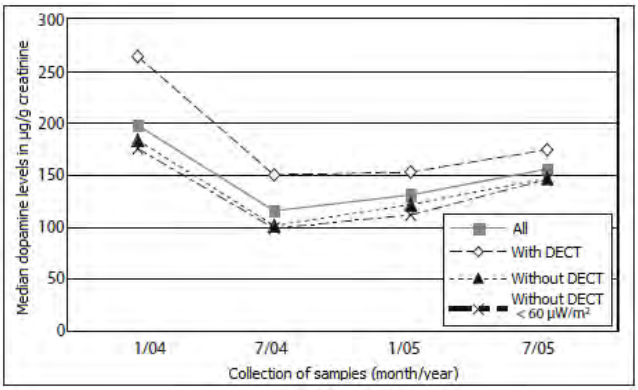

Fig. 11: Median dopamine levels for all participating citizens of Rimbach, for those with and without DECT phone, Wi-Fi, or Bluetooth, and for those without indoor wireless devices who had a GSM exposure level below 60 µW/m^2 (peak value).

It is to be emphasized that the lowest exposure group without such indoor wireless devices and with a GSM power density level < 60 µW/m^2 responds almost as strongly as all other study subjects. This is consistent with the data in Figure 10: the data suggest that the effect of the radiation on the dopamine levels can already be observed at very low power density levels; however, it still can increase at levels above 100 µW/m^2.

Figure 12 shows that the radiation effect is somewhat more pronounced in children compared to the average, i.e. the gradient of the curves between the first two data points is somewhat greater. However, the difference is far too small to be statistically significant.

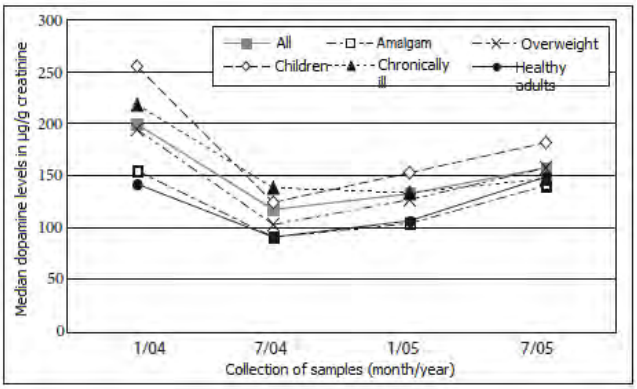

Fig. 12: Median dopamine levels of children, the chronically ill, with amalgam burden, overweight subjects, and healthy adults in Rimbach

In summary, dopamine levels decreased after the activation of the GSM transmitter and were not restored to the initial level over the following one and a half years. A significant dose-response relationship is observed. In children, the decrease is somewhat more pronounced than in adults.

5 Phenylethylamine (PEA)

Phenylethylamine (PEA) levels respond more slowly to the radiation compared to the substances investigated so far (Tab. 6, Fig. 13). Only in the exposure group above 100 µW/m^2 GSM radiation do the PEA levels decrease within the first six months. Thereafter, hardly any differences can be discerned between PEA values of the various power density levels investigated here.

The decrease of PEA levels between July 2004 and July 2005 is highly significant ($p<0.0001$)

Similar to adrenaline and noradrenaline, a previous exposure to indoor wireless devices intensifies the effect of the GSM radiation (see Fig. 14). The subjects of the low-exposure groups without indoor wireless devices do respond in a time-delayed fashion, but after six months they respond just as clearly as the subjects of the highest exposure group. In this regard, the PEA levels behave like those of dopamine in contrast to adrenaline and noradrenaline, which only respond to stronger fields.

		January 2004	July 2004	January 2005	July 2005
All	Average	725	701	525	381
	Median	638	671	432	305
	CI	535 -749	569 - 745	348 - 603	244 - 349
0-60 µW/m^2	Average	655	678	523	329
	Median	604	653	484	243
	CI	477 - 835	445 - 835	279 - 675	184 - 380
60-100 µW/m^2	Average	714	699	535	451
	Median	641	678	426	330
	CI	492 - 746	569 - 790	310 - 804	293 - 438
>100 µW/m^2	Average	843	739	514	371
	Median	780	671	413	305
	CI	451 - 1144	334 - 822	338 - 748	157 - 513

Tab. 6: Results for phenylethylamine (PEA) levels in ng/g creatinine
CI = 95% confidence interval of median

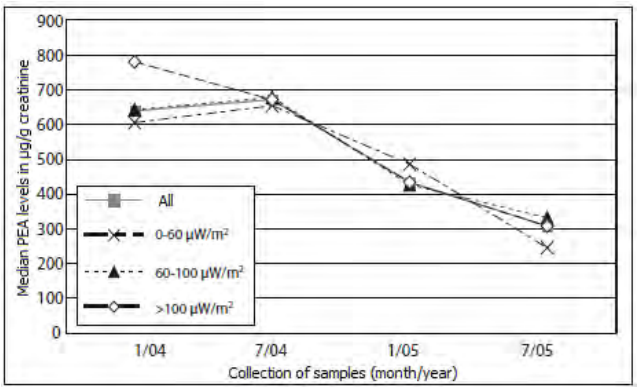

Fig. 13: Median phenylethylamine (PEA) levels for various GSM power density levels

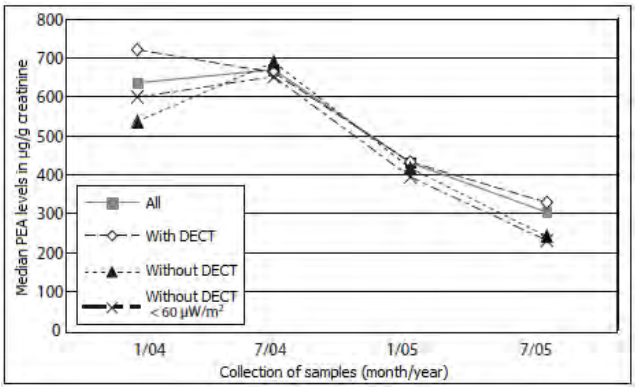

Fig. 14: Median phenylethylamine (PEA) concentrations in µg/g creatinine of subjects with and without indoor wireless devices at home and subjects without indoor wireless devices with a GSM power density level below 60 µW/m^2

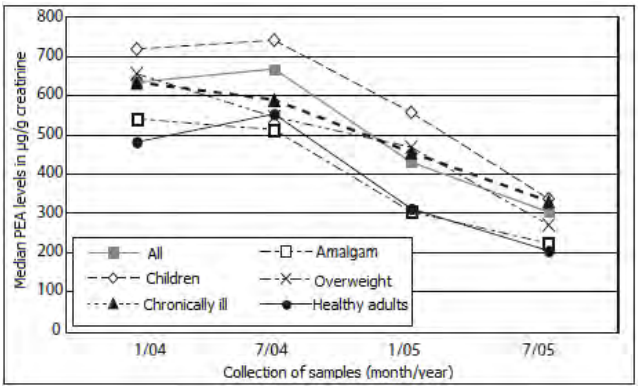

Fig. 15: Median phenylethylamine (PEA) concentrations in µg/g creatinine of children, the chronically ill, with amalgam burden, and overweight subjects, as well as health adults in Rimbach

In children, the effect of GSM radiation on their PEA levels is no greater than in the average of the study subjects; healthy adults also do not respond substantially differently. In contrast to the other substances looked at so far, the group of overweight subjects does respond particularly rapidly to PEA.

Summary of Results

Adrenaline and noradrenaline levels increase during the first six months after the GSM transmitter had been activated; thereafter, they decrease again. After an exposure period of one and a half years, the initial levels are almost restored. Only at power density levels above 100 µW/m^2 is this decrease delayed for several months. In contrast, dopamine levels decrease substantially after the exposure begins. Even after one and a half years, the initial levels are not restored. Six months after the activation of the transmitter, PEA levels decrease continuously over the entire exposure period. Only in the exposure group above 100 µW/m^2 is this effect observed immediately. All findings were observed well below current exposure limits (14).

Wireless devices used at home such as DECT, Wi-Fi, and Bluetooth amplify the effect of the GSM radiation. In the case of adrenaline and noradrenaline, almost exclusively children and chronically ill subjects (here mostly subjects with allergies) are affected. However, the response of chronically ill subjects to dopamine and the response of children to PEA are very similar to those found in the average of the study subjects. Except for PEA, overweight subjects show only very weak responses to GSM radiation.

Discussion

Catecholamine System and Phenylethylamine (PEA)

The survival of mammals depends on their ability to respond to external sources of stress. An established, well-researched axis of the human stress system represents the catecholamine system (6, 15, 16). It can be activated by psychic or physical stressors. Impulses mediated by nerves are responsible for an induction of the catecholamine biosynthesis at the level of tyrosine hydroxylase as well as dopamine beta-hydroxylase, whereby the effect is based on an induction of both enzymes. Many biochemical regulatory mechanisms tightly control catecholamine synthesis (8, 15, 17). Chronic dysregulation always leads to health problems in the long run. The development of high blood pressure under continuous stress serves as a clinical example; so-called "beta blockers" directly block the action of adrenaline and noradrenaline on the target receptors, and it is impossible to imagine medication-based therapy without them (15).

PEA can be synthesized from the essential amino acid phenylalanine either via tyrosine, dopamine, noradrenaline, and adrenaline or via a direct biochemical path (15) (Fig. 16). The sympathetic-mimetic effect of PEA was first described by Barger in 1910 (18).

PEA is also synthesized from phenylalanine and is considered a superordinate neuromodulator for the regulation of catecholamine synthesis (19-22).

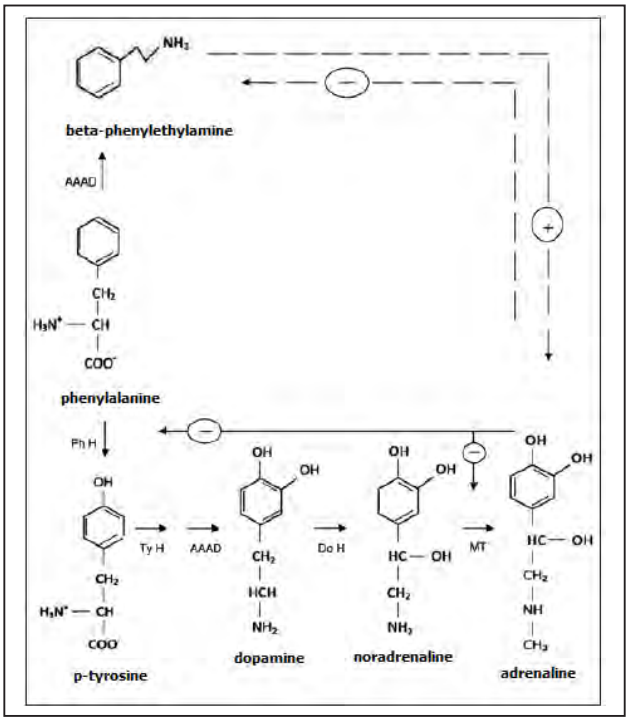

Fig. 16: Chemical structure of derivatives of the essential amino acid phenylalanine and the simplified synthesis pathways of catecholamines or phenylethylamine, respectively, simplified according to Löffler (15).

Abbreviations
AAAD: aromatic l-amino acid decarboxylase,
DoH: dopamine beta-hydroxylase,
PhH: phenylalanine hydroxylase,
MT: n-methyltransferase,
TyH: tyrosine hydroxylase
—(—)— ---- known feedback loop, - - (---) - - postulated feedback loop

In 1976, Zeller described the physiological relationships (23) and points out that PEA is released by the brain via electrical stimulation (24).

The effect mechanism of PEA in the catecholamine system is the center of current pharmaceutical research efforts. In molecular biological terms, intracellular TAAR (trace amine-associated receptor) G-protein-coupled receptors that mediate modulatory effects of PEA are verified (20).

For high nanomolar to low micromolar PEA concentrations, in vivo studies have shown amphetamine-like effects. During an increase of PEA, an increased amount of noradrenaline and dopamine is also released and the reuptake of these substances is impaired (25, 26).
According to Burchett, the following effects of PEA amplifying the catecholamine effect are assumed to be known: Direct agonist action via increased release of transmitters, reuptake inhibition, and stimulation of transmitter synthesis as well as inhibition of monoamine oxidase (MAO) (19). PEA's high lipophilia—a prerequisite for the permeability of membrane barriers such as the blood-brain barrier—is of note here; PEA levels in the brain, serum, and urine correlate quite well (10, 21, 25, 27).

The clinical relevance of changed PEA levels is well documented for mental illnesses. Endogenous depression is associated with lowered PEA levels, whereby the transition from depression to maniac episodes is accompanied by an increase in PEA levels (28-32).

The therapeutic increase in the PEA level has a positive impact on the course of the disease. Phenylalanine improves the effectiveness of antidepressants; PEA by itself is a good antidepressant—effective in 60% of the cases of depression.

In persons with ADD/ADHD (attention deficit hyperactivity disorder), PEA levels are substantially lower; the ADHD treatment with methylphenidate (Ritalin®) normalizes PEA excretion in the urine of responders (33, 34).

Contributing Factors

Laboratory tests of catecholamine have been established for years. Increased values are found in disorders such as pheochromocytoma, neuroblastoma, and arterial hypertension, whereby it is impossible for a subject to consciously regulate these values. Especially urine tests offer a sufficient level of sensitivity and specificity because urine contains 100 to 1000 times higher levels than blood plasma. The intraindividual variation coefficient ranges from 7% to 12% from one day to another; stored under appropriate conditions, the stability of the samples can be guaranteed without problems (8).

In Rimbach, urine samples were always collected at the same time of the day so that a circadian dependence could be ruled out. Other contributing factors such as increased physical activity as well as large meals were also ruled out by collecting the urine in the morning. Seasonal factors of the samples collected twice in winter and summer should have been reflected as undulating levels in the testing results. Only in the adrenaline levels of the lower exposure groups (Fig. 5) can such a corresponding correlation be found. All other data did not indicate any seasonal influences.

In the study presented here, the selection of the participating citizens of Rimbach was not based on random assignment, but on self-selection. We can assume that the subjects, especially the adults, had informed themselves about the issue of cell tower radiation. However, because it is impossible to consciously regulate these levels, this self-selection should not make any difference in this study.
Especially in children below age ten, it is not thought possible to maintain a chronic state of anxiety for one and a half years due to an abstract term such as cell tower radiation.

This study limits itself to the following type of questions: "Did the level of a given substance predominantly increase or decrease during the study period?" Independent of each model, this question can be clearly answered with the Wilcoxon test and the indication of the confidence interval. The corresponding results are statistically very well supported. Any statements beyond this—e.g. the dependence of levels on certain parameters—cannot be made because with 60 study subjects the number of cases is too small to establish the same type of statistical significance.

The great advantage of the "Rimbach data" is that prior to January 2004 the exposure levels were very low because there was no cell phone tower and because only a few citizens had installed DECT, Wi-Fi and similar devices. In addition, due to the testing equipment with a measurement accuracy of less than ± 3 dB combined with repeated control measurements, the classification of the exposure groups can be considered to be verified.

For the stress hormones adrenaline and noradrenaline, the increase occurred only after the installation and activation of the transmitter, and thereafter, levels continued to decrease but did not fully normalize.
For dopamine, significant differences in the dose-response relationship according to exposure group could be shown after the activation of the new cell tower antenna. Also, the consistently decreasing levels of the hypothetically superordinate regulatory PEA do not support the hypothesis that the stress factor for the observed changes in the adrenergic system would exclusively be found in the realm of psychological factors.

Mode of Action of Microwave Radiation

There is a wide range of evidence to interpret the newly emerging microwave exposures as an invisible stressor.

Microwaves are absorbed by living tissue. The frequencies used for cell phone technologies have a half-life penetration depth of several centimeters, whereby cell membranes constitute no obstacle (35).

Microwaves cause enzymes to malfunction directly by, for example, monomerization (36). Thus, it is conceivable that enzymes of the catecholamine system could be affected directly.

Intracellular processes are changed, and cellular mitosis is disturbed by forces acting on the cellular spindle apparatus (37, 38). The human body is required to provide a higher level of repair services that is comparable to a chronic state of stress. A decrease in adenosine triphosphate (ATP) due to microwave exposure could be demonstrated by Sanders in intracerebral tissue already in 1980 (39).

Within current exposure limits, Friedman could show the stress caused by microwaves in the cell membranes of a cell model (40). The oxygen radicals formed by NADH have an activating effect on subsequent intracellular cascades that amplify the membrane effect by a factor of 10^7, which in turn substantially change intracellular processes (17). Even reproductive impairments due to microwaves are mediated by the formation of free radicals (41).

In industry, more and more microwave devices are being used for chemical peptoid syntheses, which allow for a 100 times faster and more precise production even without any measurable heating (42). The toxic effects of free radicals formed by microwaves are used in such technical applications as water purification (43).

In several studies, the chronic symptoms of residents near cell tower antennas were described (44-48). Interestingly, the expansion of wireless networks corresponds with the increase in prescription expenses for methylphenidate, a drug whose chemical structure is related to PEA and which is indicated in cases of attention deficit disorder (ADD) (49).

Long-term studies over five years suggested an increased cancer incidence due to microwave exposure (50, 51). Since the catecholamine system is directly linked with the nervous system within the psychoneuroimmunological framework beside its organ-specific effects, the observed increase in cancer incidence can now also be understood from a pathophysiological perspective (6, 15, 52, 53).

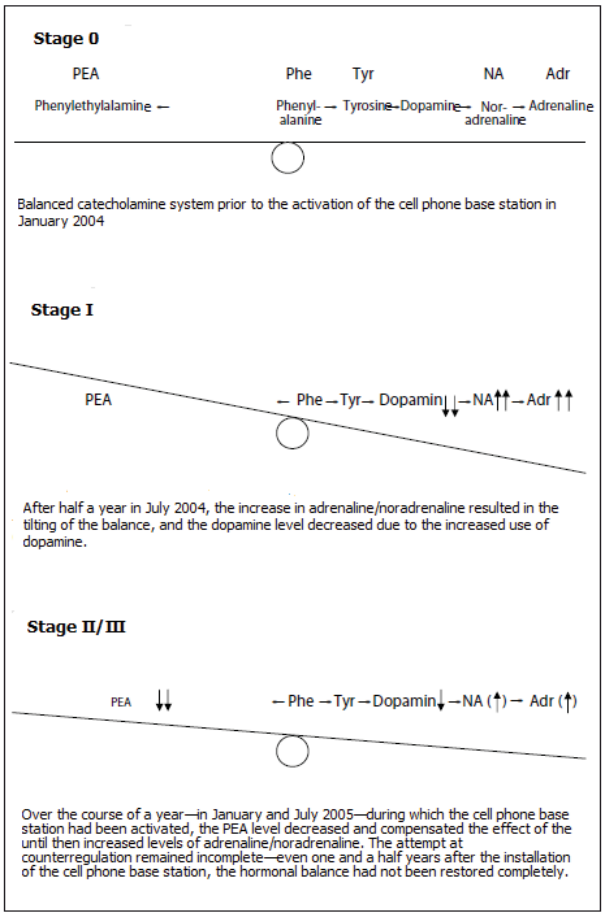

Fig. 17: Stage-like course of the stress response in Rimbach

Hypothesis of the Course of the Stress Response in Rimbach

Significant research on the stress-response axis was carried out in the 1950s. Selye established the nowadays generally accepted theory of the general adaptation syndrome of the human body to a stressor (16). He distinguished between three stages in the stress response, which can be found again in the description of the microwave syndrome according to Hecht (2, 3). Thus, after the stages of alarm and resistance, the last stage of exhaustion sets in (Fig. 17). The parameters investigated in the Rimbach study follow this pattern.

STAGE I—Activation Stage

The results of the long-term study presented here show an immediate activation of the adrenergic system. After the activation of the cell phone base station under investigation, the parameters adrenaline and noradrenaline increase significantly within a period of one and a half years. Because of the increased production of the final hormones noradrenaline/adrenaline, the use of dopamine increases, and as a result, the dopamine level decreases. The decrease in the dopamine level is the more pronounced, the higher the GSM radiation exposure level is at the residence of the individual participants.

STAGE II—Adaptation Stage

After this sympathicotonic activation stage, the body tries to compensate the increase in adrenaline and noradrenaline. In order to inhibit the overshooting catecholamine production and to ensure a stable regulation, the phenylethylamine level (PEA level) decreases. Here the decrease in PEA starts in the highest exposure group first.

STAGE III—Premorbid Stage

According to our hypothesis, the effects of adrenaline and noradrenaline are inhibited by feedback mechanisms at the expense of a chronically, over six continuous months, lowered PEA level. However, the attempt at counterregulation remains incomplete—even one and a half years after the installation of the cell phone base station; the hormonal balance had not been restored completely. The PEA level remains at a low level, which is to be interpreted as evidence for the beginning of exhaustion.

---------- Conclusion

Thus, the following hypothesis is proposed: Although participants maintained their usual lifestyle, they developed chronic stress with a primary increase in adrenaline/noradrenaline and a subsequent decrease in dopamine in response to the microwave exposure from the newly installed cell phone base station. During the stage of counterregulation, the "trace amine" PEA decreases and remains decreased.
This is of considerable clinical relevance because psychiatric symptoms also exhibit altered PEA levels. In Rimbach, the increase in sleep problems, cephalgia, vertigo, concentration problems, and allergies could be clinically documented after the cell phone base station had been activated. The newly developed symptoms can be explained clinically with the help of disturbances in the humoral stress axis (53).

After having exhausted the biological feedback mechanisms, major health problems are to be expected. The possible long-term consequences of remaining caught in the exhaustion stage have already been described by Hecht and Selye (3, 16).

Thus, the significant results presented here not only provide clear evidence for health-relevant effects in the study subjects of Rimbach after a new GSM base station had been installed there, but they also offer the opportunity to carry out a causal analysis. This has already been successfully done in the "shut-down study" of Schwarzenburg, Switzerland (54). In Rimbach, the documented levels should return to normal once the relevant base station is shut down.

Epidemiological Evidence

There is current epidemiological evidence for the considerable clinical relevance of the dysfunction of the humoral stress axis with its endpoints of PEA decrease and adrenaline increase, as documented by us.

1. Decreased PEA levels can be found in a large portion of ADD/ADHD patients. As therapy methylphenidate is used, a substance that is structurally related to PEA. Between 1990 and 2004, the boom time of cell phones, prescription costs for this medication had increased by a factor of 86 (49, 55).

2. As part of the German Mobile Telecommunication Research Programme, approximately 3000 children and adolescents were studied in Bavaria for their individual cell phone radiation exposure levels in relation to health problems. Among the various data sets, the data set regarding behavioral problems showed a significant increased risk for both adolescents (OR: 3.7, 95%-CI: 1.6-8.4) and also children (OR: 2.9, 95%-CI: 1.4-5.9) in the highest exposure group (56). For the first time, the "Rimbach Study" provides a model of explanation in biochemical terms.

3. Pheochromocytomata are adrenaline- and noradrenaline-secreting tumors of the adrenal gland (57). This type of tumor due to microwave exposure has already been demonstrated in animal experiments in 1985 (5). The increase of this disease in the US population is highly significant. Concurrent with the increase in local microwave exposures due to an increased number of base stations and use of wireless communication technologies, the number of cases have increased from 1,927 to 3,344 between 1997 and 2006 (58, 59).

It is a physician's responsibility—not bound by directives—to work toward the preservation of the natural basis of life regarding human health (60). Now it is the duty of the responsible agencies (public health department, Bavarian State Ministry of the Environment and Public Health as well as other federal ministries) to investigate the current situation.

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Literature

(1) STRAHLENSCHUTZKOMMISSION (2003): Forschungsbedarf im Sonderforschungsprogramm Mobilfunk, 3./04.07.2003.

(2) HECHT, K. (2001): Auswirkungen von Elektromagnetischen Feldern - Eine Recherche russischer Studienergebnisse 1960-1996, [Erhebung im Auftrag des Bundesinstituts für Telekommunikation (Auftrag Nr. 4231/630402)], umwelt-medizin-gesellschaft 14(3): 222-231.

(3) HECHT, K., SAVOLEY, E. N. (2007): Überlastung der Städte mit Sendeanlagen - eine Gefahr für die Gesundheit der Menschen und eine Störung der Ökoethik International Research Centre of Healthy and Ecological Technology, Berlin.

(4) BECKER, R. O. (1990): Cross Currents, J. P. Tarcher, Los Angeles.

(5) GUY, A. W., CHOU, C. K., KUNZ, L. L.,CROWLEY, J., KRUPP, J. (1985): Effects of long-term low-level radiofrequency radiation exposure on rats, summary, august 1985, Prepared for USAF SCHOOL OF AEROSPACE MEDECINE, Seattle, USAFSAM-TR-85-64, contract number F33615-80-C-0612, 9: 1-20.

(6) SCHMIDT, R. F., THEWS, G. (1983): Physiologie des Menschen, 21. Auflage, Springer Verlag, Berlin: 124

(7) BUNDESNETZAGENTUR (2004): STANDORTBESCHEINIGUNG Nr. 680 894 vom 5. 4 2004

(8) THOMAS, L. (1992): Labor und Diagnose, 4. Auflage, Die Medizinische Verlagsgesellschaft, Marburg.

(9) LABOR DIAGNOSTIKA Nord GmbH & Co. KG (Hrsg) (2008): Instructions For Use 3-Cat ELISA, [http://www.ldn.de/index.php/Catecholamines-ELISA/View-all-products.html, letzter Zugriff: 11.11.2010].

(10) BIEGER, W. P. (2004): Neuroscience - Grundlagen, Diagnostik und Therapie von Neurotransmitter-vermittelten Erkrankungen, [http://dr-bieger.de/neurostress-aktuallisierte-kurzuebersicht/#0, letzter Zugriff: 08.06.2010].

(11) HUISMANN, H., WYNVEEN, P., SETTER, P. W. (2009): Studies on the immune response and preparation of antibodies against a large panel of conjugated neurotransmitters and biogenic amines: specific polyclonal antibody response and tolerance, Journal of Neurochemistry, 10.1111/j.1471-4159.2009.06492.x.

(12) BÜNING, H., TRENKLER, G. (1978): Nichtparametrische statistische Methoden, W. de Gruyter, Berlin, New York.

(13) BOSCH, K. (2005): Elementare Einführung in die angewandte Statistik, vieweg studium, Wiesbaden.

(14) INTERNATIONAL COMMISSION ON NON-IONIZING RADIATION PROTECTION - ICNIRP (1998): Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic, and Electromagnetic Fields (up to 300 GHz). Health Physics 74 (4): 494-522; 1998. [http://www.icnirp.org/PubMost.htm, letzter Zugriff 11.11.2010].

(15) LÖFFLER, G., PETRIDES, P. (1997): Biochemie und Pathochemie, 6. Auflage, Springer Verlag, Berlin: 800-821.

(16) SELYE, H. (1953): Einführung in die Lehre von Adaptations-Syndrom, Thieme Verlag, Stuttgart.

(17) LINDER, H. (2005): Biologie, 22. Auflage, Schroedelverlag, Braunschweig: 155

(18) BARGER, A., DALE, H. (1910): Chemical structure and sympathomimetic action of amines, J. Physiol. (Lond.) 41: 19-59.

(19) BURCHETT, S. A., HICKS, T. P. (2006): The mysterious trace amines: Protean neuromodulators of synaptic transmission in mammalian brain, Progress in Neurobiology 79: 223-246.

(20) LINDEMANN, L., HOENER, M. (2005): A renaissance in trace amines inspired by a novel GPCR family, TRENDS in Pharmacological Sciences 26(5): 274-281.

(21) BERRY, M. D. (2004): Mammalian central nervous system trace amines Pharmacologic amphetamines, physiologic neuromodulators, J. Neurochem. 90: 257-271.

(22) XIE, Z., MILLER, G. M. (2008): ß-Phenylethylamine Alters Monoamine Transporter Function via Trace Amine-Associated Receptor 1: Implication for Modulatory Roles of Trace Amines in Brain, The journal of pharmacology and experimental therapeutics 325: 617-628.

(23) ZELLER, E. A., MOSNAIM, A. D, BORISON, R. L, HUPRIKAR S. V. (1976): Phenylethylamine: Studies on the Mechanism of Its Physiological Action, Advances in Biochemical Psychopharmacology 15: 75-86.

(24) ORREGO, H. (1976): pers. Mitteilung, in: ZELLER, E. A., MOSNAIM, A. D, BORISON, R. L, HUPRIKAR S. V. (1976): Phenylethylamine: Studies on the Mechanism of Its Physiological Action, Advances in Biochemical Psychopharmacology 15: 83.

(25) BOULTON, A. (1976): Identification, Distribution, Metabolism, and Function of Meta and Para-Tyramine, Phenylethylamine and Tryptamine in Brain, Advances in Biochemical Psychopharmacology 15: 57-67.

(26) BERRY, M. D. ET AL. (1994): The effects of administration of monoamine oxidase-B inhibitors on rat striatal neurone responses to dopamine, Br. J. Pharmacol. 113: 1159-1166.

(27) RAO, T. S., BAKER, G. B., COUTTS, R. T. (1987): N-(3-Chloropropyl) Phenylethylamine as a possible Prodrug of ß-Phenylethylamine: Studies in the rat brain, Progress in neuro-psychopharmacology & biological psychiatry 11: 301 -308.

(28) SABELLI, H. C., MOSNAIM, A. D. (1974): Phenylethylamine hypothesis of affective behavior, Am. J. Psychiatry 131: 695-699.

(29) SABELLI, H. C. (1995): Phenylethylamine modulation of affect, Journal of neuropsychiatry and clinical neurosciences 7: 6-14.

(30) BIRKMAYER, W., RIEDERER, P., LINAUER W., KNOLL, J. (1984): The antidepressive efficacy of l-deprenyl, Journal of Neural Transmission 59: 81-7.

(31) DAVIS, B. A., BOULTON, A. A. (1994): The trace amines and their acidic metabolites in depression - an overview, Prog. Neuropsychopharmacol. Biol. Psychiatry 18: 17-45.

(32) SABELLI, H., FINK, P., FAWCETT. J., TOM, C. (1996): Sustained Antidepressant Effect of PEA Replacement, The journal of neuropsychiatry and clinical neurosciences 8: 168-171.

(33) BAKER, G. B., BORNSTEIN, R. A., ROUGET, A. C., ASHTON, S. E., VAN MUYDEN, J. C., COUTTS, R. T. (1991): Phenylethylaminergic Mechanisms in Attention-Deficit Disorder, Biologic Psychiatry 29: 15-22.

(34) KUSAGA, A., YAMASHITA, Y., KOEDA, T., HIRATANI, M., KANEKO, M., YAMADA, S., MATSUISHI, T. (2002): Increased urine phenylethylamine after methylphenidate treatment in children with ADHD, Annals of neurology, 52(3): 372-4.

(35) SCHLIEPHAKE, E. (1960): Kurzwellentherapie, Stuttgart, Fischer Verlag [mit Zitat aus: Deutsche Medizinische Wochenschrift, Heft 32: 1235 (5. August 1932)].

(36) BARTERI, M. (2005): Structural and kinetic effects of mobile phone microwaves on acetylcholinesterase activity, Biophysical Chemistry 113: 245-253.

(37) SCHMID, E., SCHRADER, T. (2007): Different biological effectiveness of ionizing and non-ionising radiations in mammalian cells, Adv. Radio Sci. 5: 1-4.

(38) SCHRADER, T., SCHMID, E., MÜNTER, K., KLEINE-OSTMANN, T. (2008): Spindle Disturbances in Human-Hamster Hybrid (AL) Cells Induced by Mobile Communication Frequency Range Signals, Bioelectromagnetics 29: 626 - 639.

(39) SANDERS, A. P., SCHAEFER, D. J., JOINES, W. T. (1980): Microwave effects on energy metabolism of rat brain, Bioelectromagnetics 1: 171-182. 42

(40) FRIEDMAN, J., KRAUS, S., HAUPTMAN, Y., SCHIFF, Y., SEGER, R. (2007): Mechanism of a short-term ERK activation by electromagnetic fields at mobile phone frequency, Biochemical Journal 405(Pt 3): 559-568.

(41) DESAI, N. R., KESARI, K. K., AGARWAL, A. (2009): Pathophysiology of cell phone radiation: oxidative stress and carcinogenesis with focus on male reproductive system, Reproductive Biology and Endocrinology 7: 114: 1-9.

(42) OLIVOS, H. J., ALLURI, P. G., REDDY, M. M., SALONY, D., KODADEK, T. (2002): Microwave-Assisted Solid-Phase Synthesis of Peptoids, Organic Letters 4(23): 4057-4059.

(43) HORIKOSHI, S., HIDAKA, H., SERPONE, N. (2003): Hydroxyl radicals in microwave photocatalysis. Enhanced formation of OH radicals probed by ESR techniques in microwave-assisted photocatalysis in aqueous TiO2 dispersions, Chemical Physics Letters 376: 475-48.

(44) SANTINI, R., SANTINI, P., DANZE, J. M., LE RUZ, P., SEIGNE, M. (2002): Symptoms experienced by people living in vicinity of mobile phone base stations: Incidences of distance and sex, Pathol. Biol. 50: 369-373.

(45) NAVARRO, E. A., SEGURA, J., PORTOLES, M., GÖMEZ-PERRETTA DE MATEO, C. (2003): The Microwave Syndrome: A Preliminary Study in Spain, Electromagnetic biology and medicine 22(2 & 3): 161 -169.

EGER, H., JAHN, M. (2010): Spezifische Symptome und Mobilfunkstrahlung in Selbitz (Bayern) - Evidenz für eine Dosiswirkungsbeziehung, umwelt-medizin-gesellschaft 23(2):130-139.

(46) AUGNER, C., HACKER, G.W., OBERFELD, G., FLORIAN, M., HITZL, W., HUTTER, J., PAUSER, G. (2010): Effects of Exposure to GSM Mobile Phone Base Station Signals on Salivary Cortisol, Alpha-Amylase, and Immunoglobulin A., Biomed Environ Sci 23 (3): 199-207.

(47) ABDEL-RASSOUL, G., EL-FATEH, O.A., SALEM, M.A., MICHAEL, A., FARAHAT F., EL-BATANOUNY, M., SALEM, E. (2007): Neurobehavioral effects among inhabitants around mobile phone base stations. NeuroToxicology 28(2): 434-40.

(48) FEGERT, J., GLAESKE, G., JANHSEN, K., LUDOLPH, A., RONGE, C. (2002): Untersuchung zur Arzneimittel-Versorgung von Kindern mit hyperkinetischen Störungen anhand von Leistungsdaten der GKV. Projektbericht für das Bundesministerium für Gesundheit und Soziale Sicherung, [http://www.home.uni-osnabrueck.de/kjanhsen/ unter Bücher, Buchartikel, Projektberichte, letzter Zugriff 11.11.2010].

(49) EGER, H., NEPPE, F. (2009): Krebsinzidenz von Anwohnern im Umkreis einer Mobilfunksendeanlage in Westfalen, Interview-basierte Piloterhebung und Risikoschätzung, umwelt-medizin-gesellschaft 22(1): 55-60.

(50) EGER, H., HAGEN, K. U., LUCAS, B., VOGEL, P., VOIT, H. (2004): Einfluss der räumlichen Nähe von Mobilfunksendeanlagen auf die Krebsinzidenz, umwelt-medizin-gesellschaft 17(4): 326-332.

(51) FELTEN, D. L., MAIDA, M. E. (2002): Psychoneuroimmunology, in: FINK, G. (Hrsg.): Encyclopedia of the Human Brain, Vol. 4, Academic Press, San Diego: 103-127.

(52) STRAUB, R. H. (Hrsg.) (2007): Lehrbuch der klinischen Pathophysiologie komplexer chronischer Erkrankungen, Band 1 und 2, Vandenhoeck und Ruprecht, Göttingen: (2) 89-98.

(53) ABELIN, T., ALTPETER, E., RÖÖSLI, M. (2005): Sleep Disturbances in the Vicinity of the Short-Wave Broadcast Transmitter Schwarzenburg - Schlafstörungen in der Umgebung des Kurzwellensenders Schwarzenburg, Somnologie 9: 203-209.

(54) PAFFRATH, D., SCHWABE, U. (Hrsg.) (2004): Arzneiverordnungs-Report 2004, Aktuelle Daten, Kosten, Trends und Kommentare. Springer-Verlag, Berlin. [http://wido.de/arzneiverordnungs-rep.html unter download, letzter Zugriff 11.11.2010].

(55) THOMAS, S., HEINRICH, S.,VON KRIES R., RADON K. (2010): Exposure to radio-frequency electromagnetic fields and behavioural problems in Bavarian children and adolescents. Eur J Epidemiol 25(2): 135-141.

(56) SIEGENTHALER, W. K., HORNBOSTEL, H. D. (1984): Lehrbuch der Inneren Medizin, Georg Thieme Verlag, Stuttgart, New York.

(57) MILHAM, S. (2010): Dirty electricity - electrification and the diseases of civilization, universe, Bloomington.

(58) OSSIANDER, E. (2010): persönliche Mitteilung [Numbers of hospitalizations per year for ICD-9 code 227.0 (benign tumor of the adrenal gland, 1987-2007, Epidemiology Office, Washington State Department of Health Pheochromocytoma, ICD 227.0, 1997-2006, US Department of Health and Human Services, H.CUPnet.

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Horst Eger's scientific contributions

Overview

Publications (4)

The Influence of Being Physically Near to a Cell Phone Transmission Mast on the Incidence of Cancer

Article

Dec 2003

Horst Eger · Klaus Uwe Hagen · Birgitt Lucas · [...] · Helmut Voit

The result of the study shows that the proportion of newly developing cancer cases was significantly higher among those patients who had lived during the past ten years at a distance of up to 400 metres from the cellular transmitter site, which has been in operation since 1993, compared to those patients living further away, and that the patients fell ill on average 8 years earlier. In the years 1999-2004, ie after five years' operation of the

Cite Request full-text

Einfluss der räumlichen Nähe von Mobilfunksendeanlagen auf die Krebsinzidenz

Article

Dec 2003

Horst Eger · Klaus Uwe Hagen · Birgitt Lucas · [...] · Helmut Voit

Im Anschluss an die durch den rasanten Anstieg der drahtlosen Telefonie in den letzten Jahren be- dingte Zunahme der Zahl von Mobilfunksendeanlagen in oder in unmittelbarer Nähe von Wohn- gebieten erfolgte die Aufforderung des Präsidenten des Bundesamtes für Strahlenschutz, Wolfram König, an alle Ärzte, aktiv an der Abschätzung des Risikos durch Mobilfunkstrahlung mitzuarbei- ten. Das Ziel dieser

Cite Request full-text

Influência da Proximidade de um Mastro de Transmissão de Telefonia Celular sobre a Incidência de Câncer

Article

Horst Eger · Klaus Uwe Hagen · Birgitt Lucas · [...] · Helmut Voit

Cite Request full-text

Veränderung klinisch bedeutsamer Neurotransmitter unter dem Einfluss modulierter hochfrequenter Felder -Eine Langzeiterhebung unter lebensnahen Bedingungen

Article

Klaus Buchner · Horst Eger

Cite Request full-text

Citations

... The effects of RFR combined with one other stressor in lab tests can result in damage at lower RFR exposures than RFR exposures shown to cause serious damage when measured in isolation. The effects of RFR combined with myriad other stressors, as reflected in epidemiology studies, (e.g., [26] [27][28]) can result in serious damage at RFR exposures orders of magnitude less than RFR exposures shown to cause serious damage when measured in isolation. ...

Reference: The role of toxic stimuli combinations in determining safe exposure limits

The influence of Being Physically Near to a Cell Phone Transmission Mast on the Incidence of Cancer

View

... Classification of radiofrequency radiation (RFR) as " possibly carcinogenic to humans " (group 2B) by the International Agency for Research on Cancer (IARC) / the World Health Organization (WHO) in 2011 [1] was a milestone on the way to awareness of global risk for human biology from expansion of wireless technologies all over the world. There exists a number of epidemiological studies which demonstrate carcinogenic effects of low intensity RFR emitted by cell phones2345 and base transceiver stations [6, 7]. To that, there is a set of experimental data showing that low intensity RFR results in cancer promotion in animal models891011. ...

Reference: Monochromatic red light of LED protects embryonic cells from oxidative stress caused by radiofrequency radiation

Einfluss der räumlichen Nähe von Mobilfunksendeanlagen auf die Krebsinzidenz

Citing article

Dec 2004

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Kathy Noel

From: Anjali Corinne S <anjalicore2011@gmail.com>
Sent: Tuesday, August 27, 2019 2:24 PM
To: Roy Sapau
Subject: 5G cells--Additional Questions

Hello Roy,

I appreciate your talking with me recently. My questions relate to the 5G small cell ordinance.

1.This is what we discussed on the phone. We need to know what direction the antennas will be sending the frequencies. Will it include towards buildings it is in front of or away from them? On a street like El Camino Real, will the beams be directed north and south along that street or will they radiate in other directions? This is important to the people in that area who will want to know if their place of work is being radiated or not by the cells. Also, those whose residence is close to commercial districts want to know that. **I live just off El Camino Real right next to the commercial district so this applies to me and my neighbors. We are very concerned the cell antennas will radiate into our homes, reduce property values and compromise health.**

2. Private and HOA owned land: For those who live on streets that are privately owned, or HOA privately owned streets and light poles, will those areas be exempt from the FCC rulings and therefore not required to have the 5G cell towers on our land. I imagine that is true, but we need to know that for certain. **I live on private land along with 80 other homes here so this applies to me and my neighbors.**

Please notify me as soon as you get a date for the 5G workshop so we can set a date for our expert speaker.

Thank you for your help.
Sincerely,

Corinne

Kathy Noel

From: Annemarie Clisby
Sent: Monday, September 16, 2019 4:34 PM
To: Roy Sapau
Subject: FW: 5G Cell Towers: what I saw in La Jolla

Follow Up Flag: Follow up
Flag Status: Flagged

From: Anjali Corinne S <anjalicore2011@gmail.com>
Sent: Monday, September 16, 2019 1:57 PM
To: Council Members <council@encinitasca.gov>
Subject: 5G Cell Towers: what I saw in La Jolla

Dear Mayor Blakespear and City Council,

I am a 30 year resident of Encinitas. I want you to see the photos of what could be coming to Encinitas if we don't take action. Saturday I was in La Jolla and took photos of many 5G cell towers and antennas. I was disheartened to see so many of them every half block or block in the beautiful hilly section of town. I was astonished at how ugly many were and amazed the telecoms got them approved by their city council. I read an article in the **La Jolla Light** about unhappy residents who now have a cell tower in front of their home. They now have to live with constant worry about their family's health or they have to move! Tragic! I wanted you to see what the towers look like on the various poles and see how close they are to homes.

Is this what is coming to Encinitas?

5G Cell tower in front of multimillion dollar, ocean view, La Jolla homes on Pearl (property just devalued by cell tower at least 20% per surveys!) This antenna is about 20 feet from the home where a family with young children could live.

At least 4 homes closest to a cell tower are devalued 20% per surveys. If you do the math, that is a huge loss if home owners can even sell at all.

Just up the road is another type of clunky looking 5G Cell tower with lots of wires in front of several exquisite La Jolla ocean view, multimillion homes on Soledad & Kearsarge
About a half block away from the big antennas in La Jolla, are smaller ones every half block or so.

Please continue to do all you can to keep these untested cell towers out of our beloved Encinitas, for everyone's benefit for our health, peace of mind, and financial needs. We must protect our residents first and foremost!

Respectfully Yours,

Corinne Schreiner

Kathy Noel

From: Annemarie Clisby
Sent: Wednesday, August 21, 2019 3:10 PM
To: Roy Sapau
Subject: FW: Encinitas Small Cell Antenna Urgency Ordinance

From: Anjali Corinne S <anjalicore2011@gmail.com>
Sent: Wednesday, August 21, 2019 2:49 PM
To: Catherine Blakespear <cblakespear@encinitasca.gov>; Jody Hubbard <jhubbard@encinitasca.gov>; Council Members <council@encinitasca.gov>; Tony Kranz <tkranz@encinitasca.gov>; Joe Mosca <jmosca@encinitasca.gov>; Kellie Shay Hinze <khinze@encinitasca.gov>
Subject: Encinitas Small Cell Antenna Urgency Ordinance

Dear Encinitas City Council,

I am a homeowner in Encinitas, and I'm deeply concerned about the installation of 5G due to not being tested and certified as safe for health with thousands of 5G antenna sites planned. **People are now reporting illnesses where 5G has been installed**. **Please read the news articles below**. The total lack of health and safety independent testing was admitted by all the tech industry executives at a hearing on 5G in Washington D.C. which you can see on YouTube. It is astonishing to see this! Senator Blumenthal's comment after hearing the executives was, "We are flying blind." https://youtu.be/hsil3VQE5K4

I urge you to read these news reports coming in July 2019 from people getting ill after the installation of 5G in California and Switzerland. Note in this news report that Swiss doctor Dr. Bertrand Buchs, who has also called for a 5G moratorium, states he has seen more and more patients with similar symptoms.

Several cities in California, and several countries have instigated moratoriums on 5G **until it is proven safe**. I hope that we can honor all of you in the Encinitas City Council for your wisdom and common sense protection of the citizens of Encinitas. My wish is to have a moratorium as well until 5G is proven safe.

However, since you are forced by the FCC rules to install 5G, **I urge you to create an ordinance with the utmost protection possible.** That would be no installations in residential neighborhoods; at least 1000 feet from hospitals, medical centers. daycare centers and senior care facilities, and at least 100 feet from any commercial building.

I am a senior with a serious health challenge and I'm worried 5G will make me so ill I will have to leave my home and the city I love so much for over 30 years. You have the opportunity to be our heros. You have the enormous responsibility to protect us. I implore you to do that! Please read the short news articles below.

Sincerely,
Corinne Schreiner

This is from Physicians for Safe Technology

The first reported injury of 5G in a news report comes from Switzerland, where 5G has been launched in 102 locations. The weekly French-language Swiss magazine L'Illustré interviewed people living in Geneva after the 5G

rollout with alarming details of illness. In their article, With 5G, We Feel Like Guinea Pigs, posted July 18, 2019, they report neighbors met to discuss their many common symptoms and many unanswered questions.

Update 8/15/19

5G: Its Legal but Not Safe

As soon as the antennas were installed, several residents and entire families in the heart of Geneva reported similar unusual symptoms of loud ringing in the ear, intense headaches, unbearable earaches, insomnia, chest pain, fatigue and not feeling well in the house. 29-year-old Geneva resident, Johan Perruchoud, called up Swisscom and was told that indeed the 5G cell towers were activated on the same day he began to feel the symptoms. When others called Swisscom they were told everything is legal and within guidelines.

Swiss Physician Denounces 5G and Calls for a 5G Moratorium

Dr. Bertrand Buchs, who has also called for a 5G moratorium, states he has seen more and more patients with similar symptoms. He notes, "In this case, our authorities are going against common sense … we risk experiencing a catastrophe in a few years… no serious study exists yet, which is not surprising when we know that this technology was developed in China, then to the United States. In Switzerland, we could open a line for people who feel bad, listen to these complaints and examine them. Our country has the means and the skills. The debate must be launched because the story is not about to end."

Dear Diary: Loud Humming, Lots of Pain, Nausea, No Sleep

These stories parallel that of Anne Mills, author of "All EMF'd Up", who suffered wireless radiation poisoning in Germany when her husband was stationed there for work. She wrote a diary with identical symptoms of those in Geneva. As noted in the Swiss magazine L'Illustré article, her concerns, like those in Geneva, were dismissed. She consulted with German physician, Dr. Horst Eger, to confirm her symptoms were that of microwave illness seen in military radar personnel and those working on microwave towers. All EMF*d Up (*Electromagnetic Fields): My Journey Through Wireless Radiation Poisoning and How You Can Protect Yourself. (2019)Anne Mills

"Mystery Illness" In Cuban and Chinese Diplomats is Microwave Poisoning

The New York Times and CBS reported unexplained symptoms in diplomats living in China and Cuba in 2017 and 2018. The source was found to be microwave radiation. UC San Diego Professor of Medicine, Dr. Beatrice Golomb, published an article in Neural Computation in September 2018, discussing the symptoms of the diplomats living abroad. The symptoms that diplomats and their families experienced, i.e. sleep problems, headaches, strange auditory sounds, anxiety and dizziness were similar to those with microwave illness reported in military studies from pulsed microwave radiation. See Cuban Diplomats Likely Hit by Microwave Weapons.

Residents in Sacramento, California Experiencing Symptoms

After 5G towers were installed in a Sacramento neighborhood, a family began to experience generalized health issues, including headaches. This was such a concern that the father set up a website and petition to gain support for halting 5G expansion. Sacramento was one of the first in the U.S. to permit 5G cell towers, with health concerns being raised well before the towers were in place. The question remains about exactly what frequencies of radiation

and what levels of radiation are emitted by these neighborhood 5G cell towers which reportedly will use 4G frequencies as well. Should there be independent testing?

News and Research Articles

- "With 5G, We Feel Like Guinea Pigs" or "Avec la 5G, nous nous sentons comme des cobayes".Translated easily into English with google translator. https://www.illustre.ch/magazine/5g-sentons-cobayes?utm_source=facebook&fbclid=IwAR1kXKK1yWBDKoaZRVOQB7gRvC8o-1a3GyVbQHJPyPkAzzpl73iKYtaiA6Q
- Side Effects of living near 5G towers in Geneva Switzerland – testimonial. Altermedicine.org. https://www.altermedicine.org/sideeffects-of-living-near-5g-towers-in-geneva-switzerland-testimonial/
- Microwave Weapons Are Prime Suspect in Ills of U.S. Embassy Workers. Doctors and scientists say microwave strikes may have caused sonic delusions and very real brain damage among embassy staff and family members. Sept 1, 2018.William J. Broad. https://www.nytimes.com/2018/09/01/science/sonic-attack-cuba-microwave.html?action=click&module=Well&pgtype=Homepage&section=Health
- Diplomats in China report similar brain injuries as Americans in Cuba in 2016 and 2017,25 Americans in the U.S. embassy in Cuba suffered serious, unexplained brain injuries. Now, at least 15 American officials in China are reporting similar symptoms. 60 Minutes reports. March 15, 2019. https://www.cbsnews.com/news/diplomats-in-china-report-similar-brain-injuries-as-americans-in-cuba-60-minutes/
- Researcher links diplomats' mystery illness to radiofrequency/microwave radiation. Eureka alert. August 29, 2018. American Academy for the Advancement of Science. https://www.eurekalert.org/pub_releases/2018-08/uoc–rld082918.php
- Diplomats' Mystery Illness and Pulsed Radiofrequency/ Microwave Radiation. Golomb BA. Neural Computation. 2018 Sep 5:1-104. https://www.ncbi.nlm.nih.gov/pubmed/30183509
- EUROPAEM EMF Guideline 2016 for the prevention, diagnosis and treatment of EMF-related health problems and illnesses gives an "overview of the current knowledge regarding EMF-related health risks and provides recommendations for the diagnosis, treatment and accessibility measures of EHS to improve and restore individual health outcomes as well as for the development of strategies for preventionor https://www.degruyter.com/view/j/reveh.ahead-of-print/reveh-2016-0011/reveh-2016-0011.xml?format=INTor EMF Guidelines
- 'Are community concerns over the 5G network rollout based on unfounded anxiety or valid evidence?' Guest Blog from Dr. Don Maisch, Australia. Between a Rock and a Hard place. April 25, 2019. https://betweenrockandhardplace.wordpress.com/2019/04/25/guest-blog-from-dr-don-maisch-australia-are-community-concerns-over-the-5g-network-rollout-based-on-unfounded-anxiety-or-valid-evidence/
- The Prevalence of People With Restricted Access to Work in Man-Made Electromagnetic Environments. Bevington M. Journal of Environment and Health Science. January 18, 2019. https://www.ommegaonline.org/article-details/The-Prevalence-of-People-With-Restricted-Access-to-Work-in-Man-Made-Electromagnetic-Environments/2402
- Prevalence of self-reported hypersensitivity to electric or magnetic fields in a population-based questionnaire survey. Hillert L et al. Scand J Work Environ Health. 2002 Feb;28(1):33-41. https://www.ncbi.nlm.nih.gov/pubmed/11871850
- Changes of Clinically Important Neurotransmitters Under the Influence of Modulated RF Fields- A Long-term Study Under Real-life Conditions. (2011) Buchner K and Eger H. https://ecfsapi.fcc.gov/file/7521095891.pdf
- Research articles by Dr. Horst Eger. https://www.researchgate.net/scientific-contributions/2014064959_Horst_Eger

Kathy Noel

From: Annemarie Clisby
Sent: Tuesday, August 27, 2019 2:20 PM
To: Roy Sapau
Subject: FW: Important 5G Issues!

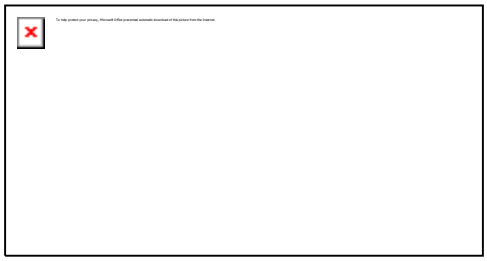
Mayor and City Council are blind copied.

Please see the email below from Sarito Sun.

From: Sarito Sun <ssarito@hotmail.com>
Sent: Tuesday, August 27, 2019 12:22 PM
To: Annemarie Clisby <Aclisby@encinitasca.gov>
Subject: Re: Important 5G Issues!

Good Morning Ms. Clisby,
Thank you for your reply. I'm happy to hear that you, the City Council, and the Mayor are studying this highly important issue. I know that you are all dedicated to keep our communities safe, healthy and thriving.

This link was posted online. I haven't watched it yet but it looks very interesting and timely. Could you please alert the
other members of your office of this series. I appreciate you sharing it at City Hall.
5G is a huge threat to our lives. We appreciate you protecting and saving us from this danger. Thank You!
Respectfully,
Sarito Sun
https://the5gsummit.com/?utm_source=ActiveCampaign&utm_medium=email&utm_content=Own+the+expert+talks+starting+at+%2459+%28plus+%24245+in+bonuses%29%21&utm_campaign=5G19



Registration - 5G Crisis: Awareness & Accountability Summit

Your guides for this event are Josh del Sol and Sayer Ji, two iconic health advocates who are known for changing the way we view and achieve improved health and happiness.If you're hungry for cutting-edge information with life-saving consequences, and want to be part of a movement dedicated to empowering ourselves and humanity, join us for this event!

the5gsummit.com

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AWARENESS & ACCOUNTABILITY

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5G wireless… the industry HAS NOT shown it to be safe for your health or privacy – yet THOUSANDS of peer-reviewed, independent studies show the risks it presents. Learn about the dangers and find solutions in your community!

You may have heard of 5G, it stands for fifth-generation cellular wireless. In a February 2019 US Senate hearing, the wireless industry was forced to admit they have no safety studies on 5G, and don't plan to do any. Meanwhile, there are thousands of independent studies concluding that **wireless radiation causes biological harm.**

Despite this, the wireless industry is working with government to deploy 5G — it's a global, for-profit, human experiment... without our consent.

What does it mean? Millions of "small" cell towers will be added to every block (which is a serious privacy concern). Each tower emitting radiation at levels known to cause **cancer, sterility, DNA damage and other harm**... especially to our children, who are most at risk.

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Kathy Noel

From: Annemarie Clisby
Sent: Thursday, September 5, 2019 1:31 PM
To: Roy Sapau
Subject: FW: Questions About Urgency Ordinance 5G cell antennas
Attachments: CA Cities 5G Restricted Areas.docx

Good afternoon,

Corinne Schreiner called the City Council phone with the questions below. Please respond and copy me so I know how to respond. Thank you!

From: Anjali Corinne S <anjalicore2011@gmail.com>
Sent: Thursday, September 5, 2019 11:23 AM
To: Council Members <council@encinitasca.gov>
Subject: Questions About Urgency Ordinance 5G cell antennas

Dear Mayor Blakespear and City Council Members,

We have concerns about your amending the urgency ordinance for small cell 5G towers soon. I have four specific questions at the end I would appreciate answers to.

My family and friends are worried that telecommunication companies will apply for a 5G cell sites in Encinitas and install them close to homes, schools and other vulnerable areas--before the ordinance is amended. I have attended recent council meetings because I'm very concerned about this. I have been researching this for **many hours** to get informed.

My understanding is the Encinitas small cell urgency ordinance is not protective for sensitive areas like hospitals, daycare centers, and schools and does not protect residential areas. There are no setbacks required for sensitive areas which would be expected based on setbacks in the wireless ordinance for macro antennas. The ordinance does not prevent installation of small cell antennas in front of our homes.This is entirely unacceptable!

Of course, you don't want a cell tower in your front yard or your child's school, or your mother's nursing home. I imagine you are also concerned about property devaluation and our city's reputation as a healthy place to live and raise children. I know you care about the environment.

I also realize this whole 5G installation situation is being forced by State and FCC rules that have taken away local control. I imagine that must be very upsetting for you, as it is for me. I appreciate the letters that Mayor Blakespear, and former Mayor Glaspar wrote to CA state legislators opposing the state bills on this matter, in 2016 and 2017, that took away our cities' local control. I appreciate that over 20 cities have sued the FCC over this! I think it is unconstitutional and outrageous!

My questions:

1. Are you working on amending this urgency ordinance to restrict cell towers from residential, schools, hospitals, daycare centers, sports parks, etc.? If so, do you have a plan when that will be finished?

2. Will it include set backs such as other cities have included? I encourage you to make those setbacks as generous as possible. **Please see my attachment of set backs in other cities**

3. I live in a mixed commercial/residential district. Of course, we don't want cell towers near us either, for health, property values, and safety-fire issues. Will you include restrictions--set backs for those mixed commercial/residential areas as well? I'm have a serious health challenge and I don't want to have to move. If a 5G antenna is close to me I would want to move.

4. Several cities in CA concerned about 5G installations, have posted on their websites: "if any Wireless Carrier installs a CPMRA-WTF on your street, AT&T, Verizon, Sprint, T-Mobile and others can come back to claim the real estate at every other light pole in the neighborhood." Is this true for Encinitas? That sounds very crucial to find out and a huge loss of local control!

Walnut City, California has an ordinance that shows a lot of consideration for children and the environment. I hope ours will be at least as considerate:

"Telecommunication towers and antennas shall not be located within 1,500 feet of any school (nursery, elementary, junior high, and high school), trail, park or outdoor recreation area, sporting venues, and residential zones."

Screenshot of Ordinance from Walnut Website,

Thank you for your time on this matter.

Respectfully Yours,

Corinne Schreiner

Walnut City, California

"Telecommunication towers and antennas shall not be located within 1,500 feet of any school (nursery, elementary, junior high, and high school), trail, park or outdoor recreation area, sporting venues, and residential zones."

Screenshot of Ordinance from Walnut Website,

To see the code online go to https://qcode.us/codes/walnut/, Click on "Title 6: Planning and Zoning" Click on "Chapter 6.88 ANTENNAS AND COMMUNICATION FACILITIES", Click on "6.88.060 Design standards, See Item "O.

Mill Valley, California: Urgency Ordinance No 18, September 6, 2018

- New or updated facilities prohibited in residential zones. Commercial only.
- Facilities installed on poles in public right of way must be 1,500 feet apart
- Design, noise standards
- Facilities in public right of way that would interfere with future projects / improvements must be relocated
- Promptly remove facilities when no longer needed; replace with smaller facilities as feasible
- Defend and indemnify the City

Mill Valley, California: Urgency Ordinance No 18, September 6, 2018 PDF

Palos Verdes, California

Palos Vardes, California Ordinance Chapter 12.18 – WIRELESS TELECOMMUNICATIONS FACILITIES IN THE PUBLIC RIGHT-OF-WAY

According to citizens of the City, after citizen uproar, Crown Castle began complying with municipal aesthetic requirements and moving proposed locations out of neighborhoods and away from homes. The ordinance has four key components, if these are met the site will almost certainly be approved:

- Minimal antenna size with screening
- All accessory equipment underground (everything except the antenna)
- Combining sites with existing vertical infrastructure (streetlights, traffic signals, etc.)
- Strict location restrictions, no sites on local, residential streets without an exception granted

  If they don't comply with these, then the applicant must demonstrate the site is required to fill a significant gap and there is no less intrusive alternative to receive an exception. This is not simply checking a box (i.e. the applicant just claiming these conditions exist) but has to be demonstrated to the City planning commission via engineering analysis.
-

Ross Valley, California: Wireless Telecommunications Facilities

- Modeled after Mill Valley's
- Adopted regulations prohibit facilities in **residential and downtown zoning district.**
- Facilities proposed in the public right-of-way subject to separate design criteria.
- Limits height and width of facilities to a minimum necessary for property function.
- Maximum height of 24 feet above the height of the existing utility pole and 7 feet above a street light standard.
- Requires equipment to be placed underground.

Ross Valley, California: Wireless Telecommunications Facilities PDF

Environmental Health Trust:

https://ehtrust.org/usa-city-ordinances-to-limit-and-control-wireless-facilities-small-cells-in-rights-of-ways/

STATE ACTIONS

New Hampshire Bill 522: An act establishing a commission to study the environmental and health effects of evolving 5G technology which asks "Why have 1,000s of peer-reviewed studies, including the recently published U.S. Toxicology Program 16-year $30 million study, that are showing a wide-range of statistically significant DNA damage, brain and heart tumors, infertility, and so many other ailments, being ignored by the Federal Communication Commission (FCC)?" and "Why are the FCC-sanctioned guidelines for public exposure to wireless radiation based only on the thermal effect on the temperature of the skin and do not account for the non- thermal, non-ionizing, biological effects of wireless radiation?"

qcode.us/codes/walnut/?view=desktop&topic=vi-25-xxv-25_253_5

Walnut City Code

Walnut, California

Current through Ordinance 17-08 and the October 2017 code supplement. For more recent amendments to this code, refer to the CodeAlert page.

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Contact:

City Clerk: (909) 595-7543

finds that using a setback area is r

(c) Telecommunication tower proposed facility will be co-locate for individual residents.

(d) Reserved.

(e) Monopoles and alternative

(f) All towers, antennas and a achieve compatibility with adjace of monopoles where there would

(g) All towers, antennas and a background and neighborhood.

(h) Satellite dishes, other than director, show that this is infeasib

(i) Ground level support facili typically found in the area. Said f

(j) Security fences shall not be view as determined by the commu

(k) All satellite dishes greater ground level from any adjacent pu combination of thereof, and must mounted installation may incorpo and material of the existing devel

(l) Backup generators shall on an exterior level of a maximum si maintenance shall only take place

(m) All areas disturbed during compatible with the vegetation in during or within six months after community development director

(n) All telecommunication fac a person is actually present; (2) th security. Where lighting is requir

(o) Building and roof mounted impacts to adjacent properties and building.

(p) Telecommunication towers

school), trail, park or outdoor rec

MILL VALLEY

STAFF REPORT

TO: Mayor and City Council

FROM: Danielle Staude, Senior Planner

SUBJECT: Introduction of Urgency Ordinance No 18-____ Amending the Mill Valley Municipal Code to add Chapter 20.73 establishing Wireless Telecommunication Facilities Regulations and Amending Mill Valley Municipal Code Sections 11.16.100; 20.24.020; 20.26.020; 20.36.030; 20.40.030; 20.52.020; and 20.56.030 to incorporate Wireless Telecommunication Facilities.

DATE: September 6, 2018

Approved for Forwarding:

James C. McCann, City Manager

ISSUE:

Consideration of an urgency ordinance modifying Title 20 "Zoning" of the Mill Valley Municipal Code ("Zoning Code"), adding Section 20.73 "Wireless Telecommunications Facilities Regulations" establishing comprehensive regulations for the installation, operation and maintenance of wireless telecommunications within the City on private property and within the City right-of-way.

RECOMMENDATION:

Receive presentation, introduce and adopt the urgency ordinance (ATTACHMENT 1) with a four-fifths vote.

BACKGROUND:

As the wireless telecommunications industry works to meet the growing demand for broadband and data services, service providers are seeking to deploy smaller cell and distributed antenna systems (also known as "DAS"), with many of these facilities installed in the public right-of-way. The Mill Valley Municipal Code does not currently provide regulations specific to the installation, operation and maintenance of wireless telecommunication facilities.

Federal Law

Both federal and state laws preempt local authority to regulate certain aspects of wireless telecommunications facilities, including regulations related to:

- radio frequency or electromagnetic waves that comply with FCC regulations, the collocation on existing wireless telecommunications facilities,
- certain modifications to existing wireless telecommunications facilities, and
- the installation of wireless telecommunications facilities on existing utility poles in the public rights of way.

Key among these limitations is that local regulations cannot have the effect of prohibiting the provision of personal wireless services. *These laws, however, preserve local authority to regulate the placement, construction and aesthetics of wireless telecommunications facilities.*

Federal law also requires the City to act on an application for wireless telecommunication facilities within a limited amount of time. These "shot clocks" provide the City:

- 60 days to act on an application for an eligible facility that does not substantially change the physical dimensions of the existing wireless telecommunication facilities tower or base station;
- 90 days to act on an application for a collocation facility; and
- 150 days to act on all other applications.

These timeframes may change with federal laws. As such the actual "shot clock" and/or timeframes are not discussed in the ordinance, but will be provided as part of the application and informational handouts.

Urgency Ordinance

The proposed urgency ordinance is intended to prescribe clear and reasonable criteria to process applications for wireless telecommunications facilities in a consistent and expeditious manner and within the limits of federal and state law.

This proposed ordinance provides an extensive and comprehensive list of procedures and regulations that allow the community, applicant and internal City Departments to understand how facilities are regulated, installed, maintained and operate within the City. The regulations contained in the proposed ordinance:

1. Ensures that the FCC standards regulating radio frequency emissions are strictly followed.
2. Establishes an application process for a conditional use permit (CUP) and design review.
3. Limits the location of new or updated wireless facilities to private property within commercial zoning districts (outside of single family and multi-family residential districts) and the public right-of-way with an order of preference in terms of location within commercial areas and configuration aimed toward existing facilities.
4. Limits the installation of new wireless facilities in the public right-of-way to existing poles that must be 1,500 feet away from the nearest facility.

5. Establishes design standards for the appearance and maintenance of facilities, including limiting the height and bulk of facilities and requires the concealment of accessory equipment to the extent feasible.
6. Imposes strict noise standards.
7. Where feasible, requires upgrades to existing facilities as new technology becomes available to replace larger more visually intrusive facilities with smaller facilities.
8. Requires the relocation of any facility in the public right-of-way that would interfere with a future public project or improvements.
9. Requires a performance bond to ensure that facilities are promptly removed when they are no longer permitted or needed.
10. Requires the permittee to defend and indemnify the City from any liabilities arising from the permits issued by the City and the installation, operation and maintenance of the facilities.

The ordinance is being proposed as an urgency ordinance which would be adopted pursuant to Government Code Section 36937(b). Under that section, ordinances adopted to protect the health, safety, and welfare with a four-fifths vote of the City Council become effective immediately adoption by 4/5ths vote is required by state law). Given the increased interest in construction of small-cell facilities in the public right-of-way, it is critical that the City update its regulations to reflect current federal and state law and recent trends in wireless facilities. The adoption of urgency standards will ensure that the City is able to limit disruption to the public right-of-way as well as impose aesthetic regulations on new facilities.

Staff is also working to establish permanent regulations which require additional public notice, Planning Commission and City Council review, followed by City Council adoption.

DISCUSSION:

The proposed urgency ordinance provides uniform and comprehensive regulations for the permitting, development, siting, installation, design, operation and maintenance of wireless telecommunications facilities in the City. The ordinance is similar to recent regulations enacted in San Anselmo and Ross. The ordinance also imposes some additional requirements on telecommunications facilities that are pole mounted to the existing public utility infrastructure (known as "small cell wireless facilities") based on community interest and recent regulations established in Petaluma (see staff report, lines 171-205).

Applicable Projects (20.73.030)

The urgency ordinance becomes effective immediately. Those applications not approved prior to the effective date of the urgency ordinance will be subject to the regulations. All other wireless facilities currently in operation will also be subject to the new regulations with regard to operation, maintenance and use.

Conditional Use Permit (CUP) Required (20.73.040)

The permitting process described in the table below reflects the requirements of federal and state law, which mandate ministerial approval of collocations on and minor modifications to existing wireless telecommunications facilities.

Description Wireless Facility	*Private Property*		*Public Right-of Way*
	RS, RSP, DR, RM Zoning Districts	*All Other Zoning Districts*	*All Zoning Districts*
Roof-mounted facility, building-mounted facility, or facility mounted on an existing pole	Not Permitted	Conditional Use Permit/ Design Review	Conditional Use Permit/ Design Review
Facility mounted on a replacement pole or new telecommunications tower	Not Permitted	Conditional Use Permit/ Design Review	Conditional Use Permit/ Design Review
New wireless telecommunications collocation facility	Not Permitted	Conditional Use Permit/ Design Review	Conditional Use Permit/ Design Review
Eligible facilities request [1] or application pursuant to California Government Code Section 65850.6 [2]	Permitted	Permitted	Permitted

[1] See requirements of section 20.73.140.
[2] See requirements of section 20.73.150.

Application for CUP Permit (20.73.050)

The proposed ordinance prescribes the content for an application for a wireless telecommunications facility permit. The application requires the submission of detailed site and engineering plans, photographs of facility equipment, a visual impact analysis with photo simulations, a noise study, documentation demonstrating compliance with the FCC standards for radio frequency emissions, and certification that the applicant has a right under state law to install facilities in the public right-of-way if that is the proposed location of the facilities. Also, the City may hire a technical consultant to assist the City in the review of the application at the expense of the applicant.

Based on existing provisions of the City's Zoning Code, initial wireless facility CUP applications will be heard by the Planning Commission. Smaller subsequent amendments to wireless facility CUPs, such as modifying or collocating equipment, will undergo Zoning Administrator approval. Amendments to CUPs that involve significant design review issues, or are deemed as significant projects by the Planning Director will be heard by Planning Commission. There are also specific design standards, findings and conditions of approval required as part of the approval process for these applications (discussed below).

Location and Configuration Preferences (20.73.060)
The proposed ordinance establishes preferences in terms of location and configuration of wireless facilities.

Configuration preferences are as follows:

1. Collocation with existing facilities,
2. Roof-mounted,
3. Building-mounted,
4. Mounted on an existing utility pole or a new utility pole that will replace an existing utility pole,
5. Mounted on a new telecommunication tower.

Location preferences are as follows:

1. Commercial zoning districts (CG, CN, CL, CD),
2. Public right-of-way within commercial zoning districts,
3. Public right-of-way within RM zoning districts,
4. Mounted on a new telecommunication tower.

Design and Development Standards for All Facilities (20.73.070)
The proposed ordinance provides specific guidance on the design techniques for camouflaging wireless facilities, and set development standards including the preference in collocating facilities, landscaping screening, signage, lighting, noise restrictions, and security requirements.

Additional Standards for Facilities Outside the Public Right-of-Way (20.73.080)
Additional design and development standards are identified for wireless facility applications that are *outside* the right-of-way including the requirement that the facility cannot interfere with designated parking spaces and additional screening criteria for roof mounted facilities, towers and accessory equipment.

Additional Standards for Facilities in the Public Right-of-Way (20.73.060-090)
Additional design and development standards are identified for wireless facility applications that are *inside* the right-of-way including establishing maximum height limits on utility and streetlight poles for antennas, occupation of space, obtaining an encroachment permit, and adhering to Americans with Disability Act (ADA) Compliance, and specific development standards.

Additional design and development standards have been incorporated based on the City of Petaluma's recently adopted ordinance, and interest from some community members that are concerned about potential health impacts associated with pole mounted wireless facilities (see ATTACHMENT 2 for public comments). Staff has incorporated a distance requirement (1,500 ft. apart) for pole mounted telecommunications facilities, but has not gone as far as establishing a restriction on the proximity of pole mounted wireless telecommunication to any residence. The City of Petaluma also establishes a 500 foot buffer from any residence as part of its ordinance. Due to the size and scale of Mill Valley, staff recommends moving forward with the following standards, and incorporating a buffer, if legally feasible, as part of the regular ordinance. Additional

research is required to ensure that such a regulation does not essentially create a ban on such facilities within the City and expose the City to potential litigation. In the meantime, the urgency ordinance provides a 1,500 foot buffer from each small cell facility and prohibits such facilities in residential and multi-family zoning districts.

The requirements indicate that wireless facilities in the right-of-way must:

1. Connect to an existing utility pole that can support its weight.
2. Be separated by at least 1,500 feet.
3. Install all new wires needed to service the telecommunications facility within the width of the existing utility pole so as to not exceed the diameter and height of the existing utility pole.
4. Underground (flush to the ground, within three (3) feet of the utility pole), all ground-mounted equipment not installed inside the pole.
5. Conceal all equipment. Aside from the transmitter/antenna itself, no additional equipment may be visible. All cables, including, but not limited to, electrical and utility cables, shall be run within the interior of the telecommunications tower and shall be camouflaged or hidden to the fullest extent feasible without jeopardizing the physical integrity of the tower.

Conditions of Approval (20.73.100-110) and Findings for Approval (20.73.120)
The proposed ordinance outlines findings and conditions of approval for granting the design review and CUP applications, with additional specific conditions for those use permits in the right-of-way. The CUP expires in 10 years unless renewals are approved by the City.

Exceptions (20.73.130)
The proposed ordinance allows an applicant to request an exception from the standards in the event that denial of a permit would violate federal or state law. The applicant has the burden of providing sufficient facts to support the request.

Wireless Telecommunications Facilities Covered under Section 6409(a) of the Middle Class Tax Relief and Job Creation Act (20.73.140)
This Section applies to all collocations or modifications to an existing wireless tower or base station submitted with a written request for approval pursuant to Section 6409(a). Section 6409(a) generally requires that State and local governments "...not deny, and shall approve" requests to collocate, remove or replace transmission equipment at an existing tower or base station. Such applications undergo administrative review, and the proposed ordinance outlines required findings for approval, denial, and appeal procedure.

Collocation Facilities Covered under CA Government Code Section 65850.6 (20.73.150)
This section provides the requirements, standards and regulations for a wireless telecommunications collocation facility for which subsequent collocation is a permitted use pursuant to California law.

Additional Requirements (20.73.160-240)
Additional regulations are established in the remainder of the ordinance including business license and encroachment permit requirements, emergency deployment, operation and

maintenance standards, permit expiration, cessation of use/abandonment, removal of equipment)

EFFECTIVE DATE/NEXT STEPS:

The urgency ordinance would become effective immediately. Staff's intent is to implement the urgency ordinance swiftly due to recent inquiries from the wireless industry to upgrade facilities. Staff intends to utilize the urgency ordinance as a means of communication, and to obtain feedback from interested parties, including the local community and wireless industry, as part of the public hearing process for development of a permanent ordinance. Staff plans to bring the regular ordinance to City Council early in 2019, with a projected effective date of approximately March 2019.

RECENT CORRESPONDENCE:

Staff has received over 150 e-mails from the community. Five of the letters are in support of the new wireless technology, the remaining pieces of correspondence express concern about the possible health impacts related to the wireless 4G and 5G technology, and are urging the City to maintaining local control over the placement, maintenance and operation of wireless telecommunications. See ATTACHMENT 2 for details.

ENVIRONMENTAL REVIEW:

The proposed amendments to MVMC, Chapter 20 "Zoning" are exempt from the California Environmental Quality Act ("CEQA"). The proposed Ordinance does not constitute a "project" within the meaning of the California Environmental Quality Act of 1970 (CEQA) Guidelines Section 15060(c)(2) because there is no potential that small cell facility regulations will result in a direct or reasonably foreseeable indirect physical change in the environment and CEQA Guidelines Section 15378 because they have no potential for either a direct physical change to the environment, or a reasonably foreseeable indirect physical change in the environment. Moreover, even if the proposed Ordinances and Resolution comprise a project for CEQA analysis, the ordinance falls within the "common sense" CEQA exemption set forth in CEQA Guidelines Section 15061(b)(3), excluding projects where "it can be seen with certainty that there is no possibility that the activity in question may have a significant effect on the environment." Adoption of this Ordinance will also enact only minor changes in land use regulations, and it can be seen with certainty that its adoption will not have a significant effect on the environment because it will not allow for the development of any new or expanded wireless telecommunication facilities anywhere other than where they were previously allowed under existing federal, state and local regulations. Finally, the wireless facilities themselves are exempt from CEQA pursuant to CEQA Guidelines Section 15305, which exempts minor encroachment permits, and Section 15303, which exempts the installation of small equipment and facilities in a small structure.

FISCAL IMPACT:

The fiscal impacts associated with the Ordinance are the costs associated with the City Attorney and staff time to prepare the Ordinance and staff report. Once the regulations are adopted and implemented, the application fees for a Conditional Use Permit and Design Review would cover the cost of the discretionary approvals.

GENERAL PLAN COMPLIANCE:

Adoption of this Ordinance is consistent with the City's General Plan. The City's General Plan provides goals and policies to preserve the high-quality design, small-town character, aesthetics and environmental characteristics while also maintaining a strong, healthy economy for its local business and assuring the health and safety of the predominantly residential character of the community. Adoption of this Ordinance will provide uniform and comprehensive regulations and standards for wireless telecommunications facilities in furtherance of these goals and objectives while reducing the potentially negative impacts.

ATTACHMENTS:

1. Ordinance
2. Recent Correspondence (over 150 e-mails received most of which are form letters, please contact planner to view all emails on file, or download all comments online at http://www.cityofmillvalley.org/gov/agendas/watchonline.htm--go to "upcoming meetings", locate the City Council tab and select the September 6, 2018 meeting.

CITY OF MILL VALLEY

ORDINANCE NO. 18-_____
AN URGENCY ORDINANCE OF THE CITY OF MILL VALLEY AMENDING TITLE 20 ("ZONING") OF THE MILL VALLEY MUNICIPAL CODE TO ADD CHAPTER 20.73 AND AMEND SECTIONS 11.16.100; 20.24.020; 20.26.020; 20.36.030; 20.40.030; 20.52.020; and 20.56.030 ESTABLISHING REGULATIONS FOR WIRELESS TELECOMMUNICATION FACILITIES

WHEREAS, This Ordinance is adopted as an urgency ordinance pursuant to Government Code Section 36937(b). The facts constituting the urgency are as follows:

(1) The purpose of this Ordinance is to amend the City's Municipal Code to provide uniform and comprehensive standards, regulations and permit requirements for the installation of wireless telecommunications facilities in the City's public right-of-way.

(2) The wireless telecommunications industry has expressed interest in submitting applications for the installation of "small cell" wireless telecommunications facilities in the City's public rights-of-way of the City. Other California cities have already received applications for small cells to be located within the public right-of-way.

(3) Installation of small cell and other wireless telecommunications facilities within the public right-of-way can pose a threat to the public health, safety and welfare, including disturbance to the right-of-way through the installation and maintenance of wireless facilities; traffic and pedestrian safety hazards due to the unsafe location of wireless facilities; impacts to trees where proximity conflicts may require unnecessary trimming of branches or require removal of roots due to related undergrounding of equipment or connection lines; land use conflicts and incompatibilities including excessive height or poles and towers; creation of visual and aesthetic blights and potential safety concerns arising from excessive size, heights, noise or lack of camouflaging of wireless facilities including the associated pedestals, meters, equipment and power generators; and the creation of unnecessary visual and aesthetic blight by failing to utilize alternative technologies or capitalizing on collocation opportunities which may negatively impact the unique quality and character of the City.

(4) The City currently regulates wireless telecommunications facilities in the public right-of-way through zoning and the encroachment permit process. The existing standards have not been updated to reflect current telecommunications trends or necessary legal requirements. Further the primary focus of the zoning regulations is wireless telecommunications facilities located on private property, and the existing Code provisions were not specifically designed to address the unique legal and practical issues that arise in connection with wireless telecommunications facilities deployed in the public right-of-way.

(5) The Federal Telecommunications Act of 1996 preempts and declares invalid all state rules that restrict entry or limit competition in both local and long-distance telephone service.

(6) The California Public Utilities Commission (CPUC) is primarily responsible for the implementation of local telephone competition and the CPUC issues certificates of public convenience and necessity to new entrants that are qualified to provide competitive local telephone exchange services and related telecommunications service, whether using their own facilities or the facilities or services provided by other authorized telephone corporations.

(7) Section 234(a) of the California Public Utilities Code defines a "telephone corporation" as "every corporation or person owning, controlling, operating, or managing any telephone line for compensation within this state."

(8) Section 616 of the California Public Utilities Code provides that a telephone corporation "may condemn any property necessary for the construction and maintenance of its telephone line."

(9) Section 2902 of the California Public Utilities Code authorizes municipal corporations to retain their powers of control to supervise and regulate the relationships between a public utility and the general public in matters affecting the health, convenience, and safety of the general public, including matters such as the use and repair of public streets by any public utility and the location of the poles, wires, mains, or conduits of any public utility on, under, or above any public streets.

(10) Section 7901 of the California Public Utilities Code authorizes telephone and telegraph corporations to construct telephone or telegraph lines along and upon any public road or highway, along or across any of the waters or lands within this state, and to erect poles, posts, piers, or abatements for supporting the insulators, wires, and other necessary fixtures of their lines, in such manner and at such points as not to incommode the public use of the road or highway or interrupt the navigation of the waters.

(11) Section 7901.1 of the California Public Utilities Code confirms the right of municipalities to exercise reasonable control as to the time, place, and manner in which roads, highways, and waterways are accessed, which control must be applied to all entities in an equivalent manner, and may involve the imposition of fees.

(12) Section 50030 of the California Government Code provides that any permit fee imposed by a city for the placement, installation, repair, or upgrading of telecommunications facilities, such as lines, poles, or antennas, by a telephone corporation that has obtained all required authorizations from the CPUC and the FCC to provide telecommunications services, must not exceed the reasonable costs of providing the service for which the fee is charged, and must not be levied for general revenue purposes.

(13) State and federal law have changed substantially since the City last adopted regulations for wireless telecommunications facilities in the City. Such changes include modifications to "shot clocks" whereby the City must approve or deny installations within a certain period of time. State and federal laws require local governments to act on permit applications for wireless facilities within a prescribed time period and may automatically deem an application approved when a failure to act occurs. See 47 U.S.C. § 332(c)(7)(B)(iii); 47 C.F.R. §§ 1.40001 et seq.; Cal. Gov't Code § 65964.1. The Federal Communications Commission (FCC) may require a decision on certain applications in as few as 60 days. See 47 C.F.R. § 1.40001(c)(2); see also In the Matter of Acceleration of Broadband Deployment by Improving Wireless Facilities Siting Policies, Report and Order, 29 FCC Rcd. 12865 (Oct. 17, 2014) [hereinafter "2014 Report and Order"]; In the Matter of Petition for Declaratory Ruling to Clarify Provisions of Section 332(c)(7)(B) to Ensure Timely Siting Review, Declaratory Ruling, 24 FCC Rcd. 13994 (Nov. 18, 2009) [hereinafter "2009 Declaratory Ruling"]. Pursuant to FCC regulations, the City cannot adopt a moratorium ordinance to toll the time period for review for certain type of facilities, even when needed to allow the City to maintain the status quo while it reviews and revises its policies for compliance with changes in state or federal law. See 47 C.F.R. § 1.40001(c)(3); 2014 Report and Order, 29 FCC Rcd. at 219, 265. The City is in immediate need of clear regulations for wireless installations in the public right-of-way given the number of anticipated applications and legal timelines upon which the City must act.

(14) The public right-of-way in the City is a uniquely valuable public resource, closely linked with the City's natural beauty including the beach and coastline, and significant number residential communities. The reasonably regulated and orderly deployment of wireless telecommunications facilities in the public right-of-way is desirable, and unregulated or disorderly deployment represents an ever-increasing and true threat to the health, welfare and safety of the community.

(15) The regulations of wireless installations in the public right-of-way are necessary to protect and preserve the aesthetics in the community, as well as the values of properties within the City, and to ensure that all wireless telecommunications facilities are installed using the least intrusive means possible.

(16) The City finds that in light of more recent developments in federal and state law with respect to the regulation of small cell and other wireless telecommunications facilities, there is a need for the City to update its current ordinances based on current telecommunications trends, updates in laws, as well as aesthetic and location options for wireless facilities. The City Council also finds that the lack of specifically-designed standards and regulations in the Municipal Code for wireless facilities located in the public right-of-way, the increasing requests for information about the City's regulation of wireless telecommunications facilities, the inability to adopt a temporary moratorium, and the potential liabilities and negative consequences for noncompliance with state and federal regulations (including, without limitation, automatic approvals) present current and immediate threat to the public health, safety and welfare. The City Council further finds and declares that the

immediate implementation of the Ordinance is necessary to preserve and protect public health, safety and welfare.

(17) The City recognizes its responsibilities under the Federal Telecommunications Act of 1996 and state law, and believes that it is acting consistent with the current state of the law in ensuring that irreversible development activity does not occur that would harm the public health, safety, or welfare. The City does not intend that this Ordinance prohibit or have the effect of prohibiting telecommunications service; rather, but includes appropriate regulations to ensure that the installation, augmentation and relocation of wireless telecommunications facilities in the public rights-of-way are conducted in such a manner as to lawfully balance the legal rights of applicants under the Federal Telecommunications Act and the California Public Utilities Code while, at the same time, protect to the full extent feasible against the safety and land use concerns described herein.

Based on the foregoing, the City Council finds and determines that the immediate preservation of the public health, safety and welfare requires that this Ordinance be enacted as an urgency ordinance pursuant to Government Code Section 36937(b), and take effect immediately upon adoption. Therefore, this Ordinance is necessary for the immediate preservation of the public peace, health, safety and welfare and its urgency is hereby declared.

WHEREAS, adoption of this Ordinance is consistent with the City's General Plan. The City's General Plan provides goals and policies to preserve the high-quality design, small-town character, aesthetics and environmental characteristics while also maintaining a strong, healthy economy for its local business and assuring the health and safety of the predominantly residential character of the community. Adoption of this Ordinance will provide uniform and comprehensive regulations and standards for wireless telecommunications facilities in furtherance of these goals and objectives while reducing the potentially negative impacts.

NOW, THEREFORE, the City of Mill Valley City Council does ordain as follows:

Section 1. **The Mill Valley Municipal Code is hereby amended as follows:**

A. A new Section 20.73, entitled "Wireless Telecommunications Facilities" is hereby added to Title 18 of the Mill Valley Municipal Code to read as set forth in Exhibit A to this Ordinance, which is hereby incorporated as though set forth in full herein.

B. Section 11.16.100 (Blanket Permits for Certain Applicants) is hereby amended to include the following subsection:

"D. Notwithstanding Subsection A of this Section, no Wireless Telecommunications Facility governed by Chapter 20.73 shall be installed or maintained pursuant to a blanket permit."

C. Section 20.24.020 of Chapter 20.24 (Residential Multifamily (RM-3.5) District) is hereby amended to include the following conditional use:

"N. Wireless Telecommunications Facilities as further outlined in 20.73."

D. Section 20.26.020 of Chapter 20.26 (Downtown Residential (DR) District) is hereby amended to include the following conditional use as part of the proposed table:

"Wireless Telecommunications Facilities as further outlined in 20.73."

E. Section 20.36.030 of Chapter 20.36 (Limited Commercial (C-L) District) is hereby amended to include the following conditional use:

"E. Wireless Telecommunications Facilities as further outlined in 20.73."

F. Section 20.40.030 of Chapter 20.40 (General Commercial (C-G) District) is hereby amended to include the following conditional use:

"AA. Wireless Telecommunications Facilities as further outlined in 20.73."

G. Section 20.52.020 of Chapter 20.52 (Commercial Recreational (C-R) District) is hereby amended to include the following conditional use:

"I. Wireless Telecommunications Facilities as further outlined in 20.73."

H. Section 20.56.030 of Chapter 20.56 (Open Area (O-A) District) is hereby amended to include the following conditional use:

"H. Wireless Telecommunications Facilities as further outlined in 20.73."

Section 2. The City Council hereby finds that Adoption of this Ordinance will enact only minor changes in land use regulations, and it can be seen with certainty that its adoption will not have a significant effect on the environment because it will not allow for the development of any new or expanded wireless telecommunication facilities anywhere other than where they were previously allowed under existing federal, state and local regulations. The wireless facilities themselves are exempt from CEQA pursuant to CEQA Guidelines Section 15305, which exempts minor encroachment permits, and Section 15303, which exempts the installation of small equipment and facilities in a small structure. The proposed Ordinance also falls within the "common sense" CEQA exemption set forth in CEQA Guidelines Section 15061(b)(3), excluding projects where "it can be seen with certainty that there is no possibility that the activity in question may have a significant effect on the environment."

Section 3. **Severability.** If any section, subsection, sentence, clause, phrase, or word of this Ordinance is, for any reason, deemed or held to be invalid or unconstitutional by the decision of any court of competent jurisdiction, or preempted by legislative enactment, such decision or legislation shall not affect the validity of the remaining portions of this Ordinance. The City Council of the City of Mill Valley hereby declares that it would have adopted this Ordinance and each section, subsection, sentence, clause, phrase, or word thereof, regardless

of the fact that any one or more sections, subsections, clauses, phrases, or word might subsequently be declared invalid or unconstitutional or preempted by subsequent legislation.

Section 4. **Notice.** The City clerk shall certify to the passage and adoption of this Ordinance and shall cause this Ordinance to be posted within 15 days after its passage, in accordance with Section 36933 of the Government Code.

Section 5. **Effective Date.** This ordinance is adopted as an urgency ordinance for the immediate preservation of the public peace, health and safety within the meaning of Government Code Section 36937(b) and therefore shall be passed immediately upon its introduction and shall become effective immediately, and shall be posted in three public places in the City.

INTRODUCED at a regular meeting of the City Council of the City of Mill Valley on the 6th day of September, 2018, and

PASSED AND ADOPTED at a regular meeting of the City Council of the City of Mill Valley on this 6th day of September, 2018, by the following vote:

AYES:
NOES:
ABSENT:

ABSTAIN:

_____
Stephanie Moulton-Peters, Mayor

ATTEST:

_____
Kelsey Rogers, City Clerk

Exhibit A
URGENCY ORDINANCE

Chapter 20.73
WIRELESS TELECOMMUNICATIONS FACILITIES

20.73.010 Purpose

A. The purpose and intent of this chapter is to provide a uniform and comprehensive set of regulations and standards for the permitting, development, siting, installation, design, operation and maintenance of wireless telecommunications facilities in the City of Mill Valley. These regulations are intended to prescribe clear and reasonable criteria to assess and process applications in a consistent and expeditious manner, while reducing the impacts associated with wireless telecommunications facilities. This chapter provides standards necessary to: (1) preserve and promote harmonious land uses and the public right-of-way in the City; (2) promote and protect public health and safety, community welfare, visual resources, and the aesthetic quality of the City consistent with the goals, objectives and policies of the General Plan; (3) provide for the orderly, managed, and efficient development of wireless telecommunications facilities in accordance with the state and federal laws, rules, and regulations; and (4) encourage new and more efficient technology in the provision of wireless telecommunications facilities.

B. This chapter is not intended to, nor shall it be interpreted or applied to: (1) prohibit or effectively prohibit any personal wireless service provider's ability to provide personal wireless services; (2) prohibit or effectively prohibit any entity's ability to provide any interstate or intrastate telecommunications service, subject to any competitively neutral and nondiscriminatory rules or regulation for rights-of-way management; (3) unreasonably discriminate among providers of functionally equivalent services; (4) deny any request for authorization to place, construct or modify personal wireless service facilities on the basis of environmental effects of radio frequency emissions to the extent that such wireless facilities comply with the FCC's regulations concerning such emissions; (5) prohibit any collocation or modification that the City may not deny under federal or state law; or (6) otherwise authorize the City to preempt any applicable federal or state law.

20.73.020 Definitions. For the purposes of this chapter, the following defined terms shall have the meaning set forth in this section unless the context clearly indicates or requires a different meaning.

A. **"Accessory Equipment"** means any equipment associated with the installation of a wireless telecommunications facility, including but not limited to cabling, generators, air conditioning units, electrical panels, equipment shelters, equipment cabinets, equipment buildings, pedestals, meters, vaults, splice boxes, and surface location markers.

B. **"Antenna"** means that part of a wireless telecommunications facility designed to radiate or receive radio frequency signals or electromagnetic waves for the provision of services, including, but not limited to, cellular, paging, personal communications services (PCS) and microwave

communications. Such devices include, but are not limited to, directional antennas, such as panel antenna, microwave dishes, and satellite dishes; omnidirectional antennas; wireless access points (Wi-Fi); and strand-mounted wireless access points. This definition does not apply to broadcast antennas, antennas designed for amateur radio use, or satellite dishes designed for residential or household purposes.

C. **"Base Station"** means the same as defined by the FCC in 47 C.F.R. § 1.40001(b)(1), as may be amended, which defines that term as a structure or equipment at a fixed location that enables FCC-licensed or authorized wireless communications between user equipment and a communications network. The term does not encompass a tower as defined in 47 C.F.R. § 1.40001(b)(9) or any equipment associated with a tower. The term includes, but is not limited to, equipment associated with wireless communications services such as private, broadcast, and public safety services, as well as unlicensed wireless services and fixed wireless services such as microwave backhaul. The term includes, but is not limited to, radio transceivers, antennas, coaxial or fiber-optic cable, regular and backup power supplies, and comparable equipment, regardless of technological configuration (including distributed antenna systems and small-cell networks). The term includes any structure other than a tower that, at the time the relevant application is filed with the State or local government under this section, supports or houses equipment described in 47 C.F.R. § 1.40001(b)(1)(i)-(ii) that has been reviewed and approved under the applicable zoning or siting process, or under another State or local regulatory review process, even if the structure was not built for the sole or primary purpose of providing such support. The term does not include any structure that, at the time the relevant application is filed with the State or local government under this section, does not support or house equipment described in 47 C.F.R. § 1.40001(b)(1)(i)-(ii).

D. **"Building-mounted"** means mounted to the side or façade, but not the roof, of a building or another structure such as a water tank, pump station, church steeple, freestanding sign, or similar structure.

E. **"Cellular"** means an analog or digital wireless telecommunications technology that is based on a system of interconnected neighboring cell sites.

F. **"Collocation"** means the same as defined by the FCC in 47 C.F.R. § 1.40001(b)(2), as may be amended, which defines that term as the mounting or installation of transmission equipment on an eligible support structure for the purpose of transmitting or receiving radio frequency signals for communications purposes. As an illustration and not a limitation, the FCC's definition effectively means "to add" and does not necessarily refer to more than one wireless telecommunication facility installed at a single site.

G. **"Eligible Facilities Request"** means the same as defined by the FCC in 47 C.F.R. § 1.40001(b)(3), as may be amended, which defines that term as any request for modification of an existing tower or base station that does not substantially change the physical dimensions of such tower or base station, involving: (i) collocation of new transmission equipment; (ii) removal of transmission equipment; or (iii) replacement of transmission equipment.

H. **"Eligible Support Structure"** means the same as defined by the FCC in 47 C.F.R. § 1.40001(b)(4), as may be amended, which defines that term as any tower or base station as defined in this section, provided that it is existing at the time the relevant application is filed with the State or local government under this section.

I. **"Existing"** means the same as defined by the FCC in 47 C.F.R. § 1.40001(b)(4), as may be amended, which provides that a constructed tower or base station is existing for purposes of the FCC's Section 6409(a) regulations if it has been reviewed and approved under the applicable zoning or siting process, or under another State or local regulatory review process, provided that a tower that has not been reviewed and approved because it was not in a zoned area when it was built, but was lawfully constructed, is existing for purposes of this definition.

J. **"FCC"** means the Federal Communications Commission or its duly appointed successor agency.

K. **"Modification"** means any change to an existing wireless telecommunications facility that involves any of the following: collocation, expansion, modification, alteration, enlargement, intensification, reduction, or augmentation, including, but not limited to, a change in size, shape, color, visual design, or exterior material. Modification does not include repair, replacement, or maintenance if those actions do not involve a change to the existing facility involving any of the following: collocation, expansion, modification, alteration, enlargement, intensification, reduction, or augmentation.

L. **"Monopole"** means a structure consisting of a single pole used to support antennas or related equipment and includes a monopine, monoredwood, and similar monopoles camouflaged to resemble trees or other objects.

M. **"Personal Wireless Services"** means the same as defined in 47 U.S.C. § 332(c)(7)(C)(i), as may be amended, which defines the term as commercial mobile services, unlicensed wireless services and common carrier wireless exchange access services.

N. **"Personal Wireless Service Facilities"** means the same as defined in 47 U.S.C. § 332(c)(7)(C)(i), as may be amended, which defines the term as facilities that provide personal wireless services.

O. **"Zoning administrator"** means the City zoning administrator or the City zoning administrator's designee.

P. **"Pole"** means a single shaft of wood, steel, concrete, or other material capable of supporting the equipment mounted thereon in a safe and adequate manner and as required by provisions of the Mill Valley Municipal Code.

Q. **"Public Right-of-Way** or **"Right-of-Way"** means any public street, public way, public alley or public place, laid out or dedicated, and the space on, above or below it, and all extensions thereof, and additions thereto, under the jurisdiction of the City.

R. **"Reviewing Authority"** means the person or body who has the authority to review and either grant or deny a wireless telecommunications facility permit pursuant to this chapter.

S. **"RF"** means radio frequency or electromagnetic waves between 30 kHz and 300 GHz in the electromagnetic spectrum range.

T. **"Roof-mounted"** means mounted directly on the roof of any building or structure, above the eave line of such building or structure.

U. **"Section 6409(a)"** means Section 6409(a) of the Middle Class Tax Relief and Job Creation Act of 2012, Pub. L. No. 112-96, 126 Stat. 156, codified as 47 U.S.C. § 1455(a), as such law may be amended from time to time.

V. **"Section 6409(a) Approval"** means the approval required by Section 6409(a).

W. **"Site"** means the same as defined by the FCC in 47 C.F.R. § 1.40001(b)(6), as may be amended, which provides that for towers other than towers in the public rights-of-way, the current boundaries of the leased or owned property surrounding the tower and any access or utility easements currently related to the site, and, for other eligible support structures, further restricted to that area in proximity to the structure and to other transmission equipment already deployed on the ground.

X. **"Substantial Change"** means the same as defined by the FCC in 47 C.F.R. § 1.40001(b)(7), as may be amended, which defines that term differently based on the particular wireless facility type (tower or base station) and location (in or outside the public right-of-way). For clarity, this definition organizes the FCC's criteria and thresholds for a substantial change according to the wireless facility type and location.

1. For towers outside the public rights-of-way, a substantial change occurs when:

    a) the proposed collocation or modification increases the overall height more than 10% or the height of one additional antenna array not to exceed 20 feet (whichever is greater); or

    b) the proposed collocation or modification increases the width more than 20 feet from the edge of the wireless tower or the width of the wireless tower at the level of the appurtenance (whichever is greater); or

    c) the proposed collocation or modification involves the installation of more than the standard number of equipment cabinets for the technology involved, not to exceed four; or

    d) the proposed collocation or modification involves excavation outside the current boundaries of the leased or owned property surrounding the wireless tower, including any access or utility easements currently related to the site.

2. For towers in the public rights-of-way and for all base stations, a substantial change occurs when:

   a) the proposed collocation or modification increases the overall height more than 10% or 10 feet (whichever is greater); or

   b) the proposed collocation or modification increases the width more than 6 feet from the edge of the wireless tower or base station; or

   c) the proposed collocation or modification involves the installation of any new equipment cabinets on the ground when there are no existing ground-mounted equipment cabinets; or

   d) the proposed collocation or modification involves the installation of any new ground-mounted equipment cabinets that are ten percent (10%) larger in height or volume than any existing ground-mounted equipment cabinets; or

   e) the proposed collocation or modification involves excavation outside the area in proximity to the structure and other transmission equipment already deployed on the ground.

3. In addition, for all towers and base stations wherever located, a substantial change occurs when:

   a) the proposed collocation or modification would defeat the existing concealment elements of the support structure as determined by the zoning administrator; or

   b) the proposed collocation or modification violates a prior condition of approval, provided however that the collocation need not comply with any prior condition of approval related to height, width, equipment cabinets or excavation that is inconsistent with the thresholds for a substantial change described in this section.

The thresholds for a substantial change outlined above are disjunctive. The failure to meet any one or more of the applicable thresholds means that a substantial change would occur. The thresholds for height increases are cumulative limits. For sites with horizontally separated deployments, the cumulative limit is measured from the originally-permitted support structure without regard to any increases in size due to wireless equipment not included in the original design. For sites with vertically separated deployments, the cumulative limit is measured from the permitted site dimensions as they existed on February 22, 2012—the date that Congress passed Section 6409(a).

Y. **"Telecommunications Tower"** or **"Tower"** means a freestanding mast, pole, monopole, guyed tower, lattice tower, free standing tower or other structure designed and primarily used to support wireless telecommunications facility antennas.

Z. **"Transmission Equipment"** means the same as defined by the FCC in 47 C.F.R. § 1.40001(b)(8), as may be amended, which defines that term as equipment that facilitates

transmission for any FCC-licensed or authorized wireless communication service, including, but not limited to, radio transceivers, antennas, coaxial or fiber-optic cable, and regular and backup power supply. The term includes equipment associated with wireless communications services including, but not limited to, private, broadcast, and public safety services, as well as unlicensed wireless services and fixed wireless services such as microwave backhaul.

AA. **"Utility Pole"** means a pole or tower owned by any utility company that is primarily used to support wires or cables necessary to the provision of electrical or other utility services regulated by the California Public Utilities Commission.

BB. **"Wireless Services"** means any FCC-licensed or authorized wireless communication service transmitted over frequencies in the electromagnetic spectrum.

CC. **"Wireless Telecommunications Facility"** means any facility constructed, installed, or operated for wireless service. "Wireless telecommunications facility" includes, but is not limited to, antennas or other types of equipment for the transmission or receipt of such signals, telecommunications towers or similar structures supporting such equipment, related accessory equipment, equipment buildings, parking areas, and other accessory development. "Wireless telecommunications facility" does not mean any of the following:

1. A facility that qualifies as an amateur station as defined by the FCC, 47 C.F.R. Part 97, of the Commission's Rules, or its successor regulation.

2. An antenna facility that is subject to the FCC Over-The-Air-Receiving Devices rule, 47 C.F.R. Section 1.4000, or any successor regulation, including, but not limited to, direct-to-home satellite dishes that are less than one meter in diameter, TV antennas used to receive television broadcast signals and wireless cable antennas.

3. Portable radios and devices including, but not limited to, hand-held, vehicular, or other portable receivers, transmitters or transceivers, cellular phones, CB radios, emergency services radio, and other similar portable devices as determined by the zoning administrator.

4. Telecommunications facilities owned and operated by any government agency.

5. Telecommunications facilities owned and operated by any emergency medical care provider.

6. Mobile services providing public information coverage of news events of a temporary nature.

7. Any wireless telecommunications facilities exempted from the Mill Valley Municipal Code by federal law or state law.

20.73.030 Applicability

A. This chapter applies to all wireless telecommunications facilities as follows:

1. All facilities for which applications were not approved prior to the effective date of this chapter shall be subject to and comply with all provisions of this chapter;

2. All facilities, notwithstanding the date approved, shall be subject immediately to the provisions of this chapter governing the operation and maintenance, cessation of use and abandonment, removal and restoration of wireless telecommunications facilities and wireless telecommunications collocation facilities and the prohibition of dangerous conditions or obstructions by such facilities; provided, however, that in the event a condition of approval conflicts with a provision of this chapter, the condition of approval shall control unless and until the permit is amended or revoked.

B. Title 20, including but not limited to this chapter 20.73 shall not apply to a wireless telecommunications facility on property owned by the City.

C. Notwithstanding any provision of the Mill Valley Municipal Code to the contrary, provisions governing the installation of a public utility facility or accessory equipment shall not apply to wireless telecommunications facilities. This chapter 20.73 shall govern all applications for wireless telecommunications facilities.

20.73.040 Wireless Telecommunications Facility Permit Required

A. **Conditional Use Permit required.** No wireless telecommunications facility shall be located or modified within the City on any property, including the public right-of-way, without the issuance of a permit as required by this chapter as set forth in the table below. Such permit shall be in addition to any other permit required pursuant to the Mill Valley Municipal Code.

Description Wireless Facility	Private Property		Public Right-of Way[3]
	RS, RSP, DR, MFR Zoning Districts	All Other Zoning Districts	All Zoning Districts
Roof-mounted facility, building-mounted facility, or facility mounted on an existing pole	Not Permitted	Conditional Use Permit/ Design Review	Conditional Use Permit/ Design Review
Facility mounted on a replacement pole or new telecommunications tower	Not Permitted	Conditional Use Permit/ Design Review	Conditional Use Permit/ Design Review
New wireless telecommunications collocation facility	Not Permitted	Conditional Use Permit/ Design Review	Conditional Use Permit/ Design Review
Eligible facilities request [1] or application pursuant to California Government Code Section 65850.6 [2]	Permitted	Permitted	Permitted

[1] See requirements of section 20.73.140.
[2] See requirements of section 20.73.150.
[3] For any public right of way not within a zoning district, the location of a wireless telecommunication facility shall be determined based upon the closest district adjacent to the facility's location.

B. **Non-exclusive grant.** No approval granted under this chapter shall confer any exclusive right, privilege, license, or franchise to occupy or use the public right-of-way of the City for delivery of telecommunications services or any other purposes. Further, no approval shall be construed as any warranty of title.

20.73.050 Application for Permit

A. **Application content.** All applications for a permit required by this chapter must be made in writing on such form as the zoning administrator prescribes, which shall include the following information, in addition to all other information determined necessary by the zoning administrator as well as all other information required by the City as part of an application for a conditional use permit:

1. Full name and contact information for the facility owner, facility operator, agent (if any), and property owner, and related letter(s) of authorization.

2. The type of facility, including a full written description of the proposed facility, its purpose and specifications.

3. A detailed site and engineering plan of the proposed facility containing the exact proposed location of the facility, created by a qualified licensed engineer and in accordance with requirements set by the zoning administrator.

4. Photographs of facility equipment and an accurate visual impact analysis with photo simulations.

5. Completion of an RF exposure guidelines checklist, and proof of all applicable licenses or other approvals required by the FCC.

6. If the application is for a facility that will be located within the public right-of-way, the applicant shall certify that it is a telephone corporation or state the basis for its claimed right to enter the right-of-way, and provide a copy of its certificate of public convenience and necessity (CPCN), if a CPCN has been issued by the California Public Utilities Commission.

7. A written description identifying the geographic service area for the subject installation, accompanied by a plan and maps showing anticipated future installations and modifications for the following two years.

8. A written report that analyzes acoustic levels for the proposed wireless telecommunications facility and all associated equipment including without limitation all environmental control units, sump pumps, temporary backup power generators, and permanent backup power generators in order to demonstrate compliance with chapter 7.16 (Noise Control). The acoustic analysis must be prepared and certified by an engineer and include an analysis of the manufacturers' specifications for all noise-emitting equipment and a depiction of the proposed equipment relative to all adjacent property lines. In lieu of a written report, the applicant may submit evidence from the equipment manufacturer that the ambient noise emitted from all the proposed equipment will not, both individually and cumulatively, exceed the applicable limits.

9. If the applicant claims it requires an exception to the requirements of this chapter, all information and studies necessary for the City to evaluate that claim.

10. An application and processing fee and a deposit for a consultant review as set forth in paragraph (B) of this section.

11. Any other studies or information determined necessary by the zoning administrator may be required.

B. Independent expert.

1. The zoning administrator is authorized to retain on behalf of the City an independent, qualified consultant to review any application for a permit for a wireless telecommunications facility to review the technical aspects of the application, including but not limited to the following matters:

    (a) The accuracy, adequacy, and completeness of submissions,

    (b) Compliance with applicable radio frequency emission standards,

    (c) Whether any requested exception is necessary to close a significant gap in coverage and is the least intrusive means of doing so,

    (d) Technical demonstration of the unavailability of alternative sites, facility designs or configurations, and coverage analysis, and

    (e) The validity of conclusions reached or claims made by applicant.

2. The cost of this review shall be paid by the applicant through a deposit pursuant to an adopted fee schedule resolution.

20.73.060 Location and Configuration Preferences

A. **Purpose.** The purpose of this section is to provide guidelines to applicants and the reviewing authority regarding the preferred locations and configurations for wireless telecommunication facilities in the City, provided that nothing in this section shall be construed to permit a wireless telecommunication facility in any location or configuration that it is otherwise prohibited by this chapter.

B. **Review of Location and Configuration.** The reviewing authority shall consider the extent to which a proposed wireless telecommunication facility complies with these preferences and whether there are feasible alternative locations or configurations to the proposed facility that are more preferred under this section. If the location or configuration of a proposed facility qualifies for two or more categories of preferred locations or configurations, it shall be deemed to belong to the least preferred category.

C. **Order of Preference - Configurations.** The order of preference for the configuration for wireless telecommunication facilities from most preferred to least preferred is:

1. Collocation with existing facilities,

2. Roof-mounted,

3. Building-mounted,

4. Mounted on an existing pole or utility pole

5. Mounted on a new pole or utility pole that will replace an existing pole or utility pole,

6. Mounted on a new telecommunication tower.

D. **Order of Preference - Location.** The order of preference for the location of wireless telecommunications facilities from most preferred to least preferred is:

1. In the C-G zoning district,

2. In the C-N zoning district,

3. In the C-L zoning district,

4. In the C-D zoning district,

5. In the public right-of-way with the closest adjacent district being the C-G district,

6. In the public right-of-way with the closest adjacent district being the C-N district,

7. In the public right-of-way with the closest adjacent district being the C-L district,

8. In the public right-of-way with the closest adjacent district being the C-D district,

9. In the public right-of-way with the closest adjacent district being the RM district,

10. Any public right-of-way location that abuts the property line of a structure recognized as a local, state or national historic landmark, historic district or on the register of historic places,

E. **Accessory equipment.** In order of preference from most preferred to least preferred, accessory equipment for wireless telecommunication facilities and wireless telecommunications collocation facilities shall be located underground, within a building or structure, on a screened roof top area or structure, or in a rear yard if not readily visible from surrounding properties and the roadway, unless the reviewing authority finds that another location is preferable under the circumstances of the application.

20.73.070 Design and Development Standards for All Facilities

A. **Basic requirements.** The design and development standards set forth in this section apply to all wireless telecommunications facilities no matter where they are located. Wireless telecommunications facilities shall be designed and maintained so as to minimize visual, noise, and other impacts on the surrounding community and shall be planned, designed, located, and erected in accordance with the design and development standards in this section.

B. **No speculative facilities.** A wireless telecommunications facility, wireless

telecommunications collocation facility, or a telecommunications tower, which is built on speculation and for which there is no wireless tenant is prohibited within the City.

C. **General guidelines.** The applicant shall employ screening and camouflage design techniques in the design and placement of wireless telecommunications facilities in order to ensure that the facility is as visually inconspicuous as possible, to prevent the facility from dominating the surrounding area and to hide the facility from predominant views from surrounding properties, all in a manner that achieves compatibility with the community.

D. **Traffic safety.** All facilities shall be designed and located in such a manner as to avoid adverse impacts on traffic safety.

E. **Antennas.** The applicant shall use the least visible antennas possible to accomplish the coverage objectives. Antenna elements shall be flush mounted, to the extent reasonably feasible. All antenna mounts shall be designed so as not to preclude possible future collocation by the same or other operators or carriers. Antennas shall be situated as to reduce visual impact without compromising their function. Whip antennas need not be screened.

F. **Landscaping.** Where appropriate, facilities shall be installed so as to maintain and enhance existing landscaping on the site, including trees, foliage and shrubs, whether or not utilized for screening. Additional landscaping shall be planted, irrigated, and maintained where such vegetation is deemed necessary by the City to provide screening or to block the line of sight between facilities and adjacent uses.

G. **Signage.** Wireless telecommunications facilities and wireless telecommunications collocation facilities shall not bear any signs or advertising devices other than certification, warning or other signage required by law or permitted by the City.

H. **Lighting.** No wireless telecommunications facility may be illuminated unless either specifically required by the Federal Aviation Administration or other government agency or in association with the illumination of an athletic field on City or school property. Lightning arresters and beacon lights are not permitted unless required by the Federal Aviation Administration or other government agency. Legally required lightning arresters and beacons shall be included when calculating the height of facilities such as telecommunications towers, lattice towers, and monopoles.

I. **Noise.**

1. Each wireless telecommunications facility and wireless telecommunications collocation facility shall be operated in such a manner so as to minimize any possible disruption caused by noise.

2. Backup generators shall only be operated during periods of power outages, and shall not be tested on weekends or holidays, or between the hours of 5:00 p.m. and 7:00 a.m.

3. At no time shall equipment noise from any facility exceed an exterior noise level of 50 dBA at the facility's property line if the facility is located in a business or commercial zone that permits those uses, provided, however, that for any such facility located within 500 feet of any property zoned residential or improved with a residential use, such equipment noise shall at no time be audible at the property line of any such residential property. For any facility located within a residential zone, such equipment noise shall at no time be audible at the property line of any residentially improved or residential zoned property.

4. Any equipment, including but not limited to air conditioning units, that may emit noise that would be audible from beyond three feet from the facility in the case of a facility located in the right-of-way, or in the case of other facilities the facility's property line, shall be enclosed or equipped with noise attenuation devices to the extent necessary to ensure compliance with applicable noise limitations under the Mill Valley Municipal Code.

J. **Security.** Each wireless telecommunications facility and wireless telecommunications collocation facility shall be designed to be resistant to, and minimize opportunities for, unauthorized access, climbing, vandalism, graffiti and other conditions that would result in hazardous situations, visual blight, or attractive nuisances. The reviewing authority may require the provision of warning signs, fencing, anti-climbing devices, or other techniques to prevent unauthorized access and vandalism when, because of their location or accessibility, a facility has the potential to become an attractive nuisance.

K. **Modification**. At the time of modification of a wireless telecommunications facility, existing equipment shall, to the extent feasible, be replaced with equipment that reduces visual, noise, and other impacts, including, but not limited to, undergrounding the equipment and replacing larger, more visually intrusive facilities with smaller, less visually intrusive facilities.

20.73.080 Additional Design and Development Standards for Facilities Outside the Public Right-of-Way

A. **Basic Requirements.** Facilities located outside the public right-of-way are subject to the design and development standards set forth in this section in addition to all design and development standards that apply to all facilities.

B. **No parking interference.** In no event shall the installation of facilities replace or interfere with parking spaces in such a way as to reduce the total number of parking spaces below the number that is required.

C. **Roof-mounted facilities.** Roof-mounted facilities shall be designed and constructed to be fully concealed or screened in a manner compatible with the existing architecture of the building the facility is mounted to in color, texture, and type of material. Screening shall not increase the bulk of the structure nor alter the character of the structure.

D. **Facilities mounted to a telecommunications tower.** Facilities mounted to a telecommunications tower shall be located in close proximity to existing above-ground utilities, such as electrical towers or utility poles (which are not scheduled for removal or under grounding for at least 18 months after the date of application), light poles, trees of comparable heights, and in areas where they will not detract from the appearance of the City.

1. Facilities mounted to a telecommunications tower, including, but not limited to, the attached antennas, shall be designed to be the minimum functional height and width required to adequately support the proposed facility and meet FCC requirements. The applicant shall provide documentation satisfactory to the zoning administrator establishing compliance with this paragraph. In any event, facilities mounted to a telecommunications tower shall not exceed the applicable height limit for structures in the applicable zoning district.

2. Aside from the antenna itself, no additional equipment may be visible. All cables, including, but not limited to, electrical and utility cables, shall be run within the interior of the telecommunications tower and shall be camouflaged or hidden to the fullest extent feasible without jeopardizing the physical integrity of the tower.

3. Monopole installations shall be situated so as to utilize existing natural or man-made features including topography, vegetation, buildings, or other structures to provide the greatest amount of visual screening.

4. All antenna components and accessory wireless equipment shall be treated with exterior coatings of a color and texture to match the predominant visual background or existing architectural elements so as to visually blend in with the surrounding development. Subdued colors and non-reflective materials that blend with surrounding materials and colors shall be used.

5. Monopoles shall be no greater in diameter or other cross-sectional dimensions than is necessary for the proper functioning of the facility.

6. If a faux tree is proposed for the monopole installation, it shall be of a type of tree compatible with those existing in the immediate areas of the installation. If no trees exist within the immediate areas, the applicant shall create a landscape setting that integrates the faux tree with added species of a similar height and type. Additional camouflage of the faux tree may be required depending on the type and design of faux tree proposed.

E. **Accessory equipment.** All accessory equipment associated with the operation of any wireless telecommunications facility shall be fully screened or camouflaged, and located in a manner to minimize their visibility to the greatest extent possible utilizing the following methods for the type of installation:

1. Accessory equipment for roof-mounted facilities shall be installed inside the building to which it is mounted or underground, if feasible. If not feasible, such accessory equipment may be located on the roof of the building that the facility is mounted on, provided that both the equipment and screening materials are painted the color of the building, roof, or surroundings. All screening materials for roof-mounted facilities shall be of a quality and design that is architecturally integrated with the design of the building or structure.

2. Accessory equipment for facilities mounted to a telecommunications tower shall be visually screened by locating the equipment either within a nearby building, in an underground vault (with the exception of required electrical panels) or in another type of enclosed structure, which shall comply with the development and design standards of the zoning district in which the accessory equipment is located. Such enclosed structure shall be architecturally treated and adequately screened from view by landscape plantings, decorative walls, fencing or other appropriate means, selected so that the resulting screening will be visually integrated with the architecture and landscaping of the surroundings.

20.73.090 Additional Design and Development Standards for Facilities in the Public Right-of-Way

A. **Basic Requirements.** Facilities located in the public right-of-way are subject to the design and development standards set forth in this section in addition to all design and development standards that apply to all facilities.

B. **Right-of-way authority.** An encroachment permit must be obtained for any work in the public righr of way. Only applicants authorized to enter the public right-of-way pursuant to state or federal law or a franchise or other agreement with the City shall be eligible for a permit to install or modify a wireless telecommunications facility in the public right-of-way.

C. **Antennas.**

1. *Utility poles*. The maximum height of any antenna mounted to an existing utility pole shall not exceed 24 inches above the height of an existing utility pole, nor shall any portion of the antenna or equipment mounted on a pole be less than 18 feet above any drivable road surface. All installations on utility poles shall fully comply with the California Public Utilities Commission general orders, including, but not limited to, General Order 95, as revised.

2. *Street light poles*. The maximum height of any antenna mounted to a street light pole shall not exceed seven feet above the existing height of a street light pole in a location with its closest adjacent district being a commercial zoning district and shall not exceed three feet above the existing height of a street light pole in any other zoning district. Any portion of the antenna or equipment mounted on such a pole shall be no less than 18 feet above any drivable road surface.

D. **Poles.**

1. Only pole-mounted antennas shall be permitted in the right-of-way. All other telecommunications towers are prohibited, and no new poles are permitted that are not replacing an existing pole.

2. Pole height and width limitations:

   (a) All poles shall be designed to be the minimum functional height and width required to support the proposed antenna installation and meet FCC requirements. Poles and antennas and similar structures shall be no greater in diameter or other cross-sectional dimensions than is necessary for the proper functioning of the facility.

   (b) Notwithstanding the above, no facility shall be located on a pole that is less than 26 feet in height and no facility shall exceed 35 feet in height, including, but not limited to the pole and any antenna that protrudes above the pole.

   (c) Pole mounted equipment shall not exceed six cubic feet in dimension.

3. If an applicant proposes to replace a pole in order to accommodate the facility, the pole shall match the appearance of the original pole to the extent feasible, unless another design better accomplishes the objectives of this section. Such replacement pole shall not exceed the height of the pole it is replacing by more than seven feet.

4. If an exception is granted for placement of new poles in the right-of-way, new poles shall be designed to resemble existing poles in the right-of-way, including size, height, color, materials and style, with the exception of any existing pole designs that are scheduled to be removed and not replaced, unless another design better accomplishes the objectives of this section. Such new poles that are not replacement poles shall be located no closer than 90 feet to an existing pole.

E. **Space occupied.** Facilities shall be designed to occupy the least amount of space in the right-of-way that is technically feasible.

F. **Location.**

1. Each component part of a facility shall be located so as not to cause any physical or visual obstruction to pedestrian or vehicular traffic, inconvenience to the public's use of the right-of-way, or safety hazards to pedestrians and motorists.

2. A facility shall not be located within any portion of the public right-of-way interfering with access to fire hydrants, fire stations, fire escapes, water valves, underground vaults, valve housing structures, or any other vital public health and safety facility.

3. Facilities mounted to a telecommunications tower, above-ground accessory equipment, or walls, fences, landscaping or other screening methods shall be setback a minimum of 18 inches from the front of a curb.

4. Each pole mounted wireless telecommunications facility must be separated by at least 1,500 feet.

5. All cables, including, but not limited to, electrical and utility cables, between the pole and any accessory equipment shall be placed underground, if feasible.

6. All new wires needed to service the wireless telecommunications facility must be installed within the width of the existing utility pole so as to not exceed the diameter and height of the existing utility pole.

G. **Americans with Disabilities Act Compliance.** All facilities shall be built in compliance with the Americans with Disabilities Act (ADA).

H. **Accessory equipment.** With the exception of the electric meter, which shall be pole-mounted to the extent feasible, all accessory equipment shall be located underground to the extent feasible. When above-ground is the only feasible location for a particular type of accessory equipment and when such accessory equipment cannot be pole-mounted, such accessory equipment shall be enclosed within a structure, and shall not exceed a height of five feet and a total footprint of 15 square feet, and shall be screened and camouflaged to the fullest extent possible, including the use of landscaping or alternate screening. Required electrical meter cabinets shall be adequately screened and camouflaged.

I. **Documentation.** The applicant shall provide documentation satisfactory to the zoning administrator establishing compliance with this section 20.73.090.

20.73.100 Conditions of Approval for All Facilities

A. In addition to compliance with the requirements of this chapter, upon approval all facilities shall be subject to each of the following conditions of approval, as well as any modification of these conditions or additional conditions of approval deemed necessary by the reviewing authority:

1. Before the permittee submits any application for a building permit or other permits required by the Mill Valley Municipal Code, the permittee must incorporate the wireless telecommunication facility permit granted under this chapter, all conditions associated with the wireless telecommunications facility permit and the approved plans and any photo simulations (the "Approved Plans") into the project plans. The permittee must construct, install and operate the wireless telecommunications facility in strict compliance with the Approved Plans. The permittee shall submit an as built drawing within 90 days after installation of the facility.

2. Where feasible, as new technology becomes available, the permittee shall:

(a) place above-ground wireless telecommunications facilities below ground, including, but not limited to, accessory equipment that has been mounted to a telecommunications tower or mounted on the ground; and

(b) replace larger, more visually intrusive facilities with smaller, less visually intrusive facilities, after receiving all necessary permits and approvals required pursuant to the Mill Valley Municipal Code.

3. The permittee shall submit and maintain current at all times basic contact and site information on a form to be supplied by the City. The permittee shall notify the City of any changes to the information submitted within seven days of any change, including change of the name or legal status of the owner or operator. This information shall include, but is not limited to, the following:

(a) Identity, including the name, address and 24-hour local or toll free contact phone number of the permittee, the owner, the operator, and the agent or person responsible for the maintenance of the facility.

(b) The legal status of the owner of the wireless telecommunications facility, including official identification numbers and FCC certification.

(c) Name, address, and telephone number of the property owner if different than the permittee.

4. The permittee shall not place any facilities that will deny access to, or otherwise interfere with, any public utility, easement, or right-of-way located on the site. The permittee shall allow the City reasonable access to, and maintenance of, all utilities and existing public improvements within or adjacent to the site, including, but not limited to, pavement, trees, public utilities, lighting and public signage.

5. At all times, all required notices and signs shall be posted on the site as required by the FCC and California Public Utilities Commission, and as approved by the City. The location and dimensions of a sign bearing the emergency contact name and telephone number shall be posted pursuant to the approved plans.

6. At all times, the permittee shall ensure that the facility complies with the most current regulatory and operational standards including, but not limited to, radio frequency emissions standards adopted by the FCC and antenna height standards adopted by the Federal Aviation Administration.

7. If the zoning administrator determines there is good cause to believe that the facility may emit radio frequency emissions that are likely to exceed FCC standards, the zoning administrator may require the permittee to submit a technically sufficient written report certified by a qualified radio frequency emissions engineer, certifying that the facility is in compliance with such FCC standards.

8. Permittee shall pay for and provide a performance bond, which shall be in effect until the facilities are fully and completely removed and the site reasonably returned to its original condition, to cover permittee's obligations under these conditions of approval and the Mill Valley Municipal Code. The bond coverage shall include, but not be limited to, removal of the facility, maintenance obligations and landscaping obligations. The amount of the performance bond shall be set by the zoning administrator in an amount rationally related to the obligations covered by the bond and shall be specified in the conditions of approval.

9. Permittee shall defend, indemnify, protect and hold harmless the City, its elected and appointed council members, boards, commissions, officers, officials, agents, consultants, employees, and volunteers from and against any and all claims, actions, or proceeding against the City and its elected and appointed council members, boards, commissions, officers, officials, agents, consultants, employees and volunteers to attack, set aside, void or annul, an approval of the City, Planning Commission or City council concerning this permit and the project. Such indemnification shall include damages, judgments, settlements, penalties, fines, defensive costs or expenses, including, but not limited to, interest, attorneys' fees and expert witness fees, or liability of any kind related to or arising from such claim, action, or proceeding. The City shall promptly notify the permittee of any claim, action, or proceeding. Nothing contained herein shall prohibit City from participating in a defense of any claim, action or proceeding. The City shall have the option of coordinating the defense, including, but not limited to, choosing counsel for the defense at permittee's expense.

10. All conditions of approval shall be binding as to the applicant and all successors in interest to permittee.

11. A condition setting forth the permit expiration date in accordance with section 20.73.200 shall be included in the conditions of approval.

20.73.110 Additional Conditions of Approval for Facilities in the Public Right-of-Way

A. In addition to compliance with the requirements of this chapter, upon approval all facilities in the public right-of-way shall be subject to each of the conditions of approval set forth in section 20.73.100, each of the following conditions of approval, and any modification of these conditions or additional conditions of approval deemed necessary by the reviewing authority:

1. The wireless telecommunications facility shall be subject to such conditions, changes or limitations as are from time to time deemed necessary by the City engineer for the purpose of: (a) protecting the public health, safety, and welfare, (b) preventing interference with pedestrian and vehicular traffic, and (c) preventing damage to the public right-of-way or any property adjacent to it. The City may modify the permit to reflect such conditions, changes or limitations by following the same notice and public hearing procedures as are applicable to the grant of a wireless telecommunications facility permit for similarly located facilities, except the permittee shall be given notice by

personal service or by registered or certified mail at the last address provided to the City by the permittee.

2. The permittee shall not move, alter, temporarily relocate, change, or interfere with any existing structure, improvement or property without the prior consent of the owner of that structure, improvement or property. No structure, improvement or property owned by the City shall be moved to accommodate a wireless telecommunications facility unless the City determines that such movement will not adversely affect the City or any surrounding businesses or residents, and the permittee pays all costs and expenses related to the relocation of the City's structure, improvement or property. Prior to commencement of any work pursuant to an encroachment permit issued for any facility within the public right-of-way, the permittee shall provide the City with documentation establishing to the City's satisfaction that the permittee has the legal right to use or interfere with any other structure, improvement or property within the public right-of-way to be affected by applicant's facilities.

3. The permittee shall assume full liability for damage or injury caused to any property or person by the facility.

4. The permittee shall repair, at its sole cost and expense, any damage including, but not limited to subsidence, cracking, erosion, collapse, weakening, or loss of lateral support to City streets, sidewalks, walks, curbs, gutters, trees, parkways, street lights, traffic signals, improvements of any kind or nature, or utility lines and systems, underground utility line and systems, or sewer systems and sewer lines that result from any activities performed in connection with the installation or maintenance of a wireless telecommunications facility in the public right-of-way. The permittee shall restore such areas, structures and systems to the condition in which they existed prior to the installation or maintenance that necessitated the repairs. In the event the permittee fails to complete such repair within the number of days stated on a written notice by the zoning administrator, the zoning administrator shall cause such repair to be completed at permittee's sole cost and expense.

5. Prior to issuance of a building permit, the applicant shall obtain the zoning administrator's approval of a tree protection plan prepared by a certified arborist if the installation of the wireless telecommunication facility will be located within the canopy of a street tree, or a protected tree on private property, or within a ten-foot radius of the base of such a tree. Depending on site specific criteria (e.g., location of tree, size, and type of tree, etc.), a radius greater than ten feet may be required by the zoning administrator.

6. Should any utility company offer electrical service that does not require the use of a meter cabinet, the permittee shall at its sole cost and expense remove the meter cabinet and any related foundation within 30 days of such service being offered and reasonably restore the area to its prior condition.

7. The permittee shall modify, remove, or relocate its facility, or portion thereof, without cost or expense to City, if and when made necessary by:

   a) Any public improvement project, including, but not limited to, the construction, maintenance, or operation of any underground or aboveground facilities including but not limited to sewers, storm drains, conduits, gas, water, electric or other utility systems, or pipes owned by City or any other public agency;

   b) Any abandonment of any street, sidewalk, or other public facility;

   c) Any change of grade, alignment or width of any street, sidewalk or other public facility; or

   d) A determination by the zoning administrator that the wireless telecommunications facility has become incompatible with public health, safety or welfare or the public's use of the public right-of-way.

8. Any modification, removal, or relocation of the facility shall be completed within 90 days of written notification by City unless exigencies dictate a shorter period for removal or relocation. Modification or relocation of the facility shall require submittal, review and approval of a permit amendment pursuant to the Mill Valley Municipal Code. The permittee shall be entitled, on permittee's election, to either a pro-rata refund of fees paid for the original permit or to a new permit, without additional fee, at a location as close to the original location as the standards set forth in the Mill Valley Municipal Code allow. In the event the facility is not modified, removed, or relocated within said period of time, the City may cause the same to be done at the sole cost and expense of permittee. Further, due to exigent circumstances as provided in the Mill Valley Municipal Code, the City may modify, remove, or relocate wireless telecommunications facilities without prior notice to permittee provided permittee is notified within a reasonable period thereafter.

20.73.120 Findings

A. Where a wireless telecommunication facility requires a conditional use permit under this chapter, the reviewing authority shall not approve any application unless, in addition to the findings generally applicable to all conditional use permits, all of the following additional findings are made:

1. The proposed facility complies with all applicable provisions of this chapter.

2. The proposed facility has been designed and located to achieve compatibility with the community to the maximum extent reasonably feasible.

3. The applicant has submitted a statement of its willingness to allow other carriers to collocate on the proposed wireless telecommunications facility wherever technically and economically feasible and where collocation would not harm community compatibility.

4. Noise generated by equipment will not be excessive, annoying nor be detrimental to the public health, safety, and welfare and will not exceed the standards set forth in this chapter.

B. In addition to the findings in paragraph (A) above, approval of a wireless telecommunications facility permit for a facility that will be located in the public right-of-way may be granted only if the following findings are made by the reviewing authority:

1. The applicant has provided substantial written evidence supporting the applicant's claim that it has the right to enter the public right-of-way pursuant to state or federal law, or the applicant has entered into a franchise or other agreement with the City permitting them to use the public right-of-way.

2. The applicant has demonstrated that the facility will not interfere with the use of the public right-of-way, existing subterranean infrastructure, or the City's plans for modification or use of such location and infrastructure.

20.73.130 Exceptions

A. Exceptions pertaining to any provision of this chapter, including, but not limited to, exceptions from findings that would otherwise justify denial, may be granted by the reviewing authority if the reviewing authority makes the finding that:

1. Denial of the facility as proposed would violate federal law, state law, or both; or

2. A provision of this chapter, as applied to applicant, would deprive applicant of its rights under federal law, state law, or both.

B. An applicant may only request an exception at the time of applying for a wireless telecommunications facility permit. The request must include both the specific provision(s) of this chapter from which the exception is sought and the basis of the request. Any request for an exception after the City has deemed an application complete shall be treated as a new application.

C. Notwithstanding any other provision of this chapter, a conditional use permit shall be required for a facility when an exception is requested.

D. The applicant shall have the burden of proving that denial of the facility as proposed would violate federal law, state law, or both, or that the provisions of this chapter, as applied to applicant, would deprive applicant of its rights under federal law, state law, or both, using the evidentiary standards required by that law at issue. The City shall have the right to hire an independent consultant, at the applicant's expense, to evaluate the issues raised by the exception request and shall have the right to submit rebuttal evidence to refute the applicant's claim.

20.73.140 Wireless Telecommunications Facilities Covered under Section 6409(a) of the Middle Class Tax Relief and Job Creation Act of 2012

A. **Purpose.** Section 6409(a) of the Middle Class Tax Relief and Job Creation Act of 2012, Pub. L. 112-96, codified in 47 U.S.C. § 1455(a), generally requires that State and local governments "may not deny, and shall approve" requests to collocate, remove or replace transmission equipment at an existing tower or base station. Federal Communication Commission regulations interpret this statute and create procedural rules for local review, which generally preempt certain subjective land-use regulations, limit permit application content requirements and provide the applicant with a potential "deemed granted" remedy when the State or local government fails to approve or deny the request within sixty (60) days after submittal (accounting for any tolling periods). Moreover, whereas Section 704 of the Telecommunications Act of 1996, Pub. L. 104-104, codified in 47 U.S.C. § 332, applies to only "personal wireless service facilities" (e.g., cellular telephone towers and equipment), Section 6409(a) applies to all "wireless" facilities licensed or authorized by the FCC (e.g., cellular, Wi-Fi, satellite, microwave backhaul, etc.).

The overlap between wireless deployments covered under Section 6409(a) and other wireless deployments, combined with the different substantive and procedural rules applicable to such deployments, creates a potential for confusion that harms the public interest in both efficient wireless facilities deployment and carefully planned community development in accordance with local values. A separate permit application and review process specifically designed for compliance with Section 6409(a) contained in a section devoted to Section 6409(a) will mitigate such potential confusion, streamline local review and preserve the City's land-use authority to maximum extent possible.

B. **Applicability.** This Section applies to all collocations or modifications to an existing wireless tower or base station submitted with a written request for approval pursuant to Section 6409(a).

C. **Approval Required.** Any request to collocate, replace or remove transmission equipment at an existing wireless tower or base station submitted with a written request for a 6409(a) approval shall be subject to the zoning administrator's approval, conditional approval or denial without prejudice pursuant to the standards and procedures contained in this chapter.

D. **Other Regulatory Approvals.** No collocation or modification approved under any section 6409(a) approval may occur unless the applicant also obtains all other applicable permits or regulatory approvals from the City and state or federal agencies. Furthermore, any section 6409(a) approval granted under this chapter shall remain subject to any and all lawful conditions or requirements associated with such other permits or regulatory approvals from the City and state or federal agencies.

E. **Application Requirement.** The City shall not approve any wireless facility subject to this chapter except upon a duly filed application consistent with this Section and any other written rules the City or the zoning administrator may establish from time to time. An application must include the information required by Section 20.73.050 and the following additional information:

1. A title report prepared within the six months prior to the application filing date in order for the City verify the property owner's identity. If the applicant does not own the subject property, the application must include a written authorization signed by the property owner that empowers the applicant to file the application and perform all wireless facility construction, installation, operation and maintenance to the extent described in the application.

2. A written statement that explains in plain factual detail whether and why Section 6409(a) and the related FCC regulations at 47 C.F.R. § 1.40001 et seq. require approval for the specific project. A complete written narrative analysis will state the applicable standard and all the facts that allow the City to conclude the standard has been met. Bare conclusions not factually supported do not constitute a complete written analysis. As part of this written statement the applicant must also include (i) whether and why the support structure qualifies as an existing tower or existing base station; and (ii) whether and why the proposed collocation or modification does not cause a substantial change in height, width, excavation, equipment cabinets, concealment or permit compliance.

F. **Procedures for a Duly Filed Application.** The City shall not review any application unless duly filed in accordance with this Section, as follows:

1. *Pre-Submittal Conference*. Before application submittal, applicants must schedule and attend a pre-application meeting with the zoning administrator for all proposed modifications submitted for approval pursuant to Section 6409(a). The pre-submittal conference is intended to streamline the review process through informal discussion that includes, without limitation, the appropriate project classification, including whether the project qualifies for Section 6409(a); any latent issues in connection with the existing tower or base station; potential concealment issues (if applicable); coordination with other City departments responsible for application review; and application completeness issues. To mitigate unnecessary delays due to application incompleteness, applicants are encouraged (but not required) to bring any draft applications or other materials so that City staff may provide informal feedback about whether such applications or other materials may be incomplete or unacceptable. The zoning administrator may, in the zoning administrator's discretion, grant a written exemption to the submittal appointment under Section 20.73.140(F)(2) or for a specific requirement for a complete application to any applicant who (i) schedules, attends and fully participates in any pre-submittal conference and (ii) shows to the zoning administrator's satisfaction that such specific requirement duplicates information already provided in other materials to be submitted or is otherwise unnecessary to the City's review under facts and circumstances in that particular case. Any written exemption will be limited to the project discussed at the pre-submittal conference and will not be extended to any other project.

2. *Submittal Appointment*. All applications must be filed with the City at a pre-scheduled appointment. Applicants may generally submit one application per appointment, but may schedule successive appointments for multiple applications whenever feasible and

not prejudicial to other applicants. Any application received without an appointment, whether delivered in-person or through any other means, will not be considered duly filed unless the applicant received a written exemption from the zoning administrator at a pre-submittal conference.

3. *Appointment Scheduling Procedures*. For any event in the submittal process that requires an appointment, applicants must submit a written request to the zoning administrator. The zoning administrator shall endeavor to provide applicants with an appointment as soon as reasonably feasible and within five business days after a written request is received.

4. *Applications Deemed Withdrawn*. To promote efficient review and timely decisions, an application will be automatically deemed withdrawn by the applicant when the applicant fails to tender a substantive response to the City within 90 calendar days after the City deems the application incomplete in a written notice to the applicant. The zoning administrator may, in the zoning administrator's discretion, grant a written extension for up to an additional 30 calendar days when the applicant submits a written request prior to the 90th day that shows good cause to grant the extension. Delays due to circumstances outside the applicant's reasonable control will be considered good cause to grant the extension.

5. *Departmental Forms, Rules and Other Regulations*. The City council authorizes the zoning administrator to develop and publish permit application forms, checklists, informational handouts and other related materials that the zoning administrator finds necessary, appropriate or useful for processing requests for section 6409(a) approvals. Without further authorization from the City council, the zoning administrator may from time-to-time update and alter any such permit application forms, checklists, informational handouts and other related materials as the zoning administrator deems necessary, appropriate or useful to respond to regulatory, technological or other changes related to this chapter. The City council authorizes the zoning administrator to establish other reasonable rules and regulations, which may include without limitation regular hours for appointments with applicants, as the zoning administrator deems necessary or appropriate to organize, document and manage the application intake process.

G. **Administrative Review; Decision Notices.** The zoning administrator shall administratively review an application for a section 6409(a) approval and act on such an application without prior notice or a public hearing. Within five working days after the zoning administrator conditionally approves or denies an application submitted for Section 6409(a) approval or before the FCC timeframe for review expires (whichever occurs first), the zoning administrator shall send a written notice to the applicant. In the event that the zoning administrator determines that an application submitted for approval pursuant to Section 6409(a) does not qualify for approval, the zoning administrator will send written notice to the applicant that includes the reasons to support the review authority's decision and states that the application will be automatically denied without prejudice on the 60th day after the date the application was filed unless the applicant withdraws the application.

H. **Required Findings for 6409(a) Approval.** The zoning administrator may approve or conditionally approve an application submitted for Section 6409(a) approval when the zoning administrator finds that the proposed project:

1. Involves collocation, removal or replacement of transmission equipment on an existing wireless tower or base station; and

2. Does not substantially change the physical dimensions of the existing wireless tower or base station.

I. **Criteria for Denial Without Prejudice.** Notwithstanding any other provisions in this chapter, and consistent with all applicable federal laws and regulations, the zoning administrator may deny without prejudice an application submitted for approval pursuant to Section 6409(a) when it finds that the proposed project:

1. Does not satisfy the criteria for approval;

2. Violates any legally enforceable standard or permit condition reasonably related to public health and safety then in effect; or

3. Involves the replacement of the entire support structure.

J. **Conditional 6409(a) Approvals.** Subject to any applicable limitations in federal or state law, nothing in this chapter is intended to limit the City's authority to conditionally approve an application for a section 6409(a) approval to protect and promote the public health, safety and welfare.

K. **Appeals.** Notwithstanding any provision of the Mill Valley Municipal Code to the contrary, including but not limited to section , an applicant may appeal a decision by the zoning administrator to deny without prejudice a Section 6409(a) application. The appeal must be filed within 10 days from the zoning administrator's decision. The appeal must state in plain terms the grounds for reversal and the facts that support those grounds. The City manager shall serve as the appellate authority for all appeals of all actions of the zoning administrator taken pursuant to this section. The

City shall provide notice for an administrative hearing by the City manager. The City manager shall limit its review to whether the project should be approved or denied in accordance with the provisions in paragraphs (H) and (I) of this section. The decision of the City manager shall be final and not subject to any further administrative appeals.

L. **Standard Conditions of Approval.** In addition to all other conditions adopted by the zoning administrator, all Section 6409(a) approvals, whether approved by the zoning administrator or deemed approved by the operation of law, shall be automatically subject to the following conditions in this Section; provided, however, that the zoning administrator shall have discretion to modify or amend these conditions on a case-by-case basis as may be necessary or appropriate under the circumstances:

1. *Approved Plans.* Before the permittee submits any application for a building permit or other permits required by the Mill Valley Municipal Code, the permittee must incorporate the wireless telecommunications facility permit granted under this section, all conditions associated with the wireless telecommunications facility permit and the approved plans and any photo simulations (the "Approved Plans") into the project plans. The permittee must construct, install and operate the wireless telecommunications facility in strict compliance with the Approved Plans. The permittee shall submit an as built drawing within 90 days after installation of the facility.

2. *Permit Term.* The City's grant or grant by operation of law of a Section 6409(a) approval constitutes a federally-mandated modification to the underlying permit or other prior regulatory authorization for the subject tower or base station. The City's grant or grant by operation of law of a section 6409(a) approval will not extend the permit term, if any, for any conditional use permit, or other underlying prior regulatory authorization. Accordingly, the term for a section 6409(a) approval shall be coterminous with the underlying permit or other prior regulatory authorization for the subject tower or base station.

3. *Accelerated Permit Terms Due to Invalidation.* In the event that any court of competent jurisdiction invalidates any portion of Section 6409(a) or any FCC rule that interprets Section 6409(a) such that federal law would not mandate approval for any Section 6409(a) approval, such 6409(a) approvals shall automatically expire one year from the effective date of the judicial order, unless the decision would not authorize accelerated termination of previously approved section 6409(a) approvals or the zoning administrator grants an extension upon written request from the permittee that shows good cause for the extension, which includes without limitation extreme financial hardship. Notwithstanding anything in the previous sentence to the contrary, the zoning administrator may not grant a permanent exemption or indefinite extension. A permittee shall not be required to remove its improvements approved under the invalidated section 6409(a) approval when it has submitted an application for a conditional use permit for those improvements before the one-year period ends.

4. *No Waiver of Standing.* The City's grant or grant by operation of law of a Section 6409(a) approval does not waive, and shall not be construed to waive, any standing by the City to challenge Section 6409(a), any FCC rules that interpret Section 6409(a) or any section 6409(a) approval.

5. *Build-out Period.* The section 6409(a) approval will automatically expire one year from the issuance date unless the permittee obtains all other permits and approvals required to install, construct and operate the approved wireless facility, which includes without limitation any permits or approvals required by the any federal, state or local public agencies with jurisdiction over the subject property, the wireless facility or its use. The zoning administrator may grant one written extension to a date certain when the permittee shows good cause to extend the limitations period in a written request for an extension submitted at least 30 days prior to the automatic expiration date in this condition. Any further extensions may be granted by the planning commission.

6. *Maintenance Obligations; Vandalism.* The permittee shall keep the site, which includes without limitation any and all improvements, equipment, structures, access routes, fences and landscape features, in a neat, clean and safe condition in accordance with the Approved Plans and all conditions in this section 6409(a) approval. The permittee shall keep the site area free from all litter and debris at all times. The permittee, at no cost to the City, shall remove and remediate any graffiti or other vandalism at the site within 48 hours after the permittee receives notice or otherwise becomes aware that such graffiti or other vandalism occurred.

7. *Compliance with Laws.* The permittee shall maintain compliance at all times with all federal, state and local statutes, regulations, orders or other rules that carry the force of law ("Laws") applicable to the permittee, the subject property, the wireless facility or any use or activities in connection with the use authorized in this section 6409(a) approval. The permittee expressly acknowledges and agrees that this obligation is intended to be broadly construed and that no other specific requirements in these conditions are intended to reduce, relieve or otherwise lessen the permittee's obligations to maintain compliance with all Laws.

8. *Adverse Impacts on Other Properties.* The permittee shall use all reasonable efforts to avoid any and all undue or unnecessary adverse impacts on nearby properties that may arise from the permittee's construction, installation, operation, modification, maintenance, repair, removal or other activities at the site. The permittee shall not perform or cause others to perform any construction, installation, operation, modification, maintenance, repair, removal or other work that involves heavy equipment or machines on any day and at any time prohibited under the Mill Valley Municipal Code. The restricted work hours in this condition will not prohibit any work required to prevent an actual, immediate harm to property or persons, or any work during an emergency declared by the City. The zoning administrator may issue a stop work order for any work that violates this condition.

9. *Noise Complaints.* The permittee shall conduct all activities on the site in compliance with the noise standards in the Mill Valley Municipal Code. In the event that any person files a noise complaint and the City verifies that such complaint is valid, the permittee must remedy the violation within 10 days after notice from the City, which may include a demonstration that the permittee has amended its operational guidelines in situations where the violation arises from the permittee's personnel rather than the permittee's equipment.

10. *Inspections; Emergencies.* The permittee expressly acknowledges and agrees that the City or its designee may enter onto the site and inspect the improvements and equipment upon reasonable prior notice to the permittee; provided, however, that the City or its designee may, but will not be obligated to, enter onto the site area without prior notice to support, repair, disable or remove any improvements or equipment in emergencies or when such improvements or equipment threatens actual, imminent harm to property or persons. The permittee will be permitted to supervise the City or its designee while such inspection or emergency access occurs.

11. *Contact Information.* The permittee shall furnish the City with accurate and up-to-date contact information for a person responsible for the wireless facility, which includes without limitation such person's full name, title, direct telephone number, facsimile number, mailing address and email address. The permittee shall keep such contact information up-to-date at all times.

12. *Indemnification.* The permittee and, if applicable, the property owner upon which the wireless facility is installed shall defend, indemnify and hold harmless the City, its agents, officers, officials, employees and volunteers from any and all (1) damages, liabilities, injuries, losses, costs and expenses and from any and all claims, demands, law suits, writs and other actions or proceedings ("Claims") brought against the City or its agents, officers, officials, employees or volunteers to challenge, attack, seek to modify, set aside, void or annul the City's approval of this section 6409(a) approval, and (2) other Claims any kind or form, whether for personal injury, death or property damage, that arise from or in connection with the permittee's or its agents', directors', officers', employees', contractors', subcontractors', licensees', or customers' acts or omissions in connection with this section 6409(a) approval or the wireless facility. In the event the City becomes aware any Claims, the City will use best efforts to promptly notify the permittee and the private property owner and shall reasonably cooperate in the defense. The permittee expressly acknowledges and agrees that the City shall have the right to approve, which approval shall not be unreasonably withheld, the legal counsel providing the City's defense, and the property owner or permittee (as applicable) shall promptly reimburse City for any costs and expenses directly and necessarily incurred by the City in the course of the defense. The permittee expressly acknowledges and agrees that the permittee's indemnification obligations under this condition are a material consideration that motivates the City to approve this section 6409(a) approval, and that such

indemnification obligations will survive the expiration or revocation of this section 6409(a) approval.

13. *Performance Bond.* Before the City issues any construction permit in connection with the wireless facility, the permittee shall post a performance bond from a surety and in a form acceptable to the City manager in an amount equal to or greater than a written estimate from a qualified contractor with experience in wireless facilities removal. The written estimate must include the cost to remove all equipment and other improvements, which includes without limitation all antennas, radios, batteries, generators, utilities, cabinets, mounts, brackets, hardware, cables, wires, conduits, structures, shelters, towers, poles, footings and foundations, whether above ground or below ground, constructed or installed in connection with the wireless facility. In establishing or adjusting the bond amount required under this condition, and in accordance with California Government Code § 65964(a), the City manager shall take into consideration information provided by the permittee regarding the cost to remove the wireless facility.

14. *Record Retention.* The permittee must maintain complete and accurate copies of all permits and other regulatory approvals issued in connection with the wireless facility, which includes without limitation this approval, the approved plans and photo simulations incorporated into this approval, all conditions associated with this approval and any ministerial permits or approvals issued in connection with this approval. In the event that the permittee does not maintain such records as required in this condition, any ambiguities or uncertainties that would be resolved through an inspection of the missing records will be construed against the permittee.

15. *Compliance Obligations.* An applicant or permittee will not be relieved of its obligation to comply with every applicable provision in the Mill Valley Municipal Code, any permit, any permit condition or any applicable law or regulation by reason of any failure by the City to timely notice, prompt or enforce compliance by the applicant or permittee.

20.73.150 Wireless Telecommunications Collocation Facilities Covered under California Government Code Section 65850.6

A. **Purpose.** The purpose of this section is to comply with an application for a Wireless Telecommunications Collocation Facility under California Government Code Section 65850.6, for which a 6509(a) approval is not being requested. This section provides the requirements, standards and regulations for a wireless telecommunications collocation facility for which subsequent collocation is a permitted use pursuant to California law. Only those facilities that fully comply with the eligibility requirements set forth in California Government Code Section 65850.6, or its successor provision, and which strictly adhere to the requirements and regulations set forth in this section shall qualify as a wireless telecommunications collocation facility.

B. **Definitions.** For the purposes of this section, the following terms are defined as follows:

1. **"Collocation Facility"** means the placement or installation of wireless facilities, including antennas, and related equipment, on, or immediately adjacent to, a wireless telecommunications collocation facility.

2. **"Wireless Telecommunications Facility"** means equipment and network components such as towers, utility poles, transmitters, base stations, and emergency power systems that are integral to providing wireless telecommunications services.

3. **"Wireless Telecommunications Collocation Facility"** means a wireless telecommunications facility that includes collocation facilities.

C. **Procedures.** An application for a Wireless Telecommunications Collocation Facility under California Government Code Section 65850.6 shall be processed in the same manner as an application for 6409(a) approval is processed, except that where the process requires justification for the 6409(a) approval, the applicant shall instead provide the justification for a Wireless Telecommunications Collocation Facility under California Government Code Section 65850.6.

D. **Requirements.** All requirements, regulations, and standards set forth in this chapter for a wireless telecommunications facility shall apply to a wireless telecommunications collocation facility; provided, however, the following shall also apply to a wireless telecommunications collocation facility:

1. The applicant for a wireless telecommunications collocation facility permit shall describe or depict:

    (a) The wireless telecommunications collocation facility as it will be initially built; and

    (b) All collocations at full build-out, including, but not limited to, all antennas, antenna support structures, and accessory equipment.

2. Any collocation shall use screening methods substantially similar to those used on the existing wireless telecommunications facilities unless other optional screening methods are specified in the conditions of approval.

3. A wireless telecommunications collocation facility permit shall not be approved unless an environmental impact report, negative declaration, or mitigated negative declaration was prepared and approved for the wireless telecommunications collocation facility.

E. **Permitted Use.** Notwithstanding any other provision of this chapter, a subsequent collocation on a wireless telecommunications collocation facility shall be a permitted use only if all of the following requirements are satisfied:

1. The wireless telecommunications collocation facility:

    (a) Was approved after January 1, 2007, by discretionary permit;

(b) Was approved subject to an environmental impact report, negative declaration, or mitigated negative declaration; and

(c) Otherwise complies with the requirements of California Government Code Section 65850.6(b), or its successor provision, for addition of a collocation facility to a wireless telecommunications collocation facility, including, but not limited to, compliance with all performance and maintenance requirements, regulations and standards in this chapter and the conditions of approval in the wireless telecommunications collocation facility permit; and

2. The collocations were specifically considered when the relevant environmental document was prepared for the wireless telecommunications collocation facility.

3. Before collocation, the applicant seeking collocation shall obtain all other applicable non-discretionary permits, as required pursuant to the Mill Valley Municipal Code.

F. **New or Amended Permit.** Except as otherwise provided above, approval of a new or amended permit shall be required when the facility is modified other than by collocation in accordance with this section, or the proposed collocation:

1. Increases the height of the existing permitted telecommunications tower or otherwise changes the bulk, size, location, or any other physical attributes of the existing permitted wireless telecommunications collocation facility unless specifically permitted under the conditions of approval applicable to such wireless telecommunications collocation facility; or

2. Adds any microwave dish or other antenna not expressly permitted to be included in a collocation facility by the conditions of approval.

G. **Appeals**. Notwithstanding any provision of the Mill Valley Municipal Code to the contrary, including but not limited to Section 20.62.060, any applicant may appeal a decision by the zoning administrator. The appeal must be filed within 10 days from the zoning administrator's decision. The appeal must state in plain terms the grounds for reversal and the facts that support those grounds. The City manager shall serve as the appellate authority for all appeals of all actions of the zoning administrator taken pursuant to this section. The City shall provide notice for an administrative hearing by the City manager. The City manager shall limit its review to whether the project should be approved or denied in accordance with the provisions in this section. The decision of the City manager shall be final and not subject to any further administrative appeals.

20.73.160 Business License

A permit issued pursuant to this chapter shall not be a substitute for any business license otherwise required under the Mill Valley Municipal Code.

20.73.170 Emergency Deployment

In the event of a declared federal, state, or local emergency, or when otherwise warranted by conditions that the zoning administrator deems to constitute an emergency, the zoning administrator may approve the installation and operation of a temporary wireless telecommunications facility (e.g., a cell on wheels or "COW"), which is subject to such reasonable conditions that the zoning administrator deems necessary.

20.73.180 Operation and Maintenance Standards

A. All wireless telecommunications facilities must comply at all times with the following operation and maintenance standards. All necessary repairs and restoration shall be completed by the permittee, owner, or operator within 48 hours:

1. After discovery of the need by the permittee, owner, operator or any designated maintenance agent; or

2. After permittee, owner, operator, or any designated maintenance agent receives notification from a resident or the zoning administrator.

B. All facilities, including, but not limited to, telecommunication towers, poles, accessory equipment, lighting, fences, walls, shields, cabinets, artificial foliage or camouflage, and the facility site shall be maintained in good condition, including ensuring the facilities are reasonably free of:

1. General dirt and grease;

2. Chipped, faded, peeling, and cracked paint;

3. Rust and corrosion;

4. Cracks, dents, and discoloration;

5. Missing, discolored, or damaged artificial foliage or other camouflage;

6. Graffiti, bills, stickers, advertisements, litter and debris;

7. Broken and misshapen structural parts; and

8. Any damage from any cause.

C. All trees, foliage or other landscaping elements approved as part of the facility shall be maintained in good condition at all times, and the permittee, owner and operator of the facility shall be responsible for replacing any damaged, dead or decayed landscaping. No amendment to any approved landscaping plan may be made until it is submitted to and approved by the zoning administrator.

D. The permittee shall replace its facilities, after obtaining all required permits, if maintenance

or repair is not sufficient to return the facility to the condition it was in at the time of installation.

E. Each facility shall be operated and maintained at all times in compliance with applicable federal regulations, including FCC radio frequency emissions standards.

F. Each facility shall be operated and maintained to comply at all times with the noise regulations of this chapter and shall be operated and maintained in a manner that will minimize noise impacts to surrounding residents. Except for emergency repairs, any testing and maintenance activities that will be audible beyond the property line shall only occur between the hours of 7:00 a.m. and 5:00 p.m. on Monday through Friday, excluding holidays, unless alternative hours are approved by the zoning administrator. Backup generators, if permitted, shall only be operated during periods of power outages or for testing.

G. If a flagpole is used for camouflaging a wireless telecommunications facility, flags shall be flown and shall be properly maintained at all times.

H. Each owner or operator of a facility shall routinely inspect each site to ensure compliance with the standards set forth in this section and the conditions of approval.

20.73.190 No Dangerous Conditions or Obstructions Allowed

No person shall install, use or maintain any wireless telecommunications facility which in whole or in part rests upon, in or over any public sidewalk or parkway, when such installation, use or maintenance endangers or is reasonably likely to endanger the safety of persons or property, or when such site or location is used for public utility purposes, public transportation purposes or other governmental use, or when such facility unreasonably interferes with or impedes the flow of pedestrian or vehicular traffic including any legally parked or stopped vehicle, the ingress into or egress from any residence or place of business, the use of poles, posts, traffic signs or signals, hydrants, mailboxes, permitted sidewalk dining, permitted street furniture or other objects permitted at or near said location.

20.73.200 Permit Expiration

A. A permit for any wireless telecommunications facility shall be valid for a period of 10 years, unless the Planning commission authorizes a longer period or pursuant to another provision of the Mill Valley Municipal Code the permit lapses sooner or is revoked. At the end of such period, the permit shall expire.

B. A permittee may apply for extensions of its permit in increments of no more than ten years and no sooner than twelve months prior to expiration of the permit.

C. If a permit has not expired at the time an application is made for an extension, the zoning administrator may administratively extend the term of the permit for subsequent ten-year terms upon verification of continued compliance with the findings and conditions of approval under which the application was originally approved, as well as any other applicable provisions of the Mill Valley Municipal Code that are in effect at the time the permit extension is granted.

1. At the zoning administrator's discretion, additional studies and information may be required of the applicant.

2. If the zoning administrator determines that the facility is nonconforming or that additional conditions of approval are necessary to bring the facility into compliance with the provisions of the Mill Valley Municipal Code that are then in effect at the time of permit expiration, the zoning administrator shall refer the extension request to the Planning commission.

D. The request for an extension shall be decided by the Planning commission if the permit expired before the application is made for an extension or if the zoning administrator refers the matter to the Planning commission. After notice and a public hearing, the Planning commission may approve, conditionally approve, or deny the extension.

20.73.210 Cessation of Use or Abandonment

A. A wireless telecommunications facility is considered abandoned and shall be promptly removed as provided herein if it ceases to provide wireless telecommunications services for 90 or more consecutive days. If there are two or more users of a single facility, then this provision shall not become effective until all users cease using the facility.

B. The operator of a facility shall notify the City in writing of its intent to abandon or cease use of a permitted site or a nonconforming site (including unpermitted sites) within ten days of ceasing or abandoning use. Notwithstanding any other provision herein, the operator of the facility shall provide written notice to the zoning administrator of any discontinuation of operations of 30 days or more.

C. Failure to inform the zoning administrator of cessation or discontinuation of operations of any existing facility as required by this section shall constitute a violation of any approvals and be grounds for:

1. Prosecution;

2. Revocation or modification of the permit;

3. Calling of any bond or other assurance required by this chapter or conditions of approval of the permit;

4. Removal of the facilities by the City in accordance with the procedures established under the Mill Valley Municipal Code for abatement of a public nuisance at the owner's expense; and

5. Any other remedies permitted under the Mill Valley Municipal Code.

20.73.220 Removal and Restoration, Permit Expiration, Revocation or Abandonment

A. **Permittee's removal obligation.** Upon the expiration date of the permit, including any extensions, earlier termination or revocation of the permit or abandonment of the facility, the permittee, owner or operator shall remove its wireless telecommunications facility and restore the site to its natural condition except for retaining the landscaping improvements and any other improvements at the discretion of the City. Removal shall be in accordance with proper health and safety requirements and all ordinances, rules, and regulations of the City. The facility shall be removed from the property within 30 days, at no cost or expense to the City. If the facility is located on private property, the private property owner shall also be independently responsible for the expense of timely removal and restoration.

B. **Failure to remove.** Failure of the permittee, owner, or operator to promptly remove its facility and restore the property within 30 days after expiration, earlier termination, or revocation of the permit, or abandonment of the facility, shall be a violation of the Mill Valley Municipal Code, and be grounds for:

1. Prosecution;

2. Calling of any bond or other assurance required by this chapter or conditions of approval of permit;

3. Removal of the facilities by the City in accordance with the procedures established under the Mill Valley Municipal Code for abatement of a public nuisance at the owner's expense; or

4. Any other remedies permitted under the Mill Valley Municipal Code.

C. **Summary removal.** In the event the zoning administrator determines that the condition or placement of a wireless telecommunications facility located in the public right-of-way constitutes a dangerous condition, obstruction of the public right-of-way, or an imminent threat to public safety, or determines other exigent circumstances require immediate corrective action (collectively, "exigent circumstances"), the zoning administrator may cause the facility to be removed summarily and immediately without advance notice or a hearing. Written notice of the removal shall be served upon the person who owns the facility within five business days of removal and all property removed shall be preserved for the owner's pick-up as feasible. If the owner cannot be identified following reasonable effort or if the owner fails to pick-up the property within 60 days, the facility shall be treated as abandoned property.

D. **Removal of facilities by City.** In the event the City removes a facility in accordance with nuisance abatement procedures or summary removal, any such removal shall be without any liability to the City for any damage to such facility that may result from reasonable efforts of removal. In addition to the procedures for recovering costs of nuisance abatement, the City may collect such costs from the performance bond posted and to the extent such costs exceed the amount of the performance bond, collect those excess costs in accordance with the Mill Valley Municipal Code. Unless otherwise provided herein, the City has no obligation to store such facility. Neither the permittee nor the owner nor operator shall have any claim if the City destroys any such facility not timely removed by the permittee, owner, or operator after notice, or removed by the City due to exigent circumstances.

20.73.230 Effect on Other Ordinances

Compliance with the provisions of this chapter shall not relieve a person from complying with any other applicable provision of the Mill Valley Municipal Code, including but not limited to obtaining any necessary encroachment or building permits. In the event of a conflict between any provision of this chapter and other provisions of the Mill Valley Municipal Code, this chapter shall control.

20.73.240 Effect of State or Federal Law

In the event that state or federal law prohibits discretionary permitting requirements for certain wireless telecommunications facilities, the permits required by this chapter for those facilities shall be deemed to be ministerial permits. For those facilities, in lieu of a conditional use permit, a ministerial permit shall be required prior to installation or modification of a wireless telecommunications facility and all provisions of this chapter shall be applicable to any such facility with the exception that the required permit shall be reviewed and administered as a ministerial permit by the zoning administrator rather than as a discretionary permit. Any conditions of approval set forth in this chapter or deemed necessary by the zoning administrator shall be imposed and administered as reasonable time, place and manner rules.

ATTACHMENT 2: Public Comments

Danielle Staude

From: Katharine Spencer <katharinespencer@hotmail.com>
Sent: Sunday, August 26, 2018 7:02 PM
To: Danielle Staude
Subject: Potential 4G/5G Wireless Telecommunications Facilities

Dear Danielle Staude,

We have recently become aware of the possible arrival of 4G & 5G wireless networks in our neighborhood and we are very concerned about the serious adverse health and environmental impacts caused by the microwave radiation emitted from these 4G and 5G Small Cell Towers.

We urge you to please prevent the installment of these dangerous antennae in the City of Mill Valley.

Yours sincerely,

David & Katharine Spencer
138 Kipling Drive
Mill Valley

Danielle Staude

From: Liz Specht <liz@edliz.com>
Sent: Monday, August 27, 2018 11:55 AM
To: Danielle Staude
Subject: Please: No small cell towers

Dear Danielle,

We are concerned about the potential adverse health and environmental impacts caused by the microwave radiation emitted from 4G and 5G Small Cell Towers, as proposed by AT&T and Verizon.

Please prevent the installment of these dangerous antennae in the City of Mill Valley until conclusive data is available about health risks.

Sincerely,
Liz and Ed Specht
102 Nelson Avenue
Mill Valley, CA

Danielle Staude

From: Tracy Ferm <rtferm@comcast.net>
Sent: Monday, August 27, 2018 8:34 AM
To: Danielle Staude
Subject: 5 G

Dear Danielle-
I am very concerned about the possible side effects of the 5 G. My husband is a cancer survivor and I have cancer at present. There are power poles right in front of our home on Montford.
PLEASE help to research this. Is there a shark in the water?
Thank-you! Tracy

Danielle Staude

From: Lisa Salkever <lsalkever@gmail.com>
Sent: Monday, August 27, 2018 7:12 AM
To: Danielle Staude
Subject: Please prevent installment of smAll cell phone towers in Mill Valley

Dear Danielle Staude,

I and my family are very concerned about the serious adverse health and environmental impacts caused by the microwave radiation emitted from 4G and 5G Small Cell Towers. Please prevent the installment of these dangerous antennae in the City of Mill Valley.

Thank you,
Lisa Salkever

Danielle Staude

From: Kier Holmes <kierandmatt@gmail.com>
Sent: Monday, August 27, 2018 6:28 AM
To: Danielle Staude
Subject: cell towers

Danielle Staude, I urge you to stop the imminent placement of dangerous 4G and 5G Small Cell Towers on telephone poles in Mill Valley. For the health of our children, please do whatever you can to stop this!
Thank you!
Kier Holmes, and family

Danielle Staude

From: Lynne Frame <lynnef2@comcast.net>
Sent: Monday, August 27, 2018 4:05 AM
To: Danielle Staude
Subject: small cell towers -- please no

Dear Ms. Staude,

I am writing from overseas to register my grave concern about the placement of small cell towers throughout Mill Valley in the coming months — or ever. As a person with several constitutional sensitivities, I work constantly to minimize my exposure to electromagnetic radiation and I am extremely concerned that the introduction of these towers throughout our neighborhoods and in close proximity to homes and schools will make avoiding such exposure nearly impossible for me, my family, and our community. Although we cannot be absolutely sure of the level of harm this will have on various individuals, it is a risk to at least some that is not worth the potential benefits to others.

Please count me as a community member who is strongly opposed to such installations.

Respectfully yours,
Lynne Frame

38 Helens Lane
Mill Valley, CA 94941

Danielle Staude

From: Sarah Wilson <sarah@wilson.tv>
Sent: Sunday, August 26, 2018 9:20 PM
To: Danielle Staude
Subject: 5G cell towers

Hi Danielle,

We are very concerned about the potential adverse health and environmental risks associated with the installment of 5G cell towers around Mill Valley. Please do what you can to stop the installation of these towers.

Thank you,
Sarah & Jason Wilson

send from my iPhone

Danielle Staude

From: Leslie Myers <lesliewmyers@yahoo.com>
Sent: Sunday, August 26, 2018 11:01 PM
To: Danielle Staude
Subject: 5G in Mill Valley - Please oppose it!

Dear Senior Planner Danielle Staude,

Regarding placement of 5G Mini Cell Towers in Mill Valley, we are very concerned about the serious adverse health and environmental impacts caused by the microwave radiation emitted from 4G and 5G Small Cell Towers.

We do not want high frequency energy waves pumped into our neighborhoods. The long term impact to the health of our residents is unknown.

5G is not necessary. Wired networks, both optical fiber and copper, are a much better option than the potentially harmful 5G wireless networks. Fiber optic cable is faster, more secure, more reliable, more energy efficient, more cost effective, healthier and safer than wireless networks.

Please prevent the installment of these dangerous antennae in the City of Mill Valley.

Thank you!

Best and be well. Leslie Myers

Danielle Staude

From: Pamela Alma Weymouth <pamelaweymouth@gmail.com>
Sent: Sunday, August 26, 2018 10:29 PM
To: Danielle Staude
Subject: No cell towers pls!

Pls don't place cell towers on phone lines near homestead or in mill valley! Let's keep this a healthy green community with less radiation waves!! Please! Mother of twin boys, journalist. Thank you.

We should get to vote on this!

Sent from modern device while negotiating twin truces & juggling flaming knives

Read more masterpieces at:pamela alma.org

Danielle Staude

From: redmond@mac.com
Sent: Sunday, August 26, 2018 10:16 PM
To: Danielle Staude
Subject: Adverse effects on humans from microwave radiation emitted from 4G and 5G Small Cell Towers

Dear Ms Staude,

We are extremely concerned about the serious adverse health and environmental impacts caused by the microwave radiation emitted from 4G and 5G Small Cell Towers. Please prevent the installation of these dangerous antennae in the City of Mill Valley and preserve our healthy environment that has made Mill Valley the wonderful place to live. I am a 40 year resident and I believe that this installation would cause me as well as many other health-conscious residents to move out.

Sincerely,
Pamela Redmond
290 Sycamore Av

Danielle Staude

From: Sarab Stewart <sarabsemail@gmail.com>
Sent: Sunday, August 26, 2018 9:40 PM
To: Danielle Staude
Subject: Please prevent Cell Tower installation in Mill Valley

Dear Ms. Staude, I have been alerted to the plan to install 4G and 5G cell towers in Mill Valley. As a resident, I am very concerned about the serious adverse health risks and environmental impacts caused by the microwave radiation emitted from these towers. Please prevent the installment of these dangerous antennae in all of the of Mill Valley area, including Strawberry. I appreciate your attention to this most serious matter.

Thank you,
Sarab Stewart

Danielle Staude

From: ursula1001@yahoo.com
Sent: Sunday, August 26, 2018 9:14 PM
To: Danielle Staude
Subject: please prevent installment of 4G, 5G Small Cell Towers

Dear Danielle Staude,

I am very concerned about the serious adverse health and environmental impacts caused by the microwave radiation emitted from 4G and 5G Small Cell Towers. Please prevent the installment of these dangerous antennae in the City of Mill Valley.
Sincerely,

Ursula Hanrahan

Danielle Staude

From: Megan Mokri <megan@bytefoods.co>
Sent: Sunday, August 26, 2018 8:14 PM
To: Danielle Staude
Subject: Small cell towers

Dear Danielle Staude,

I am very concerned about the serious adverse health and environmental impacts caused by the microwave radiation emitted from 4G and 5G Small Cell Towers. Please prevent the installment of these dangerous antennae in the City of Mill Valley.

Sincerely,
Megan Mokri

Danielle Staude

From: Barbara <barbarabowman4@gmail.com>
Sent: Sunday, August 26, 2018 7:43 PM
To: Danielle Staude
Subject: 5g small cell towers

Dear Danielle Staude, We are very concerned about the serious adverse health and environmental impacts caused by the microwave radiation emitted from 4G and 5G Small Cell Towers. Please prevent the installment of these dangerous antennae in the City of Mill Valley

Barbara Bowman
Resident of mill valley for 18 years

All thumbs
Barbara
Sent from my iPhone

Danielle Staude

From: Victoria Ritchie <Victoriauranus@aol.com>
Sent: Sunday, August 26, 2018 7:06 PM
To: Danielle Staude
Subject: cell towers in mill valley

Dear Ms Staude,

Absolutely — Mill Valley cannot allow this threat to its residents' health. Can you please do all that you can to stop this action from going forward. I'm sure that a host of others feel the same as I do. This is just to throw my hat into the ring.

Thank you so much.

A Ritchie
downtown mill valley resident

Danielle Staude

From: Alice Torres <alicetorres@comcast.net>
Sent: Sunday, August 26, 2018 6:56 PM
To: Danielle Staude
Subject: 4g 5g

NO to 5G and 4G antennae's!!

Sent from my iPhone

Danielle Staude

From: John Feeney <JFeeney@MPBF.com>
Sent: Sunday, August 26, 2018 6:54 PM
To: Danielle Staude
Subject: 4G and 5G Cell Towers

We are opposed to their placement in our residential neighborhoods. John and Joyce Feeney

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Danielle Staude

From: Cory Mason <corymason1220@gmail.com>
Sent: Sunday, August 26, 2018 9:31 AM
To: Danielle Staude
Subject: 4G and 5G Small Cell Towers

Dear Danielle Staude,

We are very concerned about the serious adverse health and environmental impacts caused by the microwave radiation emitted from 4G and 5G Small Cell Towers. Please prevent the installment of these dangerous antennae in the City of Mill Valley.

Sincerely,

Cory Mason

Danielle Staude

From: Anne Smith <anne.smith2@comcast.net>
Sent: Saturday, August 25, 2018 6:39 PM
To: Danielle Staude
Subject: Please keep us safe and healthy

Dear Danielle Staude,

We are very concerned about the serious adverse health and environmental impacts caused by the microwave radiation emitted from 4G and 5G Small Cell Towers. Please prevent the installment of these dangerous antennae in the City of Mill Valley.

Anne, Kelly, Will and Jim Smith
132 Sycamore Ave

Danielle Staude

From: Elizabeth Schumacher <lizschumacher@comcast.net>
Sent: Saturday, August 25, 2018 5:38 PM
To: Danielle Staude
Subject: Small cell towers a health risk

"Dear Danielle Staude,

We are very concerned about the serious adverse health and environmental impacts caused by the microwave radiation emitted from 4G and 5G Small Cell Towers. Please prevent the installment of these dangerous antennae in the City of Mill Valley.

Sincerely,

Elizabeth Schumacher

schumacher interiors
49 Loring Ave
Mill Valley, CA 94941
415 509 2434

Danielle Staude

From: email4brad <email4brad@comcast.net>
Sent: Saturday, August 25, 2018 10:15 AM
To: Danielle Staude
Subject: 4G and 5G small cell towers

lol towers"Dear Danielle Staude,

My wife and I are very concerned about the serious adverse health and environmental impacts caused by the microwave radiation emitted from 4G and 5G Small Cell Towers. Please prevent the installment of these dangerous antennae in the City of Mill Valley.

Sincerely,
Brad Summers

Sent from my iPad

Danielle Staude

From: Stephen Burger <scburger@gmail.com>
Sent: Saturday, August 25, 2018 10:11 AM
To: Danielle Staude
Subject: Wireless Telecom Towers

Dear Ms. Staude,

I was informed that there is a proposal to install 4G and 5G towers in Mill Valley. Until the science on the health effects of these towers is better understood, I am opposed to the installation of these devices in Mill Valley

Thank you,
Stephen Burger
386 E Blithedale, MV

--
Stephen Burger
scburger@gmail.com
LinkedIn: stephenburger
206-369-5889

Danielle Staude

From: Mitch Wortzman <mwortzman@yahoo.com>
Sent: Saturday, August 25, 2018 9:36 AM
To: Danielle Staude
Subject: Cell Phone Towers

Hi Danielle, I just received an e-mail re: the addition of 4G and 5G cell cabling, transmitters, antennas in the City.

How can I find out exactly what is being planned, and where the antennas are being located?

I successfully led an effort years ago to stop the addition of antennas on the Sequoia theater. I recall that the cell companies may have had Federal rights to expand their antennas, but that there was local ability to protect citizens including precedent to limit towers near schools.

Thanks,

Mitch

Mitch Wortzman
mwortzman@yahoo.com
415-336-4549 cell

Danielle Staude

From: Kris_Doug Saeltzer <dnksaeltzer@msn.com>
Sent: Friday, August 24, 2018 6:21 PM
To: Danielle Staude
Subject: Small Cell Tower

Dear Senior Planner Danielle Staude,

We are very concerned about the serious adverse health and environmental impacts caused by the microwave radiation emitted from 4G and 5G Small Cell Towers. Please prevent the installation of these dangerous antennae in the City of Mill Valley.

Sincerely,

Kris & Doug Saeltzer

8 Meadow Ridge Drive

Corte Madera, CA 94925

Sent from my iPhone

Danielle Staude

From: mprice@the-acorn.com
Sent: Friday, August 24, 2018 1:52 AM
To: Danielle Staude
Subject: RE: Telecommunication: Good background material for our meeting

Hi Danielle,
Just a quick message to thank you for referring Paige and Rachel to me. I have been in email communication with them and attended their meeting tonight. On reviewing all the links they sent me I do share their concerns about the 4 and 5g wireless issue. I will send our MVCAN Eco Team background information on the issue and let them know of the Sept 6 date when the Mill Valley City Council will discuss it.

I hope all is going well for you!
Marilyn Price
415-381-2941

> -------- Original Message --------
> Subject: Telecommunication: Good background material for our meeting
> From: Danielle Staude <dstaude@cityofmillvalley.org>
> Date: Fri, August 17, 2018 8:21 am
> To: Rachel Gaunt <rachel@couragecorps.com>
> Cc: Paige Hutson <paige@hutsonconsulting.com>, "mprice@the-acorn.com" <mprice@the-acorn.com>
>
> Hi Marilyn,
>
> I am playing matchmaker. Paige and Rachel (part of this email) are working to get The word out about their concerns about the upcoming move to 4 and 5g for wireless telecommunications and are also working on a campaign to educate the community about healthy households in terms of such issues.
>
> Below is some information, and I know they would be most happy to attend an eco-warrior meeting to explain more.
>
> Cheers,
> Danielle Staude
>
> Sent from my i-phone
>
> On Aug 10, 2018, at 4:22 PM, Rachel Gaunt <rachel@couragecorps.com><mailto:rachel@couragecorps.com>> wrote:
>
> Hello Danielle
>
> In case it's useful background, here's the one pager that we sent Kate Sears before our meeting yesterday.
> From our email exchange I can tell that you are already up to speed on a lot of the information, but in case there's anything that is new and relevant, I am including it for you and Jill.
>
> Have a great weekend!
> our best
> Rachel and Paige

Hello Kate,

We hope you are having an enjoyable weekend.

In preparation for our meeting on Thursday, we thought the following "one pager" with related backup studies and data would offer you a greater scope of the science and key issues at hand:

1. There has been an extraordinary rise in our exposure to wireless radiation over the past decade, from smart phones, Wi-Fi, cell towers, iPads and smart meters. (One scientist estimated that this in an increase of a quintillion times the amount of exposure.

2. This wireless exposure is harmful, affecting our bodies on a cellular level and causing disease of all kinds. Thousands of peer reviewed studies worldwide show clear evidence of the harm from wireless exposure, with a significant rise in brain tumors, a clear indicator of the impact.

Related studies: Experts Find "Clear Evidence" of Cancer from Cell Phone Radiation in NTP Study, April 10, 2018<https://www.saferemr.com/2018/01/national-toxicology-program-peer-public.html> and Ramazzini Institute Cell Phone Radiation Study Replicates NTP Study<https://ehtrust.org/worlds-largest-animal-study-on-cell-tower-radiation-confirms-cancer-link/> - - March 22, 2018 and The BioInitiative Report: 2017<http://www.bioinitiative.org/whats-new-2/> which offers a comprehensive overview of studies that give a rationale for biologically based exposure standards for low intensity electromagnetic radiation.

3. The wireless industry is aware of the dangers and rather than try to convince us that wireless is safe, they are using "doubt" to confuse and perpetuate the debate. Their industry funded studies are in marked contrast to independent studies which show strong evidence of harm.

Related Article, "How Big Wireless Made Us Think That Cell Phones Are Safe<https://www.thenation.com/article/how-big-wireless-made-us-think-that-cell-phones-are-safe-a-special-investigation/>".

4. There is a race between wireless providers to "own" the public and private space, with Wi-Fi strong enough to stream TV shows on your phone even in the street. 5g is being heralded as the next and wonderful new era by wireless companies with deep pockets, but it represents a significant increase in wireless exposure and is untested.

Related Articles: Environmental Health Trust Fact Sheet on 5G<https://ehtrust.org/wp-content/uploads/5G_What-You-Need-to-Know_V4-1.pdf> and Environmental Health Trust Research on 5G and Health<https://ehtrust.org/scientific-research-on-5g-and-health/>

5. AT&T and Verizon are keen to win back market share lost to Comcast and are now entering the Wi-Fi space using Close Proximity Microwave Radiation Antennas (CPMRA) on telephone poles to initially beam 4G DAS and then 5G into our homes, every 2 to 5 poles. They have already been stringing cable and preparing telephone poles in unincorporated Mill Valley with indication that they intend to install CPMRA's within two months, despite having no permits from the County.

Related Article, Wireless Radiation Coming to a Lamppost Near You<https://www.westonaprice.org/health-topics/environmental-toxins/microwave-radiation-coming-lamppost-near/>, December, 2017.

6. Firemen have been exempted from having to have these powerful Small Cells, (CPMRA's) next to their station, after a study showing that all the firemen tested had abnormal brain scans after exposure, even at low levels of radiation.

Related article, KPIX news report<https://www.youtube.com/watch?time_continue=2&v=61h_vuBujw0>.

7. Fiber Optic cable is a faster, more secure, more reliable, more energy efficient, healthier and

safer option for us.
a. There is no radiation exposure
b. There is less fire risk from overloading telephone poles
c. There is no danger of loss of connection or communication in a fire if a 5g cell goes down
d. .Emergency response is faster and more accurate because of better location detection
e. And in the long run it is much cheaper

Related article, "Reinventing Wires"<https://www.businesswire.com/news/home/20180126005137/en/Wireless-Networks-Fast-Secure-Reliable-Energy-Efficient-Wired>

8. Marin residents need an immediate moratorium on all CPMRA installations, (both 4g DAS and 5g) to give us time to rework and strengthen the current Country Wireless Ordinance to protect ourselves, as the cities of Petaluma and San Jose have successfully done.

We look forward to meeting you and to a productive discussion. Thank you for making the time in your busy schedule to meet with us.

Our Best,

Rachel Gaunt and Paige Hutson

Rachel Gaunt, Co-Founder
COURAGE CORPS<http://www.couragecorps.com/> | 415.381.8208
<Courage_Corps_3Beliefs.png>
Enlightened business, backed by science.

Danielle Staude

From: Marin Oyster Company, Inc. <kt@marinoyster.com>
Sent: Thursday, August 23, 2018 7:50 PM
To: Danielle Staude
Subject: Cell towers in Scott Valley

Ms. Staude, please do not approve small or any more Cellular Transmitters in Scott Valley. Phones work fine anywhere one goes, begging the question why it's being proposed. We are rational here, no tin foil hats. However, radiation from transmission equipment is a documented health problem, closer proximity being the higher risk.
My family is adamant in our opposition to the unnecessary increase in health risks to the community.
Thank you for not approving this.

Toussaint Family
9 Midhill Dr.
707-338-2188 cell

Sent from my iPhone

Danielle Staude

From: Suzanne Leon <suzannels@comcast.net>
Sent: Wednesday, August 22, 2018 6:17 PM
To: Danielle Staude
Cc: Ms. Renee Marler; Lynne Frame; Tim Standing; Mr. & Mrs. Richard Hoskins; Madeleine Sklar; Mr. & Mrs. Scott Sklar; Raushan Akhmedyarova; Gina & Chris Cooper; Robin McKee; Linda Lukas; Cathy Down
Subject: 5G is even more invasive than 4G

San Rafael Residents Speak Out Against 5G Microwave Cell Tower Installations

http://www.marinij.com/general-news/20180821/san-rafael-residents-take-pre-emptive-strike-against-5g-installations\ By Keri Brenner, Marin Independent Journal Packed house at San Rafael City Council Monday night. Many stood and applauded in a show of support for city regulations banning 5G cellphone towers. San Rafael residents have launched a campaign to block cellphone companies from attempting to build 5G towers in Marin. The 5G towers, which would allow for faster and higher-capacity video streaming and other transmissions, could exacerbate health symptomsalready suspected as a result of exposure to electromagnetic fields, Vicki Sievers, of the EMF Safety Network, told the San Rafael City Council on Monday. According to the EMF Safety Network website, those symptoms can include fatigue, headaches, sleep problems, anxiety, heart problems, learning and memory disorders, ringing in the ears and increased cancer risk. "We've experienced 2G, 3G, 4G and now, on the horizon, is a fifth generation called millimeter wave technology," Sievers said after her presentation that brought standing applause from about 20 people at the packed meeting. "Around the world, doctors and scientists are gravely alarmed about the biological and physiological effects of that technology." Sievers said no permits for 5G so-called "small cell" towers have been issued in Marin as of yet — though they have in other Bay Area cities — and she suspects they are being planned in San Rafael and Marin. "(We want) amendments to the current telecommunications ordinance — which has not been reviewed since 2004 — that protect residential areas, schools and parks through setbacks and attention to power profiles," Sievers said in an email Tuesday. According to Sievers, San Anselmo, Fairfax and Mill Valley are working on strengthening their cell tower ordinances. "Our effort has to do with making pre-emptive strikes before Verizon, AT&T (and others) actually make formal applications to each town and city," Sievers said. "There are no applications in San Rafael to date, but there surely have been permits granted and installations begun in other Bay Area cities." In May, Verizon was forced to withdraw its application to build two "small cell" towers in Sebastopol after four months of heavy opposition by residents and attorneys for the EMF Safety Network. "Several of us San Rafael residents went to the (San Rafael) council on Feb. 20 (when the Sebastopol issue arose), urging them to prevent such debacles here," Sievers said. San Rafael Mayor Gary Phillips said Tuesday he was not aware of any ongoing activity to strengthen or upgrade cell tower regulations in the city and there were no immediate plans for further discussion. "It kind of came a little bit out of the blue," he said of Monday's presentation. EMFs include wireless radiation emitted by cell towers, cell and cordless phones, smart meters, smart grid, Wi-Fi and computers, power lines, fluorescent lights, indoor wiring and other electronic devices, according to the EMF Safety Network. According to the U.S. Centers for Disease Control and Prevention, the jury is still out on the health risks of exposure to EMFs. "Studies have shown that some workers exposed to high magnetic fields have increased cancer rates," the CDC reported on its website. "But such associations do not necessarily show that EMF exposures cause cancer (any more than the springtime association of robins and daffodils shows that one causes the other). Scientists have looked carefully at all the EMF evidence, but they disagree about the health effects of EMFs except to say that better information is needed." According to the website whatis5g.info, the 5G "small cell" tower "will include the higher millimeter wave frequencies never before used for internet and communications technology. These waves do not travel easily through buildings so 5G will require millions of new cell towers. The wireless telecom industry is aggressively seeking to outfit nearly every lamppost and utility pole around the country with a wireless 'small cell' antenna beaming hazardous radiation next to, or into our homes, 24/7." San Rafael resident Chandu Vyas said Monday he is wary of EMFs after a health challenge about five years ago. He said he developed severe and constant headaches after a smart meter was installed at his

home. The headaches went away after he "opted out" and had the smart meter at his property removed. "I don't want to go through the same health problem again," he told the City Council. "I ask your help." Kiah Bosy of Chi Home Design showed the council how her EMF meters ratcheted up to high pitch when she walked toward a TV screen in front of the council chambers. "It's serious," she said. "We're microwaving each other."

Danielle Staude

From: js <jscafidimv@aol.com>
Sent: Thursday, August 23, 2018 8:57 AM
To: Danielle Staude
Subject: Action Alert

Danielle Staude

I feel that the 4G and 5G Small Cell Towers should NOT be installed in our community until further research is done and approved that it is 100% safe to do so.

Joe Scafidi
Mill Valley, CA

Danielle Staude

From: holly downes <hollydownes@sbcglobal.net>
Sent: Wednesday, August 22, 2018 1:15 PM
To: Danielle Staude
Subject: 5G towers

Dear Danielle,
Please review your findings about the micro towers and exposure to those living close to them. Scientific studies show the heath risks far out weigh the benefits.
I strongly encourage you to decline their placement.
sincerely,
Dr. Holly Downes

Danielle Staude

From: Carol Lenherr <nonnamv@gmail.com>
Sent: Monday, August 20, 2018 8:27 PM
To: Danielle Staude
Subject: NO to Wireless Telecommunications Facilities

Hello Ms. Staude,

We appreciate the work you do on behalf of the residents of Mill Valley.

Though we are unfortunately unable to make the meeting on September 6, we would like to communicate that we do not support the proposed Ordinance for Wireless Telecommunications Facilities.

We are very concerned about the serious adverse health and environmental impacts caused by the microwave radiation emitted from 4G and 5G Small Cell Towers.

Please prevent the installment of these dangerous antennae in the City of Mill Valley.

Sincerely,

Carol Lenherr
32 Midhill Drive

Danielle Staude

From: ru4morningsun <ru4morningsun@comcast.net>
Sent: Monday, August 20, 2018 5:19 PM
To: Danielle Staude
Subject: Stop installation of small cell towers

Dear Senior Planner Danielle Staude,

We are very concerned about the serious adverse health and environmental impacts caused by the microwave radiation emitted from 4G and 5G Small Cell Towers. Please prevent the installation of these dangerous antennae in the City of Mill Valley.

Sincerely,

Debbie Alstad
132 Morningsun Ave
Mill Valley

Danielle Staude

From: Suzanne Leon <suzannels@comcast.net>
Sent: Monday, August 20, 2018 4:26 PM
To: Danielle Staude
Subject: Fwd: No on 4G and 5G cell towers around Mill Valley!!!

PS. I am a resident at 8 Lower Dr, Mill Valley

Begin forwarded message:

From: Suzanne Leon <suzannels@comcast.net>
Subject: No on 4G and 5G cell towers around Mill Valley!!!
Date: August 19, 2018 at 10:54:03 PM PDT
To: dstaude@cityofmillvalley.org

Dear Danielle Staude,

I am extremely opposed to the installation of 4G and 5G cell towers around Mill Valley! It's bad enough that our bodies and environment are bombarded by all the toxins and chemicals in our food supply, homes and land along with pollution from our vehicles, jet streams, water, depletion of our ozone layer….but EMFs are a serious health hazard that we haven't begun to fully understand. I was enraged that we had smart meters installed by our utility companies, and we are inundated by wifi, cell phones, etc everywhere. We turn off our wifi at night, we don't have microwaves, bluetooth headsets, smart TVs or other gadgets….. our desktop computers are ethernet connected. We have no control over the rest of the neighborhood, or the rest of society. We chose not to live near power companies or large power lines. I NEVER walk through full body scanners at the airport and always ask for a patdown.

There have been enough cancers in my extended family - do not help create more! PLEASE prevent this insanity!

Yours Truly,

Suzanne Leon

Danielle Staude

From: Gina Cooper <ginacooper06@comcast.net>
Sent: Monday, August 20, 2018 3:45 PM
To: Danielle Staude
Subject: Small cell towers

Dear Danielle Staude,

I am very concerned about the addition of small cell phone towers around my neighborhood in Mill Valley. Please prevent the installation of these towers.

Thankyou,
Gina Cooper
26 Somerset Lane
Mill Valley

Sent from my iPhone

Danielle Staude

From: Graham Brandt <graham.brandt@gmail.com>
Sent: Monday, August 20, 2018 3:41 PM
To: Danielle Staude
Cc: Talia Brandt
Subject: 4G & 5G Small Cell Towers

Dear Danielle Staude,

We are very concerned about the serious adverse health and environmental impacts caused by the microwave radiation emitted from 4G and 5G Small Cell Towers. Please prevent the installment of these dangerous antennae in the City of Mill Valley until such time as they have been further studied and assurances can be made regarding their health and environmental impact.

Sincerely,
Graham & Talia Brandt
3 Upperhill Road

Sent from my gPad

Danielle Staude

From: drkanga@aol.com
Sent: Monday, August 20, 2018 7:23 AM
To: Danielle Staude
Subject: cell towers in mill valley

Dear Danielle:

My family and are very concerned about serious advesrse health and environmental impacts due to microwave radiation emitted from cell toweres, including 4G and 5g towers. Please do not allow the installation of these dangerous antennae in the City of Mill Valley.
Sincerely,
Benson L. Kaukonen and Family

Danielle Staude

From: Nancy <nglasenk@gmail.com>
Sent: Monday, August 20, 2018 4:46 AM
To: Danielle Staude
Subject: Opposed to 5G Cell towers

Hello Danielle

I am extremely concerned about the serious adverse health and environmental impacts caused by the microwave radiation emitted from 4G and 5G Small Cell Towers. There needs to be far more research and understanding before jumping on this corporate bandwagon.

Please prevent the installment of these dangerous antennae in the City of Mill Valley.

Sincerely
Nancy Glasenk
29 Vasco Drive

Danielle Staude

From: Dorothy McQuown <dr.dorothym@yahoo.com>
Sent: Monday, August 20, 2018 2:45 AM
To: Danielle Staude
Subject: Cell Towers

Dear Marin County Board of Supervisors,

We are very concerned about the serious adverse health and environmental impacts caused by the microwave radiation emitted from 4G and 5G Small Cell Towers. Please put this topic on your Agenda and prevent the installation of these dangerous Close Proximity Microwave Radiation Antennae in Unincorporated Marin. Please help us maintain local control in the face of corporate pressure.

Sincerely,

Dorothy MCQuown, Ph. D.

Sent from my iPad

Danielle Staude

From: Suzanne Leon <suzannels@comcast.net>
Sent: Sunday, August 19, 2018 10:54 PM
To: Danielle Staude
Subject: No on 4G and 5G cell towers around Mill Valley!!!

Dear Danielle Staude,

I am extremely opposed to the installation of 4G and 5G cell towers around Mill Valley! It's bad enough that our bodies and environment are bombarded by all the toxins and chemicals in our food supply, homes and land along with pollution from our vehicles, jet streams, water, depletion of our ozone layer....but EMFs are a serious health hazard that we haven't begun to fully understand. I was enraged that we had smart meters installed by our utility companies, and we are inundated by wifi, cell phones, etc everywhere. We turn off our wifi at night, we don't have microwaves, bluetooth headsets, smart TVs or other gadgets..... our desktop computers are ethernet connected. We have no control over the rest of the neighborhood, or the rest of society. We chose not to live near power companies or large power lines. I NEVER walk through full body scanners at the airport and always ask for a patdown.

There have been enough cancers in my extended family - do not help create more! PLEASE prevent this insanity!

Yours Truly,

Suzanne Leon

Danielle Staude

From: Caitlin Greene <caitlinbgreene@gmail.com>
Sent: Sunday, August 19, 2018 10:28 PM
To: Danielle Staude
Subject: Wirelss Telecommuications Facilities

"Dear Danielle Staude,

We are very concerned about the serious adverse health and environmental impacts caused by the microwave radiation emitted from 4G and 5G Small Cell Towers. Please prevent the installment of these dangerous antennae in the City of Mill Valley.

Sincerely,
Caitlin Greene
415-595-6863
26 Azalea Dr.
Mill Valley, CA 94941

Danielle Staude

From: John Palmer <jp@montgomerypartners.net>
Sent: Sunday, August 19, 2018 8:53 PM
To: Danielle Staude
Cc: Jim McCann
Subject: Proposed plan to install 4G and 5G towers on power poles in Mill Valley

Dear Ms Staude,

My family and I are very concerned about the serious adverse health and environmental impacts caused by microwave radiation emitted from 4G and 5G Small Cell Towers.

Please do not permit the installment of these antennae, which are dangerous and unnecessary, in the City of Mill Valley.

Sincerely,

John Palmer
Montgomery Partners
100 Shoreline Highway Suite 160B
Mill Valley, CA 94941
(415) 332 4440 (O)
(415) 272 1728 (C)

Danielle Staude

From: Deena Grady Berger <dgberger22@mindspring.com>
Sent: Sunday, August 19, 2018 8:46 PM
To: Danielle Staude
Subject: Cell Phone 4G & 5G Towers - Mill Valley

Importance: High

Dear Ms. Staude,

My family is opposed to the installation of Small Cell Towers in and around Mill Valley. One of the reasons we chose to live in Mill Valley is that it is a very environmentally-aware and health-conscious community. There could be serious adverse health and environmental impacts caused by the microwave radiation emitted from 4G and 5G Small Cell Towers. We DO NOT want to be the "testing ground" or the "lab rats" for this technological advancement. We have seen no concrete evidence that these radiation-emitting towers are safe, only evidence to the contrary. Please prevent the installment of these dangerous antennae in the City of Mill Valley. Thank you!

Very truly yours,

Deena Grady Berger, J.D.
District Leader Volunteer
California Congressional District 2
dgberger22@mindspring.com
t 415.686.8778
humanesociety.org

Celebrating 60 Years
THE HUMANE SOCIETY OF THE UNITED STATES

The Humane Society of the United States is the nation's largest and most effective animal protection organization. HSUS and our affiliates provide hands-on care and services to more than 100,000 animals each year. We are the leading animal advocacy organization, seeking a humane world for people and animals alike. We are driving transformational change in the U.S. and around the world by combating large-scale cruelties such as puppy mills, animal fighting, factory farming, seal slaughter, horse cruelty, captive hunts and the wildlife trade.

Danielle Staude

From: Robert Mithun <rmithun@comcast.net>
Sent: Sunday, August 19, 2018 8:41 PM
To: Danielle Staude
Cc: Francine SF
Subject: My Concern RE: 5G Small Cell Phone Towers in MV

Dear Danielle Staude,

I want you to know we are concerned about the possible adverse effects of 5G cell phone towers in Mill Valley on our MV residents as well a local animals. We expect more information about the effects of 5G microwave radiation will be available in the near future and believe a better decision can be made about this then. We understand and appreciate that you are assessing the sentiment of Mill Valley residents regarding this issue.

We do not have a concern about much lower frequency EMF radiation in general, such as AM, FM, Citizens' Band, and amateur radio or earlier generation cell phone radiation. These have been shown not to be harmful to humans in the doses we are usually currently exposed to. These new, much higher frequency, microwave radiation radiations do have very different biologic effects than those lower frequencies and we advise that we NOT act to permit the construction of these towers until we know more accurately what the risks to us would be.

Thank you for your consideration.

Robert J. Mithun, MD
Anne K. Fukutome, MD

Danielle Staude

From: Joel Yanowitz <jyanowitz@gmail.com>
Sent: Sunday, August 19, 2018 8:18 PM
To: Danielle Staude
Subject: 4G and 5G Small Cell Towers

Dear Danielle Staude,

I am very concerned about the serious adverse health and environmental impacts caused by the microwave radiation emitted from 4G and 5G Small Cell Towers. Please prevent the installment of these dangerous antennae in the City of Mill Valley.

Please keep me informed as to the City's actions around this issue.

Sincerely,

Joel Yanowitz
3 Stanton Way
Mill Valley

Danielle Staude

From: patricia lakner <pslakner@yahoo.com>
Sent: Sunday, August 19, 2018 8:11 PM
To: Danielle Staude
Subject: Cell towers in Mill Valley

Thank you very much for upgrading the cell tower system. Please keep up the good work.

Best,
Pat Lakner

Danielle Staude

From: Joanne Lillich <joannelillich@gmail.com>
Sent: Sunday, August 19, 2018 1:12 PM
To: Danielle Staude
Subject: Cell Towers

Please take notice I understand that 4G and 5G cell towers near us are dangerous, if so I am certainly against it. Thank you in advance, I was made aware of this! Sincerely, Joanne Lillich

Sent from my iPhone

Danielle Staude

From: Catherine Cook MacRae <cookmacrae@comcast.net>
Sent: Sunday, August 19, 2018 12:36 PM
To: Danielle Staude
Subject: no small cell towers please

Dear Danielle,

After reading the recent studies, my family is very concerned about the serious adverse health and environmental impacts caused by the microwave radiation emitted from 4G and 5G Small Cell Towers. What we currently have is working just fine and we don't need other towers.

Please prevent the installment of these dangerous antennae in the City of Mill Valley.

Sincerely,
Catherine

Catherine Cook MacRae
106 Ryan Ave
Mill Valley 94941
m 415.260.0453

Danielle Staude

From: Rachel Gaunt <rachel@couragecorps.com>
Sent: Sunday, August 19, 2018 11:30 AM
To: Danielle Staude
Cc: Paige Hutson; Elisa Sarlatte; Jill McNeal; Stephanie Moulton-Peters; julieurban01@gmail.com
Subject: A strong wireless signal is coming from the telephone pole at 400 Summit

Good morning Danielle,

At our meeting on August 13th, Elisa and Jill expressed concern about what was "happening on the streets of Mill Valley" without their knowledge and that they, understandably, had a hard time covering the office and being out in the community "policing" all the AT&T and Verizon work crews to ensure they were compliant with the permitting process. As such, they were open to our "boots on the ground" support. We mentioned the dead oak tree at 400 Summit and have done some follow-up work on it that we are very concerned about and wanted to alert you.

Yesterday, Paige and I measured the levels coming from the equipment on two telephone poles on that corner and the levels were up in the "extreme range" on our meter. The residents in the house have been experiencing significant health issues ever since AT&T put installations up on the poles a few weeks ago - headaches, brain fog, sleep issues and generally feeling ill.

This is an urgent situation and we strongly recommend The City of Mill Valley investigate this situation right away. Unlike readings elsewhere in Mill Valley, where a lot of the prep work is being conducted, these installations are "live" and emitting extreme levels of radiation.

Our questions are:

1. Which company installed the equipment, (we think it is AT&T but are not completely sure)?
2. What type of wireless equipment is it, (4G DAS, 5G, something else?)
3. Did they have permits to put this up?
4. If so, who granted the permits?
5. If not, is this illegal? Or does the current lighting pole agreements allow them to proceed unchecked.

We are deeply concerned **that the same thing could happen anywhere in Mill Valley,** especially if they were proceeding with permits, and would appreciate it if you could look into this as a matter of urgency. (If you want to meet us at the pole at 400 Summit and see the levels with our meters we are happy to meet you there.)

We look forward to hearing back from you.

Warmly,
Rachel and Paige

Rachel Gaunt, Co-Founder
COURAGE CORPS | 415.381.8208

Danielle Staude

From: Susan Kirsch <susankirsch@hotmail.com>
Sent: Sunday, August 19, 2018 11:16 AM
To: Danielle Staude
Cc: city council
Subject: No to 5G Small Cell Towers in Mill Valley

Hi Danielle,
I'm concerned about the potential adverse health and environmental impacts caused by the microwave radiation emitted from 4G and 5G Small Cell Towers, as proposed by AT&T and Verizon. Please prevent the installment of these dangerous antennae in the City of Mill Valley until conclusive data is available about health risks.
Sincerely,
Susan Kirsch
109 Ryan Avenue
Mill Valley, CA
Member, Freeman Park Neighborhood Association

Danielle Staude

From: mrsstim <mrsstim@gmail.com>
Sent: Saturday, August 18, 2018 2:13 PM
To: Danielle Staude
Subject: 4G/5G small cel

I am very concerned about the serious adverse health and environmental impacts caused by the microwave radiation emitted from 4G and 5G Small Cell Towers. Please put this topic on your Agenda and prevent the installation of these dangerous Close Proximity Microwave Radiation Antennae in Unincorporated Marin.

andrea ross
unincorp marin

Danielle Staude

From: Joan Doc <joan235@comcast.net>
Sent: Monday, August 27, 2018 12:14 PM
To: Danielle Staude
Subject: Small cell towers

I am opposed to the installation of small cell towers in my neighborhood.
Joan Dox
235 Marguerite Ave
Sent from my iPhone

Danielle Staude

From: Heather & Ray Keane <thekeanes@gmail.com>
Sent: Monday, August 27, 2018 12:42 PM
To: Danielle Staude
Subject: No CELL TOWERS in MILL VALLEY PLEASE

Dear Danielle Staude, We are very concerned about the serious adverse health and environmental impacts caused by the microwave radiation emitted from 4G and 5G Small Cell Towers. Please prevent the installment of these dangerous antennae in the City of Mill Valley. We have small children and would hate to fry their little brains. Thank you in advance for your consideration!

Kindly,
Heather Keane

--
Warmly,

Heather

Heather Keane
thekeanes@gmail.com

Chapter 18.55

WIRELESS COMMUNICATIONS FACILITIES

Sections:

18.55.010 Purpose.
18.55.020 Definitions.
18.55.030 Applicability.
18.55.040 Wireless Telecommunications Facility Permit Required.
18.55.050 Application for Permit.
18.55.060 Location and Configuration Preferences.
18.55.070 Design and Development Standards for All Facilities.
18.55.080 Additional Design and Development Standards for Facilities Outside the Public Right-of-Way.
18.55.090 Additional Design and Development Standards for Facilities in the Public Right-of-Way.
18.55.100 Conditions of Approval for All Facilities.
18.55.110 Additional Conditions of Approval for Facilities in the Public Right-of-Way.
18.55.120 Findings.
18.55.130 Exceptions.
18.55.140 Wireless Telecommunications Facilities Covered under Section 6409(a) of the Middle Class Tax Relief and Job Creation Act of 2012.
18.55.150 Wireless Telecommunications Collocation Facilities Covered under California Government Code Section 65850.6.
18.55.160 Business License.
18.55.170 Emergency Deployment.
18.55.180 Operation and Maintenance Standards.
18.55.190 No Dangerous Conditions or Obstructions Allowed.
18.55.200 Permit Expiration.
18.55.210 Cessation of Use or Abandonment.
18.55.220 Removal and Restoration, Permit Expiration, Revocation or Abandonment.
18.55.230 Effect on Other Ordinances.
18.55.240 Effect on State or Federal Law.

18.55.010 Purpose.

The purpose and intent of this chapter is to provide a uniform and comprehensive set of regulations and standards for the permitting, development, siting, installation, design, operation and maintenance of wireless telecommunications facilities in the town. These regulations are intended to prescribe clear and reasonable criteria to assess and process applications in a consistent and expeditious manner, while reducing the impacts associated with wireless telecommunications facilities. This chapter provides standards necessary to: (1) preserve and promote harmonious land uses and the public right-of-way in the town; (2) promote and protect public health and safety, community welfare, visual resources, and the aesthetic quality of the town consistent with the goals, objectives and policies of the General Plan; (3) provide for the orderly, managed, and efficient development of wireless telecommunications facilities in accordance with the state and federal laws, rules, and regulations; and (4) encourage new and more efficient technology in the provision of wireless telecommunications facilities.

This chapter is not intended to, nor shall it be interpreted or applied to: (1) prohibit or effectively prohibit any personal wireless service provider's ability to provide personal wireless services; (2) prohibit or effectively prohibit any entity's ability to provide any interstate or intrastate telecommunications service, subject to any competitively neutral and nondiscriminatory rules or regulation for rights-of-way management; (3) unreasonably discriminate among providers of functionally equivalent services; (4) deny any request for authorization to place, construct or modify personal wireless service facilities on the basis of environmental effects of radio frequency emissions to the extent that such wireless facilities comply with the FCC's regulations concerning such emissions; (5) prohibit any collocation or modification that the town may not deny under federal or state law; or (6) otherwise authorize the town to preempt any applicable federal or state law. (Ord. 692 (part), 2018).

18.55.020 Definitions.

For the purposes of this chapter, the following defined terms shall have the meaning set forth in this section unless the context clearly indicates or requires a different meaning.

Accessory equipment means any equipment associated with the installation of a wireless telecommunications facility, including but not limited to cabling, generators, air conditioning units, electrical panels, equipment shelters, equipment cabinets, equipment buildings, pedestals, meters, vaults, splice boxes, and surface location markers.

Antenna means that part of a wireless telecommunications facility designed to radiate or receive radio frequency signals or electromagnetic waves for the provision of services, including, but not limited to, cellular, paging, personal communications services (PCS) and microwave communications. Such devices include, but are not limited to, directional antennas, such as panel antenna, microwave dishes, and satellite dishes; omnidirectional antennas; wireless access points (Wi-Fi); and strand-mounted wireless access points. This definition does not apply to broadcast antennas, antennas designed for amateur radio use, or satellite dishes designed for residential or household purposes.

Base station means the same as defined by the FCC in 47 C.F.R. § 1.40001(b)(1), as may be amended, which defines that term as a structure or equipment at a fixed location that enables FCC-licensed or authorized wireless communications between user equipment and a communications network. The term does not encompass a tower as defined in 47 C.F.R. § 1.40001(b)(9) or any equipment associated with a tower. The term includes, but is not limited to, equipment associated with wireless communications services such as private, broadcast, and public safety services, as well as unlicensed wireless services and fixed wireless services such as microwave backhaul. The term includes, but is not limited to, radio transceivers, antennas, coaxial or fiber-optic cable, regular and backup power supplies, and comparable equipment, regardless of technological configuration (including distributed antenna systems and small-cell networks). The term includes any structure other than a tower that, at the time the relevant application is filed with the State or local government under this section, supports or houses equipment described in 47 C.F.R. § 1.40001(b)(1)(i)-(ii) that has been reviewed and approved under the applicable zoning or siting process, or under another State or local regulatory review process, even if the structure was not built for the sole or primary purpose of providing such support. The term does not include any structure that, at the time the relevant application is filed with the State or local government under this section, does not support or house equipment described in 47 C.F.R. § 1.40001(b)(1)(i)-(ii).

Building-mounted means mounted to the side or façade, but not the roof, of a building or another structure such as a water tank, pump station, church steeple, freestanding sign, or similar structure.

Cellular means an analog or digital wireless telecommunications technology that is based on a system of interconnected neighboring cell sites.

Collocation means the same as defined by the FCC in 47 C.F.R. § 1.40001(b)(2), as may be amended, which defines that term as the mounting or installation of transmission equipment on an eligible support structure for the purpose of transmitting or receiving radio frequency signals for communications purposes. As an illustration and not a limitation, the FCC's definition effectively means "to add" and does not necessarily refer to more than one wireless telecommunication facility installed at a single site.

Eligible facilities request means the same as defined by the FCC in 47 C.F.R. § 1.40001(b)(3), as may be amended, which defines that term as any request for modification of an existing tower or base station that does not substantially change the physical dimensions of such tower or base station, involving: (i) collocation of new transmission equipment; (ii) removal of transmission equipment; or (iii) replacement of transmission equipment.

Eligible support structure means the same as defined by the FCC in 47 C.F.R. § 1.40001(b)(4), as may be amended, which defines that term as any tower or base station as defined in this section, provided that it is existing at the time the relevant application is filed with the State or local government under this section.

Existing means the same as defined by the FCC in 47 C.F.R. § 1.40001(b)(4), as may be amended, which provides that a constructed tower or base station is existing for purposes of the FCC's Section 6409(a) regulations if it has been reviewed and approved under the applicable zoning or siting process, or under another State or local regulatory review process, provided that a tower that has not been reviewed and approved because it was not in a zoned area when it was built, but was lawfully constructed, is existing for purposes of this definition.

FCC means the Federal Communications Commission or its duly appointed successor agency.

Modification means any change to an existing wireless telecommunications facility that involves any of the following: collocation, expansion, modification, alteration, enlargement, intensification, reduction, or augmentation, including, but not limited to, a change in size, shape, color, visual design, or exterior material. Modification does not include repair, replacement, or maintenance if those actions do not involve a change to the existing facility involving any of the following: collocation, expansion, modification, alteration, enlargement, intensification, reduction, or augmentation.

Monopole means a structure consisting of a single pole used to support antennas or related equipment and includes a monopine, monopalm, and similar monopoles camouflaged to resemble trees or other objects.

Personal wireless services means the same as defined in 47 U.S.C. § 332(c)(7)(C)(i), as may be amended, which defines the term as commercial mobile services, unlicensed wireless services and common carrier wireless exchange access services.

Personal wireless service facilities means the same as defined in 47 U.S.C. § 332(c)(7)(C)(i), as may be amended, which defines the term as facilities that provide personal wireless services.

Planner means the town planner or the town planner's designee.

Pole means a single shaft of wood, steel, concrete, or other material capable of supporting the equipment mounted thereon in a safe and adequate manner and as required by provisions of the Ross Municipal Code.

Public right-of-way or **right-of-way** means any public street, public way, public alley or public place, laid out or dedicated, and the space on, above or below it, and all extensions thereof, and additions thereto, under the jurisdiction of the town.

Reviewing authority means the person or body who has the authority to review and either grant or deny a wireless telecommunications facility permit pursuant to this chapter.

RF means radio frequency or electromagnetic waves between 30 kHz and 300 GHz in the electromagnetic spectrum range.

Roof-mounted means mounted directly on the roof of any building or structure, above the eave line of such building or structure.

Section 6409(a) means Section 6409(a) of the Middle Class Tax Relief and Job Creation Act of 2012, Pub. L. No. 112-96, 126 Stat. 156, codified as 47 U.S.C. § 1455(a), as such law may be amended from time to time.

Section 6409(a) approval means the approval required by Section 6409(a).

Site means the same as defined by the FCC in 47 C.F.R. § 1.40001(b)(6), as may be amended, which provides that for towers other than towers in the public rights-of-way, the current boundaries of the leased or owned property surrounding the tower and any access or utility easements currently related to the site, and, for other eligible support structures, further restricted to that area in proximity to the structure and to other transmission equipment already deployed on the ground.

Substantial change means the same as defined by the FCC in 47 C.F.R. § 1.40001(b)(7), as may be amended, which defines that term differently based on the particular wireless facility type (tower or base station) and location (in or outside the public right-of-way). For clarity, this definition organizes the FCC's criteria and thresholds for a substantial change according to the wireless facility type and location.

For towers outside the public rights-of-way, a substantial change occurs when:

(1) the proposed collocation or modification increases the overall height more than 10% or the height of one additional antenna array not to exceed 20 feet (whichever is greater); or

(2) the proposed collocation or modification increases the width more than 20 feet from the edge of the wireless tower or the width of the wireless tower at the level of the appurtenance (whichever is greater); or

(3) the proposed collocation or modification involves the installation of more than the standard number of equipment cabinets for the technology involved, not to exceed four; or

(4) the proposed collocation or modification involves excavation outside the current boundaries of the leased or owned property surrounding the wireless tower, including any access or utility easements currently related to the site.

For towers in the public rights-of-way and for all base stations, a substantial change occurs when:

(1) the proposed collocation or modification increases the overall height more than 10% or 10 feet (whichever is greater); or

(2) the proposed collocation or modification increases the width more than 6 feet from the edge of the wireless tower or base station; or

(3) the proposed collocation or modification involves the installation of any new equipment cabinets on the ground when there are no existing ground-mounted equipment cabinets; or

(4) the proposed collocation or modification involves the installation of any new ground-mounted equipment cabinets that are ten percent (10%) larger in height or volume than any existing ground-mounted equipment cabinets; or

(5) the proposed collocation or modification involves excavation outside the area in proximity to the structure and other transmission equipment already deployed on the ground.

In addition, for all towers and base stations wherever located, a substantial change occurs when:

(1) the proposed collocation or modification would defeat the existing concealment elements of the support structure as determined by the planner; or

(2) the proposed collocation or modification violates a prior condition of approval, provided however that the collocation need not comply with any prior condition of approval related to height, width, equipment cabinets or excavation that is inconsistent with the thresholds for a substantial change described in this section.

The thresholds for a substantial change outlined above are disjunctive. The failure to meet any one or more of the applicable thresholds means that a substantial change would occur. The thresholds for height increases are cumulative limits. For sites with horizontally separated deployments, the cumulative limit is measured from the originally-permitted support structure without regard to any increases in size due to wireless equipment not included in the original design. For sites with vertically separated deployments, the cumulative limit is measured from the permitted site dimensions as they existed on February 22, 2012—the date that Congress passed Section 6409(a).

Telecommunications tower or **tower** means a freestanding mast, pole, monopole, guyed tower, lattice tower, free standing tower or other structure designed and primarily used to support wireless telecommunications facility antennas.

Transmission equipment means the same as defined by the FCC in 47 C.F.R. § 1.40001(b)(8), as may be amended, which defines that term as equipment that facilitates transmission for any FCC-licensed or authorized wireless communication service, including, but not limited to, radio transceivers, antennas, coaxial or fiber-optic cable, and regular and backup power supply. The term includes equipment associated with wireless communications services including, but not limited to, private, broadcast, and public safety services, as well as unlicensed wireless services and fixed wireless services such as microwave backhaul.

Utility pole means a pole or tower owned by any utility company that is primarily used to support wires or cables necessary to the provision of electrical or other utility services regulated by the California Public Utilities Commission.

Wireless services means any FCC-licensed or authorized wireless communication service transmitted over frequencies in the electromagnetic spectrum.

Wireless telecommunications facility means any facility constructed, installed, or operated for wireless service. "Wireless telecommunications facility" includes, but is not limited to, antennas or other types of equipment for the transmission or receipt of such signals, telecommunications towers or similar structures supporting such equipment, related accessory equipment, equipment buildings, parking areas, and other accessory development. "Wireless telecommunications facility" does not mean any of the following:

(1) A facility that qualifies as an amateur station as defined by the FCC, 47 C.F.R. Part 97, of the Commission's Rules, or its successor regulation.

(2) An antenna facility that is subject to the FCC Over-The-Air-Receiving Devices rule, 47 C.F.R. Section 1.4000, or any successor regulation, including, but not limited to, direct-to-home satellite dishes that are less than one meter in diameter, TV antennas used to receive television broadcast signals and wireless cable antennas.

(3) Portable radios and devices including, but not limited to, hand-held, vehicular, or other portable receivers, transmitters or transceivers, cellular phones, CB radios, emergency services radio, and other similar portable devices as determined by the planner.

(4) Telecommunications facilities owned and operated by any government agency.

(5) Telecommunications facilities owned and operated by any emergency medical care provider.

(6) Mobile services providing public information coverage of news events of a temporary nature.

(7) Any wireless telecommunications facilities exempted from the Ross Municipal Code by federal law or state law. (Ord. 692 (part), 2018).

18.55.030 Applicability.

(A) This chapter applies to all wireless telecommunications facilities as follows:

(1) All facilities for which applications were not approved prior to the effective date of this chapter shall be subject to and comply with all provisions of this chapter;

(2) All facilities, notwithstanding the date approved, shall be subject immediately to the provisions of this chapter governing the operation and maintenance, cessation of use and abandonment, removal and restoration of wireless telecommunications facilities and wireless telecommunications collocation facilities and the prohibition of dangerous conditions or obstructions by such facilities; provided, however, that in the event a condition of approval conflicts with a provision of this chapter, the condition of approval shall control unless and until the permit is amended or revoked.

(B) Title 18, including but not limited to this chapter 18.55 shall not apply to a wireless telecommunications facility on property owned by the town. (Ord. 692 (part), 2018).

18.55.040 Wireless Telecommunications Facility Permit Required.

(A) *Permit required*. No wireless telecommunications facility shall be located or modified within the town on any property, including the public right-of-way, without the issuance of a permit as required by this chapter. Such permit shall be in addition to any other permit required pursuant to the Ross Municipal Code.

(B) *Permit required for facilities outside the public right-of-way*. Wireless telecommunications facilities located outside the public right-of-way require a permit as set forth in the following table:

	R-1 District	***C-C District***	***All other districts***
Roof-mounted facility, building-mounted facility, or facility mounted on an existing pole	NP	NP	UP/DR
Facility mounted on a replacement pole or new telecommunications tower	NP	NP	UP/DR
New wireless telecommunications collocation facility	NP	NP	UP/DR
Eligible facilities request [1] or application pursuant to California Government Code Section 65850.6 [2]	P	P	P

[1] See requirements of section 18.55.140.
[2] See requirements of section 18.55.150.

(C) *Permit required for facilities in the public right-of-way*. Wireless telecommunications facilities located in or over the public right-of-way require a permit as set forth in the following table:

	All districts
Facility mounted on an existing pole or collocated with an existing facility	UP/DR
Facility mounted on a replacement pole or new telecommunications tower	UP/DR
New wireless telecommunications collocation facility	UP/DR
Eligible facilities request [1] or application pursuant to California Government Code Section 65850.6 [2]	P
[1] See requirements of section 18.55.140. [2] See requirements of section 18.55.150.	

For purposes of the above table, the location of a wireless telecommunication facility shall be determined based upon the closest district adjacent to the facility's location.

(D) *Legend and explanations*. The following legend and explanations apply to the tables in this section.

P	Permitted use subject to planner approval
UP	Use permit required
DR	Design review required
NP	Not permitted

(E) *Non-exclusive grant*. No approval granted under this chapter shall confer any exclusive right, privilege, license, or franchise to occupy or use the public right-of-way of the town for delivery of telecommunications services or any other purposes. Further, no approval shall be construed as any warranty of title. (Ord. 692 (part), 2018).

18.55.050 Application for Permit.

(A) *Application content*. All applications for a permit required by this chapter must be made in writing on such form as the planner prescribes, which shall include the following information, in addition to all other information determined necessary by the planner as well as all other information required by the town as part of an application for a use permit:

(1) Full name and contact information for the facility owner, facility operator, agent (if any), and property owner, and related letter(s) of authorization.

(2) The type of facility, including a full written description of the proposed facility, its purpose and specifications.

(3) A detailed site and engineering plan of the proposed facility containing the exact proposed location of the facility, created by a qualified licensed engineer and in accordance with requirements set by the planner.

(4) Photographs of facility equipment and an accurate visual impact analysis with photo simulations.

(5) Completion of an RF exposure guidelines checklist, and proof of all applicable licenses or other approvals required by the FCC.

(6) If the application is for a facility that will be located within the public right-of-way, the applicant shall certify that it is a telephone corporation or state the basis for its claimed right to enter the right-of-way, and provide a copy of its certificate of public convenience and necessity (CPCN), if a CPCN has been issued by the California Public Utilities Commission.

(7) A written description identifying the geographic service area for the subject installation, accompanied by a plan and maps showing anticipated future installations and modifications for the following two years.

(8) A written report that analyzes acoustic levels for the proposed wireless telecommunications facility and all associated equipment including without limitation all environmental control units, sump pumps, temporary backup power generators, and permanent backup power generators in order to demonstrate compliance with chapter 9.20 (Unnecessary Noise). The acoustic analysis must be prepared and certified by an engineer and include an analysis of the manufacturers' specifications for all noise-emitting equipment and a depiction of the proposed equipment relative to all adjacent property lines. In lieu of a written report, the applicant may submit evidence from the equipment manufacturer that the ambient noise emitted from all the proposed equipment will not, both individually and cumulatively, exceed the applicable limits.

(9) If the applicant claims it requires an exception to the requirements of this chapter, all information and studies necessary for the town to evaluate that claim.

(10) An application and processing fee and a deposit for a consultant review as set forth in paragraph (B) of this section.

(11) Any other studies or information determined necessary by the planner may be required.

(B) Independent expert.

(1) The planner is authorized to retain on behalf of the town an independent, qualified consultant to review any application for a permit for a wireless telecommunications facility to review the technical aspects of the application, including but not limited to the following matters:

(a) The accuracy, adequacy, and completeness of submissions,

(b) Compliance with applicable radio frequency emission standards,

(c) Whether any requested exception is necessary to close a significant gap in coverage and is the least intrusive means of doing so,

(d) Technical demonstration of the unavailability of alternative sites, facility designs or configurations, and coverage analysis, and

(e) The validity of conclusions reached or claims made by applicant.

(2) The cost of this review shall be paid by the applicant through a deposit pursuant to an adopted fee schedule resolution. (Ord. 692 (part), 2018).

18.55.060 Location and Configuration Preferences.

(A) *Purpose*. The purpose of this section is to provide guidelines to applicants and the reviewing authority regarding the preferred locations and configurations for wireless telecommunication facilities in the town, provided that nothing in this section shall be construed to permit a wireless telecommunication facility in any location or configuration that it is otherwise prohibited by this chapter.

(B) *Review of Location and Configuration.* The reviewing authority shall consider the extent to which a proposed wireless telecommunication facility complies with these preferences and whether there are feasible alternative locations or configurations to the proposed facility that are more preferred under this section. If the location or configuration of a proposed facility qualifies for two or more categories of preferred locations or configurations, it shall be deemed to belong to the least preferred category.

(C) *Order of Preference - Configurations*. The order of preference for the configuration for wireless telecommunication facilities from most preferred to least preferred is:

(1) Collocation with existing facilities,

(2) Roof-mounted,

(3) Building-mounted,

(4) Mounted on an existing utility pole or a new utility pole that will replace an existing utility pole,

(5) Mounted on a new telecommunication tower.

(D) *Order of Preference - Location*. The order of preference for the location of wireless telecommunications facilities from most preferred to least preferred is:

(1) In the C-D district,

(2) In the C-L district,

(3) In the public right-of-way with the closest adjacent district being the C-D district,

(4) In the public right-of-way with the closest adjacent district being the C-L district,

(5) In the public right-of-way with the closest adjacent district being the C-C district,

(6) Any public right-of-way location that abuts the property line of a structure recognized as a local, state or national historic landmark, historic district or on the

register of historic places,

(7) In the public right-of-way with the closest adjacent district being the R-1 district.

(E) *Accessory equipment*. In order of preference from most preferred to least preferred, accessory equipment for wireless telecommunication facilities and wireless telecommunications collocation facilities shall be located underground, within a building or structure, on a screened roof top area or structure, or in a rear yard if not readily visible from surrounding properties and the roadway, unless the reviewing authority finds that another location is preferable under the circumstances of the application. (Ord. 692 (part), 2018).

18.55.070 Design and Development Standards for All Facilities.

(A) *Basic requirements*. The design and development standards set forth in this section apply to all wireless telecommunications facilities no matter where they are located. Wireless telecommunications facilities shall be designed and maintained so as to minimize visual, noise, and other impacts on the surrounding community and shall be planned, designed, located, and erected in accordance with the design and development standards in this section.

(B) *No speculative facilities*. A wireless telecommunications facility, wireless telecommunications collocation facility, or a telecommunications tower, which is built on speculation and for which there is no wireless tenant is prohibited within the town.

(C) *General guidelines.* The applicant shall employ screening and camouflage design techniques in the design and placement of wireless telecommunications facilities in order to ensure that the facility is as visually inconspicuous as possible, to prevent the facility from dominating the surrounding area and to hide the facility from predominant views from surrounding properties, all in a manner that achieves compatibility with the community.

(D) *Traffic safety*. All facilities shall be designed and located in such a manner as to avoid adverse impacts on traffic safety.

(E) *Antennas.* The applicant shall use the least visible antennas possible to accomplish the coverage objectives. Antenna elements shall be flush mounted, to the extent reasonably feasible. All antenna mounts shall be designed so as not to preclude possible future collocation by the same or other operators or carriers. Antennas shall be situated as to reduce visual impact without compromising their function. Whip antennas need not be screened.

(F) *Landscaping*. Where appropriate, facilities shall be installed so as to maintain and enhance existing landscaping on the site, including trees, foliage and shrubs, whether or not utilized for screening. Additional landscaping shall be planted, irrigated, and maintained where such vegetation is deemed necessary by the town to provide screening or to block the line of sight between facilities and adjacent uses.

(G) *Signage*. Wireless telecommunications facilities and wireless telecommunications collocation facilities shall not bear any signs or advertising devices other than certification, warning or other signage required by law or permitted by the town.

(H) *Lighting*. No wireless telecommunications facility may be illuminated unless either specifically required by the Federal Aviation Administration or other government agency or in

association with the illumination of an athletic field on town or school property. Lightning arresters and beacon lights are not permitted unless required by the Federal Aviation Administration or other government agency. Legally required lightning arresters and beacons shall be included when calculating the height of facilities such as telecommunications towers, lattice towers, and monopoles.

(I) *Noise*.

(1) Each wireless telecommunications facility and wireless telecommunications collocation facility shall be operated in such a manner so as to minimize any possible disruption caused by noise.

(2) Backup generators shall only be operated during periods of power outages, and shall not be tested on weekends or holidays, or between the hours of 5:00 p.m. and 7:00 a.m.

(3) At no time shall equipment noise from any facility exceed an exterior noise level of 50 dBA at the facility's property line if the facility is located in a business or commercial zone that permits those uses, provided, however, that for any such facility located within 500 feet of any property zoned residential or improved with a residential use, such equipment noise shall at no time be audible at the property line of any such residential property. For any facility located within a residential zone, such equipment noise shall at no time be audible at the property line of any residentially improved or residential zoned property.

(4) Any equipment, including but not limited to air conditioning units, that may emit noise that would be audible from beyond three feet from the facility in the case of a facility located in the right-of-way, or in the case of other facilities the facility's property line, shall be enclosed or equipped with noise attenuation devices to the extent necessary to ensure compliance with applicable noise limitations under the Ross Municipal Code.

(J) *Security*. Each wireless telecommunications facility and wireless telecommunications collocation facility shall be designed to be resistant to, and minimize opportunities for, unauthorized access, climbing, vandalism, graffiti and other conditions that would result in hazardous situations, visual blight, or attractive nuisances. The reviewing authority may require the provision of warning signs, fencing, anti-climbing devices, or other techniques to prevent unauthorized access and vandalism when, because of their location or accessibility, a facility has the potential to become an attractive nuisance.

(K) *Modification*. At the time of modification of a wireless telecommunications facility, existing equipment shall, to the extent feasible, be replaced with equipment that reduces visual, noise, and other impacts, including, but not limited to, undergrounding the equipment and replacing larger, more visually intrusive facilities with smaller, less visually intrusive facilities. (Ord. 692 (part), 2018).

<u>18.55.080 Additional Design and Development Standards for Facilities Outside the Public Right-of-Way.</u>

(A) *Basic Requirements*. Facilities located outside the public right-of-way are subject to the design and development standards set forth in this section in addition to all design and

development standards that apply to all facilities.

(B) *No parking interference*. In no event shall the installation of facilities replace or interfere with parking spaces in such a way as to reduce the total number of parking spaces below the number that is required.

(C) *Roof-mounted facilities*. Roof-mounted facilities shall be designed and constructed to be fully concealed or screened in a manner compatible with the existing architecture of the building the facility is mounted to in color, texture, and type of material. Screening shall not increase the bulk of the structure nor alter the character of the structure.

(D) *Facilities mounted to a telecommunications tower*.

(1) Facilities mounted to a telecommunications tower shall be located in close proximity to existing above-ground utilities, such as electrical towers or utility poles (which are not scheduled for removal or under grounding for at least 18 months after the date of application), light poles, trees of comparable heights, and in areas where they will not detract from the appearance of the town.

(2) Facilities mounted to a telecommunications tower, including, but not limited to, the attached antennas, shall be designed to be the minimum functional height and width required to adequately support the proposed facility and meet FCC requirements. The applicant shall provide documentation satisfactory to the planner establishing compliance with this paragraph. In any event, facilities mounted to a telecommunications tower shall not exceed the applicable height limit for structures in the applicable zoning district.

(3) All cables, including, but not limited to, electrical and utility cables, shall be run within the interior of the telecommunications tower and shall be camouflaged or hidden to the fullest extent feasible without jeopardizing the physical integrity of the tower.

(4) Monopole installations shall be situated so as to utilize existing natural or man-made features including topography, vegetation, buildings, or other structures to provide the greatest amount of visual screening.

(5) All antenna components and accessory wireless equipment shall be treated with exterior coatings of a color and texture to match the predominant visual background or existing architectural elements so as to visually blend in with the surrounding development. Subdued colors and non-reflective materials that blend with surrounding materials and colors shall be used.

(6) Monopoles and antennas and similar structures shall be no greater in diameter or other cross-sectional dimensions than is necessary for the proper functioning of the facility. The applicant shall provide documentation satisfactory to the planner establishing compliance with this paragraph (D).

(7) If a faux tree is proposed for the monopole installation, it shall be of a type of tree compatible with those existing in the immediate areas of the installation. If no trees exist within the immediate areas, the applicant shall create a landscape setting that integrates the faux tree with added species of a similar height and type.

Additional camouflage of the faux tree may be required depending on the type and design of faux tree proposed.

(E) *Accessory equipment*. All accessory equipment associated with the operation of any wireless telecommunications facility shall be fully screened or camouflaged, and located in a manner to minimize their visibility to the greatest extent possible utilizing the following methods for the type of installation:

(1) Accessory equipment for roof-mounted facilities shall be installed inside the building to which it is mounted or underground, if feasible. If not feasible, such accessory equipment may be located on the roof of the building that the facility is mounted on, provided that both the equipment and screening materials are painted the color of the building, roof, or surroundings. All screening materials for roof-mounted facilities shall be of a quality and design that is architecturally integrated with the design of the building or structure.

(2) Accessory equipment for facilities mounted to a telecommunications tower shall be visually screened by locating the equipment either within a nearby building, in an underground vault (with the exception of required electrical panels) or in another type of enclosed structure, which shall comply with the development and design standards of the zoning district in which the accessory equipment is located. Such enclosed structure shall be architecturally treated and adequately screened from view by landscape plantings, decorative walls, fencing or other appropriate means, selected so that the resulting screening will be visually integrated with the architecture and landscaping of the surroundings. (Ord. 692 (part), 2018).

<u>18.55.090 Additional Design and Development Standards for Facilities in the Public Right-of-Way.</u>

(A) *Basic Requirements*. Facilities located in the public right-of-way are subject to the design and development standards set forth in this section in addition to all design and development standards that apply to all facilities.

(B) *Right-of-way authority*. Only applicants authorized to enter the public right-of-way pursuant to state or federal law or a franchise or other agreement with the town shall be eligible for a permit to install or modify a wireless telecommunications facility in the public right-of-way.

(C) *Antennas*.

(1) *Utility poles*. The maximum height of any antenna mounted to an existing utility pole shall not exceed 24 inches above the height of an existing utility pole, nor shall any portion of the antenna or equipment mounted on a pole be less than 18 feet above any drivable road surface. All installations on utility poles shall fully comply with the California Public Utilities Commission general orders, including, but not limited to, General Order 95, as revised.

(2) *Street light poles*. The maximum height of any antenna mounted to a street light pole shall not exceed seven feet above the existing height of a street light pole in a location with its closest adjacent district being a C-D or a C-L district and shall not exceed three feet above the existing height of a street light pole in any other

location. Any portion of the antenna or equipment mounted on such a pole shall be no less than 18 feet above any drivable road surface.

(D) *Poles*.

(1) Only pole-mounted antennas shall be permitted in the right-of-way. All other telecommunications towers are prohibited, and no new poles are permitted that are not replacing an existing pole.

(2) Pole height and width limitations:

(a) All poles shall be designed to be the minimum functional height and width required to support the proposed antenna installation and meet FCC requirements. Poles and antennas and similar structures shall be no greater in diameter or other cross-sectional dimensions than is necessary for the proper functioning of the facility.

(b) Notwithstanding the above, no facility shall be located on a pole that is less than 26 feet in height and no facility shall exceed 35 feet in height, including, but not limited to the pole and any antenna that protrudes above the pole.

(c) Pole mounted equipment shall not exceed six cubic feet in dimension.

(d) The applicant shall provide documentation satisfactory to the planner establishing compliance with this paragraph (D)(2).

(3) *Replacement poles*. If an applicant proposes to replace a pole in order to accommodate the facility, the pole shall match the appearance of the original pole to the extent feasible, unless another design better accomplishes the objectives of this section. Such replacement pole shall not exceed the height of the pole it is replacing by more than seven feet.

(4) If an exception is granted for placement of new poles in the right-of-way, new poles shall be designed to resemble existing poles in the right-of-way, including size, height, color, materials and style, with the exception of any existing pole designs that are scheduled to be removed and not replaced, unless another design better accomplishes the objectives of this section. Such new poles that are not replacement poles shall be located no closer than 90 feet to an existing pole.

(E) *Space occupied*. Facilities shall be designed to occupy the least amount of space in the right-of-way that is technically feasible.

(F) *Location*.

(1) Each component part of a facility shall be located so as not to cause any physical or visual obstruction to pedestrian or vehicular traffic, inconvenience to the public's use of the right-of-way, or safety hazards to pedestrians and motorists.

(2) A facility shall not be located within any portion of the public right-of-way

interfering with access to fire hydrants, fire stations, fire escapes, water valves, underground vaults, valve housing structures, or any other vital public health and safety facility.

(3) Facilities mounted to a telecommunications tower, above-ground accessory equipment, or walls, fences, landscaping or other screening methods shall be setback a minimum of 18 inches from the front of a curb.

(4) All cables, including, but not limited to, electrical and utility cables, between the pole and any accessory equipment shall be placed underground, if feasible.

(G) *Americans with Disabilities Act Compliance*. All facilities shall be built in compliance with the Americans with Disabilities Act (ADA).

(H) *Accessory equipment*. With the exception of the electric meter, which shall be pole-mounted to the extent feasible, all accessory equipment shall be located underground to the extent feasible. When above-ground is the only feasible location for a particular type of accessory equipment and when such accessory equipment cannot be pole-mounted, such accessory equipment shall be enclosed within a structure, and shall not exceed a height of five feet and a total footprint of 15 square feet, and shall be screened and camouflaged to the fullest extent possible, including the use of landscaping or alternate screening. Required electrical meter cabinets shall be adequately screened and camouflaged. (Ord. 692 (part), 2018).

18.55.100 Conditions of Approval for All Facilities.

(A) In addition to compliance with the requirements of this chapter, upon approval all facilities shall be subject to each of the following conditions of approval, as well as any modification of these conditions or additional conditions of approval deemed necessary by the reviewing authority:

(1) Before the permittee submits any application for a building permit or other permits required by the Ross Municipal Code, the permittee must incorporate the wireless telecommunication facility permit granted under this chapter, all conditions associated with the wireless telecommunications facility permit and the approved plans and any photo simulations (the "Approved Plans") into the project plans. The permittee must construct, install and operate the wireless telecommunications facility in strict compliance with the Approved Plans. The permittee shall submit an as built drawing within 90 days after installation of the facility.

(2) Where feasible, as new technology becomes available, the permittee shall:

(a) place above-ground wireless telecommunications facilities below ground, including, but not limited to, accessory equipment that has been mounted to a telecommunications tower or mounted on the ground; and

(b) replace larger, more visually intrusive facilities with smaller, less visually intrusive facilities, after receiving all necessary permits and approvals required pursuant to the Ross Municipal Code.

(3) The permittee shall submit and maintain current at all times basic contact and site information on a form to be supplied by the town. The permittee shall notify the town of any changes to the information submitted within seven days of any change, including change of the name or legal status of the owner or operator. This information shall include, but is not limited to, the following:

(a) Identity, including the name, address and 24-hour local or toll free contact phone number of the permittee, the owner, the operator, and the agent or person responsible for the maintenance of the facility.

(b) The legal status of the owner of the wireless telecommunications facility, including official identification numbers and FCC certification.

(c) Name, address, and telephone number of the property owner if different than the permittee.

(4) The permittee shall not place any facilities that will deny access to, or otherwise interfere with, any public utility, easement, or right-of-way located on the site. The permittee shall allow the town reasonable access to, and maintenance of, all utilities and existing public improvements within or adjacent to the site, including, but not limited to, pavement, trees, public utilities, lighting and public signage.

(5) At all times, all required notices and signs shall be posted on the site as required by the FCC and California Public Utilities Commission, and as approved by the town. The location and dimensions of a sign bearing the emergency contact name and telephone number shall be posted pursuant to the approved plans.

(6) At all times, the permittee shall ensure that the facility complies with the most current regulatory and operational standards including, but not limited to, radio frequency emissions standards adopted by the FCC and antenna height standards adopted by the Federal Aviation Administration.

(7) If the planner determines there is good cause to believe that the facility may emit radio frequency emissions that are likely to exceed FCC standards, the planner may require the permittee to submit a technically sufficient written report certified by a qualified radio frequency emissions engineer, certifying that the facility is in compliance with such FCC standards.

(8) Permittee shall pay for and provide a performance bond, which shall be in effect until the facilities are fully and completely removed and the site reasonably returned to its original condition, to cover permittee's obligations under these conditions of approval and the town of Ross Municipal Code. The bond coverage shall include, but not be limited to, removal of the facility, maintenance obligations and landscaping obligations. The amount of the performance bond shall be set by the planner in an amount rationally related to the obligations covered by the bond and shall be specified in the conditions of approval.

(9) Permittee shall defend, indemnify, protect and hold harmless town, its elected and appointed council members, boards, commissions, officers, officials, agents, consultants, employees, and volunteers from and against any and all claims,

actions, or proceeding against the town and its elected and appointed council members, boards, commissions, officers, officials, agents, consultants, employees and volunteers to attack, set aside, void or annul, an approval of the town, Planning Commission or town council concerning this permit and the project. Such indemnification shall include damages, judgments, settlements, penalties, fines, defensive costs or expenses, including, but not limited to, interest, attorneys' fees and expert witness fees, or liability of any kind related to or arising from such claim, action, or proceeding. The town shall promptly notify the permittee of any claim, action, or proceeding. Nothing contained herein shall prohibit town from participating in a defense of any claim, action or proceeding. The town shall have the option of coordinating the defense, including, but not limited to, choosing counsel for the defense at permittee's expense.

(10) All conditions of approval shall be binding as to the applicant and all successors in interest to permittee.

(11) A condition setting forth the permit expiration date in accordance with section 18.55.200 shall be included in the conditions of approval. (Ord. 692 (part), 2018).

18.55.110 Additional Conditions of Approval for Facilities in the Public Right-of-Way.

(A) In addition to compliance with the requirements of this chapter, upon approval all facilities in the public right-of-way shall be subject to each of the conditions of approval set forth in section 18.55.100, each of the following conditions of approval, and any modification of these conditions or additional conditions of approval deemed necessary by the reviewing authority:

(1) The wireless telecommunications facility shall be subject to such conditions, changes or limitations as are from time to time deemed necessary by the town engineer for the purpose of: (a) protecting the public health, safety, and welfare, (b) preventing interference with pedestrian and vehicular traffic, and (c) preventing damage to the public right-of-way or any property adjacent to it. The town may modify the permit to reflect such conditions, changes or limitations by following the same notice and public hearing procedures as are applicable to the grant of a wireless telecommunications facility permit for similarly located facilities, except the permittee shall be given notice by personal service or by registered or certified mail at the last address provided to the town by the permittee.

(2) The permittee shall not move, alter, temporarily relocate, change, or interfere with any existing structure, improvement or property without the prior consent of the owner of that structure, improvement or property. No structure, improvement or property owned by the town shall be moved to accommodate a wireless telecommunications facility unless the town determines that such movement will not adversely affect the town or any surrounding businesses or residents, and the permittee pays all costs and expenses related to the relocation of the town's structure, improvement or property. Prior to commencement of any work pursuant to an encroachment permit issued for any facility within the public right-of-way, the permittee shall provide the town with documentation establishing to the town's satisfaction that the permittee has the legal right to use or interfere

with any other structure, improvement or property within the public right-of-way to be affected by applicant's facilities.

(3) The permittee shall assume full liability for damage or injury caused to any property or person by the facility.

(4) The permittee shall repair, at its sole cost and expense, any damage including, but not limited to subsidence, cracking, erosion, collapse, weakening, or loss of lateral support to town streets, sidewalks, walks, curbs, gutters, trees, parkways, street lights, traffic signals, improvements of any kind or nature, or utility lines and systems, underground utility line and systems, or sewer systems and sewer lines that result from any activities performed in connection with the installation or maintenance of a wireless telecommunications facility in the public right-of-way. The permittee shall restore such areas, structures and systems to the condition in which they existed prior to the installation or maintenance that necessitated the repairs. In the event the permittee fails to complete such repair within the number of days stated on a written notice by the planner, the planner shall cause such repair to be completed at permittee's sole cost and expense.

(5) Prior to issuance of a building permit, the applicant shall obtain the planner's approval of a tree protection plan prepared by a certified arborist if the installation of the wireless telecommunication facility will be located within the canopy of a street tree, or a protected tree on private property, or within a ten-foot radius of the base of such a tree. Depending on site specific criteria (e.g., location of tree, size, and type of tree, etc.), a radius greater than ten feet may be required by the planner.

(6) Should any utility company offer electrical service that does not require the use of a meter cabinet, the permittee shall at its sole cost and expense remove the meter cabinet and any related foundation within 30 days of such service being offered and reasonably restore the area to its prior condition.

(7) The permittee shall modify, remove, or relocate its facility, or portion thereof, without cost or expense to town, if and when made necessary by:

(a) Any public improvement project, including, but not limited to, the construction, maintenance, or operation of any underground or aboveground facilities including but not limited to sewers, storm drains, conduits, gas, water, electric or other utility systems, or pipes owned by town or any other public agency;

(b) Any abandonment of any street, sidewalk, or other public facility;

(c) Any change of grade, alignment or width of any street, sidewalk or other public facility; or

(d) A determination by the planner that the wireless telecommunications facility has become incompatible with public health, safety or welfare or the public's use of the public right-of-way.

(8) Any modification, removal, or relocation of the facility shall be completed

within 90 days of written notification by town unless exigencies dictate a shorter period for removal or relocation. Modification or relocation of the facility shall require submittal, review and approval of a permit amendment pursuant to the Ross Municipal Code. The permittee shall be entitled, on permittee's election, to either a pro-rata refund of fees paid for the original permit or to a new permit, without additional fee, at a location as close to the original location as the standards set forth in the Ross Municipal Code allow. In the event the facility is not modified, removed, or relocated within said period of time, the town may cause the same to be done at the sole cost and expense of permittee. Further, due to exigent circumstances as provided in the Ross Municipal Code, the town may modify, remove, or relocate wireless telecommunications facilities without prior notice to permittee provided permittee is notified within a reasonable period thereafter. (Ord. 692 (part), 2018).

18.55.120 Findings.

(A) Where a wireless telecommunication facility requires a use permit under this chapter, the reviewing authority shall not approve any application unless, in addition to the findings generally applicable to all use permits, all of the following additional findings are made:

(1) The proposed facility complies with all applicable provisions of this chapter.

(2) The proposed facility has been designed and located to achieve compatibility with the community to the maximum extent reasonably feasible.

(3) The applicant has submitted a statement of its willingness to allow other carriers to collocate on the proposed wireless telecommunications facility wherever technically and economically feasible and where collocation would not harm community compatibility.

(4) Noise generated by equipment will not be excessive, annoying nor be detrimental to the public health, safety, and welfare and will not exceed the standards set forth in this chapter.

(B) In addition to the findings in paragraph (A) above, approval of a wireless telecommunications facility permit for a facility that will be located in the public right-of-way may be granted only if the following findings are made by the reviewing authority:

(1) The applicant has provided substantial written evidence supporting the applicant's claim that it has the right to enter the public right-of-way pursuant to state or federal law, or the applicant has entered into a franchise or other agreement with the town permitting them to use the public right-of-way.

(2) The applicant has demonstrated that the facility will not interfere with the use of the public right-of-way, existing subterranean infrastructure, or the town's plans for modification or use of such location and infrastructure. (Ord. 692 (part), 2018).

18.55.130 Exceptions.

(A) Exceptions pertaining to any provision of this chapter, including, but not limited to, exceptions from findings that would otherwise justify denial, may be granted by the reviewing authority if the reviewing authority makes the finding that:

(1) Denial of the facility as proposed would violate federal law, state law, or both; or

(2) A provision of this chapter, as applied to applicant, would deprive applicant of its rights under federal law, state law, or both.

(B) An applicant may only request an exception at the time of applying for a wireless telecommunications facility permit. The request must include both the specific provision(s) of this chapter from which the exception is sought and the basis of the request. Any request for an exception after the town has deemed an application complete shall be treated as a new application.

(C) Notwithstanding any other provision of this chapter, a use permit shall be required for a facility when an exception is requested.

(D) The applicant shall have the burden of proving that denial of the facility as proposed would violate federal law, state law, or both, or that the provisions of this chapter, as applied to applicant, would deprive applicant of its rights under federal law, state law, or both, using the evidentiary standards required by that law at issue. The town shall have the right to hire an independent consultant, at the applicant's expense, to evaluate the issues raised by the exception request and shall have the right to submit rebuttal evidence to refute the applicant's claim. (Ord. 692 (part), 2018).

18.55.140 Wireless Telecommunications Facilities Covered under Section 6409(a) of the Middle Class Tax Relief and Job Creation Act of 2012.

(A) *Purpose*. Section 6409(a) of the Middle Class Tax Relief and Job Creation Act of 2012, Pub. L. 112-96, codified in 47 U.S.C. § 1455(a), generally requires that State and local governments "may not deny, and shall approve" requests to collocate, remove or replace transmission equipment at an existing tower or base station. Federal Communication Commission regulations interpret this statute and create procedural rules for local review, which generally preempt certain subjective land-use regulations, limit permit application content requirements and provide the applicant with a potential "deemed granted" remedy when the State or local government fails to approve or deny the request within sixty (60) days after submittal (accounting for any tolling periods). Moreover, whereas Section 704 of the Telecommunications Act of 1996, Pub. L. 104-104, codified in 47 U.S.C. § 332, applies to only "personal wireless service facilities" (e.g., cellular telephone towers and equipment), Section 6409(a) applies to all "wireless" facilities licensed or authorized by the FCC (e.g., cellular, Wi-Fi, satellite, microwave backhaul, etc.).

The overlap between wireless deployments covered under Section 6409(a) and other wireless deployments, combined with the different substantive and procedural rules applicable to such deployments, creates a potential for confusion that harms the public interest in both efficient wireless facilities deployment and carefully planned community development in accordance with local values. A separate permit application and review process specifically designed for compliance with Section 6409(a) contained in a section devoted to Section 6409(a) will mitigate

such potential confusion, streamline local review and preserve the town's land-use authority to maximum extent possible.

(B) *Applicability*. This Section applies to all collocations or modifications to an existing wireless tower or base station submitted with a written request for approval pursuant to Section 6409(a).

(C) *Approval Required*. Any request to collocate, replace or remove transmission equipment at an existing wireless tower or base station submitted with a written request for a 6409(a) approval shall be subject to the planner's approval, conditional approval or denial without prejudice pursuant to the standards and procedures contained in this chapter.

(D) *Other Regulatory Approvals*. No collocation or modification approved under any section 6409(a) approval may occur unless the applicant also obtains all other applicable permits or regulatory approvals from the town and state or federal agencies. Furthermore, any section 6409(a) approval granted under this chapter shall remain subject to any and all lawful conditions or requirements associated with such other permits or regulatory approvals from the town and state or federal agencies.

(E) *Application Requirement*. The town shall not approve any wireless facility subject to this chapter except upon a duly filed application consistent with this Section and any other written rules the town or the planner may establish from time to time. An application must include the information required by Section 18.55.050 and the following additional information:

(1) A title report prepared within the six months prior to the application filing date in order for the town verify the property owner's identity. If the applicant does not own the subject property, the application must include a written authorization signed by the property owner that empowers the applicant to file the application and perform all wireless facility construction, installation, operation and maintenance to the extent described in the application.

(2) A written statement that explains in plain factual detail whether and why Section 6409(a) and the related FCC regulations at 47 C.F.R. § 1.40001 et seq. require approval for the specific project. A complete written narrative analysis will state the applicable standard and all the facts that allow the town to conclude the standard has been met. Bare conclusions not factually supported do not constitute a complete written analysis. As part of this written statement the applicant must also include (i) whether and why the support structure qualifies as an existing tower or existing base station; and (ii) whether and why the proposed collocation or modification does not cause a substantial change in height, width, excavation, equipment cabinets, concealment or permit compliance.

(F) *Procedures for a Duly Filed Application*. The town shall not review any application unless duly filed in accordance with this Section, as follows:

(1) *Pre-Submittal Conference*. Before application submittal, applicants must schedule and attend a pre-application meeting with the planner for all proposed modifications submitted for approval pursuant to Section 6409(a). The pre-submittal conference is intended to streamline the review process through informal discussion that includes, without limitation, the appropriate project classification, including whether the project qualifies for Section 6409(a); any latent issues in

connection with the existing tower or base station; potential concealment issues (if applicable); coordination with other town departments responsible for application review; and application completeness issues. To mitigate unnecessary delays due to application incompleteness, applicants are encouraged (but not required) to bring any draft applications or other materials so that town staff may provide informal feedback about whether such applications or other materials may be incomplete or unacceptable. The planner may, in the planner's discretion, grant a written exemption to the submittal appointment under Section 18.92.050(c)(2) or for a specific requirement for a complete application to any applicant who (i) schedules, attends and fully participates in any pre-submittal conference and (ii) shows to the planner's satisfaction that such specific requirement duplicates information already provided in other materials to be submitted or is otherwise unnecessary to the town's review under facts and circumstances in that particular case. Any written exemption will be limited to the project discussed at the pre-submittal conference and will not be extended to any other project.

(2) *Submittal Appointment*. All applications must be filed with the town at a pre-scheduled appointment. Applicants may generally submit one application per appointment, but may schedule successive appointments for multiple applications whenever feasible and not prejudicial to other applicants. Any application received without an appointment, whether delivered in-person or through any other means, will not be considered duly filed unless the applicant received a written exemption from the planner at a pre-submittal conference.

(3) *Appointment Scheduling Procedures*. For any event in the submittal process that requires an appointment, applicants must submit a written request to the planner. The planner shall endeavor to provide applicants with an appointment as soon as reasonably feasible and within five business days after a written request is received.

(4) *Applications Deemed Withdrawn*. To promote efficient review and timely decisions, an application will be automatically deemed withdrawn by the applicant when the applicant fails to tender a substantive response to the town within 90 calendar days after the town deems the application incomplete in a written notice to the applicant. The planner may, in the planner's discretion, grant a written extension for up to an additional 30 calendar days when the applicant submits a written request prior to the 90th day that shows good cause to grant the extension. Delays due to circumstances outside the applicant's reasonable control will be considered good cause to grant the extension.

(5) *Departmental Forms, Rules and Other Regulations*. The town council authorizes the planner to develop and publish permit application forms, checklists, informational handouts and other related materials that the planner finds necessary, appropriate or useful for processing requests for section 6409(a) approvals. Without further authorization from the town council, the planner may from time-to-time update and alter any such permit application forms, checklists, informational handouts and other related materials as the planner deems necessary, appropriate or useful to respond to regulatory, technological or other changes related to this chapter. The town council authorizes the planner to establish other reasonable rules and regulations, which may include without limitation regular hours for

appointments with applicants, as the planner deems necessary or appropriate to organize, document and manage the application intake process.

(G) *Administrative Review; Decision Notices*. The planner shall administratively review an application for a section 6409(a) approval and act on such an application without prior notice or a public hearing. Within five working days after the planner conditionally approves or denies an application submitted for Section 6409(a) approval or before the FCC timeframe for review expires (whichever occurs first), the planner shall send a written notice to the applicant. In the event that the planner determines that an application submitted for approval pursuant to Section 6409(a) does not qualify for approval, the planner will send written notice to the applicant that includes the reasons to support the review authority's decision and states that the application will be automatically denied without prejudice on the 60th day after the date the application was filed unless the applicant withdraws the application.

(H) *Required Findings for 6409(a) Approval*. The planner may approve or conditionally approve an application submitted for Section 6409(a) approval when the planner finds that the proposed project:

(1) Involves collocation, removal or replacement of transmission equipment on an existing wireless tower or base station; and

(2) Does not substantially change the physical dimensions of the existing wireless tower or base station.

(I) *Criteria for Denial Without Prejudice*. Notwithstanding any other provisions in this chapter, and consistent with all applicable federal laws and regulations, the planner may deny without prejudice an application submitted for approval pursuant to Section 6409(a) when it finds that the proposed project:

(1) Does not satisfy the criteria for approval;

(2) Violates any legally enforceable standard or permit condition reasonably related to public health and safety then in effect; or

(3) Involves the replacement of the entire support structure.

(J) *Conditional 6409(a) Approvals*. Subject to any applicable limitations in federal or state law, nothing in this chapter is intended to limit the town's authority to conditionally approve an application for a section 6409(a) approval to protect and promote the public health, safety and welfare.

(K) *Appeals*. Notwithstanding any provision of the Ross Municipal Code to the contrary, including but not limited to Section 18.60.040, an applicant may appeal a decision by the planner to deny without prejudice a Section 6409(a) application. The appeal must be filed within 10 days from the planner's decision. The appeal must state in plain terms the grounds for reversal and the facts that support those grounds. The town manager shall serve as the appellate authority for all appeals of all actions of the planner taken pursuant to this section. The town shall provide notice for an administrative hearing by the town manager. The town manager shall limit its review to whether the project should be approved or denied in accordance with the provisions in paragraphs (H) and (I) of this section. The decision of the town manager shall be final and not subject to any further administrative appeals.

(L) *Standard Conditions of Approval*. In addition to all other conditions adopted by the planner, all Section 6409(a) approvals, whether approved by the planner or deemed approved by the operation of law, shall be automatically subject to the following conditions in this Section; provided, however, that the planner shall have discretion to modify or amend these conditions on a case-by-case basis as may be necessary or appropriate under the circumstances:

(1) *Approved Plans*. Before the permittee submits any application for a building permit or other permits required by the Ross Municipal Code, the permittee must incorporate the wireless telecommunications facility permit granted under this section, all conditions associated with the wireless telecommunications facility permit and the approved plans and any photo simulations (the "Approved Plans") into the project plans. The permittee must construct, install and operate the wireless telecommunications facility in strict compliance with the Approved Plans. The permittee shall submit an as built drawing within 90 days after installation of the facility.

(2) *Permit Term*. The town's grant or grant by operation of law of a Section 6409(a) approval constitutes a federally-mandated modification to the underlying permit or other prior regulatory authorization for the subject tower or base station. The town's grant or grant by operation of law of a section 6409(a) approval will not extend the permit term, if any, for any use permit, or other underlying prior regulatory authorization. Accordingly, the term for a section 6409(a) approval shall be coterminous with the underlying permit or other prior regulatory authorization for the subject tower or base station.

(3) *Accelerated Permit Terms Due to Invalidation*. In the event that any court of competent jurisdiction invalidates any portion of Section 6409(a) or any FCC rule that interprets Section 6409(a) such that federal law would not mandate approval for any Section 6409(a) approval, such 6409(a) approvals shall automatically expire one year from the effective date of the judicial order, unless the decision would not authorize accelerated termination of previously approved section 6409(a) approvals or the planner grants an extension upon written request from the permittee that shows good cause for the extension, which includes without limitation extreme financial hardship. Notwithstanding anything in the previous sentence to the contrary, the planner may not grant a permanent exemption or indefinite extension. A permittee shall not be required to remove its improvements approved under the invalidated section 6409(a) approval when it has submitted an application for a use permit for those improvements before the one-year period ends.

(4) *No Waiver of Standing.* The town's grant or grant by operation of law of a Section 6409(a) approval does not waive, and shall not be construed to waive, any standing by the town to challenge Section 6409(a), any FCC rules that interpret Section 6409(a) or any section 6409(a) approval.

(5) *Build-out Period*. The section 6409(a) approval will automatically expire one year from the issuance date unless the permittee obtains all other permits and approvals required to install, construct and operate the approved wireless facility, which includes without limitation any permits or approvals required by the any federal, state or local public agencies with jurisdiction over the subject property,

the wireless facility or its use. The planner may grant one written extension to a date certain when the permittee shows good cause to extend the limitations period in a written request for an extension submitted at least 30 days prior to the automatic expiration date in this condition. Any further extensions may be granted by the town council pursuant to Section 18.60.060.

(6) *Maintenance Obligations; Vandalism*. The permittee shall keep the site, which includes without limitation any and all improvements, equipment, structures, access routes, fences and landscape features, in a neat, clean and safe condition in accordance with the Approved Plans and all conditions in this section 6409(a) approval. The permittee shall keep the site area free from all litter and debris at all times. The permittee, at no cost to the town, shall remove and remediate any graffiti or other vandalism at the site within 48 hours after the permittee receives notice or otherwise becomes aware that such graffiti or other vandalism occurred.

(7) *Compliance with Laws*. The permittee shall maintain compliance at all times with all federal, state and local statutes, regulations, orders or other rules that carry the force of law ("Laws") applicable to the permittee, the subject property, the wireless facility or any use or activities in connection with the use authorized in this section 6409(a) approval. The permittee expressly acknowledges and agrees that this obligation is intended to be broadly construed and that no other specific requirements in these conditions are intended to reduce, relieve or otherwise lessen the permittee's obligations to maintain compliance with all Laws.

(8) *Adverse Impacts on Other Properties*. The permittee shall use all reasonable efforts to avoid any and all undue or unnecessary adverse impacts on nearby properties that may arise from the permittee's construction, installation, operation, modification, maintenance, repair, removal or other activities at the site. The permittee shall not perform or cause others to perform any construction, installation, operation, modification, maintenance, repair, removal or other work that involves heavy equipment or machines on any day and at any time prohibited under the Ross Municipal Code. The restricted work hours in this condition will not prohibit any work required to prevent an actual, immediate harm to property or persons, or any work during an emergency declared by the town. The planner may issue a stop work order for any work that violates this condition.

(9) *Noise Complaints*. The permittee shall conduct all activities on the site in compliance with the noise standards in the Ross Municipal Code. In the event that any person files a noise complaint and the town verifies that such complaint is valid, the permittee must remedy the violation within 10 days after notice from the town, which may include a demonstration that the permittee has amended its operational guidelines in situations where the violation arises from the permittee's personnel rather than the permittee's equipment.

(10) *Inspections; Emergencies*. The permittee expressly acknowledges and agrees that the town or its designee may enter onto the site and inspect the improvements and equipment upon reasonable prior notice to the permittee; provided, however, that the town or its designee may, but will not be obligated to, enter onto the site area without prior notice to support, repair, disable or remove any improvements or equipment in emergencies or when such improvements or

equipment threatens actual, imminent harm to property or persons. The permittee will be permitted to supervise the town or its designee while such inspection or emergency access occurs.

(11) *Contact Information*. The permittee shall furnish the town with accurate and up-to-date contact information for a person responsible for the wireless facility, which includes without limitation such person's full name, title, direct telephone number, facsimile number, mailing address and email address. The permittee shall keep such contact information up-to-date at all times.

(12) *Indemnification*. The permittee and, if applicable, the property owner upon which the wireless facility is installed shall defend, indemnify and hold harmless the town, its agents, officers, officials, employees and volunteers from any and all (1) damages, liabilities, injuries, losses, costs and expenses and from any and all claims, demands, law suits, writs and other actions or proceedings ("Claims") brought against the town or its agents, officers, officials, employees or volunteers to challenge, attack, seek to modify, set aside, void or annul the town's approval of this section 6409(a) approval, and (2) other Claims any kind or form, whether for personal injury, death or property damage, that arise from or in connection with the permittee's or its agents', directors', officers', employees', contractors', subcontractors', licensees', or customers' acts or omissions in connection with this section 6409(a) approval or the wireless facility. In the event the town becomes aware any Claims, the town will use best efforts to promptly notify the permittee and the private property owner and shall reasonably cooperate in the defense. The permittee expressly acknowledges and agrees that the town shall have the right to approve, which approval shall not be unreasonably withheld, the legal counsel providing the town's defense, and the property owner or permittee (as applicable) shall promptly reimburse town for any costs and expenses directly and necessarily incurred by the town in the course of the defense. The permittee expressly acknowledges and agrees that the permittee's indemnification obligations under this condition are a material consideration that motivates the town to approve this section 6409(a) approval, and that such indemnification obligations will survive the expiration or revocation of this section 6409(a) approval.

(13) *Performance Bond*. Before the town issues any construction permit in connection with the wireless facility, the permittee shall post a performance bond from a surety and in a form acceptable to the town manager in an amount equal to or greater than a written estimate from a qualified contractor with experience in wireless facilities removal. The written estimate must include the cost to remove all equipment and other improvements, which includes without limitation all antennas, radios, batteries, generators, utilities, cabinets, mounts, brackets, hardware, cables, wires, conduits, structures, shelters, towers, poles, footings and foundations, whether above ground or below ground, constructed or installed in connection with the wireless facility. In establishing or adjusting the bond amount required under this condition, and in accordance with California Government Code § 65964(a), the town manager shall take into consideration information provided by the permittee regarding the cost to remove the wireless facility.

(14) *Record Retention*. The permittee must maintain complete and accurate copies of all permits and other regulatory approvals issued in connection with the

wireless facility, which includes without limitation this approval, the approved plans and photo simulations incorporated into this approval, all conditions associated with this approval and any ministerial permits or approvals issued in connection with this approval. In the event that the permittee does not maintain such records as required in this condition, any ambiguities or uncertainties that would be resolved through an inspection of the missing records will be construed against the permittee.

(15) *Compliance Obligations*. An applicant or permittee will not be relieved of its obligation to comply with every applicable provision in the Ross Municipal Code, any permit, any permit condition or any applicable law or regulation by reason of any failure by the town to timely notice, prompt or enforce compliance by the applicant or permittee. (Ord. 692 (part), 2018).

18.55.150 Wireless Telecommunications Collocation Facilities Covered under California Government Code Section 65850.6.

(A) *Purpose*. The purpose of this section is to comply with an application for a Wireless Telecommunications Collocation Facility under California Government Code Section 65850.6, for which a 6509(a) approval is not being requested. This section provides the requirements, standards and regulations for a wireless telecommunications collocation facility for which subsequent collocation is a permitted use pursuant to California law. Only those facilities that fully comply with the eligibility requirements set forth in California Government Code Section 65850.6, or its successor provision, and which strictly adhere to the requirements and regulations set forth in this section shall qualify as a wireless telecommunications collocation facility.

(B) *Definitions*. For the purposes of this section, the following terms are defined as follows:

(1) **Collocation facility** means the placement or installation of wireless facilities, including antennas, and related equipment, on, or immediately adjacent to, a wireless telecommunications collocation facility.

(2) **Wireless telecommunications facility** means equipment and network components such as towers, utility poles, transmitters, base stations, and emergency power systems that are integral to providing wireless telecommunications services.

(3) **Wireless telecommunications collocation facility** means a wireless telecommunications facility that includes collocation facilities.

(C) *Procedures*. An application for a Wireless Telecommunications Collocation Facility under California Government Code Section 65850.6 shall be processed in the same manner as an application for 6409(a) approval is processed, except that where the process requires justification for the 6409(a) approval, the applicant shall instead provide the justification for a Wireless Telecommunications Collocation Facility under California Government Code Section 65850.6.

(D) *Requirements*. All requirements, regulations, and standards set forth in this chapter for a wireless telecommunications facility shall apply to a wireless telecommunications collocation facility; provided, however, the following shall also apply to a wireless telecommunications collocation facility:

(1) The applicant for a wireless telecommunications collocation facility permit shall describe or depict:

(a) The wireless telecommunications collocation facility as it will be initially built; and

(b) All collocations at full build-out, including, but not limited to, all antennas, antenna support structures, and accessory equipment.

(2) Any collocation shall use screening methods substantially similar to those used on the existing wireless telecommunications facilities unless other optional screening methods are specified in the conditions of approval.

(3) A wireless telecommunications collocation facility permit shall not be approved unless an environmental impact report, negative declaration, or mitigated negative declaration was prepared and approved for the wireless telecommunications collocation facility.

(E) *Permitted Use*. Notwithstanding any other provision of this chapter, a subsequent collocation on a wireless telecommunications collocation facility shall be a permitted use only if all of the following requirements are satisfied:

(1) The wireless telecommunications collocation facility:

(a) Was approved after January 1, 2007, by discretionary permit;

(b) Was approved subject to an environmental impact report, negative declaration, or mitigated negative declaration; and

(c) Otherwise complies with the requirements of California Government Code Section 65850.6(b), or its successor provision, for addition of a collocation facility to a wireless telecommunications collocation facility, including, but not limited to, compliance with all performance and maintenance requirements, regulations and standards in this chapter and the conditions of approval in the wireless telecommunications collocation facility permit; and

(2) The collocations were specifically considered when the relevant environmental document was prepared for the wireless telecommunications collocation facility.

(3) Before collocation, the applicant seeking collocation shall obtain all other applicable non-discretionary permits, as required pursuant to the Ross Municipal Code.

(F) *New or Amended Permit*. Except as otherwise provided above, approval of a new or amended permit shall be required when the facility is modified other than by collocation in accordance with this section, or the proposed collocation:

(1) Increases the height of the existing permitted telecommunications tower or otherwise changes the bulk, size, location, or any other physical attributes of the

existing permitted wireless telecommunications collocation facility unless specifically permitted under the conditions of approval applicable to such wireless telecommunications collocation facility; or

(2) Adds any microwave dish or other antenna not expressly permitted to be included in a collocation facility by the conditions of approval.

(G) *Appeals*. Notwithstanding any provision of the Ross Municipal Code to the contrary, including but not limited to Section 18.60.040, any applicant may appeal a decision by the planner. The appeal must be filed within 10 days from the planner's decision. The appeal must state in plain terms the grounds for reversal and the facts that support those grounds. The town manager shall serve as the appellate authority for all appeals of all actions of the planner taken pursuant to this section. The town shall provide notice for an administrative hearing by the town manager. The town manager shall limit its review to whether the project should be approved or denied in accordance with the provisions in this section. The decision of the town manager shall be final and not subject to any further administrative appeals. (Ord. 692 (part), 2018).

18.55.160 Business License.

A permit issued pursuant to this chapter shall not be a substitute for any business license otherwise required under the Ross Municipal Code. (Ord. 692 (part), 2018).

18.55.170 Emergency Deployment.

In the event of a declared federal, state, or local emergency, or when otherwise warranted by conditions that the planner deems to constitute an emergency, the planner may approve the installation and operation of a temporary wireless telecommunications facility (e.g., a cell on wheels or "COW"), which is subject to such reasonable conditions that the planner deems necessary. (Ord. 692 (part), 2018).

18.55.180 Operation and Maintenance Standards.

(A) All wireless telecommunications facilities must comply at all times with the following operation and maintenance standards. All necessary repairs and restoration shall be completed by the permittee, owner, or operator within 48 hours:

(1) After discovery of the need by the permittee, owner, operator or any designated maintenance agent; or

(2) After permittee, owner, operator, or any designated maintenance agent receives notification from a resident or the planner.

(B) All facilities, including, but not limited to, telecommunication towers, poles, accessory equipment, lighting, fences, walls, shields, cabinets, artificial foliage or camouflage, and the facility site shall be maintained in good condition, including ensuring the facilities are reasonably free of:

(a) General dirt and grease;

(b) Chipped, faded, peeling, and cracked paint;

(c) Rust and corrosion;

(d) Cracks, dents, and discoloration;

(e) Missing, discolored, or damaged artificial foliage or other camouflage;

(f) Graffiti, bills, stickers, advertisements, litter and debris;

(g) Broken and misshapen structural parts; and

(h) Any damage from any cause.

(3) All trees, foliage or other landscaping elements approved as part of the facility shall be maintained in good condition at all times, and the permittee, owner and operator of the facility shall be responsible for replacing any damaged, dead or decayed landscaping. No amendment to any approved landscaping plan may be made until it is submitted to and approved by the planner.

(4) The permittee shall replace its facilities, after obtaining all required permits, if maintenance or repair is not sufficient to return the facility to the condition it was in at the time of installation.

(5) Each facility shall be operated and maintained at all times in compliance with applicable federal regulations, including FCC radio frequency emissions standards.

(6) Each facility shall be operated and maintained to comply at all times with the noise regulations of this chapter and shall be operated and maintained in a manner that will minimize noise impacts to surrounding residents. Except for emergency repairs, any testing and maintenance activities that will be audible beyond the property line shall only occur between the hours of 7:00 a.m. and 5:00 p.m. on Monday through Friday, excluding holidays, unless alternative hours are approved by the planner. Backup generators, if permitted, shall only be operated during periods of power outages or for testing.

(7) If a flagpole is used for camouflaging a wireless telecommunications facility, flags shall be flown and shall be properly maintained at all times.

(8) Each owner or operator of a facility shall routinely inspect each site to ensure compliance with the standards set forth in this section and the conditions of approval. (Ord. 692 (part), 2018).

18.55.190 No Dangerous Conditions or Obstructions Allowed.

No person shall install, use or maintain any wireless telecommunications facility which in whole or in part rests upon, in or over any public sidewalk or parkway, when such installation, use or maintenance endangers or is reasonably likely to endanger the safety of persons or property, or when such site or location is used for public utility purposes, public transportation purposes or other governmental use, or when such facility unreasonably interferes with or impedes the flow of pedestrian or vehicular traffic including any legally parked or stopped vehicle, the ingress into or egress from any residence or place of business, the use of poles, posts, traffic signs or signals,

hydrants, mailboxes, permitted sidewalk dining, permitted street furniture or other objects permitted at or near said location. (Ord. 692 (part), 2018).

18.55.200 Permit Expiration.

(A) A permit for any wireless telecommunications facility shall be valid for a period of 10 years, unless the town council authorizes a longer period or pursuant to another provision of the Ross Municipal Code the permit lapses sooner or is revoked. At the end of such period, the permit shall expire.

(B) A permittee may apply for extensions of its permit in increments of no more than ten years and no sooner than twelve months prior to expiration of the permit.

(C) If a permit has not expired at the time an application is made for an extension, the planner may administratively extend the term of the permit for subsequent ten-year terms upon verification of continued compliance with the findings and conditions of approval under which the application was originally approved, as well as any other applicable provisions of the Ross Municipal Code that are in effect at the time the permit extension is granted.

(1) At the planner's discretion, additional studies and information may be required of the applicant.

(2) If the planner determines that the facility is nonconforming or that additional conditions of approval are necessary to bring the facility into compliance with the provisions of the Ross Municipal Code that are then in effect at the time of permit expiration, the planner shall refer the extension request to the town council.

(D) The request for an extension shall be decided by the town council if the permit expired before the application is made for an extension or if the planner refers the matter to the town council. After notice and a public hearing, the town council may approve, conditionally approve, or deny the extension. (Ord. 692 (part), 2018).

18.55.210 Cessation of Use or Abandonment.

(A) A wireless telecommunications facility is considered abandoned and shall be promptly removed as provided herein if it ceases to provide wireless telecommunications services for 90 or more consecutive days. If there are two or more users of a single facility, then this provision shall not become effective until all users cease using the facility.

(B) The operator of a facility shall notify the town in writing of its intent to abandon or cease use of a permitted site or a nonconforming site (including unpermitted sites) within ten days of ceasing or abandoning use. Notwithstanding any other provision herein, the operator of the facility shall provide written notice to the planner of any discontinuation of operations of 30 days or more.

(C) Failure to inform the planner of cessation or discontinuation of operations of any existing facility as required by this section shall constitute a violation of any approvals and be grounds for:

(1) Prosecution;

(2) Revocation or modification of the permit;

(3) Calling of any bond or other assurance required by this chapter or conditions of approval of the permit;

(4) Removal of the facilities by the town in accordance with the procedures established under the Ross Municipal Code for abatement of a public nuisance at the owner's expense; and

(5) Any other remedies permitted under the Ross Municipal Code. (Ord. 692 (part), 2018).

18.55.220 Removal and Restoration, Permit Expiration, Revocation or Abandonment.

(A) *Permittee's removal obligation.* Upon the expiration date of the permit, including any extensions, earlier termination or revocation of the permit or abandonment of the facility, the permittee, owner or operator shall remove its wireless telecommunications facility and restore the site to its natural condition except for retaining the landscaping improvements and any other improvements at the discretion of the town. Removal shall be in accordance with proper health and safety requirements and all ordinances, rules, and regulations of the town. The facility shall be removed from the property within 30 days, at no cost or expense to the town. If the facility is located on private property, the private property owner shall also be independently responsible for the expense of timely removal and restoration.

(B) *Failure to remove*. Failure of the permittee, owner, or operator to promptly remove its facility and restore the property within 30 days after expiration, earlier termination, or revocation of the permit, or abandonment of the facility, shall be a violation of the Ross Municipal Code, and be grounds for:

(1) Prosecution;

(2) Calling of any bond or other assurance required by this chapter or conditions of approval of permit;

(3) Removal of the facilities by the town in accordance with the procedures established under the Ross Municipal Code for abatement of a public nuisance at the owner's expense; or

(4) Any other remedies permitted under the Ross Municipal Code.

(C) *Summary removal*. In the event the planner determines that the condition or placement of a wireless telecommunications facility located in the public right-of-way constitutes a dangerous condition, obstruction of the public right-of-way, or an imminent threat to public safety, or determines other exigent circumstances require immediate corrective action (collectively, "exigent circumstances"), the planner may cause the facility to be removed summarily and immediately without advance notice or a hearing. Written notice of the removal shall be served upon the person who owns the facility within five business days of removal and all property removed shall be preserved for the owner's pick-up as feasible. If the owner cannot be identified following reasonable effort or if the owner fails to pick-up the property within 60 days, the facility shall be treated as abandoned property.

(D) *Removal of facilities by town.* In the event the town removes a facility in accordance with nuisance abatement procedures or summary removal, any such removal shall be

without any liability to the town for any damage to such facility that may result from reasonable efforts of removal. In addition to the procedures for recovering costs of nuisance abatement, the town may collect such costs from the performance bond posted and to the extent such costs exceed the amount of the performance bond, collect those excess costs in accordance with the Ross Municipal Code. Unless otherwise provided herein, the town has no obligation to store such facility. Neither the permittee nor the owner nor operator shall have any claim if the town destroys any such facility not timely removed by the permittee, owner, or operator after notice, or removed by the town due to exigent circumstances. (Ord. 692 (part), 2018).

18.55.230 Effect on Other Ordinances.

Compliance with the provisions of this chapter shall not relieve a person from complying with any other applicable provision of the Ross Municipal Code, including but not limited to obtaining any necessary encroachment or building permits. In the event of a conflict between any provision of this chapter and other provisions of the Ross Municipal Code, this chapter shall control. (Ord. 692 (part), 2018).

18.55.240 Effect of State or Federal Law.

In the event that state or federal law prohibits discretionary permitting requirements for certain wireless telecommunications facilities, the permits required by this chapter for those facilities shall be deemed to be ministerial permits. For those facilities, in lieu of a use permit, a ministerial permit shall be required prior to installation or modification of a wireless telecommunications facility and all provisions of this chapter shall be applicable to any such facility with the exception that the required permit shall be reviewed and administered as a ministerial permit by the planner rather than as a discretionary permit. Any conditions of approval set forth in this chapter or deemed necessary by the planner shall be imposed and administered as reasonable time, place and manner rules. (Ord. 692 (part), 2018).

V1uV2KuGuR0_QuiG_HtZS0YsYS4aPeVUDDykOurVBFwi75EMH4sN4N2p-B2yLv-KiK0gdX86jE8SQn5VS0bkLnSeDAXGqy6IY%3D)

USA City Ordinances To Limit And Control Wireless Facilities Small Cells In Rights Of Ways

(/#facebook) (/#twitter)
(https://www.addtoany.com/share#url=https%3A%2F%2Fehtrust.org%2Fusa-city-ordinances-to-limit-and-control-wireless-facilities-small-cells-in-rights-of-ways%2F&title=USA%20City%20Ordinances%20to%20Limit%20and%20Control%20Wireless%20Facilities%20Small%20Cells%20in%20Rights%20of%20Ways)

LOCAL GOVERNMENT POLICIES & ORDINANCES TO REGULATE AND CONTROL WIRELESS FACILITIES SMALL CELLS

From coast to coast local governments are taking action to protect their communities from the unfettered deployment of 4G and 5G "small cell" wireless facilities. Several cities are passing ordinances that strictly limit the buildout. Many policymakers ask "What are other cities doing?"

This page is a compilation of top examples of what cities are doing to protect their communities. For each city we provide a short synopsis along with a link to download the ordinance or policy. Scroll down to see the City and policy. Please download and share these examples with your community.

Local ordinances note various purposes such as preserving visual character, protecting environmental resources, and protecting residents against adverse health effects. They take a variety of approaches, such as prohibiting small cells in certain areas, creating application and recertification fees and imposing aesthetic and administrative requirements. Some combine several of these approaches.

CELL PHONE FINE PRINT WARNINGS
(https://ehtrust.org/key-issues/fine-print-warnings/)

CELL PHONE RADIATION FAQ'S
(https://ehtrust.org/take-action/educate-yourself/cell-phones-and-wireless-radiation-faqs/)

WIFI IN SCHOOLS
(https://ehtrust.org/key-issues/wifi-in-schools/)

CELL PHONES AND BREAST CANCER
(https://ehtrust.org/key-issues/cell-phones-and-breast-cancer/)

Importantly, federal pre-emption has been exaggerated. Local governments do have authority to impose procedural requirements for example. Please consider these two useful documents that came out of the efforts in Montgomery County Maryland by the law office of *Mark C. Del Bianco* and which clarify what localities can and cannot do in terms of procedural requirements for companies.

- 12/ 20/2018 "Summary of Proposed FCC Small Cell Order": (https://ehtrust.org/wp-content/uploads/Guide-to-FCC-Small-Cell-Order.pdf) A critical read on the FCC order.
- 10/2018 Memo: "Federal Law Does Not Prohibit the County from Imposing Stricter Procedural Requirements on Wireless Facilities Than on Other Pole Attachments" (https://ehtrust.org/wp-content/uploads/DelBianco_Conditional.Use_.Federal-Law-Does-Not-Prohibit-the-County-from-Imposing-Stricter-Procedural-Requirements-on-Wireless-Facilities-Than-on-Other-Pole-Attachments.pdf)

See more resources on 5G (https://ehtrust.org/resources-to-take-action-on-us-5g-streamlining-bills/) – including the research in health effects and impacts to people, trees and wildlife here (https://ehtrust.org/resources-to-take-action-on-us-5g-streamlining-bills/). Wireless radiation has harmful biological effects levels far below government limits.

Examples of areas addressed in these ordinances:

LOCATION

- Prohibiting small cell installations in residential areas, certain streets, etc
- Requiring installations to be a certain distance away from residences, schools, hospitals, and/or other installations
- Specifying that installations must be relocated if/when they would interfere with a public project

AESTHETICS / ENVIRONMENT

- Aesthetic, design, and noise requirements such as colocation, camouflage, height and light limits, etc.

ADMINISTRATIVE / LEGAL

- Requiring that residents who will be within a certain distance of an installation be notified
- Instating automatic time limits for permits
- Requiring annual recertification fees
- Requiring permittees to defend and indemnify the city from any liabilities arising from permits and the installation, operation and maintenance of small cell installations
- Reserving the right to hire independent consultants at the applicant's expense

OTHER

- Appointing a committee to study the viability of a fiber optic network

STATE ACTIONS

New Hampshire has a proposed bill which would establish a commission to study the environmental and health effects of 5G technology and Montana has a proposed Joint Resolution of the Senate and House of Representatives urging Congress to amend the 1996 TCA to account for health effects.

Louisiana ***Bill: Requests the Department of Environmental Quality in conjunction with the Louisiana Department of Health to study the effects of evolving 5G technology. (https://legiscan.com/LA/text/HR145/2019)***To urge and request the Department of Environmental Quality in conjunction with the Louisiana Department

of Health to study the environmental and health effects of evolving fifth generation cellular network technology (5G) and report its findings to the House Committee….WHEREAS, peer-reviewed studies on this topic show the potential for wide-range effects; and WHEREAS, 5G technology requires small cellular towers to be placed a short distance apart, closer than existing towers, at telephone pole height, and will operate in conjunction with the 3G and 4G technology infrastructure; andWHEREAS, the insurance industry may have placed exclusions in policies to exempt damage caused by this technology; and WHEREAS, certain manufacturers provide warnings to consumers regarding the reception of devices using this technology;…"

New Hampshire Bill 522: An act establishing a commission to study the environmental and health effects of evolving 5G technology (https://trackbill.com/bill/new-hampshire-house-bill-522-establishing-a-commission-to-study-the-environmental-and-health-effects-of-evolving-5g-technology/1630657/?fbclid=IwAR28psMtRFU7mBGMmA8SKxoS0AIkf8LzcQR7e7vO_MiifUzs0N4GfUNcLC4) which asks "Why have 1,000s of peer-reviewed studies, including the recently published U.S. Toxicology Program 16-year $30 million study, that are showing a wide-range of statistically significant DNA damage, brain and heart tumors, infertility, and so many other ailments, being ignored by the Federal Communication Commission (FCC)?" and "Why are the FCC-sanctioned guidelines for public exposure to wireless radiation based only on the thermal effect on the temperature of the skin and do not account for the non- thermal, non-ionizing, biological effects of wireless radiation?"

***Did not pass but was proposed*: Montana Joint Resolution 13**
(https://leg.mt.gov/bills/2019/billpdf/HJ0013.pdf?fbclid=IwAR1SPkpwFE99JZWKTMiVJfrw_IZ04LhvO6laVo7iQKZzGN67nfK7w9o88pE)" (https://leg.mt.gov/bills/2019/billpdf/HJ0013.pdfbclid=IwAR1SPkpwFE99JZWKTMiVJfrw_IZ04LhvO6laVo7iQKZzGN67nfK7w9o88pE)
A JOINT RESOLUTION OF THE SENATE AND THE HOUSE OF REPRESENTATIVES OF THE STATE OF MONTANA URGING CONGRESS TO AMEND THE FEDERAL TELECOMMUNICATIONS ACT TO ACCOUNT FOR HEALTH EFFECTS OF SITING SMALL CELL NETWORK EQUIPMENT IN RESIDENTIAL AREAS" (https://leg.mt.gov/bills/2019/billpdf/HJ0013.pdf?fbclid=IwAR1SPkpwFE99JZWKTMiVJfrw_IZ04LhvO6laVo7iQKZzGN67nfK7w9o88pE)

CITY RESOLUTIONS

US City Actions

10/22/2019 Carmel City Council (Indiana) Resolution: The Carmel City Council approved a resolution Monday asking state lawmakers, the Federal Communications Commission and Congress to limit 5G technology deployment in Indiana until the health effects are fully understood."

According to news accounts (https://www.ibj.com/articles/carmel-council-urges-lawmakers-fcc-to-limit-5g-technology-deployment-further-study-health-impacts)

- "Carmel's resolution urges the state Legislature, Congress and the FCC to "take a second look" at the evidence regarding health impacts and limit deployment in the meantime, Green said.
- "While the council supports the innovation and use of new technology that will provide a better quality of life to Indiana residents and guests, it is very concerned about rushing to implement 5G technology before its effects on humans are fully understood, and urges prudent care be taken to ensure that no one is harmed therefrom," it reads.
- The resolution as originally drafted called for the state Legislature to "immediately suspend the deployment and use of 5G technology until

scientific evidence conclusively establishes that this technology poses no health risks to humans." That language was softened to "limit" before being presented to the council.

Hallandale Beach Florida Passes 5G Small Cell Tower Resolution: Read press release here. (https://ehtrust.org/hallandale-beach-florida-passes-5g-small-cell-tower-resolution/) See the Hallandale Beach Florida Resolution here. (https://ehtrust.org/wp-content/uploads/Hallandale-Small-Cell-5G-Health-Study-Resolution.pdf)

Greendale, Wisconsin Resolution No. R2018-20 in November 2018 **(http://www.greendale.org/docs/Resolution%20R2018-20%20-%20Expanded%20Use%20of%20Highway%20ROW%20by%20Cell%20Providers%20AMENDED2.pdf)**

The Board of Trustees of the Village of Greendale (http://www.greendale.org/), County of Milwaukee, State of Wisconsin, passed Resolution No. R2018-20 in November 2018 in opposition to the FCC's September 26, 2018 Order because the Order s an unprecedented attack on local control of Greendale's largest asset, the public rights-of-way, for 5G technology; threatens the Village's responsibility to protect the health, safety and welfare of its residents; and threatens the Village of Greendale's designation as a National Historic Landmark.

The Village asked the FCC for changes that maintain a reasonable level of local control. The Resolution was sent to the FCC and State and Federal officials.**Resolution No. R2018-20 Greendale Wisconsin RESOLUTION RELATING TO EXPANDED USE OF PUBLIC RIGHT OF WAY BY WIRELESS PROVIDERS FOR 5G TECHNOLOGY AND OTHER WIRELESS SERVICES, AND ASKING FOR CHANGES THAT MAINTAIN A REASONABLE LEVEL OF LOCAL CONTROL (http://www.greendale.org/docs/Resolution%20R2018-20%20-%20Expanded%20Use%20of%20Highway%20ROW%20by%20Cell%20Providers%20AMENDED2.pdf)**

EXAMPLES OF POLICIES & ORDINANCES

Note: These were compiled from EHT research of various sources and a special thank you to Physicians for Safe Technology (https://mdsafetech.org/cell-tower-and-city-ordinances/)*, My Streets My Choice,* (http://mystreetmychoice.com/) *Scientists for Wired Technolo* (http://scientists4wiredtech.com/what-are-4g-5g/4g-5g-small-cells-what-you-need-to-know/)*gy* (http://scientists4wiredtech.com/what-are-4g-5g/4g-5g-small-cells-what-you-need-to-know/)*and Last Tree Laws* (https://www.lasttreelaws.com/ordinances.html)*for their extensive resources utilized on this page. Please be sure to go to these pages for more information. Please contact EHT to add your Cities information to this page.*

In addition, Americans For Responsible Technology has created a Sample Small Cell Ordinance (https://www.telecompowergrab.org/uploads/3/8/5/9/38599771/sample_5g_code_v1.1.pdf) that cities can use as a starting point which incorporates several- although not all- of these issues. Please download their model ordinance and utilize their extensive resources at this link. (https://www.telecompowergrab.org/tool-kit.html)

Ordinances

Los Altos California

- no small cell antennas in residential areas
- 500 foot setback for multi-family residences in commercial districts
- 500 ft separation from schools

- 1500 ft separation between nodes
- Los Altos Urgency Ordinance: (https://www.losaltosca.gov/sites/default/files/fileattachments/city_council/page/48421/2019-08-05_19-460_1.pdf)
- Los Altos Citing Guidelines: (https://www.losaltosca.gov/sites/default/files/fileattachments/city_council/page/48421/resolution_no._2019-35.pdf)

Marin County California *Draft as of June 21, 2019*

Marin drafts preferences for 5G rollout, (https://www.ptreyeslight.com/article/marin-drafts-preferences-5g-rollout?fbclid=IwAR3woG2LODTZWNb258vDDb1JtkweNWEFWGNjtRpHCSH5elHZtC3c6yMoVxg)
Point Reyes Light

- "Marin's draft rules select industrial, commercial or agricultural sites, or sites near public facilities, as preferred locations for the antennas; residential and mixed-use sites and areas within 1,500 feet of schools and daycare centers are the least-preferred locations.The draft favors placing antennas on existing street poles or traffic lights, versus new poles or small cell facilities. It limits antennas to one per pole and stipulates they must be at least 1,000 feet apart. It also includes aesthetic requirements that aim to blend equipment, and prohibits equipment on historic buildings."

San Diego County, California
Draft ordinance (5-31-2019) for small cell antenna sites in San Diego County has the following requirement:
"SCWs shall not be located within **1,000 feet** of schools, child care centers, hospitals, or churches. Distance, without regard to intervening structures, shall be a straight line measured from the closest property lines."
San Diego County Ordinance (https://www.sandiegocounty.gov/content/sdc/pds/advance/smallcellwirelessfacilities.html)
Petaluma, California: Ordinance of the City Council of Petaluma

- Protect environmental resources; protect residents against adverse health effects
- Protect visual character; don't create visual blight
- Protect environmental resources; protect residents against adverse health effects
- Commercial or industrial zones
- Antennas must connect to an already existing utility pole that can support its weight.
- Servicing wires must be installed within the width of the existing utility.
- All ground-mounted equipment not to be installed inside the pole must be undergrounded, flush to the ground, within three (3) feet of the utility pole.
- Dedicated power source to be installed and metered separately.
- 1,500 feet minimum between each Small Cell facility.
- No Small Cell shall be within 500 feet of any residence.
- An encroachment permit must be obtained for any work in the right-of-way.

Petaluma, California: Ordinance of the City Council of Petaluma (https://www.codepublishing.com/CA/Petaluma/) PDF (https://ehtrust.org/wp-content/uploads/Petaluma-Chapter-14.44-TELECOMMUNICATIONS-FACILITY-AND-ANTENNA-CRITERIA.pdf)

Fairfax, California: Urgency Ordinance to Establish New Regulations for Wireless Telecommunications Facilities; Ad hoc committee to study viability of fiber network

Ordinance No.819 (https://storage.googleapis.com/proudcity/fairfaxca/uploads/2018/10/Ord-819-URGENCYsmall-cell.pdf)An Urgency Ordinance Enacting Title 20 ("Telecommunications") of the Fairfax Municipal Code to Establish New Regulations for Wireless Telecommunication Facilities [small cell devices a.k.a. 5G]
Redlined version https://storage.googleapis.com/proudcity/fairfaxca/uploads/2019/07/Item-17-Att-A-Ord-5G-REDLINE.pdf (https://storage.googleapis.com/proudcity/fairfaxca/uploads/2019/07/Item-17-Att-A-Ord-5G-REDLINE.pdf)
News: Marin Independent Journal Fairfax to study fiber-optic broadband amid protest against 5G (https://www.marinij.com/2018/10/04/fairfax-to-study-fiber-optic-broadband-amid-protest-against-5g/)

Warren Connecticut

This policy defines adequate coverage and adequate capacity. It details that it was designed "to locate towers and/or antennas in a manner which protects property values, as well as the general safety, health, welfare and quality of life of the citizens of Warren and all those who visit this community, minimize the total number and height of towers throughout Warren, and provide standards and requirements for the regulation, placement, design, appearance, construction, monitoring, modification and removal of telecommunications facilities and towers."

- "Coverage is considered to be "adequate" within that area surrounding a Base Station where the predicted or measured median field strength of the transmitted signal is such that the majority of the time, transceivers properly installed and operated will be able to communicate with the base station. In the case of cellular communications in a rural environment like Warren, this would be a signal strength of at least -90 dBm for at least 75% of the coverage area. It is acceptable for there to be holes within the area of Adequate Coverage where the signal is less than -90 dBm, as long as the signal regains its strength to greater than -90 dBm further away from the Base Station."
- "Capacity is considered to be "adequate" if the Grade of Service (GOS) is p.05 or better for median traffic levels offered during the typical busy hour, as assessed by direct measurement of the Personal Wireless Service Facility in question."

TOWN OF WARREN SECTION 29 – SPECIAL PERMIT FOR TELECOMMUNICATIONS: FACILITIES AND TOWERS December 11, 2012, (https://ehtrust.org/wp-content/uploads/Warren_Zoning_Telecom_Regs_-_December_11_2012-4.pdf)
Warren website link (https://www.warrenct.org/sites/warrenct/files/uploads/warren_zoning_telecom_regs_effective_jan_14_2013.pdf)

Burlington, Massachusetts: Town of Burlington Policy Applications for Small Cell Wireless Installations, October 22, 2018

- Small Cell Committee drafted policy with annual recertification fees. Verizon withdrew its application, concerned by the precedent it would set and questioning its legality.
- Verizon attorney Mr. Klasnick stated "My client respectfully requests to withdraw the petition rather than have a fee," he said.(BCATTV) (http://www.bcattv.org/bnews/top-stories/verizon-drops-small-cell-wireless-booster-application-in-face-of-fees/)

The Town of Burlington Policy / Application for Small Cell Wireless Installations approved by the Burlington Board of Selectmen on October 22, 2018 PDF. (http://cms2.revize.com/revize/burlingtonma/Small.Cell.Wireless.Equiptment.Policy.Approved.10.22.2018.BURLINGTON.MA.pdf)

According to BCATTV **Verizon Drops Small Cell Wireless Booster Application in Face of Fees:** (http://www.bcattv.org/bnews/top-stories/verizon-drops-small-cell-wireless-booster-application-in-face-of-fees/)

"This week Selectman Jim Tigges, the board's representative on the Small Cells Committee, said the group had come up with a new policy for small cell applications. The policy contains a number of provisions while filing an application, including setting installation fees, listing the town department that must receive a copy for review and setting up the timeline for approval.

The Verizon application, however, would not be subject to the policy because it was submitted before its adoption. However, Tigges and the committee did have a number of conditions for the project it recommended to the board. They included:

– No apparatus on double poles

– An agreement to annual recertification

– Equipment shall be located on top of the poles, colored similarly to the polse so as to blend in.

– Equipment shall not interfere with other equipment on the pole, nor obstruct or interfere with access to or operation of street lights or traffic controls devices on the pole.

– Poles must meet ADA standards."

-NEWS: **Verizon Drops Small Cell Wireless Booster Application in Face of Fees** (http://www.bcattv.org/bnews/top-stories/verizon-drops-small-cell-wireless-booster-application-in-face-of-fees/)**, October 23, 2018**

Palos Vardes, California

According to citizens of the City, after citizen uproar, Crown Castle began complying with municipal aesthetic requirements and moving proposed locations out of neighborhoods and away from homes. The ordinance has four key components, if these are met the site will almost certainly be approved:

- Minimal antenna size with screening
- All accessory equipment underground (everything except the antenna)
- Combining sites with existing vertical infrastructure (streetlights, traffic signals, etc.)
- Strict location restrictions, no sites on local, residential streets without an exception granted

  If they don't comply with these, then the applicant must demonstrate the site is required to fill a significant gap and there is no less intrusive alternative to receive an exception. This is not simply checking a box (i.e. the applicant just claiming these conditions exist) but has to be demonstrated to the City planning commission via engineering analysis.

Palos Vardes, California Ordinance Chapter 12.18 – WIRELESS TELECOMMUNICATIONS FACILITIES IN THE PUBLIC RIGHT-OF-WAY (https://library.municode.com/ca/rancho_palos_verdes/codes/code_of_ordinances?nodeId=TIT12STSIPUPL_CH12.18WITEFAPURI-W)

Palo Alto California

City Council voted unanimously to approve a Resolution and amended Wireless Ordinance that City Staff had proposed. Council *also* voted unanimously in favor of a motion to direct City Staff "to come back as soon as possible but [in] no more than [one year], with an updated Ordinance/Resolution that considers" (and e summarizing):

1. Disfavoring the placement of cell towers in, for example, residential zones and near schools;
2. Minimum setbacks for cell towers from homes and schools, and minimum distances between cell towers;
3. Creating a list of city-owned buildings that would be appropriate sites for macro cell towers (i.e., as an alternative to small cell node cell towers next to people's homes);

Council also voted to direct City Staff to return to Council with a recommendation for "best practices" with respect to inspecting antennas.

"Seeking to strike a balance between federal requirements and resident concerns, Palo Alto approved on Monday night new rules for reviewing the flurry of applications that the city has been receiving from telecommunication companies seeking to install antennas on local streetlights and utility poles.

By a 6-0 vote, with Councilman Greg Tanaka absent, the council adopted a set of "objective standards" for wireless communication facilities, including a menu of preferred design alternatives for radio equipment and antennas. And in a nod to the dozens of residents who have raised alarms about the proliferation of cellular facilities on their blocks, the council launched a new effort to further restrict where such technology can be installed and to explore "minimum distance" requirements for wireless equipment in relation to local schools and homes."

Palo Alto looks to distance cell antennas from homes, schools (https://www.paloaltoonline.com/news/2019/04/16/palo-alto-looks-to-distance-cell-antennas-from-homes-schools)

Monterey California

Monterey California has now included that it can deny outright an incomplete application "without prejudice". That stops the shotclock, and it allows an application to be resubmitted all over again along with paying the fees again.

to be updated soon.

Mill Valley, California: Urgency Ordinance No 18, September 6, 2018

- New or updated facilities prohibited in residential zones. Commercial only.
- Facilities installed on poles in public right of way must be 1,500 feet apart
- Design, noise standards
- Facilities in public right of way that would interfere with future projects / improvements must be relocated
- Promptly remove facilities when no longer needed; replace with smaller facilities as feasible
- Defend and indemnify the City

Mill Valley, California: Urgency Ordinance No 18, September 6, 2018 (http://cityofmillvalley.granicus.com/MetaViewer.php?view_id=2&clip_id=1290&meta_id=59943) PDF

News Stories

Tech Crunch" Bay Area Blocks 5G Deployment Over Cancer Concerns (https://techcrunch.com/2018/09/10/bay-area-city-blocks-5g-deployments-over-cancer-concerns/)

Marin Post Mill Valley Council Adopts Wireless Ordinance Protects Community (https://marinpost.org/blog/2018/9/9/mill-valley-council-adopts-wireless-telecommunications-facility-ordinance-protects-community)

San Anselmo, California Council Policy

- People within 300 feet of proposed antenna will be notified
- Town is entitled to employ independent consultant at applicant's expense to evaluate exceptions

San Anselmo, California PDF (https://www.townofsananselmo.org/DocumentCenter/View/23597/Wireless-Facility-Policy-for-new-and-expanded-facilities)

Ross Valley, California: Wireless Telecommunications Facilities

- Modeled after Mill Valley's
- Adopted regulations prohibit facilities in residential and downtown zoning district.
- Facilities proposed in the public right-of-way subject to separate design criteria.
- Limits height and width of facilities to a minimum necessary for property function.
- Maximum height of 24 feet above the height of the existing utility pole and 7 feet above a street light standard.
- Requires equipment to be placed underground.

Ross Valley, California: Wireless Telecommunications Facilities PDF (https://www.townofross.org/sites/default/files/fileattachments/administration/page/249/18.55_wireless_telecommunications_facilitie

News Stories

https://www.marinij.com/2018/10/27/ross-valley-officials-work-to-tighten-5g-antenna-rules/

Danville, California: Proposed Ordinance No. 2018-07: Wireless Communication Facilities

- Aesthetic requirements (design guidelines may be developed and amended from time to time to clarify aesthetic and public safety goals and standards)
- Utilities must be underground to extent feasible. "Meters, panels, disconnect switches and other associated improvements must be placed in inconspicuous locations to the extent possible".
- Permits valid for initial period of 10 years max
- "Where feasible, the location of wireless communication facilities shall be encouraged to be located on publicly owned or controlled property or right-of-way."
- Would allow small cells in residential districts:

–"All facilities shall be substantially screened from the view of surrounding properties and the public view or collocated with existing facilities or structures so as not to create substantial additional visual, noise, or thermal impacts. "

–Property owners within 300 ft of proposed site must be notified

Danville, California: Ordinance No. 2018-07 Wireless Communications Facilities PDF (https://www.danville.ca.gov/DocumentCenter/View/2292/Danville-Wireless-Communication-Facilities-Ordinance-PDF?bidId=)

Other Links

http://mystreetmychoice.com/danville.html
(http://mystreetmychoice.com/danville.html)

http://scientists4wiredtech.com/danville/municipal-wireless-code/
(http://scientists4wiredtech.com/danville/municipal-wireless-code/)

Little Silver New Jersey

- Carriers should provide notice to property owners within five hundred (500') feet of the proposed Telecommunications Facility.
- The applicant must demonstrate to the reasonable satisfaction of the Borough that no existing personal wireless Telecommunication Service Facility within a reasonable distance can accommodate needs.
- Indemnification clause: "Each license grantee shall indemnify and hold the Borough and its officers, employees, agents and representatives harmless from and against any and all damages, losses and expenses, including reasonable attorney's fees and costs of suit or defense, arising out of, resulting from or alleged to arise out of or result from the negligent, careless or wrongful acts, omissions, failures to act or misconduct of the grantee or its affiliates, officers, employees, agents, contractors or subcontractors in the construction, operation, maintenance, repair or removal of its Telecommunications Facilities, and in providing or offering Telecommunications Services over the facilities, whether such acts or omissions are authorized, allowed or prohibited by this Chapter or by a grant agreement made or entered into pursuant to this Chapter."
- "Little Silver New Jersey: AN ORDINANCE AMENDING AND SUPPLEMENTING CHAPTER 16A "LAND USE AND DEVELOPMENT ORDINANCE" OF THE REVISED GENERAL ORDINANCES OF THE BOROUGH OF LITTLE SILVER, COUNTY OF MONMOUTH, STATE OF NEW JERSEY AMENDING SECTION 16A-2 "DEFINITIONS" AND 16A-5 GENERAL PROVISION ADDING NEW SUBSECTION 5-28 "PLACEMENT OF TELECOMMUNICATIONS FACILITIES" (http://www.littlesilver.org/ls/Announcements/Telecommunications%20Ordinance.pdf?1548971889&fbclid=IwAR0NDX2oaUbreLseq9Z_HO1rmYV7a16s-kdtWdTxFdkTfbiIwNgEuiAamqc)

Walnut City, California

"Telecommunication towers and antennas shall not be located within 1,500 feet of any school (nursery, elementary, junior high, and high school), trail, park or outdoor recreation area, sporting venues, and residential zones."

Screenshot of Ordinance from Walnut Website, (https://ehtrust.org/wp-content/uploads/Walnut-CA-Telcom-Setbacks-1.png)

To see the code online go to https://qcode.us/codes/walnut/, (https://qcode.us/codes/walnut/)Click on "Title 6: Planning and Zoning" Click on "Chapter 6.88 ANTENNAS AND COMMUNICATION FACILITIES", Click on "6.88.060 Design standards, See Item "O.

(https://ehtrust.org/wp-content/uploads/Walnut-CA-Telcom-Setbacks-1.png)

Sebastopol, California: City Council Agenda Item Report and Urgency Ordinance (Recommended)

- Purpose: Institute a moratorium on applications for small cells in the public right-of-way until adoption of a permanent ordinance

Previous regulations on telecommunications facilities (according to the recommended urgency ordinance, these did not anticipate 5G and do not address installation of telecommunications facilities in the right-of-way):

- Purpose: Protect visual character, inhabitants, environmental resources

Cannot be located in any required yard setback area

- Facilities within 400 feet of residential areas, schools, churches, hospitals etc must comply with NIER standards
- Minor facilities must be 75 feet away from a "residential dwelling unit" except 1 single family residence on the property where it is located

Sebastopol, California: City Council Agenda Item Report and Urgency Ordinance Establishing a Moratorium on Small Cells in the Public Right of Way (https://www.ci.sebastopol.ca.us/getattachment/Meeting-Event/City-Council/2018/Special-City-Council-Meeting-October-30,-2018/Agenda-Item-Number-7-Urgency-Ordinance-small-cell-telecommunications-moratorium-(1).pdf.aspx)

Other Links

- http://scientists4wiredtech.com/sebastopol/sb-muni-code/ (http://scientists4wiredtech.com/sebastopol/sb-muni-code/)
- http://mystreetmychoice.com/sebastopol.html (http://mystreetmychoice.com/sebastopol.html)

Pittsfield, Massachusetts: Proposed Section: Wireless Communications Facilities

- Telecom company must prove prefered site/existing structure does not work
- Above ground aesthetic requirements
- Sound and light restrictions with emphasis on industry proving compliance

Pittsfield, Massachusetts: Proposed Section: Wireless Communications Facilities PDF (https://ehtrust.org/wp-content/uploads/pittsfield_-_proposed_section_7.855_of_zoning_ordinance_finaldraft_cdb.pdf)

Hempstead, New York: Wireless Communications Facilities

- Requires a special use permit for cell towers that encourages location of new wireless facilities so as to minimize their impact on historically sensitive areas around residences, schools, houses of worship, day-care centers. Seven consideration factors are listed in order from more to least preferred, with existing towers being most preferred and new towers in residential zones least preferred.
- Prohibits towers from exceeding a height that permits it to operate without artificial lighting
- Allows the town to hire consultants and do inspections
- Set a fee schedule of $500 per pole
- Requires a 4 foot warning sign on the pole
- Utilities at wireless installations should be underground when possible

Hempstead, New York: Wireless Communications Facilities Ordinance eCode Chapter 142 (https://ecode360.com/15967597)

Other Links

https://mdsafetech.org/cell-tower-and-city-ordinances/ (https://mdsafetech.org/cell-tower-and-city-ordinances/)

https://hempsteadny.gov/permits-and-applications/wireless-telecom-ordinance (https://hempsteadny.gov/permits-and-applications/wireless-telecom-ordinance)

Mason, Ohio: Zoning Ordinance – Wireless Communications Systems

- No small cells in residential areas or within 100 feet of property used for residential use
- Small cells must be 2000 feet apart (unless colocated)
- Small cells are between 20-30 ft high (may be able to exceed 30 ft if colocated)
- Every attempt shall be made to locate small cells on existing structures; if not available, within public right of way
- All related equipment should be underground or wholly contained so not visible
- Each facility shall consist of no more than 1 antenna/user and capable of providing communication for at least 2 users

Mason, Ohio Zoning Ordinance PDF (https://www.imaginemason.org/download/PDFs/building/MasonZoningCodev-05-15-2017.pdf)

Sonoma, California: Report and Urgency Ordinance

On Nov 5, 2018 Sonoma approved (https://www.sonomacity.org/urgency-ordinance-regarding-small-cell-towers-approved/)their 5G urgency ordinance.

"Based on the foregoing, the City Council finds and determines that the immediate preservation of the public health, safety and welfare requires that this Ordinance be enacted as an urgency ordinance pursuant to Government Code Section 36937(b), and take effect immediately upon adoption. Therefore, this Ordinance is necessary for the immediate preservation of the public peace, health, safety and welfare and its urgency is hereby declared."

The City also has a Small Cell Tower page (https://www.sonomacity.org/small-cell-towers/).

Sonoma California Ordinance on 5G (https://sonomacity.civicweb.net/document/17797) PDF

San Rafael, California: City Council Report

Dec. 5, 2018 front page news story: https://www.marinij.com/2018/12/04/san-rafael-officials-work-to-tighten-5g-antenna-rules/ (https://www.marinij.com/2018/12/04/san-rafael-officials-work-to-tighten-5g-antenna-rules/)
Dec. 18, 2018 front page story: https://www.marinij.com/2018/12/18/san-rafael-adopts-urgency-ordinance-to-keep-grip-on-5g-proliferation/ (https://www.marinij.com/2018/12/18/san-rafael-adopts-urgency-ordinance-to-keep-grip-on-5g-proliferation/)

- City Staff Report: URGENCY ORDINANCE AMENDING THE SAN RAFAEL MUNICIPAL CODE TITLE 14 (https://ehtrust.org/wp-content/uploads/6.c-Small-Wireless-Facilities.pdf)(ZONING) AND ACCOMPANYING POLICY RESOLUTION TO ESTABLISH PROVISIONS AND PROCEDURES FOR REGULATING THE PLACEMENT OF SMALL WIRELESS FACILITIES (https://ehtrust.org/wp-content/uploads/6.c-Small-Wireless-Facilities.pdf)
- San Rafael, California: December 2018 Documentation for City Action on 12/18/2018 (http://cityofsanrafael.granicus.com/MetaViewer.php?view_id=38&event_id=1149&meta_id=133663)

This document also reviews other Cities 5G small cell policies.

News stories

"I want the city and county government to clearly say no to the FCC," said resident Arthur Saftlas. "No 5G installations of any kind in Marin, until it can be proven safe for us and the environment." - San Rafael, Calif., Officials Work to Tighten 5G Regulation (http://www.govtech.com/policy/San-Rafael-Calif-Officials-Work-to-Tighten-5G-Regulation.html)

- San Rafael Residents Take Pre-emptive Strike Against 5G (https://www.marinij.com/2018/08/21/san-rafael-residents-take-pre-emptive-strike-against-5g-installations/)

Lancaster, Pennsylvania: Zoning Changes via Ordinance 9-2016

- City Council rushed through zoning changes to declare many streets off limits to new poles (said they could be much taller than existing ones)
- Public Utility Commission stripped Mobilitie and other distributed-antenna companies of utility status, meaning that they would not get any more "certificates of public convenience" in Pennsylvania.

Lancaster, Pennsylvania Ordinance No. 9-2016 (http://www.cityoflancasterpa.com/sites/default/files/documents/Ord0916%20-%20Wireless%20Tower%20regulation.pdf)PDF (https://ehtrust.org/wp-content/uploads/Lancaster-Ord0916-Wireless-Tower-regulation.pdf)

News Stories

- http://www.philly.com/philly/business/comcast/philly-and-suburbs-brace-for-attack-of-the-small-cells-20170601.html?arc404=true
- http://www.govtech.com/dc/articles/Philadelphia-Braces-For-Small-Cell-Future.html

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Holyoke, MA: Initial Request

- Draft policy $500 fee for city inspection of rooftop poles/roofs every 2 years
- Holyoke has submitted an order from councilor Bartley Roman to limit equipment and require $500 apiece per small cell–$500 may exceed FCC limits. At-large councilor Rebecca Lisi, on behalf of a Holyoke resident, recently submitted to the town lawyer a copy of the ordinance drafted by Pittsfield.

Information from https://www.lasttreelaws.com/ordinances.html (https://www.lasttreelaws.com/ordinances.html)

Booneville, Arkansas, September 2018

Proposed Ordinance would limit cell towers to 250 ft max; industrial zones

News Stories

Cell tower ordinance read for first time at council meeting (http://www.boonevilledemocrat.com/news/20180905/cell-tower-ordinance-read-for-first-time-at-council-meeting), Sept 5, 2018

OTHER ACTIONS

Monterey, California: Verizon's application denied

Commissioners overruled staff and voted 7-0 to deny telecom giant Verizon's small cell application

Small Cell Towers nixed in 7-hour Monterey Planning Commission (http://www.cedarstreettimes.com/18237-2/)

- http://mystreetmychoice.com/monterey.html (http://mystreetmychoice.com/monterey.html)

Los Angeles, California: Deal with Verizon; letter from Mayor to FCC

- "in exchange for amenities such as free Wi-Fi in Skid Row and at recreation centers, $400,000 of scholarship money, and launching an innovation center in the city, L.A. is charging Verizon just $175 per device per year for 10 years for up to 1,000 installations, plus the cost of electricity." (LA Times (http://www.latimes.com/business/technology/la-fi-tn-5g-fcc-rollout-20181006-story.html))
- "In a letter to the FCC, Mayor Eric Garcetti urged the commission to rewrite the ruling before its adoption, arguing that the decision would "insert confusion into the market, and sow mistrust between my technology team and the carriers with whom we have already reached agreements."" (LA Times (http://www.latimes.com/business/technology/la-fi-tn-5g-fcc-rollout-20181006-story.html))

News Stories

LA Times: 5G service rolls out — but not without controversy (http://www.latimes.com/business/technology/la-fi-tn-5g-fcc-rollout-20181006-story.html)

San Jose, California: Negotiated agreement

"officials made improved access to areas with low internet participation a precondition for reducing fees…agreement set tiered costs per network node installation, with lower fees for companies deploying more nodes. Along with this incentive, three companies pledged to contribute a total of $24 million over the next decade to a digital inclusion fund." (GovTech (http://www.govtech.com/network/The-Future-of-5G-The-Bitter-Battle-for-Local-Control.html))

News Stories

September 2018 The Future of 5G: The Bitter Battle for Local Control (http://www.govtech.com/network/The-Future-of-5G-The-Bitter-Battle-for-Local-Control.html)

Note: These were compiled from EHT research of various sources and a special thank you to Physicians for Safe Technology (https://mdsafetech.org/cell-tower-and-city-ordinances/)*, My Streets My Choice* (http://mystreetmychoice.com/)*and Last Tree Laws* (https://www.lasttreelaws.com/ordinances.html)*for their extensive resources. Please contact EHT to add your Cities information.*

Other Important Websites on 5G and Small Cells.

Whatis5g.info (https://whatis5g.info)

MyStreetMyChoice (http://mystreetmychoice.com/)

Win19.org on Small Cells and 5G (http://www.win19.org/cell-towers--small-cells.html)

Americans For Responsible Technology (https://www.americansforresponsibletech.org/)

Last Tree Laws (https://www.lasttreelaws.com/ordinances.html)

Physicians for Safe Technology 5G Resources (https://mdsafetech.org/5g-telecommunications-science/)

International 5G Appeal (http://www.5gappeal.eu/)

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6Jun2019... 2461-EBA

2019 SESSION

19-0261
05/01

HOUSE BILL *522*

AN ACT establishing a commission to study the environmental and health effects of evolving 5G technology.

SPONSORS: Rep. Abrami, Rock. 19; Sen. Sherman, Dist 24

COMMITTEE: Science, Technology and Energy

ANALYSIS

This bill establishes a commission to study the environmental and health effects of evolving 5G technology.

- -

Explanation: Matter added to current law appears in ***bold italics.***
Matter removed from current law appears [~~in brackets and struckthrough.~~]
Matter which is either (a) all new or (b) repealed and reenacted appears in regular type.

CHAPTER 260
HB 522 - FINAL VERSION

6Jun2019... 2461-EBA **19-0261**
05/01

STATE OF NEW HAMPSHIRE

In the Year of Our Lord Two Thousand Nineteen

AN ACT **establishing a commission to study the environmental and health effects of evolving 5G technology.**

Be it Enacted by the Senate and House of Representatives in General Court convened:

260:1 New Subdivision; Commission to Study the Environmental and Health Effects of Evolving 5G Technology. Amend RSA 12-K by inserting after section 11 the following new subdivision:

Commission to Study the Environmental and Health Effects of Evolving 5G Technology

12-K:12 Commission Established. There is established a commission to study the environmental and health effects of evolving 5G technology, which includes the use of earlier generation technologies. Fifth generation, or 5G, wireless technology is intended to greatly increase device capability and connectivity but also may pose significant risks to humans, animals, and the environment due to increased radiofrequency radiation exposure. The purpose of the study is to examine the advantages and risks associated with 5G technology, with a focus on its environmental impact and potential health effects, particularly on children, fetuses, the elderly, and those with existing health compromises.

12-K:13 Membership.

I. The members of the commission shall be as follows:

(a) Three members of the house of representatives, including one member from the house science, technology, and energy committee, and one member from the health, human services and elderly affairs committee, appointed by the speaker of the house of representatives.

(b) Two members of the senate, appointed by the president of the senate.

(c) A member of the public, appointed by the governor.

(d) The attorney general, or designee.

(e) Two members of the New Hampshire High Technology Council, appointed by the council.

(f) One member representing the Business and Industry Association, appointed by the association.

(g) One member of the New Hampshire Medical Society who specializes in environmental medicine and is familiar with electromagnetic radiation, appointed by the society.

(h) One member representing the university system of New Hampshire

knowledgeable in radiofrequency radiation, appointed by the chancellor.

(i) One member of the cell phone/wireless technology industry, appointed by the president of the senate.

(j) The commissioner of the department of health and human services, or designee.

(k) One public member with expertise in the biological effects of radiofrequency radiation, appointed by the speaker of the house of representatives.

II. Legislative members of the commission shall receive mileage at the legislative rate when attending to the duties of the commission.

III. The members of the commission shall elect a chairperson from among the members. The first meeting of the commission shall be called by the first-named house member. The first meeting of the commission shall be held within 45 days of the effective date of this section. Seven members of the commission shall constitute a quorum.

12-K:14 Duties and Reporting Requirement.

I. The commission shall:

(a) Examine the health and environmental impacts from radiofrequency (RF) radiation emitted from the waves in the 30-300 gigahertz (GHZ) range of the electromagnetic spectrum, which falls somewhere between microwaves and infrared waves, and which are required with the rollout of 5G technology.

(b) Assess the health and environmental impacts of 5G technology, which requires small cell towers to be placed at a distance of 250 meters from each other at telephone pole height from the ground and will operate in conjunction with the 3G and 4G technology infrastructure.

(c) Receive testimony from the scientific community including but not limited to physicists and electrical engineers, the medical community including but not limited to cellular experts and oncologists, the wireless technology industry including but not limited to cell phone businesses and businesses working on the development of autonomous vehicles which will rely on 5G technology, as well as other organizations and members of the public with an interest in 5G technology.

(d) Consider the following questions and the impact on New Hampshire citizens, municipalities, and state government of:

(1) Why the insurance industry recognizes wireless radiation as a leading risk and has placed exclusions in their policies not covering damages caused by the pathological properties of electromagnetic radiation?

(2) Why do cell phone manufacturers have in the legal section within the devise saying keep the phone at least 5mm from the body?

(3) Why have 1,000s of peer-reviewed studies, including the recently published U.S. Toxicology Program 16-year $30 million study, that are showing a wide-range of statistically significant DNA damage, brain and heart tumors, infertility, and so many other ailments, been ignored by the Federal Communication Commission (FCC)?

(4) Why are the FCC-sanctioned guidelines for public exposure to wireless radiation based only on the thermal effect on the temperature of the skin and do not account for the non-thermal, non-ionizing, biological effects of wireless radiation?

(5) Why are the FCC radiofrequency exposure limits set for the United States 100 times higher than countries like Russia, China, Italy, Switzerland, and most of Eastern Europe?

(6) Why did the World Health Organization (WHO) signify that wireless radiation is a Group B Possibly Carcinogenic to Humans category, a group that includes lead, thalidomide, and others, and why are some experts who sat on the WHO committee in 2011 now calling for it to be placed in the Group 1, which are known carcinogens, and why is such information being ignored by the FCC?

(7) Why have more than 220 of the worlds leading scientists signed an appeal to the WHO and the United Nations to protect public health from wireless radiation and nothing has been done?

(8) Why have the cumulative biological damaging effects of ever-growing numbers of pulse signals riding on the back of the electromagnetic sine waves not been explored, especially as the world embraces the Internet of Things, meaning all devices being connected by electromagnetic waves, and the exploration of the number of such pulse signals that will be created by implementation of 5G technology?

II. The commission shall prepare and publish an interim and final report of its findings and recommendations. The reports shall:

(a) Outline the advantages of, and risks associated with, 5G technology running in conjunction with the 3G and 4G technology infrastructure.

(b) Develop a strategy, if deemed necessary, to limit RF radiation exposure from 5G or lesser generation technology relying upon electromagnetic waves.

(c) Include a public policy statement on 5G wireless systems, which either declares the technology safe or outlines actions required to protect the health of its citizens and environment.

(d) Consider alternatives to 5G technology that will accelerate information flow speeds and volumes without the use of electromagnetic waves that emit high levels of radiation.

(e) Provide any recommendations for proposed legislation developed by the commission.

III. The commission shall submit the interim report required under paragraph II to the speaker of the house of representatives, the president of the senate, the house clerk, the senate clerk, the governor, and the state library on or before November 1, 2019, and shall submit the final report on or before November 1, 2020.

260:2 Repeal. RSA 12-K:12 - 12-K:14 and the subdivision heading preceeding RSA 12-K:12, relative to the commission to study the environmental and health effects of the evolving 5G technology, are repealed.

260:3 Effective Date.

I. Section 2 of this act shall take effect November 1, 2020.

II. The remainder of this act shall take effect upon its passage.

Approved: July 19, 2019
Effective Date:
I. Section 2 shall take effect November 1, 2020.
II. Remainder shall take effect July 19, 2019.

Kathy Noel

From: Annemarie Clisby
Sent: Tuesday, August 27, 2019 4:56 PM
To: Roy Sapau
Subject: FW: Urgent 5G cells: UN Staff reports Children ill from roll out in Vienna--a must read

From: Anjali Corinne S <anjalicore2011@gmail.com>
Sent: Tuesday, August 27, 2019 4:21 PM
To: Catherine Blakespear <cblakespear@encinitasca.gov>; Jody Hubbard <jhubbard@encinitasca.gov>; Council Members <council@encinitasca.gov>; Tony Kranz <tkranz@encinitasca.gov>; Joe Mosca <jmosca@encinitasca.gov>; Kellie Shay Hinze <khinze@encinitasca.gov>
Subject: Urgent 5G cells: UN Staff reports Children ill from roll out in Vienna--a must read

United Nations: Disclosure about 5G – and its considerable risk for humanity – is occurring within the United Nations. This is thanks to longtime UN staff member and whistle-blower Claire Edwards.

These are excerpts from Claire's interview that describe the symptoms people are having after the 5G cell rollout in Vienna this year. THIS IS VERY SAD AND SCARY. Please read this!

By Claire Edwards, UN staff member

I live in Vienna, Austria, where the 5G rollout is suddenly upon us. Within the last five weeks, pre-5G has been officially announced at Vienna airport and 5G at the Rathausplatz, the main square in Vienna. Along with birds and insects, children are the most vulnerable to 5G depredation because of their little bodies

Friends and acquaintances and their children in Vienna are **already reporting the classic symptoms of EMR poisoning**: nosebleeds, **headaches**, eye pains, chest pains, nausea, **fatigue**, vomiting, **tinnitus**, dizziness, flu-like symptoms, and cardiac pain. They also report a tight band around the head; pressure on the top of the head; short, stabbing pains around the body; and buzzing internal organs. Other biological effects such as tumours and dementia usually take longer to manifest, but in the case of 5G, which has never been tested for health or safety, who knows?

Seemingly overnight a forest of 5G infrastructure has sprouted in Austria. **In the space of three weeks one friend has gone from robust health to fleeing this country, where she has lived for 30 years.** Each person experiences EMR differently. **For her, it was extreme torture** so she and I spent her last two nights in Austria sleeping in the woods. Interestingly, as she drove across southern Germany, she suffered torture even worse than in Austria, while in northern Germany she had no symptoms at all and felt completely normal, which suggests that there has been as yet no 5G rollout there.

There are no legal limits on exposure to EMR. Conveniently for the telecommunications industry, there are only non-legally enforceable *guidelines* such as those produced by the grandly named **International Commission on Non-Ionising Radiation Protection**, which turns out to be like the Wizard of Oz, just a tiny

little NGO in Germany that appoints its own members, none of whom is a medical doctor or environmental expert.

Thank you for reading this.

From your Encinitas neighbor, Corinne Schreiner

Kathy Noel

From: Annemarie Clisby
Sent: Monday, September 9, 2019 8:52 AM
To: Roy Sapau
Subject: FW: Make the Encinitas Small Cell Antenna Ordinance Protective for Our Residential Areas Immediately

---

From: dave allen <fiddlinglefty@yahoo.com>
Sent: Sunday, September 8, 2019 8:14 PM
Cc: Catherine Blakespear <cblakespear@encinitasca.gov>; Jody Hubbard <jhubbard@encinitasca.gov>; Council Members <council@encinitasca.gov>; Tony Kranz <tkranz@encinitasca.gov>; Joe Mosca <jmosca@encinitasca.gov>; Kellie Shay Hinze <khinze@encinitasca.gov>
Subject: Make the Encinitas Small Cell Antenna Ordinance Protective for Our Residential Areas Immediately

Dave Allen
454 Requeza St. Apt. 303A
Encinitas CA 92024

August 27, 2019

City of Encinitas Council
Mayor Blakespear, Deputy Mayor Hubbard, and City Council Members Kellie Shay Hinze, Tony Kranz, and Joe Mosca

Re: Protective Small Cell Antenna Ordinance Needed Immediately

I am concerned about the timing of the urgency ordinance:

- scheduled for a City Council with three business days' notice;
- the last agenda item on an already full schedule;
- brought to the City Council many months after the FCC directive was issued and other local communities had implemented ordinances;
- the ordinance is not protective of sensitive and residential areas; and
- the ordinance provides a streamlined process for small cell antenna applications;

While I hope this is not true, I suspect that the urgency was a ploy to deflect and minimize the participation of citizens in Encinitas that are concerned about the environment in their community.

The urgency ordinance as it stands is not protective for sensitive areas and residential areas. There are no setbacks to sensitive areas which would be expected based on setbacks in the wireless ordinance for macro antennas. There is no protection of residential areas. And even though residential roads are one of the least preferred categories, the ordinance does not prevent Telecom

installation of small cell antennas in front of our homes, which is most of Encinitas. (Note: there are 32 small cell antennas already installed on light poles in Encinitas residential areas via a business agreement that the City made with Crown Castle a few years ago. I suspect that this was organized without community participation.)

We want the ordinance to be more protective immediately, applied to all applications in process, before there is a flood of small cell antenna applications/installations in our neighborhoods. We can't wait for a small cell antenna community meeting.

I ask that the Encinitas small cell antenna ordinance incorporate the best practices of protective small cell antennas ordinances of the California Cities of Mill Valley and Los Altos; Calabasas; Fairfield, Petaluma and San Ramon; and Hercules.

- Mill Valley and Los Altos ordinances, prepared by Gail Karish – telecommunications attorney for Best Best & Krieger LLP, prohibit small cell antennas in residential areas.
- The Calabasas ordinance does not allow small cell antennas in residential areas.
- The Fairfield, Petaluma and San Ramon ordinances require substantial setbacks to sensitive area and residential areas and structures.
- The Hercules ordinance is the best administration for control of the application and shot clock process, requires ANSI 222 class III poles for all small cell installations, and prohibits new antenna support structures in residential areas.

For me and many of my friends and colleagues, there is a perception of harm associated with microwave antennas. We know this in our guts and this is validated by frequent news and science reports that show great biological harm from microwave radiation exposure. We are afraid for our property values.

Thank you for amending the Encinitas small cell antenna ordinance immediately for our collective safety.

Sincerely,

Dave Allen

\

Kathy Noel

From: Annemarie Clisby
Sent: Monday, September 23, 2019 10:58 AM
To: Roy Sapau
Subject: FW: Cell towers

-----Original Message-----
From: Dnotrica1 <dnotrica1@cox.net>
Sent: Monday, September 23, 2019 9:09 AM
To: Council Members <council@encinitasca.gov>
Subject: Cell towers

I would love to have more cell towers in Encinitas. If 5G is as good as the hype, these will be better than cable lines. My cell service how isn't great.

Please do your best to make them inconspicuous.

David M Notrica
322 La Veta Ave
Encinitas, CA 92024

Sent from my iPhone

Kathy Noel

From: Annemarie Clisby
Sent: Monday, September 23, 2019 12:55 PM
To: Roy Sapau
Subject: FW: No to 5G

-----Original Message-----
From: Debi Mohan <debimohan429@gmail.com>
Sent: Monday, September 23, 2019 11:39 AM
To: Council Members <council@encinitasca.gov>
Subject: No to 5G

Dear councilmembers,

I do not agree with the installation of 5G cell towers in the city of Encinitas, either in business or residential areas.

Thank you,
Debi Mohan

Sent from my iPhone

Kathy Noel

From: Annemarie Clisby
Sent: Thursday, August 22, 2019 11:32 AM
To: Roy Sapau
Subject: FW: G5 installation

From: Dede Sumner <lilyonjames@yahoo.com>
Sent: Thursday, August 22, 2019 10:01 AM
To: Council Members <council@encinitasca.gov>
Subject: Re: G5 installation

Hello-
I found out about the city council meeting re: this subject too late to attend. I would like to register my opinion that not enough research has been done on this technology to start installing it in neighborhoods. The affects on humans, pets, animals, birds, and insects has not been sufficiently vetted. Without a doubt it will also affect property values. The radio waves are set at levels that are not favorable to life. The companies involved are going for the money grab while they can. Please don't let Encinitas be an area that is sucked in by this new under-researched technology. Not until we are all assured of its safety. I was told by an ATT employee that towers that had been put up around emergency agencies (ie. fire depts, police depts, etc.) were removed because the levels were too high for humans. In addition to the levels already being too high there is a feature that when one tower goes down those around it can be boosted to bypass the disabled tower. This system also has the ability to be hacked. Please take care before to decide the fates of EVERYTHING in our lovely town. Thank you, Dede Sumner

Kathy Noel

From: Browning, Diane C [GA] <Diane.C.Browning@sprint.com>
Sent: Tuesday, August 20, 2019 10:59 AM
To: Roy Sapau
Cc: Hamilton, Mary [CTO]
Subject: Small Wireless Facilities Ordinance - comments
Attachments: Ltr to Encinitas 8.20.19.pdf

Mr. Sapa'u – please see Sprint's comments attached. Should you have any questions, please contact the undersigned.

Diane C. Browning | Counsel, State Regulatory Affairs | Sprint Corporation
6450 Sprint Parkway, Mailstop KSOPHN0314-3B161 | Overland Park, KS 66251
(913) 315-9284 (office) | (913) 523-0571 (fax) | diane.c.browning@sprint.com

Diane Browning
Counsel, State Regulatory

6450 Sprint Parkway
Overland Park, KS 66251
O: 913-315-9284
diane.c.browning@sprint.com

August 20, 2019

City of Encinitas
Dept. of Development Services
ATTN: Roy Sapa'u, City Planner
Via Electronic Mail: rsapau@encinitasca.gov

RE: Proposed Small Wireless Facilities Ordinance and Resolutions

Dear Mr. Sapa'u:

Sprint appreciates the opportunity to address and comment on proposed Ordinance No. 2019-12, Resolution No. 2019-66, and Resolution No. 2019-67, and the impact on Sprint's development and implementation of wireless infrastructure necessary to support Sprint's 5G deployment in the City of Encinitas ("City").

Sprint shares the City's goal to bring the benefits of 5G technology to the citizens of Encinitas. In order to accomplish this goal, it will be necessary to remove unnecessary barriers and cumbersome, outdated administrative processes that create obstacles for wireless carriers. Among these barriers are things like unreasonably high fees for permit applications, pole attachments, and use of the right-of-way; unnecessary delays in processing permit applications; and unduly burdensome design and equipment standards that interfere with a carrier's ability to optimize their technology.

The Federal Communications Commission ("FCC") has recognized the importance of streamlining processes and procedures for the deployment of small wireless facilities (or "small cells") in its Declaratory Ruling and Third Report and Order dated September 27, 2018 ("Order"). Among other things, the Order adopts rules and procedures consistent with eliminating or minimizing the barriers described above, including "shot clocks" for the processing of permit applications and reasonable caps on administrative and right-of-way fees. Sprint strongly encourages cities and municipalities to ensure their ordinances are consistent with the FCC Order, in order to minimize delays and disruptions in deployment caused by unnecessary legal challenges.

In addition, cities should take action to adopt policies, guidelines, and procedures designed to streamline administrative processes and eliminate obstacles to facilitate the deployment of small cells and other wireless infrastructure necessary to support the implementation of 5G technology.

Sprint stands ready to work collaboratively with the City to develop and implement mutually agreeable processes and procedures that (i) are consistent with the FCC Order, (ii) eliminate or minimize unnecessary obstacles to 5G deployment, and (iii) acknowledge the proper exercise of the City's authority and oversight.

Again, we appreciate the opportunity to provide comments and look forward to working with the City.

Sincerely,

Diane Browning

cc: Mary Hamilton

Kathy Noel

From: Annemarie Clisby
Sent: Wednesday, August 28, 2019 1:20 PM
To: Roy Sapau
Subject: FW: Protective Small Cell Antenna Ordinance Needed Immediately

From: Diane Mandle <soundenergyhealing@gmail.com>
Sent: Wednesday, August 28, 2019 11:50 AM
To: Catherine Blakespear <cblakespear@encinitasca.gov>; Jody Hubbard <jhubbard@encinitasca.gov>; Council Members <council@encinitasca.gov>; Tony Kranz <tkranz@encinitasca.gov>; Joe Mosca <jmosca@encinitasca.gov>; Kellie Shay Hinze <khinze@encinitasca.gov>
Subject: Protective Small Cell Antenna Ordinance Needed Immediately

Diane Mandle
237 Cereus St
Encinitas, CA 92024

August 28, 2019

Dear City Council Members,
I am concerned about the timing of the urgency ordinance:

- scheduled for a City Council with three business days' notice;
- the last agenda item on an already full schedule;
- brought to the City Council many months after the FCC directive was issued and other local communities had implemented ordinances;
- the ordinance is not protective of sensitive and residential areas; and
- the ordinance provides a streamlined process for small cell antenna applications;

While I hope this is not true, I suspect that the urgency was a ploy to deflect and minimize the participation of citizens in Encinitas that are concerned about the environment in their community.

The urgency ordinance as it stands is not protective for sensitive areas and residential areas. There are no setbacks to sensitive areas which would be expected based on setbacks in the wireless ordinance for macro antennas. There is no protection of residential areas. And even though residential roads are one of the least preferred categories, the ordinance does not prevent Telecom installation of small cell antennas in front of our homes, which is most of Encinitas. (Note: there are 32 small cell antennas already installed on light poles in Encinitas residential areas via a business agreement that the City made with Crown Castle a few years ago. I suspect that this was organized without community participation.)

We want the ordinance to be more protective immediately, applied to all applications in process, before there is a flood of small cell antenna applications/installations in our neighborhoods. We can't wait for a small cell antenna community meeting.

I ask that the Encinitas small cell antenna ordinance incorporate the best practices of protective small cell antennas ordinances of the California Cities of Mill Valley and Los Altos; Calabasas; Fairfield, Petaluma and San Ramon; and Hercules.

- Mill Valley and Los Altos ordinances, prepared by Gail Karish – telecommunications attorney for Best Best & Krieger LLP, prohibit small cell antennas in residential areas.
- The Calabasas ordinance does not allow small cell antennas in residential areas.
- The Fairfield, Petaluma and San Ramon ordinances require substantial setbacks to sensitive area and residential areas and structures.
- The Hercules ordinance is the best administration for control of the application and shot clock process, requires ANSI 222 class III poles for all small cell installations, and prohibits new antenna support structures in residential areas.

For me and many of my friends and colleagues, there is a perception of harm associated with microwave antennas. We know this in our guts and this is validated by frequent news and science reports that show great biological harm from microwave radiation exposure. We are afraid for our property values.

Thank you for amending the Encinitas small cell antenna ordinance immediately for our collective safety.

Sincerely,

Diáne Mandle

Kathy Noel

From: Kathy Hollywood
Sent: Tuesday, August 20, 2019 1:23 PM
To: Karen Brust; Roy Sapau; Brenda Wisneski
Cc: Claudia Bingham; Annemarie Clisby
Subject: FW: 5G Deployment Item 10C August 21, 2019 City Council Hearing
Attachments: Item 10 C-5G.pdf

Mayor and Council have been blind copied on this email.

Kathy Hollywood, City Clerk
City of Encinitas
760-633-2601

From: Dr. Dietmar E Rothe <dietmarr@earthlink.net>
Sent: Tuesday, August 20, 2019 1:17 PM
To: Kathy Hollywood <khollywood@encinitasca.gov>
Subject: 5G Deployment Item 10C August 21, 2019 City Council Hearing

Dear Kathy,

Please find the attached paper and distribute to all Council Members in their August 21 Council Meeting materials (Re Item 10C).

Thanks,
Dietmar

Dietmar E Rothe
dietmarr@earthlink.net

SERIOUS CONCERNS ABOUT SMALL CELL, CITYWIDE, 5G WIRELESS BROADBAND MICROWAVE GRID DEPLOYMENTS

Re:
Item #10C on Encinitas City Council Public Hearing Agenda of August 21, 2019

Federal Communications Commission's (FCC) Regulation of Small Cell Wireless Communication Facilities; and, Consideration and Possible **Adoption of an Urgency Ordinance and Resolution to Establish Local Regulatory Framework for the Same** RECOMMENDED ACTION:

Adopt Ordinance No. 2019-12 on an urgency basis entitled "**An Urgency Ordinance of the City of Encinitas, California, amending Encinitas Municipal Code Chapter 9.70 for the regulation of small wireless facilities and other infrastructure deployments in the public rights-of-way"** that authorizes the City Council to regulate small wireless facilities and other infrastructure deployments in the public rights-of-way by a City Council policy adopted by resolution;

Adopt Resolution No. 2019-66 implementing new City Council Policy for the regulation of small wireless facilities and other infrastructure deployments in the public rights-of-way;

Adopt Resolution No. 2019-67 adopting the Right-of-Way Administrative Design Review Permit and associated fee requirements for processing of small wireless facilities and other infrastructure deployments in the public rights-of-way.

Please file with CASE NUMBER: PLCY-003285-2019
City Council Ordinance No. 2019-12

Dietmar Rothe
Cardiff

On Wednesday, August 21, 2019, in a public hearing, the City Council (see *Item 10C*) proposes to amend our General Plan to *allow carriers to deploy 5G* (5 Gigahertz and above) broadband receiver, amplifier, and antenna facilities into our neighborhoods. Council is anxious to push this through with an *Urgency Ordinance*. Notice the military term: Deploy. It is important that this process must be deterred until the safety to human and animal health of this scheme can be proven.

5G antennas will expose residents to dangerous levels of microwave radiation. We skimmed over some pages in the 151-page Staff Report, the *short* version of the 1000 page document. The report states on 1: *This project aligns with the Strategic Plan goals for* ***Public Safety;*** *Create a safe and secure environment for citizens and businesses throughout the City Environment and protect and preserve our community.*

This surely must be a joke. Page 120, Section 10-16.123 states: *Signage Facilities shall contain a sign no larger than four (4) square feet and no smaller than two (2) square feet in order to provide adequate warning to persons in the immediate area of the presence of RF radiation...*

Test deployments of 5G systems, have already been made in some EU and UK cities, resulting in a storm of complaints from residents who felt sick mentally and bodily (confusion, tiredness, sleeplessness, headaches, muscle pain, migraine, heart palpitations, etc.)

Our City Staff Report seems to be concerned only about aesthetically hiding these 5G devices and antennas from view, and arguing about how big the RF warning signs on the utility poles can be, while pretending that they are concerned about your safety. Hogwash and deception as usual!

The City must think this is a done deal. About 3 weeks ago, a 5G amplifier and antenna were installed on the utility pole across the street from us by a government truck marked HP Communications Inc. – US DOT#1060169. The technicians told us this 5G antenna would serve only about 5 houses and it would be activated in 60 days. So, will there be others installed down the block, or next to Council member's and Mayor's homes?

The final, of many insults, from the power point presentation, p.143 reads: *FCC deems permissible . . . aesthetic requirements that are reasonable in that they are technically feasible and reasonably directed to avoiding or remedying the intangible public harm of unsightly or out-of-character deployments.* And in its customary method, the City placed this item as the last important discussion of the evening. No surprise here.

The staff report says we cannot go against FCC rules without risking being sued. We heard similar arguments, when it came to updating the City's Housing Element with the State. Why are our City representatives shaking in their boots about being sued by special interests groups, when it comes to doing what is best for the citizens? Why did they have no problem declaring Encinitas a Sanctuary City, in order to shelter, aid, and abet persons violating Federal law and the US Constitution?

In truth, the safety levels for exposures to the 5GHz – 30GHz microwaves to the human psyche and biological health have not been adequately tested in the field, particularly not for long term exposures. Note that radiation at these frequencies has a relatively short range of approximately 400 ft. So, many 5G antennas will be placed right next to your homes. Every street will have an amplifier and antenna next to human habitats in every block, spaced at a maximum distance between antennas of 800 feet.

It is also true that the maximum human exposure levels for microwave radiation are based strictly on thermal heating effects on the body and totally ignore their effects on the human central nervous system, which is extremely sensitive to electromagnetic radiation at certain frequencies. ANSI exposure limits are presently set at the following values:
About one milliwatt per square centimeter (1 mW/cm^2) for cell phone frequencies (0.85–1.9 GHz);
Circa 3 mW/cm^2 for microwave oven leakage and for WiFi (2.45 GHz);
Circa 10 mW/cm^2 for 5G frequencies.

We must recognize that all natural processes in the human body are regulated by minute electrical signals in the microvolt range. Thus, human health can be drastically affected by external electromagnetic radiation interference from microwaves at even very low intensities, 100 to 1000 times lower than the above ANSI exposure limits. This is particularly so for 5G radiation exposure, because these frequencies can easily penetrate the human skull and interfere with the human central nervous system. This opens the door for *mind control* by bombarding humans with microwave signals that have been modulated to match certain brain wave frequencies.

The military has known this since WWII and has developed psychic warfare weapons at 5G frequencies. Note also that at 30 GHz the frequencies are close to millimeter wave frequencies, which have been used as antipersonnel directed energy death rays. A good summary about microwave radiation dangers can be found at:
https://antioligarch.wordpress.com/2013/08/20/death-lies-and-mutations-proof-the-military-knew-all-along-about-microwave -radiation-dangers/

Here are some quotes taken from Government documents about laboratory results of the effects produced with low-level microwaves on living beings:
…In our experiments there was no question that you can get into the brain with microwaves.
…that very small amounts of electromagnetic radiation could appreciably alter functions of living cells.
…pathological effects close to those induced by highly toxic substances could be produced by electromagnetic radiation even at very low power.
…research seems to have confirmed that low [intensity]-*level* [microwave] *fields, modulated to be similar to normal brain waves, could seriously affect brain functions.*
…We need a program of psycho-surgery for political control of our society. The purpose is physical control of the mind. Everyone who deviates from a given norm can be surgically mutilated.

Enveloping the entire globe in a network of hundreds of millions of 5G microwave (and even higher frequency mm-wave) antenna cells has long been the wet pipedream of the hidden *Cabal* that controls our *Deep State* infiltrated governments, in collaboration with multibillionaire CEOs from Silicon Valley corporations, like Google, Facebook, Microsoft, Amazon, etc. Their ultimate goal is to reduce the human population on the planet to two billion and to dumb down the remaining people, so they can easily be enslaved by the Cabal.

The implementation of this 5G microwave grid is also driven by promoters of the *Internet of Things*, by corporations who want to profit by seeing everyone's home filled with *smart* TVs, *smart* vacuum cleaners, *smart* security systems, *smart* everything; a home in which all things, including humans, are electronically interconnected into a system that can be manipulated, controlled, and spied upon by secret government agencies. The proposed *small cell* (800 ft by 800 feet) microwave grid makes it possible for inhabitants in any small cell to be individually controlled (even eliminated) by microwave signals beamed down from satellites.

Must we be the guinea pigs for such nefarious endeavors?
This is not just a City issue but a Global one.
Individuals, City, County and State Governments must fervently oppose its deployment!

Dietmar E. Rothe, P.Eng, Ph.D. Aerospace Engineering Physics
Cardiff, Calif.
20 AUG 2019

Kathy Noel

From: Annemarie Clisby
Sent: Monday, September 23, 2019 8:31 AM
To: Roy Sapau
Subject: FW: 5G Deployment in Encinitas
Attachments: 5G Microwave Presentation.pdf; ATT00001.htm

From: Catherine Blakespear <cblakespear@encinitasca.gov>
Sent: Saturday, September 21, 2019 5:19 PM
To: Annemarie Clisby <Aclisby@encinitasca.gov>
Subject: Fwd: 5G Deployment in Encinitas

Catherine S. Blakespear
Encinitas Mayor

Begin forwarded message:

> **From:** "Dr. Dietmar E Rothe" <dietmarr@earthlink.net>
> **Date:** September 21, 2019 at 3:33:52 PM EDT
> **To:** <cblakespear@encinitasca.gov>
> **Subject: 5G Deployment in Encinitas**
> **Reply-To:** <dietmarr@earthlink.net>
>
> Mayor Blakespear,
>
> Please read my comments about 5G microwave/millimeter wave deployment in Residential Districts in the attached PDF file. It is in the form of a powerpoint presentation that I may use at the September 23 Workshop.
>
> I am totally opposed to any 5G antennas within 2000 feet of any home.
>
> Please make this document a contribution to the workshop and a permanent file FOR THE RECORD.
>
> Thank you,
>
> Dietmar E Rothe
> dietmarr@earthlink.net

For the record as a vote against wireless 5g deployment

Dietmar Rothe, Ph.D. (Retired Prof. Engineer and Physicist)

September 21, 2019

ENCINITAS LEGISLATORS: KEEP OUR RESIDENTIAL NEIGHBORHOODS SAFE.

KEEP HAZARDOUS 5G MICROWAVES AND MILLIMETER WAVES OUT OF CHILDREN'S AND PARENTS' BEDROOMS.

5G Wireless Small-cell Deployment is a serious Deep-State attack on:

- **OUR MENTAL AND PHYSICAL HEALTH**
- **OUR PERSONAL PRIVACY**
- **OUR PERSONAL FREEDOMS – specifically on OUR DIVINE RIGHTS TO FREE WILL AND ACTIONS**
- **OUR SECURITY**

It violates:

- **LOCAL CITY ORDINANCES**
- **THE US CONSTITUTION (CIVIL LIBERTIES)**
- **INTERNATIONAL LAW**

Would you allow a dictatorial agency to pump dense cigarette smoke into your home without your consent, every day and night? Surely, you would consider yourself a victim of a vicious crime.

INTERNATIONAL LAW

Nuremberg CODE No. 1:

THE VOLUNTARY CONSENT OF THE HUMAN SUBJECT IS ABSOLUTELY ESSENTIAL.

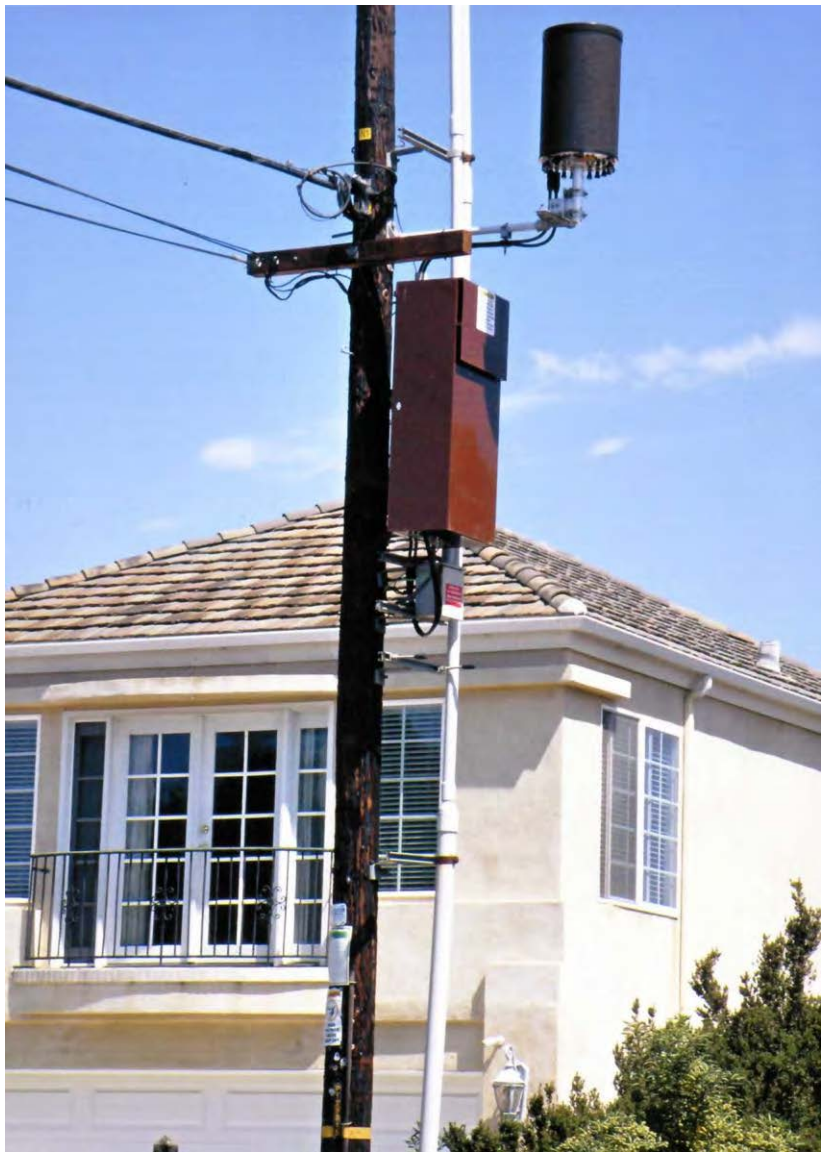
FLOODING RESIDENT'S HOMES WITH HARMFUL MICROWAVES AND MILLIMETER WAVES WITHOUT THEIR CONSENT IS AN EVIL VIOLATION OF EVERY CIVIL LIBERTIES ACT.

NATIONAL LAW

IT IS THE SWORN DUTY
OF OUR ELECTED OFFICIALS TO PROTECT
THE LIFE, LIBERTY, AND PURSUIT OF HAPPINESS
OF THE PEOPLE
(US Declaration of Independence -1776)

Ninth Amendment (US Constitution):

"THE ENUMERATION IN THE CONSTITUTION
OF CERTAIN RIGHTS SHALL NOT BE CONSTRUED
TO DENY OR DISPARAGE OTHERS
RETAINED BY THE PEOPLE."



left:
A 5G installation in Encinitas, installed in August 2019

CITY COUNCIL:
IS THIS HOW YOU PROTECT YOUR CITIZENS?

THE 5G ANTENNA IS ONLY 20 FEET FROM THE RESIDENCE'S BEDROOM WINDOW AND BALCONY

THIS IS AN ILLEGAL INSTALLATION ACCORDING TO ENCINITAS MUNICIPAL CODE

THERE ARE BETTER SOLUTIONS!

PREVAILING ENCINITAS MUNICIPAL CODE,
TITLE 9. PUBLIC SAFETY, PEACE, AND WELFARE
CHAPTER 9.70.020 STATES:

> ***"WIRELESS COMMUNICATION FACILITIES PROPOSED TO BE LOCATED IN ENCINITAS MAY BE CONSTRUCTED ONLY PURSUANT TO A PERMIT ISSUED BY THE CITY IN ACCORDANCE WITH THIS CHAPTER AND SHALL COMPLY WITH MUNICIPAL CODE TITLE 30 "ZONING" AND ALL OTHER APPLICABLE LAWS AND REGULATIONS."***

IN ALL RESIDENTIAL ZONES, THE ENCINITAS ZONING MATRIX
PROHIBITS MICROWAVE ANTENNA/TOWERS

ANY AGREEMENT THE CITY MAKES WITH TELECOM CORPORATIONS
MUST BE CONSISTENT WITH CITY CODES!

PROTECT AND RESERVE THE USE OF PUBLIC RIGHT-OF-WAYS FOR PUBLIC UTILITY SERVICES – NOT FOR PRIVATE CORPORATE PROFITS!

LET TELECOM CORPORATIONS LAY MORE EFFICIENT (AND 1000 TIMES WIDER BANDWIDTH) FIBER-OPTIC CABLES INTO INDIVIDUAL HOMES, AS THEY PROMISED US TWO DECADES AGO

ENCINITAS MUNICIPAL CODE
VOLUME II – LAND USE
TITLE 30 – ZONING
2019

"P"	Permitted by right
"C"	Conditional use permit required (major)
"Cm"	Conditional use permit required (minor)
"A"	Agriculture permit
"X"	Prohibited

USES	ZONES										
	RR; RR-1; RR-2	RS-11; R-3; R-5; R-8	R-11; R-15	R-20; R-25	MHP	OP	LC	GC	VSC	LI	BP
Accessory Building	P	P	P	P	P	X	P	P	P	P	P
Acupuncture	X	X	X	X	X	P	P	P	X	X	Cm
Medical/Dental Clinic	X	X	X	X	X	P	P	P	X	X	Cm
Microwave Antenna/Tower	X	X	X	X	X	P[22]	X	P[22]	X	P[22]	P[22]
Mobile Home Park	X	X	C	C	P	X	X	X	X	X	X
Mobile Home (Including Dwelling Unit)	P	P	P	P	P	X	X	X	X	X	X

WIRELESS HUMAN EXPOSURE LIMITS IN DIFFERENT COUNTRIES *

FOR 5G FREQUENCIES BETWEEN 300 MHz – 300GHz
INTENSITY UNITS (microwatt/cm^2)

USA	200 & 1000 **	Countries Recognize Thermal Damage only
CANADA	1000	
CHINA	10	Countries Recognize Electromagnetic Sensitivity of Humans and Animals
RUSSIA	10	
ITALY, FRANCE, POLAND, HUNGARY	10	
SWITZERLAND general	9.5	
SWITZERLAND schools & hospitals	4.25	
BELGIUM, BULGARIA, LUXEMBURG, UKRAINE	2.4	
LICHTENSTEIN	0.1	
AUSTRIA outdoor	0.001	
AUSTRIA indoor	0.0001	
CITY of BRUSSELS	5G prohibited	
AUSTRALIA	5G prohibited	

*Data taken from https://mdsafetech.org/conversion-and-exposure-limits-emr-emf

**FCC quotes an upper exposure limit of 5,000 microwatt/cm^2 for 6 minutes

NOTE THAT MANY COUNTRIES HAVE SET THEIR HUMAN EXPOSURE LIMITS TO MICROWAVES A HUNDRED TIMES LOWER THAN THE US AND CANADA – SOME COUNTRIES A THOUSAND TIMES AND A MILLION TIMES LOWER THAN WHAT THE FCC ALLOWS.

OTHER COUNTRIES RECOGNIZE THAT THE HUMAN BODY IS AN ELECTRICAL ORGANISM, REGULATED BY ELECTRIC SIGNALS IN THE MICROVOLT RANGE.

THEY RESPECT RESULTS OF THOUSANDS OF SCIENTIFIC STUDIES AROUND THE WORLD, CONFIRMING THAT EXPOSURE TO EVEN VERY MINUTE LEVELS OF MICROWAVES CAN, IN THE LONG RUN, HAVE DISASTROUS EFFECTS ON LIVING ORGANISMS.

THE SOLUTION

FOR MOBILE CELL PHONES, THE PRESENT 4G COVERAGE IN ENCINITAS HAS NO GAPS WHERE CELL PHONES DO NOT WORK. NO NEW CELL TOWERS ARE NEEDED.

KEEP 5G EMITTING CELL TOWERS 2000 FEET AWAY FROM RESIDENTIAL DISTRICTS. IT IS NOT TRUE THAT 5G RADIATION HAS A SHORT RANGE OF ONLY 500 FEET. EVEN VERIZON'S CEO ADMITTED THAT THEIR 5G TRANSMITTERS ARE BUILT FOR MORE THAN 2000 FEET RANGE.

5G DISHES FOR RECEIVING WEAK SIGNALS ONLY CAN BE POSITIONED WITHIN RESIDENTIAL AREAS. THOSE SIGNALS CAN THEN BE WIRED INTO EACH HOME THROUGH FIBER-OPTIC CABLES.

RESIDENTS WHO WANT WIFI THROUGHOUT THEIR HOME CAN BUY A ROUTER THAT WILL BROADCAST THE FIBER-OPTIC SIGNALS. THOSE WHO WANT THEIR HOME FREE OF MILLIMETER AND MICROWAVES WILL HAVE A CHOICE TO HARDWIRE ALL THEIR SMART DEVICES.

ADVANTAGES OF FIBEROPTICS OVER WIRELESS BROADCASTING METODS.

- **FIBER-OPTIC CABLES ARE CAPABLE OF OPERATING OVER A FREQUENCY BANDWIDTH THAT IS OVER A THOUSAND TIMES BROADER THAN THAT OF WIRELESS 5G FACILITIES. HENCE, FIBER-OPTICS CAN DELIVER DATA A THOUSAND TIMES FASTER.**

- **RESIDENTS WILL RETAIN A FREE CHOICE ON WHETHER TO POLLUTE THEIR HOMES WITH DANGEROUS RADIATION OR NOT.**

- **ENERGY TRANSMISSION EFFICIENCY FOR FIBER-OPTICS IS HUNDREDS OF TIMES HIGHER THAN FOR OMNIDIRECTIONAL BROADCASTING.**

- **FIBER-OPTIC NETWORKS DO NOT POLLUTE THE ENVIRONMENT.**

PHYSICIANS FOR SAFE TECHNOLOGY

Conversion Chart, World Exposure Limits, Exposures EMR/EMF

Updated 2/23/19

www.MDSafeTech.org

Conversion Chart Microwave Electromagnetic Radiation (EMR) = (EMF)

Exposure to radiofrequency (RF) radiation is classified as a Group 2B Possible Human Carcinogen by the International Agency for Research on Cancer at the WHO as of **2011**. Many scientists who work in the field of EMR feel there is clear evidence of harm from long term, low level exposure to this pulsating and penetrating non-ionizing radiation which warrants an IARC upgrade to a Group 1 Known Carcinogen. **Hardell and Carlsberg (2018).** Reading the scientific literature can be confusing as there are different units of measurements (μW/cm^2 μW/m^2 W/m^2). In addition, harm from radio frequency exposure varies with power, distance, device, modulation (pulsations and wave design) and length of exposure. Wall et al demonstrated that with a weak reception phone signal radiation is magnitudes higher. The peak power and pulsation, rather than the averaged power, are the important aspects of cellular injury.

It is important to keep in mind not only that the current **thermal (heat)** RF exposure standards vary in different countries, but also the **biologically toxic (oxidative/membrane)** RF exposure levels shown to produce harm at non-thermal levels which are far below current U.S. RF guidelines. More lenient current U.S. FCC standards put large populations at risk for a diverse array of long term health issues. We list several exposure standards and limits along with the short conversion chart to enable easier reading of the scientific literature. The Austrian Medical Association **Guidelines of 2016** are also posted below. **Scientific references on exposure measurements** are listed at the end (Ambient, Children, Skin and Body Exposures, Occupational)

Industry Standardization Worldwide?

Industry is trying to standardize all countries to allow higher levels of RF that are consistent with current IEEE & ICNIRP guidelines (Same as US and Canada) which do not take into account non thermal biological effects, only heat. Here is a slide presentation that helps to understand industry strategy. If this moves forward countries who wish to use lower precautionary limits will be unable to do so. **TIA-MWF PowerPoint for FCC Labs and OET Meeting**

To Print : Conversion Chart Microwave Electromagnetic Radiation PDF

See Also: Safe Living Technology EMF/RF/Magnetic Field full conversion charts here

Scroll down for : **Worldwide Exposure Limits *Current Heat-Based Guidelines and *Scientific References on Measured Human and Children's Exposures*

Levels of Concern and Exposure Limits

Key to Chart: * ** *** and Current Limits in U.S.

*** Low Concern– Building Biologists benchmark for long term exposure**

** **BioInitiative Limits- No observable effect on humans**

***** Extreme Concern- Building Biologists benchmark for long term exposure Building Biologist EMR Exposure Guidelines are here**

Current Limits in U.S. are in μW/m² = Red highlights and are 1000 μW/cm² =1mW/cm² =.001W/cm² = 10,000,000 μW/m² = 10,000 mW/m² = 10W/m² = 61.4 V/m= 64,100 mV/m

Conversion Chart EMR = EMF

Power equivalents— 1 μW/cm² = 10,000 μW/m² = 0.01 W/m²

Watts/Square Meter (W/m²)	microWatts/Square Meter (μW/m²)	microWatts/Square Centimeter (μW/cm²)
0.000,000,000,000,1 W/m²	0.000,000,1 μW/m²	0.000,000,000,01 μW/cm²
0.000,000,000,001 W/m²	0.000,001 μW/m²	0.000,000,000,1 μW/cm²
0.000,000,000,01 W/m²	0.000,01 μW/m²	0.000,000,001 μW/cm²
0.000,000,000,1 W/m²	0.000,1 μW/m²	0.000,000,01 μW/cm²
0.000,000,001 W/m²	0.001 μW/m²	0.000,000,1 μW/cm²
0.000,000,01 W/m²	0.01 μW/m²	0.000,001 μW/cm²
0.000,000,1 W/m² *	0.1 μW/m² *	0.000,01 μW/cm² *
0.000,001 W/m² **	1 μW/m² **	0.000,1 μW/cm² **
0.000,01 W/m²	10 μW/m²	0.001 μW/cm²
0.000,1 W/m²	100 μW/m²	0.01 μW/cm²
0.001 W/m² ***	1,000 μW/m² ***	0.1 μW/cm² ***
0.01 W/m²	10,000 μW/m²	1 μW/cm²

0.1 W/m²	100,000 μW/m²	10 μW/cm²
1 W/m²	1,000,000 μW/m²	100 μW/cm²
10 W/m²	10,000,000 μW/m²	1,000 μW/cm²
100 W/m²	100,000,000 μW/m²	10,000 μW/cm²
1000 W/m²	1,000,000,000 μW/m²	100,000 μW/cm²

Conversion chart Volts per meter (V/m) to μW/cm2

Using Acoustameter RF-10- Peak RF-EMR Emissions are in Volts/meter (V/m) which translates to power density in (μW/m²). Note Peak levels more important than average levels.

Volts per Meter (V/m) to **milli Volts per meter** (mV/m) to **microWatts per meter squared** (μW/m2) to **microWatts per centimeter squared** (μW/cm2)

- 0.000,194 V/m = 0.194 mV/m = 0.000,1 μW/m2. = 0.000,000,01 μW/cm2
- 0.000,614 V/m = 0.614 mV/m = 0.001 μW/m2. = 0.000,000,1 μW/cm2
- 0.001,94 V/m = 1.94 mV/m = 0.01 μW/m2 = 0.000,001 μW/cm2
- 0.006,14 V/m = 6.14 mV/m 0.1 μW/m2 = 0.000,01 μW/cm2 * Low concern
- 0.019,4 V/m = 19.4 mV/m = 1 μW/m2 = 0.000,1 μW/cm2 ** Bioinitiative NOE
- 0.061,4 V/m = 61.4 mV/m = 10 μW/m2 = 0.001 μW/cm2
- 0.194 V/m = 194 mV/m = 100 μW/m2 = 0.01 μW/cm2
- 0.614 V/m = 614 mV/m = 1000 μW/m2 = 0.1 μW/cm2 *** Extreme concern BB
- 1.94 V/m = 1,942 mV/m = 10,000 μW/m2 = 1 μW/cm2
- 6.14 V/m = 6,140 mV/m = 100,000 μW/m2 = 10 μW/cm2
- 19.4 V/m = 19,416 mV/m = 1,000,000 μW/m2 = 100 μW/cm2 – current U.S. guidelines
- 61.4 V/m = 61,400 mV/m = 10,000,000 μW/m2 = 1,000 μW/cm2- current guidelines
- 194 V/m = 194,164 mV/m = 100,000,000 μW/m2 = 10,000 μW/cm2
- 614 V/Mm= 614,003 mV/m = 1,000,000,000 μW/m2 = 100,000 μW/cm2
- 1942 V/m = 1,941,648 mV/m = 10,000,000,000 μW/m2 = 1,000,000 μW/cm2

Note: Current outdated FCC Guidelines

- 19.4 V/m = 19,416 mV/m = 1,000,000 µW/m2 = 100 µW/cm2
- 61.4 V/m = 61,400 mV/m = 10,000,000 µW/m2 = 1,000 µW/cm2

Note: Building Biologists Extreme Concern for Long Term Exposure

- 0.614 V/m = 614 mV/m = 1000 µW/m2 = 0.1 µW/cm2

Note: Bioinitiative Limit for no Observable Effects

- 0.019,4 V/m = 19.4 mV/m = 1 µW/m2 = 0.000,1 µW/cm2

Modern Homes Full of Microwave Radiation

This news video, from Safe Living Technologies, shows some of the sources of wireless radiation in the home. The measurements are done by a Building Biologist who acknowledges these levels are within the legal guidelines but not precautionary.
Modern Homes Full of Microwave Radiation

Wireless Exposure Limits in Different Countries

The limits are for frequencies between 300Mhz-300GHz in microwatts/cm2

Limit guidelines in U.S. are from 200 uW/cm² to 1000 uW/cm² (2 W/m² to 10 W/m2) for RF radiation depending on frequency. Countries developed different standards based on either *Thermal Effects *Non-Thermal Effects or *Precautionary Considerations

U.S. **200 microwatts/cm² to 1,000 microwatts/cm²**

Canada	**1,000 microwatts/cm²**
China	10 microwatts/cm²
Russia	10 microwatts/cm²
Italy	10 microwatts/cm²
France	10 microwatts/cm²
Poland	10 microwatts/cm²
Hungary	10 microwatts/cm²
Switzerland General	9.5 microwatts/cm²
Switzerland Schools and Hospitals	4.25 microwatts/cm²
Belgium	2.4 microwatts/cm²
Bulgaria	2.4 microwatts/cm²
Luxembourg	2.4 microwatts/cm²
Ukraine	2.4 microwatts/cm²
Lichtenstein	0.1 microwatts/cm²
Austria Outdoor	0.001 microwatts/cm²
Austria Indoor	0.0001 microwatts/cm²

Cosmic EMR background we evolved from **<0.00000000001 μW/cm²**

BioInitiative Report recommendation – 'No Observable Effect' with factor of 10 added for safety = 0.0003 μW/cm^2. http://www.bioinitiative.org/conclusions/

Austrian Medical Association (AMA) Exposure Limits

"In general, a wide variety of forms of EMF exposure (e.g. from cordless phones, wireless internet access, electrical installations and electrical devices in the building, mobile phone base stations, radio and TV transmitters, high-voltage lines or transformer stations) may be the root causes of health problems....Irrespective of the ICNIRP recommendations for acute effects, the following benchmarks apply to regular exposure of more than four hours per day..." AMA

The EUROPEAM EMF GUIDELINES 2016 for the prevention, diagnosis and treatment of EMF-related health problems and illnesses is based on the Austrian Medical Association Guidelines and gives an "overview of the current knowledge regarding EMF-related health risks and provides recommendations for the diagnosis, treatment and accessibility measures of EHS to improve and restore individual health outcomes as well as for the development of strategies for prevention." List of scientific references given. Here are their recommendations.

High-frequency electromagnetic radiation (as power flow density)

0.1 μW/cm^2 (≥1000 μW/m2) (≥1 mW/m2)—**Very far above normal**
0.001 μW/cm^2 to **0.1 μW/cm^2** (10-1000 μW/m2) (0.01-1 mW/m2)- **Far above normal**

0.000,1 μW/cm^2 to **0.001 μW/cm^2** (1-10 μW/m2) (0.001-0.01 mW/m2)- **Slightly above normal**

Less than 0.000,1 μW/cm^2 (≤1 μW/m2) (≤0.001 mW/m2) – **Within normal limits**

"The **benchmarks listed** are intended to be applied to individual types of radiation, e.g. GSM, UMTS, WiMAX, TETRA, radio, TV, DECT or WLAN, and **refer to peak levels [not averaged levels]**. The benchmarks do not apply to radar, which must be evaluated separately. Highly critical types of radiation, such as periodic signals (mobile telephony, DECT, WLAN, digital broadcasting…), should be critically evaluated, especially if levels are far above normal, while less critical types, such as non-pulsed or non-periodic signals (USW, shortwave, medium and long wave, analogue broadcasting), may be considered more leniently." AMA- Here are the EUROPEAM EMF Guidelines 2016 EHS – PDF to print or download.

Low-frequency Alternating Electric Fields

≥10 V/m Very far above normal

1.5-10 V/m -Far above normal

0.3-1.5 V/m- Slightly above normal

≤0.3 V/m – Within normal limits

*The benchmarks (potential-free measurement) are intended to be applied to the range up to and around 50 Hz; higher frequencies and distinct harmonics should be more critically evaluated.

What are the 2G, 3G, 4G and 5G frequencies?

1G – **Analog- Advanced Mobile Phone Service (AMPS)** was commercially introduced in the 1980's and operated with voice only at 800 MHz with a continuous wave signal.

2G – Global System for Mobile Communications (GSM) and Code Division Multiple Access (CDMA), are variants of 2G systems, introduced in 1990's providing text messaging, multimedia messaging and internet access. These are pulsed signals and used in the first digital cell phones. Frequencies are a combination of 850 and 1900 or 900 and 1800 MHz.

3G – Universal Mobile Telecommunications Service (UMTS)– Introduced in 1998 with broadband features providing data transfer, mobile internet and video calling. There are dozens of frequency bands available in the 800–900 MHz range and the 1700–2100 MHz range depending on the carrier.

4G – Long Term Evolution (LTE) –Was released in 2008 with higher frequency broadband supporting faster web access, gaming, video conferencing, and HD Mobile TV. These frequencies are in the 700 MHz, 1700/2100 MHz and the 2500–2690 MHz range.

5G- Device-to-Device Communication, Proposed for expansion of the Internet of Things (IoT). Uses wavelengths from 30 to 100 GHz and possibly up to 300 GHz.

- **5G**: 600 MHz = cm microwaves of 50cm ≈20 inches (“MHz” = Megahertz)
- 4G: 700 MHz = cm microwaves of ~43cm ≈ 17 inches (“cm” = centimeter)
- 3G/4G: 800 MHz = cm microwaves of 37.5cm ≈ 15 inches
- 3G/4G: 900 MHz = cm microwaves of ~33.3cm ≈ 13 inches
- 3G/4G: 1800 MHz = cm microwaves of ~16.7cm ≈6.6 inches
- 3G/4G: 2100 MHz = cm microwaves of ~14.3cm ≈ 5.6 inches
- Wi-Fi: 2450 MHz = cm microwaves of ~12cm ≈5 inches
- **5G**: 3100 MHz to 3550 MHz = ~9.7 to ~8.5cm ≈ 3.8 to 3.3 inches
- **5G**: 3550 MHz to 3700 MHz = ~8.5cm to ~8.1cm ≈3.3 to 3.2 inches
- **5G**: 3700 MHz to 4200 MHz = ~8.1cm to ~7cm ≈3.2 to 2.8 inches
- **5G**: 4200 to 4900 MHz = ~7cm to ~6cm ≈2.8 to 2.4 inches
- Wi-Fi: 5800 MHz = ~5cm microwaves of ~2 inches (“mm” = millimeter)
- **5G**: 24,250 to 24,450 MHz = mm microwaves of ~12mm **≈0.5 inch**
- **5G**: 25,050 to 25,250 MHz = mm microwaves of ~12mm **≈0.5 inch**
- **5G**: 25,250 to 27,500 MHz = mm microwaves of ~11mm **≈0.4 inch**

- **5G**: 27,500 to 29,500 MHz = mm microwaves of ~10mm **≈0.4 inch**
- **5G**: 31,800 to 33,400 MHz = mm microwaves of ~9mm **≈ 0.4 inch**
- **5G**: 37,000 to 40,000 MHz = mm microwaves of ~8mm **≈ 0.3 inch**
- **5G**: 42,000 to 42,500 MHz = mm microwaves of ~7mm **≈ 0.3 inch**
- **5G**: 64,000 to 71,000 MHz = mm microwaves of ~5mm **≈ 0.2 inch**
- **5G**: 71,000 to 76,000 MHz = mm microwaves of ~4mm **≈ 0.2 inch**
- **5G**: 81,000 to 86,000 MHz = mm microwaves of ~3.6mm **≈0.1 inch**

Exposure Limits Have Never Considered Long Term Exposure or Non-Thermal Bio-Effects

Here is a 1999 letter (posted on EHTrust.org), 1999-radiofrequency-interagency-workgroup, from US Health and Human Services Radiofrequency Interagency Working Group to the Industry IEEE. It states, "There is a need to discuss and differentiate the criteria for guidelines for acute and chronic exposure conditions. The past approach of basing the exposure limits on acute effects data with an extrapolation to unlimited chronic exposure durations is problematic. There is an extensive data base on acute effects with animal data, human data (e.g. MRI information), and modeling to address thermal insult and associated adverse effects for acute exposure (e.g., less than one day). For lower level ("non-thermal"), **chronic exposures, the effects of concern may be very different from those for acute exposure (e.g., epigenetic effects, tumor development, neurologic symptoms).** It is possible that the IEEE RF radiation guidelines development process may conclude that the data for these chronic effects exist but are inconsistent, and therefore not useable for guideline development. If the chronic exposure data are not helpful in determining a recommended exposure level, then a separate rationale for extrapolating the results of acute exposure data may be needed. In either case (chronic effects data that are useful or not useful), a clear rationale needs to be developed to support the exposure guideline for chronic as well as acute exposure."

Martin Pall, PhD. Discusses Development of ICNIRP Guidelines Based on Heat

5G: Great risk for EU, U.S. and International Health! Compelling Evidence for Eight Distinct Types of Great Harm Caused by Electromagnetic Field (EMF) Exposures and the Mechanism that Causes Them. (2018) Martin L. Pall, PhD. Discusses SCENIHR and ICNIRP (International Commission on Non Ionising Radiation Protection – ICNIRP, Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR) Guidelines for RFR and robust scientific literature on adverse health effects which are both considered and not considered in their deliberations. https://einarflydal.files.wordpress.com/2018/04/pall-to-eu-on-5g-harm-march-2018.pdf

Environmental Health Trust also has a list of Key Policy Issues related to Exposure Guidelines here.

Exposure Limits for Radio frequency Energy: Three Models

Ken Foster, University of Pennsylvania, Philadelphia

This **article** points out that different long term exposure limits in different countries are due to their different models of reasoning.

- **Heat:** The U.S. uses science based studies but only those that examine heat based adverse effects. They do not take into account studies on non-thermal adverse effects.
- **Non-Thermal Effects**: Russia and China use science based studies on non-thermal effects.
- **Precautionary:** Switzerland, Italy and many other countries use precautionary language for their long term exposure limits

"Thus, Russian (and Eastern European) limits clearly reflect the conviction that long-term (hours or more) exposures at levels far below Western limits result in adverse health effects. Indeed, the Russian and Eastern European medical literature contains many reports of health effects from low-level exposure to RF energy. These include, for example, nonspecific problems (such as headaches, fatigability, irritability, sleep disorders, and dizziness) in workers in radio factories, who are exposed to RF energy at undetermined levels11 12. The Chinese literature contains similar reports.13 **The Russian literature contains references to a "microwave disease" characterized by "asthenic, asthenovegetatic, and hypothalamic syndromes"14 The disease is not recognized in Western medicine, and its diagnostic criteria would undoubtedly strike many Western physicians as vague and nonfalsifiable. Even some Eastern European physicians have complained about the nonspecificity of these criteria as well.15 16"**

http://www.who.int/peh-emf/meetings/day2Varna_Foster.pdf

Russia Explains Protective Standards for EMR

Russian National Committee of Non-Ionizing Radiation Protection – 2008 report: This sobering report discusses the need for exposure guidelines that protect children and the general population from chronic levels of radio frequency radiation.

http://www.who.int/peh-emf/project/mapnatreps/RUSSIA%20report%202008.pdf

Russian National Committee on Non-Ionizing Radiation Protection and EMF RF standards. New conditions of EMF RF exposure and guarantee of the health to population. Prof. Yu. Grigoriev, Russian National Committee on Non-Ionizing

Radiation Protection Federal Medical Biophysical Centre, FMBA, Moscow, Russia. **https://www.radiationresearch.org/wp-content/uploads/2018/06/021235_grigoriev.pdf**

See Also

- **PST Cell Tower Exposure Levels. Cell Tower Exposures and Health Effects**
- **PST Cancer and Radiofrequency Radiation**. **Cancer and RF Radiation**
- **PST Electrosensitivity Science. Electrosensitivity Science**
- **Physicians for Safe Technology Home Page. https://mdsafetech.org**

Scientific References

Terrestrial Radiofrequency Levels: Natural versus Manmade

- **Natural and Human-activity Generated Electromagnetic Fields on Earth. (2012).** Alasdair Philips and Grahma Lamburn. http://bemri.org/publications/natural-electromagnetic-fields/427-natural-and-human-activity-generated-electromagnetic-fields-on-earth.html
- **Natural and Man-Made Terrestrial Electromagnetic Noise: An Outlook. (2007)** Cesidio Bianchi and Antonio Meloni. Annals of Geophysics. VOL. 50, N. 3, June 2007. https://www.earth-prints.org/bitstream/2122/3674/1/11bianchi.pdf
- **The Electromagnetic Spectrum: A Critical Natural Resource. (1985)** Christian A. Herter, Jr. Natural Resources Journal. Summer 1985. Symposium on Natural Resources Law. https://digitalrepository.unm.edu/cgi/viewcontent.cgi?referer=https://www.google.com/&httpsredir=1&article=2312&context=nrj

Insect and Animal Studies on Exposure Duration and

Power Limits

- **The effect of exposure duration on the biological activity of mobile telephony radiation. (2010)** Panagopoulos DJ1, Margaritis LH. Mutat Res. 2010 Jun 17;699 (1-2):17-22. https://www.ncbi.nlm.nih.gov/pubmed/20399887

Human Exposures Scientific References: Ambient, Children, Skin

Ambient Environmental RF Exposures of Cell Towers, Wi Fi and Cell Phones

- **Real-world cell phone radiofrequency electromagnetic field exposures. (2019)** Wall S et al. Environ Res. 2019 Apr;171:581-592. https://www.ncbi.nlm.nih.gov/pubmed/30448205
- **High ambient radiofrequency radiation in Stockholm city, Sweden. (2019)** Carlberg M et al. Oncology Letters. December 3, 2018. Pages: 1777-1783. https://www.spandidos-publications.com/ol/17/2/1777 *"The total mean level was 5,494 μW/m2 (median 3,346; range 36.6-205,155). The major contributions were down links from LTE 800 (4G), GSM + UMTS 900 (3G), GSM 1800 (2G), UMTS 2100 (3G) and LTE 2600 (4G). Regarding different places, the highest RF radiation was measured at the Hay Market with a mean level of 10,728 μW/m2 (median 8,578; range 335-68,815). This is a square used for shopping, and both retailers and visitors may spend considerable time at this place. Also, the Sergel Plaza had high radiation with a mean of 7,768 μW/m2. All measurements exceeded the target level of 30-60 μW/m2 based on non-thermal (no heating) effects, according to the BioInitiative Report."*

- **Radiofrequency electromagnetic field exposure in everyday microenvironments in Europe: A systematic literature review. (2018) Sagar S**

et al. J Expo Sci Environ Epidemiol. 2018 Mar;28(2):147-160. https://www.ncbi.nlm.nih.gov/pubmed/28766560

- **Spatial and temporal variability of personal environmental exposure to radio frequency electromagnetic fields in children in Europe. (2018) Birks LE.** Environ Int. 2018 Aug;117:204-214. https://www.ncbi.nlm.nih.gov/pubmed/29754001
- **Personal exposure to radio-frequency electromagnetic fields in Europe: Is there a generation gap? (2018)** Eeftens M et al. Environ Int. 2018 Dec;121(Pt 1):216-226. https://www.ncbi.nlm.nih.gov/pubmed/30216774
- **High radiofrequency radiation at Stockholm Old Town: An exposimeter study including the Royal Castle, Supreme Court, three major squares and the Swedish Parliament. (2017)** Hardell L et al. Mol Clin Oncol. 2017 Apr;6(4):462-476. https://www.ncbi.nlm.nih.gov/pubmed/28413651
- **Personal radiofrequency electromagnetic field exposure measurements in Swiss adolescents. Roser K et al.** Environ Int. 2017 Feb;99:303-314. https://www.ncbi.nlm.nih.gov/pubmed/28038972
- **Radiofrequency radiation at Stockholm Central Railway Station in Sweden and some medical aspects on public exposure to RF fields. (2016)** Hardell L et al. International Journal of Oncology. August 12, 2016. Pages: 1315-1324. https://www.spandidos-publications.com/10.3892/ijo.2016.3657
- **Use of portable exposimeters to monitor radiofrequency electromagnetic field exposure in the everyday environment. (2016) Sagar S et al.** Environ Res. 2016 Oct;150:289-298. https://www.ncbi.nlm.nih.gov/pubmed/27336233
- **A suggested limit for population exposure to radiofrequency radiation. (1983) Cahill. Health Physics. 1983 Jul;45(1):109-26.** http://www.ncbi.nlm.nih.gov/pubmed/6347972
- **[Technical possibilities of estimating the environmental exposure to electromagnetic fields for biomedical investigations based on cellular telephony systems]. (2010)** Bienkowski P et al. Med Pr. 2010;61(2):233-9. https://www.ncbi.nlm.nih.gov/pubmed/20509560

Children's Exposures to RF

- **Spatial and temporal variability of personal environmental exposure to radio frequency electromagnetic fields in children in Europe. (2018)** Birks LE. Environ Int. 2018 Aug;117:204-214. https://www.ncbi.nlm.nih.gov/pubmed/29754001
- **Personal exposure to radio-frequency electromagnetic fields in Europe: Is there a generation gap? (2018)** Eeftens M et al. Environ Int. 2018 Dec;121(Pt 1):216-226. https://www.ncbi.nlm.nih.gov/pubmed/30216774
- **Personal radiofrequency electromagnetic field exposure measurements in Swiss adolescents. (2017)** Roser K et al. Environ Int. 2017 Feb;99:303-314. https://www.ncbi.nlm.nih.gov/pubmed/28038972
- **Why children absorb more microwave radiation than adults: The consequences. (2014)** Morgan LL, Kesari S, Davis DL. J Microscopy Ultrastructure 2. 2014;2:197–204. https://www.sciencedirect.com/science/article/pii/S2213879X14000583
- **Exposure limits: the underestimation of absorbed cell phone radiation, especially in children. (2012)** Gandhi OP, Morgan LL, de Salles AA, Han Y-Y, Herberman RB, Davis DL. Electromagnetic Biology and Medicine. 2012;31(1):34–51. https://www.ncbi.nlm.nih.gov/pubmed/21999884
- **Potential health risks due to telecommunications radiofrequency radiation exposures in Lagos State Nigeria (2009)**. Aweda MA et al. Nig Q J Hosp Med. 2009 Jan-Mar;19(1):6-14. https://www.ncbi.nlm.nih.gov/pubmed/20830980
- **Cell phone radiation: Evidence from ELF and RF studies supporting more inclusive risk identification and assessment (2009).** *** Carl Blackman. Pathophysiology Journal. August 2009 Volume 16, Issues 2-3, Pages 205 –216. https://www.pathophysiologyjournal.com/article/S0928-4680(09)00004-2/fulltext
- **Health hazards of mobile phones: an Indian perspective (2008). J Assoc Physicians India.** 2008 Nov;56:893-7. https://www.ncbi.nlm.nih.gov/pubmed/19263689

Skin and Body Absorption

- **SAR investigations on the exposure compliance of wearable wireless devices using infrared thermography. (2018)** Karthik V and Rao TR. Bioelectromagnetics. . 2018 Sep;39(6):451-459. https://www.ncbi.nlm.nih.gov/pubmed/29869805
- **Personal radiofrequency electromagnetic field exposure measurements in Swiss adolescents. (2017)** Roser K et al. Environ Int. 2017 Feb;99:303-314. https://www.ncbi.nlm.nih.gov/pubmed/28038972
- **Thermal mapping on male genital and skin tissues of laptop thermal sources and electromagnetic interaction. (2017)** Safari M et al. Bioelectromagnetics. 2017 Aug 11. doi: 10.1002/bem.22068. https://www.ncbi.nlm.nih.gov/pubmed/28799651
- **Simulation of PsSAR associated with the use of laptop computers as a function of position in relation to the adult body. (2015)** Racing SM et al. BIO EM Asilomar conference. Annual meeting of Bioelectromagnetic Society 2015. https://ehtrust.org/wp-content/uploads/2016/02/BioEM2015-Poster-Laptop-psSAR.pdf

- **Why children absorb more microwave radiation than adults: The consequences. (2014)** Morgan LL, Kesari S, Davis DL. J Microscopy Ultrastructure 2. 2014;2:197–204. https://www.sciencedirect.com/science/article/pii/S2213879X14000583
- **Exposure limits: the underestimation of absorbed cell phone radiation, especially in children. (2012)** Gandhi OP, Morgan LL, de Salles AA, Han Y-Y, Herberman RB, Davis DL. Electromagnetic Biology and Medicine. 2012;31(1):34–51. https://www.ncbi.nlm.nih.gov/pubmed/21999884
- **MRI-induced heating of selected thin wire metallic implants– laboratory and computational studies– findings and new questions raised. (2006)** Bassen H et al. Minim Invasive There Allied Technol. 2006;15(2):76-84. https://www.ncbi.nlm.nih.gov/pubmed/16754190
- **Interaction of mobile phones with superficial passive metallic implants. (2005)** Virtanen H et al. Pays Med Biol. 2005 Jun 7;50(11):2689-700. https://www.ncbi.nlm.nih.gov/pubmed/15901963

Occupational Exposures

- **Effects of electromagnetic fields on serum lipids in workers of a power plant.** Wang Z1,2, Wang L1,2, Zheng S. et al. Environ Sci Pollut Res Int. 2016 Feb;23 (3):2495-504. https://www.ncbi.nlm.nih.gov/pubmed/26423285
- **Effects of electromagnetic fields exposure on plasma hormonal and inflammatory pathway biomarkers in male workers of a power plant.** Wang Z1,2, Fei Y3,4, Liu H. et al.Int Arch Occup Environ Health. 2016 Jan;89(1):33-42. https://www.ncbi.nlm.nih.gov/pubmed/25808749
- **Effect of occupational EMF exposure from radar at two different frequency bands on plasma melatonin and serotonin levels.(2015)** Singh S1, Mani KV, Kapoor N.Int J Radiat Biol. 2015 May;91(5):426-34. https://www.ncbi.nlm.nih.gov/pubmed/25565559
- **Assessment of cytogenetic damage and oxidative stress in personnel occupationally exposed to the pulsed microwave radiation of marine radar equipment.** Garaj-Vrhovac V et al. Int J Hyg Environ Health. 2011 Jan;214(1):59-65. https://www.ncbi.nlm.nih.gov/pubmed/20833106
- **Assessment of DNA sensitivity in peripheral blood leukocytes after occupational exposure to microwave radiation: the alkaline comet assay and chromatid breakage assay.** Garaj-Vrhovac V1, Orescanin V. Cell Biol Toxicol. 2009 Feb;25(1):33-43. https://www.ncbi.nlm.nih.gov/pubmed/18214694
- **The alkaline Comet assay as biomarker in assessment of DNA damage in medical personnel occupationally exposed to ionizing radiation.** Garaj-Vrhovac V1, Kopjar N. Mutagenesis. 2003 May;18(3):265-71. https://www.ncbi.nlm.nih.gov/pubmed/12714692
- **Effects of exposure to very high frequency radiofrequency radiation on six antenna engineers in two separate incidents.** Schilling CJ. Occup Med (Lond). 2000 Jan;50(1):49-56. https://www.ncbi.nlm.nih.gov/pubmed/10795393
- **Effects of acute exposure to ultrahigh radiofrequency radiation on three antenna engineers.** Schilling CJ. Occup Environ Med. 1997 Apr;54(4):281-4.

Kathy Noel

From: Annemarie Clisby
Sent: Tuesday, September 3, 2019 11:34 AM
To: Roy Sapau
Subject: FW: 5g deployment

From: dorothea zingg <dorotheazingg@gmail.com>
Sent: Monday, September 2, 2019 8:53 PM
To: Council Members <council@encinitasca.gov>
Cc: dorothea zingg <dorotheazingg@gmail.com>
Subject: 5g deployment

Thank you Everybody at the City Council for your open ears and open hearts to hear from your citizens.

On Wednesday, August 21, 19, you have heard from our Encinitas citizens what they have experienced with the smart meter installations etc. etc. The challenge with EMF's were on the agenda.

You have also heard from many others via e-mail about the 5G.

I just want to add that I have listened to several speakers at last week's 5G Summit about their experiences, findings and steps they are taking. These speakers came from all backgrounds from doctors, to lawyers from a senator of Michigan whose wife is a pediatrician and after installation of a smart meter, she suddenly got tinnitus. After the removal of the smart meter, her hearing went back to normal.

As you know, 5G is to be deployed all over the world--I wonder who decided that? Several European countries have opted out of this because apparently they had learned about the danger to mankind, to animals and plants--short-- to the planet.

Also in our United States are counties or cities who have declined this new and vailed technology.

From the 5G Summit I took away that this technology is a global agenda of profit control vs. Health of mankind and environment.
The micro wave has been used by the military as a weapon.

In short, the 5G technology will effect
Human and Environmental Health and will
harvest data from all mankind.

Also that 5G source did not reveal any test results on humans and environment. One of the speakers at the Summit also mentioned that the short microwaves would interfere with our
National Security.

A serious look into that technology is a must.
The rush and push into that 5G technology makes me suspicious.

The communication company will tell you that is will bring
faster and faster internet connections and that it would be helpful for the self driving cars in the future.

To me this all sounds dark and sinister and I pray we will have the strength and back up to push the 5G back.

I have lived through WW II in German and thereafter. At least we knew who was attacking. That was a visible monster. Now we have the hidden dragon which is more difficult to slay.

The internet speed right now is fine for most of us. We also have the fiber optic technology.

The public deserves an honest education about 5G and harm that comes from it.

Thanks you much for listening.

In gratitude and hope,

Dorothea Zingg

Kathy Noel

From: Annemarie Clisby
Sent: Wednesday, August 21, 2019 1:07 PM
To: Roy Sapau
Subject: FW: Encinitas Small Cell Antenna Urgency Ordinance

From: Dougaji <dougaji@gmail.com>
Sent: Wednesday, August 21, 2019 11:51 AM
To: Catherine Blakespear <cblakespear@encinitasca.gov>; Jody Hubbard <jhubbard@encinitasca.gov>; Council Members <council@encinitasca.gov>; Tony Kranz <tkranz@encinitasca.gov>; Joe Mosca <jmosca@encinitasca.gov>; Kellie Shay Hinze <khinze@encinitasca.gov>
Subject: Encinitas Small Cell Antenna Urgency Ordinance

Doug De Stefano
1253 N. Vulcan Ave # 6
Encinitas, CA 92024

August 21, 2019

City of Encinitas Council
Mayor Blakespear, Deputy Mayor Hubbard, and City Council Members Kellie Shay Hinze, Tony Kranz, and Joe Mosca

Re: Encinitas Small Cell Antenna Urgency Ordinance

I have a perception of harm from microwave antennas in close proximity to my home and to the businesses I frequent in Encinitas. I'm afraid for my physical well-being, for my family, and for my property value should an antenna be placed in front of my home. The FCC exposure limits protect us from adverse thermal effects such as shock, burns and being heated, but not from the harmful biological effects known by our scientists for more than 50 years. I implore you to protect me, us.

I perceive that small cell antenna in the right-of-way in front of a home means 20 percent devaluation in property value and sickness and untold suffering to one or more members of that household.

The city of Encinitas needs a small cell ordinance immediately so that there is oversight about placement of small cell antennas in our community and especially our sensitive and residential areas.

As written this urgency ordinance provides a convenient administrative process for the Telecom to put small cell antennas anywhere they want. I say this because there is an absence of administrative teeth that would empower the city of Encinitas to enforce the location preference (e.g. prevent small cell antenna installation in front of homes), control the application and shot clock process and installation quality.

My request for the City of Encinitas is that this ordinance be sent back to staff for major upgrade that would reflect the protective aspects of the Calabasas and Hercules ordinances that are part of this record. Please note that these ordinances have been certified by their city councils to meet all requirements of the FCC

directives, and therefore serve as appropriate baselines for our community. Let's not open the door to indiscriminate placement of small cell antennas in our residential areas and the cluttering of our visual space.

If the city deems it necessary to have an ordinance in place immediately, then please make approval conditional on adding the following protective features garnered from the Calabasas municipal code section 17.12.050(C) and Hercules Title 10 Chapter 16 ordinances as a condition of approval. These are a few of many important examples from these ordinances.

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Controlling the Shot Clock: Add these notes from Hercules, with edits applicable to Encinitas

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Add definitions: "least intrusive means", "significant gap", "stealth facility" and "reasonable and compelling evidence".

I believe that our ordinance can be more protective. I ask that as a condition of approval of the ordinance that the Council orders a community meeting ASAP for the purpose of bringing together the citizens of Encinitas with the staff to review every available option that would make the ordinance more protective. It would be appropriate to have other legal opinions as inputs to our ordinance; we don't want to be less conservative than we have to especially when the safety of our community is at stake. There are aspects of the Calabasas ordinance, the Hercules ordinance, and ordinances from other cities that are more protective and we should consider these in the Encinitas ordinance.

Thank you for being proactive for all of our safety.

Sincerely,

Doug De Stefano

Kathy Noel

From: Annemarie Clisby
Sent: Wednesday, August 21, 2019 3:10 PM
To: Roy Sapau
Subject: FW: Encinitas Small Cell Antenna Urgency Ordinance

From: Eileen Piersa <eileen@wisdomcircles.com>
Sent: Wednesday, August 21, 2019 2:57 PM
To: Catherine Blakespear <cblakespear@encinitasca.gov>; Jody Hubbard <jhubbard@encinitasca.gov>; Council Members <council@encinitasca.gov>; Tony Kranz <tkranz@encinitasca.gov>; Joe Mosca <jmosca@encinitasca.gov>; Kellie Shay Hinze <khinze@encinitasca.gov>
Subject: Encinitas Small Cell Antenna Urgency Ordinance

Dear City Council Members:

I am extremely concerned about 5G being rolled out into our communities and urge you to protect us from the dangers of this increase in wireless transmissions. There has not been any proper testing to determine the safety of 5 G on humans, animals or the environment.

There have been numerous studies about the safety and health hazards of 5G in Europe and the Netherlands is one country that has banned it.

Cities in Northern CA have banned 5 G.

I wonder why?

I have come to take this seriously as there seems to be mounting scientific evidence that it can impact the health of the most sensitive among us. I realize that there are political pressures to push something like this through, but I strongly believe that we should not be rats in a social experiment. Please use your legislative and representative powers to refuse to permit small cell antennas in residential areas.

I have been greatly distressed about the telecom companies' attempt to only address the “aesthetics” aspect of this issue. Please do not put our safety and health at risk because of following politics. Aesthetics is only an attempt to disguise a potential menace to our safety. I understand that in our own country fire stations won’t even allow 4G on their property because it impacts the health of the firemen and women. 5 G involves exponentially greater microwaves. These have been banned elsewhere. Please take a lead on protecting us, the residents.

Thank you for being proactive on this.

Respectfully,
Eileen Piersa

Eileen Piersa, **MS Org Dev, MA Spiritual Psychology**

760-505-6028

"Your vision will become clear only when you look into your heart. Who looks outside dreams. Who looks inside awakens." Carl Jung

Kathy Noel

From: Annemarie Clisby
Sent: Thursday, August 29, 2019 9:15 AM
To: Roy Sapau
Subject: FW: 5G implementation
Attachments: Encinitas 5G Letter_8.28.19.docx

-----Original Message-----
From: Eli Marmar <elim@freewaters.com>
Sent: Wednesday, August 28, 2019 11:19 PM
To: Catherine Blakespear <cblakespear@encinitasca.gov>; Jody Hubbard <jhubbard@encinitasca.gov>; Council Members <council@encinitasca.gov>; Tony Kranz <tkranz@encinitasca.gov>; Joe Mosca <jmosca@encinitasca.gov>; Kellie Shay Hinze <khinze@encinitasca.gov>
Subject: 5G implementation

Dear Council Members,

I am very concerned about 5G implementation here in Encinitas and urge you to give yourselves and our community the time to properly evaluate the safety in regards to proximity to our homes and families.

I grew up in Mill Valley, CA a town of highly educated, engaged and progressive minded people - much like Encinitas. Mill Valley has prohibited the use of small towers in residential areas.

I have attached a letter as well.

Thank you very much.
Eli Marmar
845 Nardo Rd
Encinitas CA 92024

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E L I M A R M A R
Co-founder / VP of Marketing
skype: elimarmar
831-334-2636
website | instagram
favorite style: Open Country

Eli Marmar
845 Nardo Rd
Encinitas CA

August 27, 2019

City of Encinitas Council
Mayor Blakespear, Deputy Mayor Hubbard, and City Council Members Kellie Shay Hinze, Tony Kranz, and Joe Mosca

Re: Protective Small Cell Antenna Ordinance Needed Immediately

I am concerned about the timing of the urgency ordinance:

- scheduled for a City Council with three business days' notice;
- the last agenda item on an already full schedule;
- brought to the City Council many months after the FCC directive was issued and other local communities had implemented ordinances;
- the ordinance is not protective of sensitive and residential areas; and
- the ordinance provides a streamlined process for small cell antenna applications;

While I hope this is not true, I suspect that the urgency was a ploy to deflect and minimize the participation of citizens in Encinitas that are concerned about the environment in their community.

The urgency ordinance as it stands is not protective for sensitive areas and residential areas. There are no setbacks to sensitive areas which would be expected based on setbacks in the wireless ordinance for macro antennas. There is no protection of residential areas. And even though residential roads are one of the least preferred categories, the ordinance does not prevent Telecom installation of small cell antennas in front of our homes, which is most of Encinitas. (Note: there are 32 small cell antennas already installed on light poles in Encinitas residential areas via a business agreement that the City made with Crown Castle a few years ago. I suspect that this was organized without community participation.)

We want the ordinance to be more protective immediately, applied to all applications in process, before there is a flood of small cell antenna applications/installations in our neighborhoods. We can't wait for a small cell antenna community meeting.

I ask that the Encinitas small cell antenna ordinance incorporate the best practices of protective small cell antennas ordinances of the California Cities of Mill Valley and Los Altos; Calabasas; Fairfield, Petaluma and San Ramon; and Hercules.

- Mill Valley and Los Altos ordinances, prepared by Gail Karish – telecommunications attorney for Best Best & Krieger LLP, prohibit small cell antennas in residential areas.
- The Calabasas ordinance does not allow small cell antennas in residential areas.
- The Fairfield, Petaluma and San Ramon ordinances require substantial setbacks to sensitive area and residential areas and structures.

- The Hercules ordinance is the best administration for control of the application and shot clock process, requires ANSI 222 class III poles for all small cell installations, and prohibits new antenna support structures in residential areas.

For me and many of my friends and colleagues, there is a perception of harm associated with microwave antennas. We know this in our guts and this is validated by frequent news and science reports that show great biological harm from microwave radiation exposure. We are afraid for our property values.

Thank you for amending the Encinitas small cell antenna ordinance immediately for our collective safety.

Sincerely,

Eli Marmar

Kathy Noel

From: Annemarie Clisby
Sent: Monday, September 23, 2019 9:43 AM
To: Roy Sapau
Subject: FW: No 5G!!!!!

-----Original Message-----
From: Elise Purcell <elisepurcell@me.com>
Sent: Wednesday, September 18, 2019 9:49 PM
To: Council Members <council@encinitasca.gov>
Subject: No 5G!!!!!

I stand firmly against 5G and/or more cell phone towers. NO WAY!

It's bad for our health! Proven to worsen auto-immune conditions , cause cancer and brain fog/Neuro degenerative does eases. We already have enough of these problems.

Also Involuntary radiation! Do your research and please don't make this a reality.

Elise Purcell

Sent from my iPhone

Kathy Noel

From: Annemarie Clisby
Sent: Thursday, August 29, 2019 7:47 AM
To: Roy Sapau
Subject: FW: the Encinitas Small Cell Antenna Ordinance Protective for Our Residential Areas Immediately
Attachments: URGENT Stop 5G -Encinitas Ordinance Amendment Email .docx

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From: Erika Chaker <erika.chaker@outlook.com>
Sent: Wednesday, August 28, 2019 4:40 PM
To: cblakespear@encinitas.gov; Jody Hubbard <jhubbard@encinitasca.gov>; Council Members <council@encinitasca.gov>; Tony Kranz <tkranz@encinitasca.gov>; Joe Mosca <jmosca@encinitasca.gov>; Kellie Shay Hinze <khinze@encinitasca.gov>
Subject: the Encinitas Small Cell Antenna Ordinance Protective for Our Residential Areas Immediately

My husband and I are Encinitas homeowners and we have two young children. We also both work in the Encinitas community. We are very concerned about the potential harmful and negative effects having 5G cell towers will bring and urge you to take action to protect us! We need an amendment to this ordinance immediately to protect our residential areas, schools, hospitals and other sensitive areas from the installations!

Attached is my letter to you, the Encinitas City Council. Please support us!

Regards,
Erika Chaker

858.525.1563
www.ElevateYourWellness.Life
www.myyl.com/elevateyourwellness
Yoga * Reiki * Aromatherapy

"Breathe and all will be revealed. Love and all will be healed." ~Sean Corne

Erika Chaker
969 Melba Rd.
Encinitas, CA 92024

August 27, 2019

City of Encinitas Council
Mayor Blakespear, Deputy Mayor Hubbard, and City Council Members Kellie Shay Hinze, Tony Kranz, and Joe Mosca

Re: Protective Small Cell Antenna Ordinance Needed Immediately

The urgency ordinance as it stands is not protective for sensitive areas like hospitals, daycare centers, and schools and does not protect residential areas. There are no setbacks required for sensitive areas which would be expected based on setbacks in the wireless ordinance for macro antennas. There is no protection of residential areas. And even though residential roads are one of the least preferred categories, the ordinance does not prevent Telecom installation of small cell antennas in front of our homes! This is entirely unacceptable!

We want the Encinitas small cell ordinance to be protective, IMMEDIATELY, applied to all applications in process, before there is a flood of small cell antenna applications/installations in our neighborhoods. We can't wait for a small cell antenna community meeting.

I urge you to amend the Encinitas small cell antenna ordinance to incorporate the best practices of protective small cell antennas ordinances of the California Cities of Mill Valley and Los Altos; Calabasas; Fairfield, Petaluma and San Ramon; and Hercules.

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For me and many of my friends and colleagues, there is a perception of harm associated with microwave antennas. This is validated by international news and science reports that show great biological harm from microwave radiation exposure. We are also very afraid for our property values.

Thank you for amending the Encinitas small cell antenna ordinance immediately for our collective safety.

Sincerely,

Erika Chaker

Kathy Noel

From: Annemarie Clisby
Sent: Monday, August 26, 2019 8:11 AM
To: Roy Sapau
Subject: FW: No 5G in Encinitas it is unproven and unsafe. Do not allow telecoms to place antennas in residential areas.

From: Gayle DeCampos <gaylebud@gmail.com>
Sent: Thursday, August 22, 2019 5:52 PM
To: Catherine Blakespear <cblakespear@encinitasca.gov>; Jody Hubbard <jhubbard@encinitasca.gov>; Council Members <council@encinitasca.gov>; Tony Kranz <tkranz@encinitasca.gov>; Joe Mosca <jmosca@encinitasca.gov>; Kellie Shay Hinze <khinze@encinitasca.gov>
Subject: Re: No 5G in Encinitas it is unproven and unsafe. Do not allow telecoms to place antennas in residential areas.

City of Encinitas Council
Mayor Blakespear, Deputy Mayor Hubbard, and City Council Members Kellie Shay Hinze, Tony Kranz, and Joe Mosca

Re: Encinitas Small Cell Antenna Urgency Ordinance

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I perceive that small cell antenna in the right-of-way in front of a home means 20 percent devaluation in property value and sickness and untold suffering to one or more members of that household.

The city of Encinitas needs a small cell ordinance immediately so that there is oversight about placement of small cell antennas in our community and especially our sensitive and residential areas.

As written this urgency ordinance provides a convenient administrative process for the Telecom to put small cell antennas anywhere they want. I say this because there is an absence of administrative teeth that would empower the city of Encinitas to enforce the location preference (e.g. prevent small cell antenna installation in front of homes), control the application and shot clock process and installation quality.

My request for the City of Encinitas is that this ordinance be sent back to staff for major upgrade that would reflect the protective aspects of the Calabasas and Hercules ordinances that are part of this record. Please note that these ordinances have been certified by their city councils to meet all requirements of the FCC directives, and therefore serve as appropriate baselines for our community. Let's not open the door to indiscriminate placement of small cell antennas in our residential areas and the cluttering of our visual space.

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Controlling the Shot Clock: Add these notes from Hercules, with edits applicable to Encinitas

Section 10-16.108 General Policies: (policy 19) *To prevent confusion and any loss of the City's rights under the FCC's 'Shot Clock' rule pursuant to the FCC Report and Order 14-153 as reference to the date an Application was officially filed and the start of the Shot Clock regarding the limited time allowed to determine if an Application is complete, at the time of the initial filing of an Application, it must contain a cover letter stating i) whether the Application is filed as an 'Eligible Facility' Application including the justification for such, or a 'Substantial Modification', or involves a new support structure; and ii) a statement that the Application contains all of the information required under Section 10.16 of the City's Code for that type of Application, and be signed by a person with first-hand personal knowledge of such.*

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for macro antenna installations. Remove all of the preapproved telephone pole installation examples from the Encinitas ordinance since these increase visual clutter and are not stealth.

Add definitions: "least intrusive means", "significant gap", "stealth facility" and "reasonable and compelling evidence".

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Thank you for being proactive for all of our safety.

Sincerely,

Gayle DeCampos
831 Starflower Rd
Encinitas Ca 92024
760 801 7413

On Thu, Aug 22, 2019, 5:48 PM Gayle DeCampos <gaylebud@gmail.com> wrote:

Encinitas Small Cell Antenna Urgency Ordinance Do not give access to anyone to fill out neighborhoods with antennas

City of Encinitas Council
Mayor Blakespear, Deputy Mayor Hubbard, and City Council Members Kellie Shay Hinze, Tony Kranz, and Joe Mosca

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Thank you for being proactive for all of our safety.

Sincerely,

your name

Kathy Noel

From: Annemarie Clisby
Sent: Wednesday, August 21, 2019 8:13 AM
To: Roy Sapau
Subject: FW: Encinitas Small Cell Antenna Urgency Ordinance

From: Glenn Frieder <drg@drglennfrieder.com>
Sent: Tuesday, August 20, 2019 9:46 PM
To: Glenn Frieder <gbfdc@aol.com>
Cc: Catherine Blakespear <cblakespear@encinitasca.gov>; Jody Hubbard <jhubbard@encinitasca.gov>; Council Members <council@encinitasca.gov>; Tony Kranz <tkranz@encinitasca.gov>; Joe Mosca <jmosca@encinitasca.gov>; Kellie Shay Hinze <khinze@encinitasca.gov>
Subject: Re: Encinitas Small Cell Antenna Urgency Ordinance

Aug 20, 2019

Dr Glenn B. Frieder
1816 eucalyptus avenue
Encintias ca 92024

drg@drglennfrieder.com
760 230-2928 home office
760 481-9210 IPhone

To: City of Encinitas Council

Mayor Blakespear, Deputy Mayor Hubbard, and City Council Members Kellie Shay Hinze, Tony Kranz, and Joe Mosca

Re: Encinitas Small Cell Antenna Urgency Ordinance

I have a perception of harm from microwave antennas in close proximity to my home and to the businesses I frequent in Encinitas. I'm afraid for my physical well-being, for my family, and for my property value should an antenna be placed in front of my home. The FCC exposure limits protect us from adverse thermal effects such as shock, burns and being heated, but not from the harmful biological effects known by our scientists for more than 50 years. I implore you to protect me, us.

I perceive that small cell antenna in the right-of-way in front of a home means 20 percent devaluation in property value and sickness and untold suffering to one or more members of that household.

The city of Encinitas needs a small cell ordinance immediately so that there is oversight about placement of small cell antennas in our community and especially our sensitive and residential areas.

As written this urgency ordinance provides a convenient administrative process for the Telecom to put small cell antennas anywhere they want. I say this because there is an absence of administrative teeth that would empower the city of Encinitas to enforce the location preference (e.g. prevent small cell antenna installation in front of homes), control the application and shot clock process and installation quality.

My request for the City of Encinitas is that this ordinance be sent back to staff for major upgrade that would reflect the protective aspects of the Calabasas and Hercules ordinances that are part of this record. Please note that these ordinances have been certified by their city councils to meet all requirements of the FCC directives, and therefore serve as appropriate baselines for our community. Let's not open the door to indiscriminate placement of small cell antennas in our residential areas and the cluttering of our visual space.

If the city deems it necessary to have an ordinance in place immediately, then please make approval conditional on adding the following protective features garnered from the Calabasas municipal code section 17.12.050(C) and Hercules Title 10 Chapter 16 ordinances as a condition of approval. These are a few of many important examples from these ordinances.

Location Preference: remove the residential areas from Encinitas Section 10.a. This would be consistent with Calabasas 17.12.050(C) 3. "Preferred Zones and Locations" which does not include residential areas. (Note: Calabasas ordinance re-enforces this zoning preference in sections that specifically address small cell location in right of way… and asserts in the preamble that the ordinance is compliant to FCC directives.)

Application Process:

- Require a pre-application site inspection and pre-application meeting for verification that all application requirements have been met before accepting an application (Hercules Section 10-16.108 General Policies, General Application Process, para 8)
- Require that all support structures are certified to meet ANSI 222 as part of the application process (Hercules Section 10-16.113.E.14 Small Cell and Small Wireless Facilities).

Controlling the Shot Clock: Add these notes from Hercules, with edits applicable to Encinitas

Section 10-16.108 General Policies: (policy 19) *To prevent confusion and any loss of the City's rights under the FCC's 'Shot Clock' rule pursuant to the FCC Report and Order 14-153 as reference to the date an Application was officially filed and the start of the Shot Clock regarding the limited time allowed to determine if an Application is complete, at the time of the initial filing of an Application, it must contain a cover letter stating i) whether the Application is filed as an 'Eligible Facility' Application including the justification for such, or a 'Substantial Modification', or involves a new support structure; and ii) a statement that the Application contains all of the information required under Section 10.16 of the City's Code for that type of Application, and be signed by a person with first-hand personal knowledge of such.*

Section 10-16.113 Batched Applications: *An Applicant, or its agent of record, may submit Applications for multiple facilities or locations with the following conditions that are intended in order to assure compliance with the FCC's 'Shot Clock' requirements:*

a. *No single batched submittal shall contain more than five (5) Applications;*
b. *There must be a minimum of seven days between submittals of batched Applications;*
c. *No more than 4 batched Applications shall be accepted in any thirty (30) consecutive day period.*

Controlling the Shot Clock: add these notes from the Calabasas 17.12.050(C) Section 6.G.4 "Application Review" … *Each application in a batch must meet all the requirements for a complete application. If any application in a batch is incomplete, the entire batch shall be deemed incomplete*

Stealth Installations: the Encinitas ordinance displays pictures of approved small cell antenna installations that include telephone poles with small cell antennas, radio boxes and all the supporting cabling attached to the poles when Encinitas favors stealth installation and could require metal poles with attractive features. Require that all small cell antennas on light poles and power poles be stealth installations. This is consistent with both the Calabasas and Hercules ordinances, and the existing Encinitas ordinance for macro antenna installations. Remove all of the preapproved telephone pole installation examples from the Encinitas ordinance since these increase visual clutter and are not stealth.

Add definitions: "least intrusive means", "significant gap", "stealth facility" and "reasonable and compelling evidence".

I believe that our ordinance can be more protective. I ask that as a condition of approval of the ordinance that the Council orders a community meeting ASAP for the purpose of bringing together the citizens of Encinitas with the staff to review every available option that would make the ordinance more protective. It would be appropriate to have other legal opinions as inputs to our ordinance; we don't want to be less conservative than we have to especially when the safety of our community is at stake. There are aspects of the Calabasas ordinance, the Hercules ordinance, and ordinances from other cities that are more protective and we should consider these in the Encinitas ordinance.

Thank you for being proactive for all of our safety.

Sincerely,

Dr Glenn Frieder

760 481-9210

Kathy Noel

From: Annemarie Clisby
Sent: Wednesday, August 21, 2019 2:07 PM
To: Roy Sapau
Subject: FW: Encinitas Small Cell Ordinance
Attachments: Letter to City of Encinitas Ordinance.pdf; Declarations and literature.pdf

From: Holly Manion <hollymanion@gmail.com>
Sent: Wednesday, August 21, 2019 1:26 PM
To: Catherine Blakespear <cblakespear@encinitasca.gov>; Jody Hubbard <jhubbard@encinitasca.gov>; Council Members <council@encinitasca.gov>; Tony Kranz <tkranz@encinitasca.gov>; Joe Mosca <jmosca@encinitasca.gov>; Kellie Shay Hinze <khinze@encinitasca.gov>
Subject: Encinitas Small Cell Ordinance

I have been in the real estate business for over 40 years, and I have never witnessed a threat as severe as 5G to our property values, family safety, privacy, environment, wildlife and health. 5G has never been tested for health and safety.
Please read the following letter and declarations. 5G should not be installed in our residential neighborhoods.

Thank you,

Holly Manion
DRE# 00646025
Pacific Sotheby's International Realty
HollyManion@gmail.com
858-756-3007 - Office
858-395-5287 - Cell

Declaration of Holly E. Manion

I, Holly E. Manion, declare as follows:

1. I am a licensed real estate broker in the State of California, and I have lived in Rancho Santa Fe my entire life. My license number is DRE 00646025. I have been a real estate professional full time for 40 years, and I founded Rancho Santa Fe Realty located in Rancho Santa Fe, California. My firm is now part of Pacific Sotheby's International Realty.

2. I represent buyers and sellers in North San Diego County. I have had numerous experiences with clients who when informed that wireless cell sites are located on or near properties in which they were interested initially, have refused to pursue transactions because of these wireless facilities. Currently, I represent sellers who have placed their home in Rancho Santa Fe on the market. It is a 4 bedroom, 3 bathroom house designed by a master architect in San Diego with stunning views. It is located on two usable acres. My clients are asking in excess of $2 million for the property. A utility pole to which three wireless antennas are attached is located on the County right of way close to the front garden. Three potential buyers came to tour the property, but would not even walk in the door because they were so concerned about the close proximity of the wireless cell site and its potential health risks. There is one prospective buyer who loves the property as it is perfect for her family of four. Her mother, however, will not lend her daughter the necessary down payment to purchase the property due to her concern about the potential health hazard resulting from the wireless antenna especially for her grandchildren who would play in the front yard. The property has been on the market for more than four months, with no offers and few showings. The current market for equivalent homes in this area is strong.

3. Another example of which I am familiar involves two of the least expensive lots in Rancho Santa Fe Covenant. They are listed for less than $1 million, an exceptionally low price for the area. One of the lots is 2.9 useable acres, with lovely views. It was just reduced in price from $715,000 to $630,000. It has been on the market 325 days with no offers. I have shown this property twice this year to qualified buyers. They had no interest in making offers after they learned that there is a wireless cell site disguised as palm trees near these properties. These fake palm trees with their wireless facilities are at least 1,500 feet away in an adjacent community, Hacienda Santa Fe. Although the lots are gorgeous, neither of these two clients were interested in pursuing a purchase at any price.

4. Numerous of my clients have refused to purchase properties near a well-known sports park in Encinitas because of the wireless antennas that are mounted on athletic field light standards towering over the playing fields.

5. I am a member of the San Diego County Board of Realtors, and I use the "Local Area Disclosures for San Diego County" in all of my transactions as required by the Board. This form includes a disclosure of Electrical and Magnetic Fields and notes the

"public concern with EMFs" affecting a property's value. Attached as Exhibit A to my declaration is a true and correct copy of the current version of the "Local Area Disclosures for San Diego County." In addition, I use the "Seller Property Questionnaire" for all my transactions. The Questionnaire states "Note to Seller: Purpose: To tell the Buyer about known material or significant items affecting the value or desirability of the Property …." It includes a disclosure for "[neighborhood noise, nuisance or other problems from sources such as, but not limited to, the following: … cell phone towers…." Attached as Exhibit B to my declaration is a true and correct copy of the current version of the Questionnaire.

6. In my professional experience, wireless sites that generate radio frequency emissions on or near residential properties cause a diminution in the value of these properties. This is due to the fact that some likely buyers refuse to even look at them, which leads to the properties staying on the market longer than like properties that do not have cell sites in the vicinity. Over time, this inevitably leads to sellers lowering prices to ensure they can sell their properties.

7. My neighbors and I are extremely happy that Rancho Santa Fe Association is installing 60 miles of underground fiber optic cable network. The trenching for fiber optics is almost completed and we will have the system up and running this year. We believe this network is going to provide us with better quality, faster, safer, and more secure Internet connection than we currently have with the wireless systems available to us. It is my understanding that fiber optics do not emit radio frequency radiation like wireless systems. It is my professional opinion that if the communities in which I work only had fiber optics and no wireless facilities, my clients would no longer have the health and safety concerns I discussed above. I also believe I would then be able to sell their properties more quickly and at top dollar.

I declare under penalty of perjury that the foregoing is true and correct.

April 8, 2019

Holly E. Manion

Holly E. Manion

CALIFORNIA ASSOCIATION OF REALTORS®

SELLER PROPERTY QUESTIONNAIRE

(C.A.R. Form SPQ, Revised 6/18)

This form is not a substitute for the Real Estate Transfer Disclosure Statement (TDS). It is used by the Seller to provide additional information when a TDS is completed. If Seller is exempt from completing a TDS, Seller should complete an Exempt Seller Disclosure (C.A.R. Form ESD) or may use this form instead.

I. Seller makes the following disclosures with regard to the real property or manufactured home described as ***17090 El Mirador***, Assessor's Parcel No. _____, situated in ***Rancho Santa Fe***, County of ***San Diego*** California ("Property").

II. **The following are representations made by the Seller and are not the representations of the Agent(s), if any. This disclosure statement is not a warranty of any kind by the Seller or any agents(s) and is not a substitute for any inspections or warranties the principal(s) may wish to obtain. This disclosure is not intended to be part of the contract between Buyer and Seller. Unless otherwise specified in writing, Broker and any real estate licensee or other person working with or through Broker has not verified information provided by Seller. A real estate broker is qualified to advise on real estate transactions. If Seller or Buyer desires legal advice, they should consult an attorney.**

III. **Note to Seller:** PURPOSE: To tell the Buyer about known material or significant items affecting the value or desirability of the Property and help to eliminate misunderstandings about the condition of the Property.

- Answer based on actual knowledge and recollection at this time.
- Something that you do not consider material or significant may be perceived differently by a Buyer.
- Think about what you would want to know if you were buying the Property today.
- Read the questions carefully and take your time.
- If you do not understand how to answer a question, or what to disclose or how to make a disclosure in response to a question, whether on this form or a TDS, you should consult a real estate attorney in California of your choosing. A broker cannot answer the questions for you or advise you on the legal sufficiency of any answers or disclosures you provide.

IV. **Note to Buyer:** PURPOSE: To give you more information about known material or significant items affecting the value or desirability of the Property and help to eliminate misunderstandings about the condition of the Property.

- Something that may be material or significant to you may not be perceived the same way by the Seller.
- If something is important to you, be sure to put your concerns and questions in writing (C.A.R. form BMI).
- Sellers can only disclose what they actually know. Seller may not know about all material or significant items.
- Seller's disclosures are not a substitute for your own investigations, personal judgments or common sense.

V. **SELLER AWARENESS: For each statement below, answer the question "Are you (Seller) aware of..." by checking either "Yes" or "No." Explain any "Yes" answers in the space provided or attach additional comments and check section VI.**

A. STATUTORILY OR CONTRACTUALLY REQUIRED OR RELATED: **ARE YOU (SELLER) AWARE OF...**

1. Within the last 3 years, the death of an occupant of the Property upon the Property . . . . . ☐ Yes ☐ No
2. An Order from a government health official identifying the Property as being contaminated by methamphetamine. (If yes, attach a copy of the Order.) . . . . . ☐ Yes ☐ No
3. The release of an illegal controlled substance on or beneath the Property . . . . . ☐ Yes ☐ No
4. Whether the Property is located in or adjacent to an "industrial use" zone . . . . . ☐ Yes ☐ No
   (In general, a zone or district allowing manufacturing, commercial or airport uses.)
5. Whether the Property is affected by a nuisance created by an "industrial use" zone. . . . . ☐ Yes ☐ No
6. Whether the Property is located within 1 mile of a former federal or state ordnance location. . . . . ☐ Yes ☐ No
   (In general, an area once used for military training purposes that may contain potentially explosive munitions.)
7. Whether the Property is a condominium or located in a planned unit development or other common interest subdivision. . . . . ☐ Yes ☐ No
8. Insurance claims affecting the Property within the past 5 years . . . . . ☐ Yes ☐ No
9. Matters affecting title of the Property . . . . . ☐ Yes ☐ No
10. Material facts or defects affecting the Property not otherwise disclosed to Buyer . . . . . ☐ Yes ☐ No
11. Plumbing fixtures on the Property that are non-compliant plumbing fixtures as defined by Civil Code Section 1101.3 . . . . . ☐ Yes ☐ No

Explanation, or ☐ (if checked) see attached; _____

Buyer's Initials (_____) (_____) Seller's Initials (_____) (_____)

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Pacific Sotheby's International Realty, 6024 Paseo Delicias Rancho Santa Fe CA 92067 Phone: 858.756.3007 Fax: 858.756.5966
Heather Manion

Produced with zipForm® by zipLogix 18070 Fifteen Mile Road, Fraser, Michigan 48026 www.zipLogix.com

Property Address: *17090 El Mirador, Rancho Santa Fe,* Date: _____

B. REPAIRS AND ALTERATIONS: **ARE YOU (SELLER) AWARE OF...**

1. Any alterations, modifications, replacements, improvements, remodeling or material repairs on the Property (including those resulting from Home Warranty claims) . . . . . ☐ Yes ☐ No
2. Any alterations, modifications, replacements, improvements, remodeling, or material repairs to the Property done for the purpose of energy or water efficiency improvement or renewable energy? . . . . . ☐ Yes ☐ No
3. Ongoing or recurring maintenance on the Property (for example, drain or sewer clean-out, tree or pest control service) . . . . . ☐ Yes ☐ No
4. Any part of the Property being painted within the past 12 months. . . . . ☐ Yes ☐ No
5. Whether the Property was built before 1978. . . . . ☐ Yes ☐ No
   (a) If yes, were any renovations (i.e., sanding, cutting, demolition) of lead-based paint surfaces started or completed. . . . . ☐ Yes ☐ No
   (b) If yes to (a), were such renovations done in compliance with the Environmental Protection Agency Lead-Based Paint Renovation Rule?. . . . . ☐ Yes ☐ No

Explanation: _____

C. STRUCTURAL, SYSTEMS AND APPLIANCES: **ARE YOU (SELLER) AWARE OF...**

1. Defects in any of the following, (including past defects that have been repaired): heating, air conditioning, electrical, plumbing (including the presence of polybutylene pipes), water, sewer, waste disposal or septic system, sump pumps, well, roof, gutters, chimney, fireplace, foundation, crawl space, attic, soil, grading, drainage, retaining walls, interior or exterior doors, windows, walls, ceilings, floors or appliances . . . . . ☐ Yes ☐ No
2. The leasing of any of the following on or serving the Property: solar system, water softener system, water purifier system, alarm system, or propane tank (s) . . . . . ☐ Yes ☐ No
3. An alternative septic system on or serving the Property. . . . . ☐ Yes ☐ No

Explanation: _____

D. DISASTER RELIEF, INSURANCE OR CIVIL SETTLEMENT: **ARE YOU (SELLER) AWARE OF...**

1. Financial relief or assistance, insurance or settlement, sought or received, from any federal, state, local or private agency, insurer or private party, by past or present owners of the Property, due to any actual or alleged damage to the Property arising from a flood, earthquake, fire, other disaster, or occurrence or defect, whether or not any money received was actually used to make repairs . . . . . ☐ Yes ☐ No

Explanation: _____

E. WATER-RELATED AND MOLD ISSUES: **ARE YOU (SELLER) AWARE OF...**

1. Water intrusion into any part of any physical structure on the Property; leaks from or in any appliance, pipe, slab or roof; standing water, drainage, flooding, underground water, moisture, water-related soil settling or slippage, on or affecting the Property . . . . . ☐ Yes ☐ No
2. Any problem with or infestation of mold, mildew, fungus or spores, past or present, on or affecting the Property . . . . . ☐ Yes ☐ No
3. Rivers, streams, flood channels, underground springs, high water table, floods, or tides, on or affecting the Property or neighborhood . . . . . ☐ Yes ☐ No

Explanation: _____

F. PETS, ANIMALS AND PESTS: **ARE YOU (SELLER) AWARE OF...**

1. Pets on or in the Property . . . . . ☐ Yes ☐ No
2. Problems with livestock, wildlife, insects or pests on or in the Property . . . . . ☐ Yes ☐ No
3. Past or present odors, urine, feces, discoloration, stains, spots or damage in the Property, due to any of the above . . . . . ☐ Yes ☐ No
4. Past or present treatment or eradication of pests or odors, or repair of damage due to any of the above. . . . . ☐ Yes ☐ No
   If so, when and by whom _____

Explanation: _____

Buyer's Initials (_____) (_____) Seller's Initials (_____) (_____)

Property Address: *17090 El Mirador, Rancho Santa Fe,* Date:

G. BOUNDARIES, ACCESS AND PROPERTY USE BY OTHERS: **ARE YOU (SELLER) AWARE OF...**

1. Surveys, easements, encroachments or boundary disputes . . . . . ☐ Yes ☐ No
2. Use or access to the Property, or any part of it, by anyone other than you, with or without permission, for any purpose, including but not limited to, using or maintaining roads, driveways or other forms of ingress or egress or other travel or drainage . . . . . ☐ Yes ☐ No
3. Use of any neighboring property by you . . . . . ☐ Yes ☐ No

Explanation: _____

H. LANDSCAPING, POOL AND SPA: **ARE YOU (SELLER) AWARE OF...**

1. Diseases or infestations affecting trees, plants or vegetation on or near the Property . . . . . ☐ Yes ☐ No
2. Operational sprinklers on the Property . . . . . ☐ Yes ☐ No
   (a) If yes, are they ☐ automatic or ☐ manually operated.
   (b) If yes, are there any areas with trees, plants or vegetation not covered by the sprinkler system . . . ☐ Yes ☐ No
3. A pool heater on the Property . . . . . ☐ Yes ☐ No
   If yes, is it operational? . . . . . ☐ Yes ☐ No
4. A spa heater on the Property . . . . . ☐ Yes ☐ No
   If yes, is it operational? . . . . . ☐ Yes ☐ No
5. Past or present defects, leaks, cracks, repairs or other problems with the sprinklers, pool, spa, waterfall, pond, stream, drainage or other water-related decor including any ancillary equipment, including pumps, filters, heaters and cleaning systems, even if repaired . . . . . ☐ Yes ☐ No

Explanation: _____

I. CONDOMINIUMS, COMMON INTEREST DEVELOPMENTS AND OTHER SUBDIVISIONS: (IF APPLICABLE)
ARE YOU (SELLER) AWARE OF...

1. Any pending or proposed dues increases, special assessments, rules changes, insurance availability issues, or litigation by or against or fines or violations issued by a Homeowner Association or Architectural Committee affecting the Property. . . . . ☐ Yes ☐ No
2. Any declaration of restrictions or Architectural Committee that has authority over improvements made on or to the Property . . . . . ☐ Yes ☐ No
3. Any improvements made on or to the Property without the required approval of an Architectural Committee or inconsistent with any declaration of restrictions or Architectural Commitee requirement. . . . . ☐ Yes ☐ No

Explanation: _____

J. TITLE, OWNERSHIP LIENS, AND LEGAL CLAIMS: **ARE YOU (SELLER) AWARE OF...**

1. Any other person or entity on title other than Seller(s) signing this form . . . . . ☐ Yes ☐ No
2. Leases, options or claims affecting or relating to title or use of the Property . . . . . ☐ Yes ☐ No
3. Past, present, pending or threatened lawsuits, settlements, mediations, arbitrations, tax liens, mechanics' liens, notice of default, bankruptcy or other court filings, or government hearings affecting or relating to the Property, Homeowner Association or neighborhood . . . . . ☐ Yes ☐ No
4. Any private transfer fees, triggered by a sale of the Property, in favor of private parties, charitable organizations, interest based groups or any other person or entity . . . . . ☐ Yes ☐ No
5. Any PACE lien (such as HERO or SCEIP) or other lien on your Property securing a loan to pay for an alteration, modification, replacement, improvement, remodel or material repair of the Property? ☐ Yes ☐ No
6. The cost of any alteration, modification, replacement, improvement, remodel or material repair of the Property being paid by an assessment on the Property tax bill? . . . . . ☐ Yes ☐ No

Explanation: _____

K. NEIGHBORHOOD: **ARE YOU (SELLER) AWARE OF...**

1. Neighborhood noise, nuisance or other problems from sources such as, but not limited to, the following: neighbors, traffic, parking congestion, airplanes, trains, light rail, subway, trucks,

freeways, buses, schools, parks, refuse storage or landfill processing, agricultural operations, business, odor, recreational facilities, restaurants, entertainment complexes or facilities, parades, sporting events, fairs, neighborhood parties, litter, construction, air conditioning equipment, air compressors, generators, pool equipment or appliances, underground gas pipelines, cell phone towers, high voltage transmission lines, or wildlife . . . . . ☐ Yes ☐ No

Explanation: _____

L. GOVERNMENTAL: **ARE YOU (SELLER) AWARE OF...**

1. Ongoing or contemplated eminent domain, condemnation, annexation or change in zoning or general plan that applies to or could affect the Property . . . . . ☐ Yes ☐ No
2. Existence or pendency of any rent control, occupancy restrictions, improvement restrictions or retrofit requirements that apply to or could affect the Property. . . . . ☐ Yes ☐ No
3. Existing or contemplated building or use moratoria that apply to or could affect the Property . . . . . ☐ Yes ☐ No
4. Current or proposed bonds, assessments, or fees that do not appear on the Property tax bill that apply to or could affect the Property . . . . . ☐ Yes ☐ No
5. Proposed construction, reconfiguration, or closure of nearby overnment facilities or amenities such as schools, parks, roadways and traffic signals . . . . . ☐ Yes ☐ No
6. Existing or proposed overnment requirements affecting the Property (i) that tall grass, brush or other vegetation be cleared; (ii) that restrict tree (or other landscaping) planting, removal or cutting or (iii) that flammable materials be removed . . . . . ☐ Yes ☐ No
7. Any protected habitat for plants, trees, animals or insects that apply to or could affect the Property . . . . . ☐ Yes ☐ No
8. Whether the Property is historically designated or falls within an existing or proposed Historic District . . . . . ☐ Yes ☐ No
9. Any water surcharges or penalties being imposed by a public or private water supplier, agency or utility; or restrictions or prohibitions on wells or other ground water supplies . . . . . ☐ Yes ☐ No

Explanation: _____

M. OTHER: **ARE YOU (SELLER) AWARE OF...**

1. Reports, inspections, disclosures, warranties, maintenance recommendations, estimates, studies, surveys or other documents, pertaining to (i) the condition or repair of the Property or any improvement on this Property in the past, now or proposed; or (ii) easements, encroachments or boundary disputes affecting the Property whether oral or in writing and whether or not provided to the Seller. . . . . ☐ Yes ☐ No

(If yes, provide any such documents in your possession to Buyer.)

2. Any occupant of the Property smoking on or in the Property. . . . . ☐ Yes ☐ No
3. Any past or present known material facts or other significant items affecting the value or desirability of the Property not otherwise disclosed to Buyer . . . . . ☐ Yes ☐ No

Explanation: _____

VI. ☐ **(IF CHECKED) ADDITIONAL COMMENTS:** The attached addendum contains an explanation or additional comments in response to specific questions answered "yes" above. Refer to line and question number in explanation.

Seller represents that Seller has provided the answers and, if any, explanations and comments on this form and any attached addenda and that such information is true and correct to the best of Seller's knowledge as of the date signed by Seller. Seller acknowledges (i) Seller's obligation to disclose information requested by this form is independent from any duty of disclosure that a real estate licensee may have in this transaction; and (ii) nothing that any such real estate licensee does or says to Seller relieves Seller from his/her own duty of disclosure.

Seller _____ Date _____

Seller _____ Date _____

By signing below, Buyer acknowledges that Buyer has read, understands and has received a copy of this Seller Property Questionnaire form.

Buyer _____ Date _____

Buyer _____ Date _____

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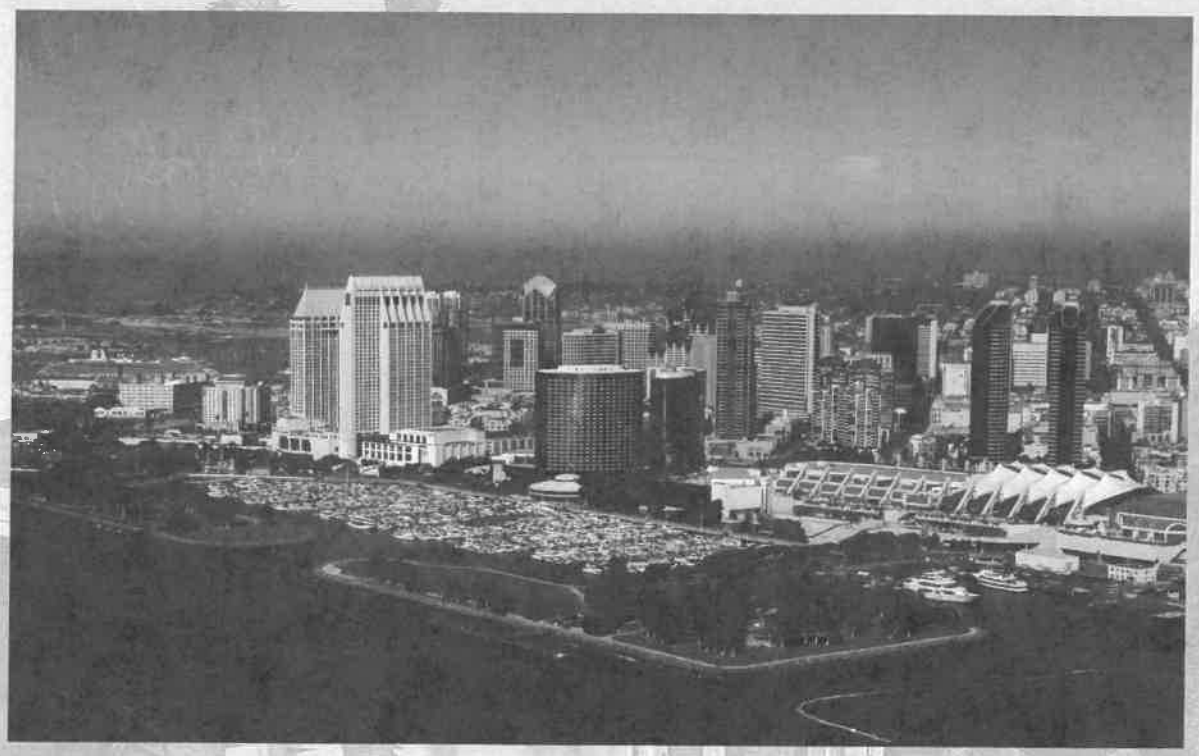
Local Area Disclosures for San Diego County



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Local Area Disclosures for San Diego County

The Local Area Disclosures for San Diego County (LAD) is intended to be reviewed by Buyer and Seller along with the Statewide Buyer and Seller Advisory (California Association of Realtor form SBSA). If you do not have the SBSA, request a copy.

- The LAD provides information on conditions in San Diego County which may impact Buyer's decision to purchase the Property, and is an advisory to Buyer and Seller.
- The LAD does not relieve Seller or Brokers from making disclosures legally required of them.
- The LAD does not eliminate Buyer's duty to conduct a thorough physical inspection of the Property.
- Buyer is advised to investigate, and obtain additional information on, all issues of concern to Buyer and not to rely solely on the information received from Seller and Brokers.
- Buyer is advised to obtain in writing all information on the condition or area of the Property received from Seller and Brokers.
- Buyer is advised to consult with qualified professional advisors, consultants and appropriate governmental authorities in evaluating all information related to the Property.
- Buyer is advised that Brokers do not verify the results of any inspections, or guarantee the performance of any inspector.
- Buyer's waiver of the right to conduct a physical inspection of the Property, or to rely on someone other than an appropriate professional for such inspection, is against the advice of Brokers.

DISCLAIMER: The LAD was prepared by the Greater San Diego Association of REALTORS® ("SDAR") based on information obtained primarily from its members who conduct business throughout San Diego County and are familiar with commonly used local disclosures in those areas. SDAR believes the sources of information is reliable but has not verified all information. Conditions impacting the Property or area (especially those listed in "Specific Area Disclosures") may have changed since the LAD was published.

THE LAD HAS BEEN APPROVED BY SDAR. NO REPRESESENTATION OR WARRANTY IS MADE AS TO THE VALIDITY OR ADEQUACY OF ANY OF ITS PROVISIONS IN ANY PARTICULAR TRANSACTION.

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16. Property Photographs and Data Online
Buyer and Seller acknowledge and understand that the Property was likely listed in the Multiple Listing Services and advertised for sale on the internet. As such, persons listing or entering onto the Property may have photos and/or videos of the Property. Once images of the Property are taken or put on the internet or otherwise, neither the Broker nor the Seller has control over the use of the images, how long they are available to the public via the internet, or who views such images after the sale of the Property.

B. Environmental Disclosures

1. Animals and Insects
Buyer and Seller are advised that the Property may be inhabited by various species of animals and pests, from insects and bees, rodents and bugs to large animals such as mountain lions, bobcats, coyotes, bears, snakes and reptiles, which may pose hazards. Areas may also be subject to domestic and farm animals, including non-native and endangered species which may pose a hazard to, or affect the potential development of a property.

2. Coastal Cliffs and Beach Areas
Buyer and Seller are advised that building structures located near or on the edge of coastal cliffs and beach areas may be prone to erosion and resulting damage. The stability of the soils and other geological characteristics can impact the Property and the ability to build on the Property.

3. Electrical and Magnetic Fields (EMFs)
Buyer and Seller are advised that Electric and Magnetic Fields (EMFs) are found wherever there is electricity, including underground power lines. Brokers are not qualified to explain potential risks associated with EMFs, if any. It is generally believed that public concern with EMFs may affect the value of a property in close proximity to high-voltage power lines. For further information, visit *www.sdge.com* and type "emf" in the search line.

4. Flooding Valleys
Buyer and Seller are advised that properties in river valleys, including Mission Valley, San Dieguito River Valley and San Luis Rey River Valley may be subject to flooding in periods of heavy rain. A property's history of flooding and potential to flood may impact its value and use, and availability and cost of flood insurance.

5. Landfills
Buyer and Seller are advised that within San Diego County there are several active landfills, including the Borrego Landfill, Las Pulgas Landfill, Miramar Landfill, Otay Landfill, San Onofre Landfill and Sycamore Landfill located in Santee. There may be other known or undiscovered, inactive landfills located within San Diego County. For more information about these and other possible landfills visit *www.sandiego.gov/environmental-services.com.*

6. Chinese Drywall
Buyer and Seller are advised that some homes built between 2003 and 2008 may contain imported defective drywall known in the press as "Chinese drywall." Some residents of properties with this drywall have reported problems, including a strong sulfur smell, like rotten eggs; health issues, like irritated and itchy eyes and skin; difficulty breathing; a persistent cough and headaches; and premature corrosion or deterioration of certain metal components in their homes, like air conditioner coils and wiring behind electrical outlets and inside electrical panel boxes. Eliminating problems associated with the drywall may require its removal from the home. For more information, visit the Consumer Product Safety Commission website at *www.cpsc.gov/info/drywall/index.html.*

7. Hazardous Materials
Buyer and Seller are advised that the Property may contain hazardous materials, including asbestos, lead, radon, and formaldehyde. Various hazardous materials, such as paint, solvents, cleaning supplies or insecticides, may remain on the Property after close of escrow and require special handling, removal and disposal. Information on these and other hazards is contained in the Homeowner's Guide to Environmental Hazards.

Declaration of Julie M. Flores

I, Julie M. Flores, declare as follows:

1. I am a licensed real estate agent in the State of California. My license number is 01054934. I have been involved in real estate since 1989. I work for Pacific Sotheby's International Realty and sell residential properties throughout San Diego County.

2. In 2018 I was showing a beautiful Spanish house on Crest Drive in Encinitas, California to a group of real estate agents. One of the agents pointed out a cell tower within 100 feet of the house. It was located at the Cardiff by the Sea, Sports Park on top of a stadium light post. This agent expressed the opinion to the entire group of real estate agents touring the house that she did not think she could get one client to buy this home once she pointed out the close proximity of the cell antenna. I believe this Realtor, who has been selling real estate for over three decades. She does have her finger on the pulse of what is going on in the community. This Realtor took some time to educate me about RF radiation which she described as being the same radiation whether coming from a cell phone, Wi-Fi, or a cell tower. She said the frequencies could differ and certainly the output could differ, but it is all data carried on microwaves.

3. The California Association of Realtors' Property Sellers Questionnaire specifically "cell towers" listed on the disclosure form for sellers of real estate. The seller must note "neighborhood noise, nuisance or other problems from.. " and includes cell towers on the long list problems.

4. The home on Crest Drive had been on the market for almost a year listed with several Realtors before it sold for a much lower price. I believe the close proximity of cell tower was one of the main reasons it took so long to sell and for a much lower price.

5. I can relate to the concern the Realtor on our agent caravan expressed when looking at the proximity of the Crest Drive home to the nearby cell tower. From a personal perspective, I am increasingly experiencing symptoms that are associated

with electro hypersensitivity. I use my cell phone "all the time". I am on this phone a great deal for business. I absolutely believe it is as a direct result of the cumulative exposure to my phone that I am experiencing more headaches, ringing in my ears, tingling in my fingers when holding the phone for any appreciable period of time, insomnia, memory lapses, and a lack of focus when I've been on my cell phone for more than a few minutes at a time. This constant exposure is concerning me, and I share and personally appreciate the concern of other Realtors, and concern that my clients may have associated with living near cell towers. I believe living near a cell tower decreases property values. It is something that must be disclosed, and given a house with a cell tower and a house without one, I show my clients the house without the cell tower. It is a very simple economic issue. Cell towers devalue property, from what we read in industry literature, and from my own personal experience.

I declare under penalty of perjury that the foregoing is true and correct.

April 21, 2019

Julie M. Flores

Julie M. Flores

Declaration of Heather Gallagher

I, Heather Gallagher, declare as follows:

1. I am a licensed real estate broker in the State of California. My license number is 00792625. I have been a real estate professional since 1983 and I am currently licensed with Pacific Sotheby's International Realty. My market consists primarily of residential properties in North County San Diego, California.

2. I have become increasingly aware of health concerns related to cell towers in close proximity to homes. This has been a topic at various formal meetings we have had among fellow realtors, and I have become better educated on the subject of wireless radiation in order to more fully serve my clients and understand their needs.

3. In January 2019 I had a client who suffers from a compromised immune system and was particularly allergic to various things. In addition to allergies in the classic sense, i.e. mold and inhaled allergens, this woman was also Electro-Hypersensitive (EHS).

4. I was able to find a property for her that was reasonably distant from cell towers. She selected this property in large part because it was as far away from some of the major towers as we could find.

5. I further found a highly qualified Industrial Hygienist Peter Sierck, a Principal at Environmental Testing & Technologies. Mr. Sierck has renowned expertise in the area of RF radiation measurements and was able to come up with a plan for shielding my client's new home from Wi-Fi coming from her neighbors' homes. My client accepted that she was going to have to deal with neighbors' Wi-Fi through various shielding materials suggested by Mr. Sierck. However, she opted to buy a home away from cell towers, something that would be more difficult to shield from given her extreme sensitivity.

6. In the area I sell homes in, North County San Diego, I find that people are becoming increasingly well-informed about the health risks associated with RF radiation. It is a fact that the vast majority of my clients use some form of wireless at home and/or in their work life. I do find there is increasing concern about radiation from cell towers, and even those clients who are not concerned about the health risks that have been associated with RF radiation are inclined to prefer the property without a cell tower nearby – as opposed to property with a cell tower within sight. They know the presence of the cell tower affects property values and they know it affects

resale. Increasingly I find clients wanting to avoid living near cell towers, and as a realtor I am obligated to disclose their locations.

I declare under penalty of perjury that the foregoing is true and correct.

April 25, 2019

Heather Gallagher

features

The Impact of Cell Phone Towers on House Prices in Residential Neighborhoods

by Sandy Bond, PhD, and Ko-Kang Wang

abstract

This article examines whether proximity to cellular phone towers has an impact on residential property values and the extent of any impact. First, a survey approach is used to examine how residents perceive living near cellular phone base stations (CPBSs) and how residents evaluate the impacts of CPBSs. Next, a market study attempts to confirm the perceived value impacts reported in the survey by analyzing actual property sales data. A multiple regression analysis in a hedonic pricing framework is used to measure the price impact of proximity to CPBSs. Both the survey and market sales analysis find that CPBSs have a negative impact on the prices of houses in the study areas.

The introduction of cellular phone systems and the rapid increase in the number of users of cellular phones have increased exposure to electromagnetic fields (EMFs). Health consequences of long-term use of cellular phones are not known in detail, but available data indicates that development of nonspecific health symptoms is possible.[1] Conversely, it appears health effects from cellular phone equipment (antennas and base stations) pose few, if any, known health hazards.[2]

A concern associated with cellular phone usage is the siting of cellular phone transmitting antennas (CPTAs) and cellular phone base stations (CPBSs). In New Zealand, CPBS sites are increasingly in demand as the major cellular phone companies there, Telecom and Vodafone, upgrade and extend their network coverage. This demand could provide the owner of a well-located property a yearly income for the siting of a CPBS.[3] However, new technology that represents potential hazards to human health and safety may cause property values to diminish due to public perceptions of hazards. Media attention to the potential health hazards of CPBSs has spread concerns among the public, resulting in increased resistance to CPBS sites.

Some studies suggest a positive correlation between long-term exposure to the electromagnetic fields and certain types of cancer,[4] yet other studies report inconclusive results on health effects.[5] Notwithstanding the research results, media reports indicate that the extent of opposition from some property owners

1. Stanislaw Szmigielski and Elizbieta Sobiczewska, "Cellular Phone Systems and Human Health—Problems with Risk Perception and Communication," *Environmental Management and Health* 11, no. 4 (2000): 352–368.
2. Jerry R. Barnes, "Cellular Phones: Are They Safe?" *Professional Safety* 44, no. 12 (Dec. 1999): 20–23.
3. R. Williams, "Phone Zone—Renting Roof Space to Ma Bell," *The Property Business* 12 (April 2001): 6–7.
4. C. M. Krause et al., "Effects of Electromagnetic Field Emitted by Cellular Phones on the EEG During a Memory Task," *Neuroreport* 11, no. 4 (2000): 761–764.
5. Independent Expert Group on Mobile Phones, *Mobile Phones and Health* (Report to the United Kingdom Government, 2000), http://www.iegmp.org.uk.

affected by the siting of CPBSs remains strong.[6] However, the extent to which such attitudes are reflected in lower property values for homes located near CPBSs is not known.

Understanding the impact of CPBSs on property values is important to telecommunications companies both for planning the siting of CPBSs and for determining likely opposition from property owners. Similarly, property appraisers need to understand the valuation implications of CPBSs when valuing CPBS-affected property. The owners of affected property also want to understand the magnitude of any effects, particularly if compensation claims or an award for damages are to be made based on any negative effects on value.

The research here uses a case study approach to determine residents' perceptions towards living near CPBSs in Christchurch, New Zealand, and to quantify these effects in monetary terms according to an increasing or decreasing percentage of property value. The case study uses both an opinion survey and an econometric analysis of sales transaction data. A comparison of the results can be used to help appraisers value affected property as well as to resolve compensation issues and damage claims in a quantitative way. Further, the results provide a potential source of information for government agencies in assessing the necessity for increased information pertaining to CPBSs.

The following provides a brief review of the cellular phone technology and relevant literature. Then, the next section describes the research procedure used, including descriptions of the case study and control areas. The results are then discussed, and the final section provides a summary and conclusion.

Cellular Telephone Technology[7]

Cellular (mobile) telephones are sophisticated two-way radios that use ultrahigh frequency (UHF) radio waves to communicate information. The information is passed between a mobile phone and a network of low-powered transceivers, called mobile phone sites or cell sites. As mobile sites are very low powered they serve only a limited geographic area (or "cell"), varying from a few hundred meters to several kilometers; they can handle only a limited number of calls at one time. When a mobile phone user on the move leaves one cell and enters another, the next site automatically takes over the call, allowing contact to be maintained.

When a mobile phone call is initiated, the phone connects to the network by using radio signals to communicate with the nearest mobile phone site. The mobile phone sites in a network are interlinked by cable or microwave beam, enabling phone calls to be passed from one cell to another automatically. A mobile phone site is typically made up of a mast with antennas connected to equipment stored in a cabinet. Power is fed into the cabinet by underground cable. The antennas are designed to transmit most of the signal away horizontally, or just below horizontal, rather than at steep angles to the ground.

Mobile phone sites can only accommodate a limited number of calls at any one time. When this limit is reached, the mobile phone signal is transferred to the next nearest site. If this site is full or is too far away, the call will fail.

Cell site capacity is a major issue for telecommunication companies. As the number of people using mobile phones grows, more and more cell sites are required to meet customer demand for reliable coverage. At the end of March 2002, Telecom had more than 1.3 million mobile phone customers and more than 750 mobile phone sites throughout New Zealand. Vodafone had over 1.1 million mobile phone customers.[8] In areas, such as Auckland (the largest city in New Zealand, with close to a third of the NZ population), where almost complete coverage has been achieved, the main issue is ensuring that there is the capacity to handle the ever-increasing number of mobile phones and calls.

Locating Cellular Phone Sites

For cellular phone service providers, the main goals when locating cell sites are (1) finding a site that provides the best possible coverage in the area without causing interference with other cells, and (2) finding a site that causes the least amount of environmental impact on the surrounding area. Service providers usually attempt to locate cell sites on existing structures such as buildings, where antennas can be mounted on the roof to minimize the environmental impact. If this is not possible, a mast will need to be erected to support the antennas for the new cell site.

6. S. Fox, "Cell Phone Antenna Worries Family," *East & Bays Courier*, November 8, 2002, 1.
7. The information in this section was sourced from Telecom, http://www.telecom.co.nz; New Zealand Ministry for the Environment, http://www.mfe.govt.nz; and New Zealand Ministry of Health, http://www.moh.govt.nz.
8. Vodafone, "Cell Sites and the Environment," http://www.vodafone.co.nz/aboutus/vdfn_about_cellsites.pdf (accessed December 19, 2002) and "Mobile Phones and Health," http://www.vodafone.co.nz/aboutus/vdfn_about_health_and_safety.pdf (accessed December 19, 2002); and Telecom, "Mobile Phone Sites and Safety," http://www.telecom.co.nz/content/0,3900,27116-1536,00.html (accessed December 19, 2002).

Service providers prefer to locate cell sites in commercial or industrial areas due to the "resource consent" procedure required by the Resource Management Act 1991[9] for towers located in residential areas.

Despite the high level of demand for better cell phone coverage, the location of cell sites continues to be a contentious issue. The majority of people want better cell phone coverage where they live and work, but they do not want a site in their neighborhood. Thus, cell sites in or near residential areas are of particular concern. Concerns expressed usually relate to health, property values, and visual impact.[10]

In general, uncertainties in the assessment of health risks from base stations are presented and distributed in reports by organized groups of residents who protest against siting of base stations. When the media publishes these reports it amplifies the negative bias and raises public concerns. According to Covello, this leads to incorrect assessment of risks and threats by the public, with a tendency to overestimate risks from base stations and neglect risks from the use of cell phones.[11]

Assessment of Environmental Effects

Under the Resource Management Act 1991 (RMA), an assessment of environmental effects is required every time an application for resource consent is made. Information that must be provided includes "an assessment of any actual or potential effects that the activity may have on the environment, and the ways in which any adverse effects may be mitigated."[12] An assessment of the environmental effects of cell sites would take into consideration such things as health and safety effects; visual effects; effects on the neighborhood; and interference with radio and television reception.

Radio Frequency and Microwave Emissions from CPBSs

According to the Ministry for the Environment, the factors that affect exposure to radiation are as follows:

- Distance. Increasing the distance from the emitting source decreases the radiation's strength and decreases the exposure.
- Transmitter power. The stronger the transmitter, the higher the exposure.
- Directionality of the antenna. Increasing the amount of antennas pointing in a particular direction increases the transmitting power and increases the exposure.
- Height of the antenna above the ground. Increasing the height of an antenna increases the distance from the antenna and decreases the exposure.
- Local terrain. Increasing the intervening ridgelines decreases the exposure.[13]

The amount of radiofrequency power absorbed by the body (the dose) is measured in watts per kilogram, known as the specific absorption rate (SAR). The SAR depends on the power density in watts per square meter. The radio frequencies from cellular phone systems travel in a "line of sight." The antennas are designed to radiate energy horizontally so that only small amounts of radio frequencies are directed down to the ground. The greatest exposures are in front of the antenna so that near the base of these towers, exposure is minimal. Further, power density from the transmitter decreases rapidly as it moves away from the antenna. However, it should be noted that by initially walking away from the base, the exposure rises and then decreases again. The initial increase in exposure corresponds to the point where the lobe from the antenna beam intersects the ground.[14]

Health Effects

According to Szmigielski and Sobiczewska, the analogue phone system (using the 800–900 megahertz band) and digital phone system (using the 1850–1990 megahertz band) expose humans to electromagnetic field (EMF) emissions: radio frequency radiation (RF) and microwave radiation (MW), respectively. These two radiations are emitted from both cellular phones and CPBSs.[15]

For years cellular phone companies have assured the public that cell phones are safe. They state that the particular set of radiation parameters associated with cell phones is the same as any other ra-

9. The Resource Management Act 1991 is the core of the legislation intended to help achieve sustainability in New Zealand; see http://www.mfe.govt.nz/laws/rma.
10. Szmigielski and Sobiczewska; and Barnes.
11. Vincent T. Covello, "Risk Perception, Risk Communication, and EMF Exposure: Tools and Techniques for Communicating Risk Information," in *Risk Perception, Risk Communication and Its Application to EMF Exposure: Proceedings of the World Health Organization and ICNIRP Conference*, ed. R. Matthes, J. H. Bernhardt, M. H. Repucholi, 179–214 (Munich, Germany, May 1998).
12. Section 88(4), (b), Resource Management Act 1991.
13. Ministry for the Environment and Ministry of Health, *National Guidelines for Managing the Effects of Radiofrequency Transmitters*, available at http://www.mfe.govt.nz and http://www.moh.govt.nz (accessed May 21, 2002).
14. Ibid.; and Szmigielski and Sobiczewska.
15. Szmigielski and Sobiczewska.

dio signal. However, reported scientific evidence challenges this view and shows that cell phone radiation causes various effects, such as altered brain activity, memory loss, and fatigue.[16]

According to Cherry, there is also strong evidence to conclude that cell sites are risk factors for certain types of cancer, heart disease, neurological symptoms and other effects.[17] The main concerns related to EMF emissions from CPBSs are linked to the fact that radio frequency fields penetrate exposed tissues.

Public concern regarding both cell phones and CPBSs in many countries has led to establishment of independent expert groups to carry out detailed reviews of the research literature. Research on the health effects of exposures to RF are reviewed by, for instance, the NZ Radiation Laboratory, the World Health Organization, the International Commission on Non-Ionizing Radiation Protection (ICNIRP), the Royal Society of Canada, and the UK Independent Expert Group on Mobile Phones. The reviews conclude that there are no clearly established health effects for low levels of exposure. Such exposures typically occur in publicly accessible areas around radio frequency transmitters. However, there are questions over the delayed effects of exposure.

While present medical and epidemiological studies reveal weak association between health effects and low-level exposures of RF/MW fields, controversy remains among scientists, producers, and the general public. Negative media attention has fuelled the perception of uncertainty over the health effects from cell phone systems. Further scientific or technological information is needed to allay fears of the public about cell phone systems.

Radio Frequency Radiation Exposure Standards

International Standards. The reviews of research on the health effects of exposures to RF have helped establish exposure standards that limit RF exposures to a safe level. Most standards–including those set by the ICNIRP, the American National Standards Institute (ANSI), and New Zealand–are based on the most-adverse potential effects.

The 1998 ICNIRP guidelines have been accepted by the world's scientific and health communities; these guidelines are both consistent with other stated standards and published by a highly respected and independent scientific organization. The ICNIRP is responsible for providing guidance and advice on the health hazards of nonionizing radiation for the World Health Organization (WHO) and the International Labour Office.[18]

The New Zealand Standard. In New Zealand, when a mobile phone site is being planned, radio frequency engineers calculate the level of electromagnetic energy (EME) that will be emitted by the site. The level of EME is predicted by taking into account factors such as power output, cable loss, antenna gain, path loss, and height and distance from the antenna. These calculations allow engineers to determine the maximum possible emissions in a worst-case scenario, i.e., as if the site was operated at maximum power all the time. The aim is to ensure that EME levels are below international and NZ standards in areas where the general public has unrestricted access.

All mobile phone sites in New Zealand must comply in all respects with the NZ standard for radio frequency exposures.[19] This standard is the same as used in most European countries, and is more stringent than that used in the United States, Canada, and Japan. Some local communities in New Zealand have even lower exposure-level standards; however, in reality mobile phone sites only operate at a fraction of the level set by the NZ standard. The National Radiation Laboratory has measured exposures around many operating cell sites, and maximum exposures in publicly accessible areas around the great majority of sites are less than 1% of the exposure limit of the NZ standard. Exposures are rarely more than a few percent of the limit, and none have been above 10%.

Court Decisions

Two court cases in New Zealand have alleged adverse effects due to CPBSs: *McIntyre v. Christchurch City*

16. K. Mann and J. Röschke, "Effects of Pulsed High-Frequency Electromagnetic Fields on Human Sleep," *Neuropsychobiology* 33, no. 1 (1996): 41–47; Krause et al.; Alexander Borbely et al., "Pulsed High-Frequency Electromagnetic Field Affects Human Sleep and Sleep Electroencephalogram," *Neurosci Let*, 275, no. 3 (1999): 207–210; L. Kellenyi et al., "Effects of Mobile GSM Radiotelephone Exposure on the Auditory Brainstem Response (ABR)," *Neurobiology* 7, no. 1 (1999): 79–81; B. Hocking, "Preliminary Report: Symptoms Associated with Mobile Phone Use," *Occup Med* 48, no. 6 (Sept. 1998): 357–360; and others as reported in Neil Cherry, *Health Effects Associated with Mobil Base Stations in Communities: The Need for Health Studies*, Environmental Management and Design Division, Lincoln University (June 8, 2000); http://pages.britishlibrary.net/orange/cherryonbasestations.htm.

17. Cherry.

18. Ministry for the Environment and Ministry of Health.

19. NZS 2772.1:1999, "Radiofrequency Fields Part I: Maximum Exposure Levels – 3kHz to 300GHz." This standard was based largely on the 1998 ICNIRP recommendations for maximum human exposure levels to radio frequency. The standard also includes a requirement for minimizing radio frequency exposure. See National Radiation Laboratory, *Cell Sites* (March 2001), 7; available at http://www.nrl.moh.govt.nz/CellsiteBooklet.pdf.

Council[20] and *Shirley Primary School v. Telecom Mobile Communications Ltd.*[21] Very few cell site cases have actually proceeded to Environment Court hearings. In these two cases the plaintiffs claimed that there was a risk of adverse health effects from radio frequency radiation emitted from cell phone base stations and that the CPBSs had adverse visual effects.

In *McIntyre*, Bell South applied for resource consent to erect a CPBS. The activity was a noncomplying activity under the Transitional District Plan. Residents objected to the application. Their objections were related to the harmful health effects from radio frequency radiation. In particular, they argued it would be an error of law to decide, based on the present state of scientific knowledge, that there are no harmful health effects from low-level radio frequency exposure. It was also argued that the Resource Management Act contains a precautionary policy and also requires a consent authority to consider potential effects of low probability but high impact in reviewing an application.

The Planning Tribunal considered residents' objections and heard experts' opinions as to the potential health effects, and granted the consent, subject to conditions. It was found that there would be no adverse health effects from low levels of radiation from the proposed transmitter, not even effects of low probability but high potential impact.

In *Shirley Primary School*, Telecom applied to the Christchurch City Council for resource consent to establish, operate, and maintain a CPBS on land adjacent to the Shirley Primary School. This activity was a noncomplying activity under the Transitional District Plan. Again, the city council granted the consent subject to conditions. However, the school appealed the decision, alleging the following four adverse effects:

- Risk of adverse health effects from the radio frequency radiation emitted from the cell site
- Adverse psychological effects on pupils and teachers because of the perceived health risks
- Adverse visual effects
- Reduced financial viability of the school if pupils withdraw because of the perceived adverse health effects

The court concluded that the risk of the children or teachers at the school developing leukemia or other cancers from radio frequency radiation emitted by the cell site is extremely low, and the risk to the pupils of developing sleep disorders or learning disabilities because of exposure to radio frequency radiation is higher, but still very small. Accordingly, the Telecom proposal was allowed to proceed.

In summary, the Environmental Court ruled that there are no established adverse health effects from the emission of radio waves from CPBSs and no epidemiological evidence to show this. The court was persuaded by the ICNIRP guidelines that risk of health effects from low-level exposure is very low and that the cell phone frequency imposed by the NZ standard is safe, being almost two and one-half times lower than that of the ICNIRP.

The court did concede that while there are no proven health effects, there was evidence of property values being affected by both of the health allegations. The court suggested that such a reduction in property values should not be counted as a separate adverse effect from, for example, adverse visual or amenities effects. That is, a reduction in property values is not an environmental effect in itself; it is merely evidence, in monetary terms, of the other adverse effects noted.

In a third case, *Goldfinch v. Auckland City Council*,[22] the Planning Tribunal considered evidence on potential losses in value of the properties of objectors to a proposal for the siting of a CPBS. The court concluded that the valuer's monetary assessments support and reflect the adverse effects of the CPBS. Further, it concluded that the effects are more than just minor as the CPBS stood upon the immediately neighboring property.

Literature Review

While experimental and epidemiological studies have focused on the adverse health effects of radiation from the use of cell phones and CPBSs, few studies have been conducted to ascertain the impact of CPBSs on property values. Further, little evidence of property value effects has been provided by the courts. Thus, the extent to which opposition from property owners affected by the siting of CPBSs is reflected in lower property values is not well known in New Zealand.

Two studies have been conducted to ascertain the adverse health and visual effects of CPBSs on property values. Telecom commissioned Knight Frank (NZ) Ltd to undertake a study in Auckland in 1998/

20. NZRMA 289 (1996).
21. NZRMA 66 (1999).
22. NZRMA 97 (1996).

99 and commissioned Telfer Young (Canterbury) Ltd to undertake a similar study in Christchurch in 2001. Although the studies show that there is not a statistically significant effect on property prices where CPBSs are present,[23] the research in both cases involves only limited sales data analysis. Further, no surveys of residents' perceptions were undertaken, and the studies did not examine media attention to the sites and the impact this may have on saleability of properties in close proximity to CPBSs. Finally, as the sponsoring party to the research was a telecommunication company it is questionable whether the results are completely free from bias. Hence, the present study aims to help fill the research void on this contentious topic in an objective way.

CPBSs are very similar structures to high-voltage overhead transmission lines (HVOTLs); therefore it is worthwhile to review the body of literature on the property values effects of HVOTLs. The only recently published study in New Zealand on HVOTLs effects is by Bond and Hopkins.[24] Their research consists of both a regression analysis of residential property transaction data and an opinion survey to determine the attitudes and reactions of property owners in the study area toward living close to HVOTLs and pylons.

The results of the sales analysis indicate that having a pylon close to a particular property is statistically significant and has a negative effect of 20% at 10–15 meters from the pylon, decreasing to 5% at 50 meters. This effect diminishes to a negligible amount after 100 meters. However, the presence of a transmission line in the case study area has a minimal effect and is not a statistically significant factor in the sale prices.

The attitudinal study results indicate that nearly two-thirds of the respondents have negative feelings about the HVOTLs. Proximity to HVOTLs determines the degree of negativity: respondents living closer to the HVOTLs expressed more negative feelings towards them than those living farther away. It appears, however, from a comparison of the results, that the negative feelings expressed are often not reflected in the prices paid for such properties.

There have been a number of HVOTLs studies carried out in the United States and Canada. A major review and analysis of the literature by Kroll and Priestley indicates that in about half the studies, HVOTLs have not affected property values and in the rest of the studies there is a loss in property value between 2%–10%.[25] Kroll and Priestley are generally critical of most valuer-type studies because of the small number of properties included and the failure to use econometric techniques such as multiple regression analysis. They identify the Colwell study as one of the more careful and systematic analyses of residential impacts.[26] That study, carried out in Illinois, finds that the strongest effect of HVOTLs is within the first 15 meters, but the effect dissipates quickly with distance, disappearing beyond 60 meters.

A Canadian study by Des Rosiers, using a sample of 507 single-family house sales, finds that severe visual encumbrance due to a direct view of either a pylon or lines exerts a significant, negative impact on property values; however location adjacent to a transmission corridor may increase value.[27] This was particularly evident where the transmission corridor was on a well-wooded, 90-meter right-of-way. The proximity advantages include enlarged visual field and increased privacy. The decrease in value from the visual impact of the HVOTLs and pylons (on average between 5% and 10% of mean house value) tends to be cancelled out by the increase in value from proximity to the easement.

A study by Wolverton and Bottemiller[28] uses a paired-sale analysis of home sales in 1989–1992 to ascertain any difference in sale price between properties abutting rights-of-way of transmission lines (subjects) in Portland, Oregon; Vancouver, Washington; and Seattle, Washington; and those located in the same cities but not abutting transmission line rights-of-way (comparisons). Subjects sold during the study period were selected first; then a matching comparison was selected that was as similar to the subject as possible. The study results did not support a finding of a price effect from abutting an HVTL right-of-way. In their conclusion, the authors

23. Mark Dunbar, Telfer Young research valuer, personal communication with Bond, 2002. The results of these studies have not been made publicly known. The study by Knight Frank of Auckland was conducted by Robert Albrecht.

24. S. G. Bond and J. Hopkins, "The Impact of Transmission Lines on Residential Property Values: Results of a Case Study in a Suburb of Wellington, New Zealand," *Pacific Rim Property Research Journal* 6, no. 2 (2000): 52–60.

25. C. Kroll and T. Priestley, "The Effects of Overhead Transmission Lines on Property Values: A Review and Analysis of the Literature," Edison Electric Institute (July 1992).

26. Peter F. Colwell, "Power Lines and Land Value," *Journal of Real Estate Research* 5, no. 1 (Spring 1990): 117–127.

27. François Des Rosiers, "Power Lines, Visual Encumbrance and House Values: A Microspatial Approach to Impact Measurement," *Journal of Real Estate Research* 23, no. 3 (2002): 275–301.

28. Marvin L. Wolverton and Steven C. Bottemiller, "Further Analysis of Transmission Line Impact on Residential Property Values," *The Appraisal Journal* (July 2003): 244–252.

warn that the results cannot and should not be generalized outside of the data. They explain that

> limits on generalizations are a universal problem for real property sale data because analysis is constrained to properties that sell and sold properties are never a randomly drawn representative sample. Hence, generalizations must rely on the weight of evidence from numerous studies, samples, and locations.[29]

Thus, despite the varying results reported in the literature on property value effects from HVOTLs, each study adds to the growing body of evidence and knowledge on this (and similar) valuation issue(s). The study reported here is one such study.

Opinion Survey Research Objectives and Methodology

Research by Abelson;[30] Chalmers and Roehr;[31] Kinnard, Geckler and Dickey;[32] Bond;[33] and Flynn et al.,[34] recommend the use of market sales analysis in tandem with opinion survey studies to measure the impact of environmental hazards on residential property values. The use of more than one approach provides the opportunity to compare the results from each and to derive a more informed conclusion than obtained from relying solely on one approach. Thus, the methods selected for this study include a public opinion survey and a hedonic house price approach (as proposed by Freeman[35] and Rosen[36]). A comparison of the results from both of these techniques will reveal the extent to which the market reacts to cell phone towers.

Public Opinion Survey

An opinion survey was conducted to investigate the current perceptions of residents towards living near CPBSs and how this proximity might affect property values. Case study areas in the city of Christchurch were selected for this study. The study included residents in ten suburbs: five case study areas (within 300 meters of a cell phone tower) and five control areas (over 1 kilometer from the cell phone tower). The five case study suburbs were matched with five control suburbs that had similar living environments (in socioeconomic terms) except for the presence of a CPBS.

The number of respondents to be surveyed (800) and the nature of the data to be gathered (perceptions/personal feelings towards CPBSs) governed the choice of a self-administered questionnaire as the most appropriate collection technique. Questionnaires were mailed to residents living in the case study and control areas.

A self-administered survey helps to avoid interviewer bias and to increase the chances of an honest reply where the respondent is not influenced by the presence of an interviewer. Also, mail surveys provide the time for respondents to reflect on the questions and answer these at their leisure, without feeling pressured by the time constraints of an interview. In this way, there is a better chance of a thoughtful and accurate reply.

The greatest limitation of mail surveys is that a low response rate is typical. Various techniques were used to help overcome this limitation, including careful questionnaire design; inclusion of a free-post return envelope; an accompanying letter ensuring anonymity; and reminder letters. An overall response rate of 46% was achieved for this study.

The questionnaire contained 43 individual response items. The first question acted as an identifier to determine whether the respondent was a homeowner or tenant. While responses from both groups were of interest, the former was of greater importance, as they are the group of purchasers/sellers that primarily influence the value of property. However, it was considered relevant to survey both groups as both are affected by proximity to a CPBS to much the same extent from an occupiers' perspective, i.e., they both may perceive risks associated with a CPBS. It was hypothesized that tenants, being less-permanent residents, would perceive the effects in a similar way, but to a much lesser degree.

Other survey questions related to overall neighborhood environmental desirability; the timing of

29. Ibid., 252.
30. P. W. Abelson, "Property Prices and Amenity Values," *Journal of Environmental Economics and Management* 6 (1979): 11–28.
31. James A. Chalmers and Scott Roehr, "Issues in the Valuation of Contaminated Property," *The Appraisal Journal* (January 1993): 28–41.
32. W. N., Kinnard, M. B. Geckler, and S. A. Dickey, "Fear (as a Measure of Damages) Strikes Out: Two Case Studies Comparisons of Actual Market Behaviour with Opinion Survey Research" (paper presented at the Tenth Annual American Real Estate Society Conference, Santa Barbara, California, April 1994).
33. S. G. Bond, "Do Market Perceptions Affect Market Prices? A Case of a Remediated Contaminated Site," in *Real Estate Valuation Theory*, ed. K. Wang and M. L. Wolverton, 285–321 (Boston: Kluwer Academic Publishers, 2002).
34. James Flynn et al., "Survey Approach for Demonstrating Stigma Effects in Property Value Litigation," *The Appraisal Journal* (Winter 2004): 35–45.
35. A. Myrick Freeman, *The Benefits of Environmental Improvement: Theory and Practice* (Baltimore: John Hopkins Press, 1979).
36. Sherwin Rosen, "Hedonic Prices and Implicit Markets: Product Differentiation in Pure Competition," *Journal of Political Economy* 82, no. 1 (Jan/Feb 1974): 34–55.

the CPBS's construction and its proximity in relation to the respondent's home; the importance placed on the CPBS as a factor in relocation decisions and on the price/rent the respondent was prepared to pay for the house; how a CPBS might affect the price the respondent would be willing to pay for the property; and the degree of concern regarding the effects of CPBSs on health, stigma, aesthetics, and property values. The surveys were coded to identify the property address of the respondent. This enabled each respondent's property to be located on a map and to show this in relation to the cell site.

Eighty questionnaires[37] were distributed to each of the ten suburbs (five case study and five control areas) in Christchurch. Respondents were instructed to complete the survey and return it in the free-post, self-addressed envelope provided. The initial response rate was 31%. A month later, a further 575 questionnaires with reminder letters were sent out to residents who had not yet responded. A total response rate of 46% was achieved. Response rates from each suburb ranged from 33% (Linwood) to 61% (Bishopdale).

The questionnaire responses were coded and entered into a computerized database.[38] The analysis of responses included the calculation of means and percentage of responses to each question to allow for an overview of the response patterns in each area.

Case Study and Control Areas

The suburbs of Beckenham, Papanui, Upper Riccarton, Bishopdale, and St Albans were selected for the case study because there is at least one CPBS within each of these communities. Census data, providing demographic and socioeconomic characteristics of geographic areas, was used to select the control suburbs of Spreydon, Linwood, Bromley, Avonhead, and Ilam.[39] The control areas are located further away (over 1 kilometer) from the CPBS in their matched case study area. As well as matching demographic and socioeconomic characteristics, each suburb was selected based on its similarity to its matched case study area in terms of living environment and housing stock, distance to the central business district, and geographic size; the only dissimilarity is that there are no CPBSs in the control areas. (See Appendix I for a location map.)

Demographic statistics show that Bromley and Ilam comprise a younger population (median age about 33), with Bishopdale and Upper Riccarton having an older population (median age about 40). The ethnic breakdown of each suburb indicates that Papanui and Spreydon have the highest proportion of Europeans (about 90%), Bromley has the highest proportion of both Maoris and Pacific Islanders (13.9% and 8.5% respectively), while Ilam, Avonhead, and Upper Riccarton have the highest proportion of Asians (16.1% to 18.5%).[40]

Median household and median family incomes (MHI and MFI) are highest in Ilam and Avonhead (MHI: $34,751NZ, $53,405NZ; MFI: $51,530NZ, $65,804NZ, respectively) and lowest in Linwood and Beckenham (MHI: $22,275NZ, $26,398NZ; MFI: $29,673NZ, $33,847NZ respectively).[41] Residents of St Albans West have the highest levels of education (21.7% have a degree or a higher degree) followed by Upper Riccarton (18.7%), Ilam (16.7%), and Avonhead (16.2%). These same suburbs have the highest proportion of professionals by occupational class (20.3% to 27.3%). Residents of Bromley have the lowest education (40% have no qualification) and the lowest proportion of professionals (5.5%).[42]

In summary, the socioeconomic data shows that Ilam is the more superior suburb, followed by Avonhead, Upper Riccarton, St Albans West, and Papanui. The lower socioeconomic areas are, in decreasing order, Spreydon, Bishopdale, Bromley, Beckenham, and Linwood.

Survey Results

A summary of the main findings from the survey is presented in Appendix II, and the survey results are discussed in the following.

Response Rates

Of the 800 questionnaires mailed to homeowners and tenants in the case study and control areas (400 to each group), 50% from the case study area and 41%

37. Approved by the University of Auckland Human Subjects Ethics Committee (reference 2002/185).
38. The computer program SPSS was selected as the appropriate analytical tool for processing the data.
39. The census is conducted in New Zealand every five years, and the data used to define the control areas is from the latest census conducted in 2001, see Christchurch City Area Unit Profile, 2001 at http://www.ccc.govt.nz/Census/ChristchurchCityAreaUnitProfile.xls.
40. Christchurch City Area Unit Profile statistics.
41. $1NZ = $0.65US, thus, $34,751NZ = $22,588US.
42. The median house price for Christchurch city in August 2003 was $185,000NZ/$120,000US (New Zealand national median house price at this time was $215,000NZ/$140,000US), http://www.reinz.co.nz/files/HousingFacts-Sample-Pg1-5.pdf (accessed March 17, 2004). Median house prices in each individual suburb could not be obtained as the median sales data from the Real Estate Institute of NZ (REINZ) contains more than one suburb in each location grouping.

from the control area were completed and returned. Over three-quarters (78.5%) of the case study respondents were homeowners compared to 94% in the control area.

Desirability of the Suburb as a Place to Live

More than half (58.3%) the case study respondents have lived in their suburb for more than five years (compared to 65% in the control group) and a quarter (25%) have lived in their suburb between 1 and 4 years (compared to 28% in the control group).

Around two-thirds (65% of the case study respondents and 68% of the control group respondents) rated their neighborhoods as either above average or superior as a place to live when compared with other similar named suburbs. The reasons given for this include close proximity to amenities (shops, library, medical facilities, public transport, and recreational facilities) and good schools.

Reasons given for rating the case study neighborhoods inferior to other similar neighborhoods include lower house prices, older homes, more student housing and lower-income residents. The reasons given by the control group respondents for an inferior rating include distance from the central business district (Avonhead); smell from the sewerage oxidation ponds and composting ponds (Bromley); and lower socioeconomic area and noise from the airport (Linwood).

Feelings About a CPBS as an Element of the Neighborhood

In the case study areas, a CPBS had already been constructed when only 39% of the respondents bought their houses or began renting in the neighborhood. Some responded that they were not notified that the CPBS was to be built, that they had no opportunity to object to it, and that they felt they should have been consulted about its construction. For the respondents who said that proximity to the tower was of concern to them, the most common reasons given for this were the impact of the CPBS on health, aesthetics, and property values. Nearly three-quarters (74%) of the respondents said they would have gone ahead with the purchase or rental of their property anyway if they had known that the CPBS was to be constructed.

In the control areas nearly three-quarters (72%) of the respondents indicated they would be opposed to construction of a CPBS nearby. The location of a CPBS would be taken into account by 83% of respondents if they were to consider moving. As with the case study respondents, the control group respondents who were concerned about proximity to a CPBS were most often concerned about the effects of CPBSs on health, aesthetics, and property values.

Impact on Decision to Purchase or Rent

In the case study areas, the tower was visible from the houses of 46% of the respondents, yet two-thirds (66%) of these said it was barely noticeable, and one-quarter said it mildly obstructed their view. When asked in what way the CPBS impacts the enjoyment of living in their home, 37% responded that its impact was related to health concerns, 21% said it impacted neighborhood aesthetics, 20% said it impacted property value, and 12% said it impacted the view from their property.

When asked about the impact that the CPBS had on the price/rent they were prepared to pay for their property, over half the case study respondents (53.1%) said that the tower was not constructed at the time of purchase/rental, and 51.4% of the respondents said the proximity to the CPBS did not affect the price they were prepared to pay for the property. Nearly 3% said they were prepared to pay a little less, 2% said they were prepared to pay a little more. For the control group respondents, 45% of the respondents would pay substantially less for a property if a CPBS were located nearby, over one-third (38%) were prepared to pay just a little less for such a property, and 17% responded that a CPBS would not influence the price they would pay.

Only 10% of the case study respondents gave an indication of the impact that the CPBS had on the price/rent they were prepared to pay for the property; one-third of these felt it would decrease price/rent by 1% to 9%. For the control group, over one-third (38%) of the respondents felt that a CPBS would decrease price/rent by more than 20%, and a similar number (36%) said they would be prepared to pay 10% to 19% less for property located near a CPBS. The responses are outlined in Table 1.

Table 1 Impact of a CPBS on Purchase/Rental Price Decision

Price/Rent Effect	Percent of Case Study Respondents (Control Group Responses)
20% more	5% (3%)
10–19% more	10% (2%)
1–9% more	14% (2%)
1–9% less	33% (19%)
10–19% less	24% (36%)
20% or greater reduction in price/rent	14% (38%)

Interestingly, it would seem that those living farther away from the CPBSs (the control group) are far more concerned about proximity to CPBSs than those living near CPBSs (the case study group); they indicated that a CPBS would have a greater price/rent effect. The possible explanations for this are discussed in the survey results section.

Concerns About Proximity to the CPBS

Most case study respondents were not worried about the effects of proximity to a CPBS related to health (50%), stigma (55%), future property value (61%), or aesthetics (63%). About one-quarter to one-third of these respondents were somewhat worried about the impact of proximity to a CPBS on health (38%), stigma (34%), future property value (25%), or aesthetics (25%). From the list of issues, respondents were most worried about future property value, but only 13.5% of the respondents responded this way.

Here again, control group respondents were much more concerned about the effects of proximity to a CPBS than their case study counterparts. Of the possible concerns about CPBSs on which respondents were asked to comment, control group respondents were most worried about the negative effects on future property values and aesthetics. Nearly half the respondents were worried a lot about these issues. Similar responses were recorded for the possibility of harmful health effects in the future from CPBSs (42% were worried a lot about this) and stigma associated with houses near CPBSs (34% were worried a lot). The responses regarding concerns about living near a CPBS are shown in Table 2.

In both the case study and control areas, the issue of greatest concern for respondents was the impact of proximity to CPBSs on future property values. The main concerns related to CPBSs were the unknown potential health effects, the possible socioeconomic implications of the siting of CPBSs, and how CPBSs affect property values. There also were concerns that the city council was not notifying the public about the possible construction of CPBSs.

Discussion of the Survey Results

The results were mixed, with responses from residents ranging from having no concerns to being very concerned about proximity to a CPBS. In general, those people living in areas farther from CPBSs were much more concerned about issues related to proximity to CPBSs than residents who lived near CPBSs.

Over 40% of the control group respondents were worried a lot about future health risks, aesthetics, and future property values compared with the case study areas, where only 13% of the respondents were worried a lot about these issues. However, in both the case study and control areas, the impact of proximity to CPBSs on future property values is the issue of greatest concern for respondents. If purchasing or renting a property near a CPBS, over a third (38%) of the control group respondents said a CPBS would reduce the price of their property by more than 20%. The perceptions of the case study respondents were again less negative, with a third saying they would reduce the price by only 1%–9%, and 24% saying they would reduce the price by 10%–19%.

The lack of concern shown by the case study respondents may be due to the CPBSs being either not visible or only barely visible from their homes. The CPBSs may be far enough away from respondents' properties (as was indicated by many respondents, particularly in St Albans West, Upper Riccarton, and Bishopdale) or hidden by trees and consequently not perceived as affecting the properties. The results may have been quite different had the CPBS being more visually prominent.

Alternatively, the apparent lower sensitivity to CPBSs of case study residents compared to the control group residents may be due to cognitive dissonance reduction. In this case, respondents may be unwilling to admit, due to the large amounts of money already paid, that they may have made a poor purchase or rental decision in buying or renting property located near a CPBS. Similarly, the homeowners may be unwilling to admit there are concerns about CPBSs when the CPBSs were built

Table 2 Concerns about Living Near a CPBS*

Concern	Does not worry me	Worries me somewhat	Worries me a lot
Possibility of harmful health effects	50% (20%)	38% (38%)	12% (42%)
Stigma effect	55% (21%)	34% (45%)	12% (34%)
Effect on future property values	61% (15%)	25% (37%)	13% (47%)
Aesthetics	63% (18%)	25% (37%)	11% (45%)

* Percent of case study respondents having that concern (control group respondents). All numbers are rounded.

after they had purchased their homes, because to do so might have a negative impact on property values.

Regardless of the reasons for the difference in responses from the case study and control groups, the overall results show that residents perceive CPBSs negatively. In both the case study and control areas, the impact of proximity to CPBSs on future property values was the issue of greatest concern for respondents. Overall, respondents felt that proximity to a CPBS would reduce value by from 10% to over 20%. The second part of the study outlined below, involving an econometric analysis of Christchurch property sales transaction data, helps to confirm these results.

Respondents' comments added at the end of the survey indicate that residents have ongoing concerns about CPBSs. Although some people accepted the need for CPBSs, they said that they did not want them built in their back yard, or they preferred that they be disguised to blend better with their environment.

Market Study Research Objectives and Methodology

A market study was undertaken to test the hypothesis that in suburbs where there is a CPBS it will be possible to observe discounts to the selling price of homes located near these structures. Such discounts would be observed where buyers of proximate homes view the CPBSs in negative terms due to a perceived risk of adverse effects on health, aesthetics, and property value.

The literature dealing specifically with the measurement of the impact of environmental hazards on residential sale prices (including proximity to transmission lines, landfill sites, and ground water contamination) indicates the popularity of hedonic pricing models, as introduced by Court[43] and later Griliches,[44] and further developed by Freeman[45] and Rosen.[46] The more recent studies, including those by Dotzour;[47] Simons and Sementelli;[48] and Reichert,[49] focus on proximity to an environmental hazard and demonstrate that this reduces residential house prices by varying amounts depending on the distance from the hazard.[50] However, there are no known published studies that use hedonic housing models to measure the impact of proximity to a CPBS on residential property values.

As in the previous residential house price studies, the standard hedonic methodology was used here to quantify the impact of a CPBS on sale prices of homes located near a CPBS. The results from this study in tandem with the opinion survey results will help test the hypothesis that proximity to a CPBS has a negative impact on property value and will reveal the extent to which the market reacts to CPBSs.

Model Specification

A hedonic price model is constructed by treating the price of a property as a function of its utility-bearing attributes. Independent variables used in the model to account for the property attributes are limited to those available in the data set and known, based on other well-tested models reported in the literature and from valuation theory, to be related to property price. The basic model used to analyze the impact on sale price of a house located near a CPBS, is as follows:

$$P_i = f(X_{1,i}, X_{2,i} \ldots \ldots \ldots \ldots \ldots X_{n,i})$$

where:

P_i = property price at the i th location

$X_{1,i} \ldots X_{n,i}$ = individual characteristics of each sold property (e.g., land area, age of house, floor area, sale date, construction materials, house condition, CPBS construction date, etc.)

The more recent hedonic pricing studies that demonstrate the effects of proximity to an environmental hazard use different functional forms to represent the relationship between price and various property characteristics.[51] In hedonic housing models the linear and log-linear models are most popular. The linear model implies constant partial effects between house prices and housing characteristics, while the log-linear model allows for nonlinear price effects and is shown in the following equation:

43. A. T. Court, "Hedonic Price Indexes with Automotive Examples," in *The Dynamics of Automobile Demand* (New York: General Motors, 1939).
44. Zvi Griliches, ed. *Price Indexes and Quality Change* (Cambridge, Mass.: Harvard University Press, 1971).
45. Freeman.
46. Rosen.
47. Mark Dotzour, "Groundwater Contamination and Residential Property Values," *The Appraisal Journal* (July 1997): 279–285.
48. Robert A. Simons and Arthur Sementelli, "Liquidity Loss and Delayed Transactions with Leaking Underground Storage Tanks," *The Appraisal Journal* (July 1997): 255–260.
49. Alan K. Reichert, "Impact of a Toxic Waste Superfund Site on Property Values," *The Appraisal Journal* (October 1997): 381–392.
50. Only Dotzour found no significant impact of the discovery of contaminated groundwater on residential house prices. This was likely due to the nonhazardous nature of the contamination where the groundwater was not used for drinking purposes.
51. See for example L. Dale et al., "Do Property Values Rebound from Environmental Stigmas? Evidence from Dallas," *Land Economics* 75, no. 2 (May 1999): 311–326; Dotzour; Simons and Sementelli; and Reichert.

$$\ln P_i = b_0 + b_1 \times X_{1,i} + b_2 \times X_{2i} + b_3 \times X_{3i} \ldots\ldots\ldots + b_n \times X_{n+1} + a_o \times D_o + \ldots\ldots + a_m \times D_m + e_0$$

where:

$\ln P_i$ = the natural logarithm of sale price

b_0 = the intercept

$b_1 \ldots b_n$; $a_o \ldots a_m$ = the model parameters to be estimated, i.e., the implicit unit prices for increments in the property characteristics

$X_1 \ldots X_n$ = the continuous characteristics, such as land area

$D_o \ldots D_m$ = the categorical (dummy) variables, such as whether the sale occurred before (0) or after (1) the CPBS was built

Sometimes the natural logarithm of land area and floor area is also used. The parameters are estimated by regressing property sales on the property characteristics and are interpreted as the households' implicit valuations of different property attributes. The null hypothesis states that the effect of being located near a CPBS does not explain any variation in property sale prices.

The Data

Part of the process for selecting appropriate case study areas was identifying areas where there had been a sufficient number of property sales to provide statistically reliable and valid results. Sales were required for the period before and after the CPBS had been built in order to study the impact of the CPBS on the surrounding properties' sale prices.

Further, due to the multitude of factors that combine to determine a neighborhood's character, such as proximity to the central business district, standard of schooling, recreational facilities provided, standard of housing, proximity to amenities, and the difficulty in allowing for these separately, sales located in areas with comparable neighborhood characteristics were preferred.

Four of the suburbs in the survey case study met the criteria for the market study: St Albans, Beckenham, Papanui, and Bishopdale. No sales data was available for Upper Riccarton after the CPBS was built in this suburb, hence this suburb was not included in the market analysis study. As each CPBS was built at a different date, the sales from each suburb were separately analyzed. The uniformity of locational and neighborhood characteristics in each of these suburbs allows the analysis to be simplified and to focus on the properties' physical attributes. The relative homogeneity of housing, locational, and neighborhood attributes was verified through field inspections.

The dependent variable is the property sale price. The data set includes 4283 property sales that occurred between 1986 and 2002 (approximately 1000 sales per suburb).[52]

The independent data set was limited to those variables that correspond to property attributes known and suspected to influence price. These variables are floor area (m^2); land area (ha); age of the house (the year the house was built); tower (a dummy variable indicating whether the sale occurred before or after the CPBS was built); sale date (month and year); time of sale based on the number of quarters before or after the CPBS was built (to help control for movements in house prices over time); category of residential property (stand-alone dwelling, dwelling converted into flats, ownership unit, etc); quality of the principal structure (as assessed by an appraiser); and roof and wall materials. The number of bedrooms was not available in the data set, but would not have been included as an independent variable since the number of bedrooms is highly correlated with floor area.

Since the GIS coordinates of properties for the initial analysis were not available, street name was included as an independent variable instead. To a limited extent, street name helped to control for the proximity effects of a CPBS. It was suspected that houses on a street close to a CPBS may, on average, sell for less than houses on a street farther away from the CPBS.

While views, particularly water views, have been shown in previous empirical studies to be an important attribute affecting sale price, in the present study the flat contour of the landscape where the homes are located, together with the suburban nature of the environment surrounding these, precluded any significant views. Thus, views were not included in the analysis. Further, due to the large number of sales included in the analysis, inspections of each individual property were not made to determine the view, if any, of a CPBS from each house. It was felt that it is not merely the view that may impact on price, but also proximity to a CPBS due to the potential effect this may have on health, cell phone coverage, and neighborhood aes-

52. These sales were obtained from Headway Systems Ltd, a data distribution and system development company. Headway is the major supplier of property market sales information to New Zealand's valuation profession; it is jointly owned by the NZ Institute of Valuers (NZIV) and PT Investments, a consortium of 28 shareholders from within the property industry.

thetics. Hence, view of a CPBS was not included as an independent variable. The variable descriptions are listed in Table 3. Variable codes are shown in Appendix III and basic descriptive statistics for selected quantitative variables are shown in Appendix IV.

Table 3 Variable Descriptions

Variable*	Definition
SLNETX	Sale price of the house (NZ$)
SITSTX	Street name
CATGYX2	Category of dwelling: D, E, etc.†
CATGYX4	Quality of the structure: A, B, C†
TIMESOLD.Q	Using the time the cell phone tower was built as a baseline quarter, the number of quarters before (–) and after (+) it was built
AGE	Year the house was built
LANDAX	Land area (ha)
MATFAX	Total floor area (m^2)
WALLCNX	Wall construction: W, B, C, etc.†
ROOFCNX	Roof construction: W, B, C, etc.†
TOWER	An indicator variable: 0 if before the cell phone tower was built, or 1 after it was built

* Sale price is the dependent variable.

† See Appendix III for explanation of variable codes.

Market Study Results

An econometric analysis of Christchurch property transaction data helped to confirm the opinion survey results. In the analysis of selected suburbs, the sales data from sales that occurred before a CPBS was built was compared to sales data from after a CPBS was built to determine any variance in price, after accounting for all the relevant independent variables.

Empirical Results

The model of choice is one that best represents the relationships between the variables and has a small variance and unbiased parameters. Various models were tested and the results are described in the next section. The following statistics were used to help select the most appropriate model: the adjusted coefficient of determination (adjusted R^2); the standard error of the regression equation; the AIC[53] and BIC[54] statistics; and *t*-test of significance of the coefficients and *F*-statistic.

Significance of Variables and the Equation: St Albans

As hedonic prices can vary significantly across different functional forms, various commonly used functional forms were examined to determine the model specification that best describes the relationship between price and the independent variables. Also, to test the belief that the relationship between *Price* and *Land Area* is not a linear function of *Price*, the variable *LANDAX* (land area) was transformed to reflect the correct relationship. Several transformations were tested including: linear of *SLNETX* (sale price) and log of *LANDAX*; log of *SLNETX* and linear of *LANDAX;* and log of *SLNETX* and log of *LANDAX*. All dummy variables remained in their linear form in each model.

It was found that the best result was obtained from using the log of *SLNETX* and log of *LANDAX*, and the linear form of all the dummy variables. Taking the log of an independent variable implies diminishing marginal benefits. For example, an extra 50 square meters of land area on a 550-square-meter site would be worth less than the previous 50 square meters. The log-log model shows the percent change in price for a one-percent change in the independent variable, while all other independent variables are held constant (as explained in Hill, Griffiths, and Judge).[55]

In the semilogarithmic equation the interpretation of the dummy variable coefficients involves the use of the formula: $100(e^{b_n} - 1)$, where b_n is the dummy variable coefficient.[56] This formula derives the percentage effect on price of the presence of the factor represented by the dummy variable and is advocated over the alternative, and commonly misused, formula of 100. (b_n). The resulting model included all the available variables as follows:

$$\begin{aligned}\log(SLNETX) = \alpha &+ \beta_1 \times TOWER + \beta_2 \times SITSTX \\ &+ \beta_3 \times CATGYX2 + \beta_4 \times CATGYX4 \\ &+ \beta_5 \times TIMESOLD \times Q + \beta_6 \times AGE \\ &+ \beta_7 \times \log(LANDAX) \\ &+ \beta_8 \times MATFAX \\ &+ \beta_9 \times WALLCNX \\ &+ \beta_{10} \times ROOFCNX\end{aligned}$$

53. AIC is the Akaike Information Criterion, and is a "goodness of fit" measure involving the standard error of the regression adjusted by a penalty factor. The model selected is the one that minimizes this criterion (Microsoft SPSSPC Online Guide, 1997).

54. The BIC is the Bayesian Information Criterion. Like the AIC, BIC takes into account both how well the model fits the observed data, and the number of parameters used in the model. The model selected is the one that adequately describes the series and has the minimum SBC. The SBC is based on Bayesian (maximum-likelihood) considerations. (Microsoft SPSSPC Online Guide, 1997).

55. R. Carter Hill, William E. Griffiths, and George G. Judge, *Undergraduate Econometrics* (New York: John Wiley & Sons, 1997).

56. See Robert Halvorsen and Raymond Palmquist, "The Interpretation of Dummy Variables in Semi-Logarithmic Equations," *American Economic Review* 70, no. 3 (1980): 474–475.

From the regression output, the variables *ROOFCNX* and *WALLCNX* were found to be insignificant so these were removed from the model and the regression was rerun. The table in Appendix V summarizes these results. The *F*-statistic (123) shows that the estimated relationship in the model is statistically significant at the 95% confidence level and that at least one of the coefficients of the independent variables within the model is not zero.

Table 4 summarizes the model selection test statistics. Based on the AIC and BIC, the regression that excludes the variables *ROOFCNX* and *WALLCNX* is superior to the regression that includes them (AIC and BIC are minimized). For this reason, the model excluding these variables was selected for analysis, and it is discussed next.

Table 4 Test Statistics — St Albans

	Adjusted R^2	AIC	BIC
Full Model	0.82	-118.38	36.55
Sub Model	0.82	-121.64	5.95

Tests for normality, heteroskedasticity, and multicollinearity generally indicated that the model was adequately specified and that the data were not severely ill conditioned (heteroskedasticity and multicollinearity were diminished when the data were transformed).

The coefficient of determination (R^2) indicates that approximately 82% of the variation in sale price is explained by the variation in the independent variable set. All variable coefficients had the expected signs,[57] except for *TOWER*, which was positive. The positive coefficient for *TOWER* shows that, when all the other variables are held constant, after the installation of a CPBS in St Albans, the price of a house would increase by $e^{0.1133} \approx 1.12$ (12%). A possible explanation is that cell phone technology was quite new at the time (1994), and as there had been little in the media about possible adverse health effects from CPBSs, people may have perceived it as a benefit as they were likely to get better cell phone coverage.

The most significant variables were *TIMESOLD.Q* (the quarter in which the sale occurred before or after the CPBS was built), *log(LANDAX)* (log of land area), and *MATFAX* (total floor area) and all have a positive influence on price. The positive *TIMESOLD.Q* indicates that the market was increasing over time since the CPBS was built (1994), but only to a limited extent (1.38%). The positive log of land area and total floor area shows that prices increase with increasing size.

The regression coefficient on *log(LANDAX)* is 0.3285, which indicates that, on average, a 10% increase in *LANDAX* will generate a 3.285% increase in price. The positive coefficient for *MATFAX* indicates that, when all the other variables are held constant, for each additional m^2 the price would increase by $e^{0.0022314} \approx 1.0022314$ (0.22% increase).

Significance of Variables and the Equation: Papanui

The same functional form used for St Albans was used for Papanui. From the regression output, the variable *CATGYX2* was found to be insignificant so it was removed from the model and the regression was rerun; Appendix VI summarizes the results. The *F*-statistic (152) shows that the estimated relationship in the model is statistically significant at the 95% confidence level and that at least one of the coefficients of the independent variables within the model is not zero.

Table 5 summarizes the model selection test statistics. Based on the AIC and BIC, the regression that excludes the variable *CATGYX2* is superior to the regression that includes it (AIC and BIC are minimized). For this reason, the model excluding this variable was selected for analysis, and is discussed next.

Table 5 Test Statistics — Papanui

	Adjusted R^2	AIC	BIC
Full Model	0.87	-509.91	-371.99
Sub Model	0.87	-510.57	-381.56

The coefficient of determination (R^2) indicates that approximately 87% of the variation in sale price is explained by the variation in the independent variable set. This would be considered high in comparison with the amount of explanation obtained in similar hedonic house studies reported in the literature.[58] All variable coefficients had the expected signs.

The most significant variables were *TIMESOLD.Q*, *MATFAX* (total floor area), and *TOWER*. The former two have a positive influence on price. The positive *TIMESOLD.Q* indicates that the

57. Note that the variable *AGE* is positive as this variable indicates the year the house was built; therefore, the higher the year, the younger the home. Newer houses have less wear and tear than older homes and sell, on average, for more than older homes.

58. For example, Reichert obtained an adjusted R^2 of 84%; Simons and Sementelli, 78%; Abelson, 68%; Dotzour, 56%–61%.

market was increasing over time since the CPBS was built (2000), but only by 1.4% per quarter. The positive coefficient for *MATFAX* indicates that, when all the other variables are held constant, the price would increase by $e^{0.0042576} \approx 1.00427$ (0.43%), with increasing size. The negative coefficient for *TOWER* shows that, when all the other variables are held constant, after the installation of a CPBS in Papanui, the price of a house would decrease by $e^{-0.2340} \approx 0.79$ (21% decrease).

Significance of Variables and the Equation: Beckenham

The same functional form used for Papanui and St Albans was used for Beckenham. From the regression output, the variable *ROOFCNX* was found to be insignificant so it was removed from the model and the regression was rerun; Appendix VII summarizes these results. The *F*-statistic (214) shows that the estimated relationship in the model is statistically significant at the 95% confidence level and that at least one of the coefficients of the independent variables within the model is not zero.

Table 6 summarizes the model selection test statistics. Based on the AIC and BIC, the regression that excludes the variable *ROOFCNX* is superior to the regression that includes it (AIC and BIC are minimized). For this reason, the model excluding this variable was selected for analysis.

Table 6 Test Statistics — Beckenham

	Adjusted R^2	AIC	BIC
Full Model	0.89	-819.00	-641.39
Sub Model	0.89	-818.66	-650.66

The coefficient of determination (R^2) indicates that approximately 89% of the variation in sale price is explained by the variation in the independent variable set. Again, as with the model for Papanui this amount of explanation would be considered high.

The most significant variables were *TIMESOLD.Q*, *MATFAX*, and *TOWER*. The former two have a positive influence on price. The positive *TIMESOLD.Q* indicates that the market was increasing over time since the CPBS was built in 2000, but only by 1.91% per quarter. The positive coefficient for *MATFAX* indicates that, when all the other variables are held constant, the price would increase by $e^{0.0042054} \approx 1.00421$ (0.42%), with increasing size. The negative coefficient for *TOWER* shows that, when all the other variables are held constant, after the installation of a CPBS in Beckenham, the price of a house would decrease by $e^{-0.23019} \approx 0.793$ (20.7% decrease).

Significance of Variables and the Equation: Bishopdale

The same functional form used for the other three suburbs was used for Bishopdale. From the regression output, the variables *ROOFCNX* and *CATGYX* were found to be insignificant so these were removed from the model and the regression was rerun; Appendix VIII summarizes these results. The *F*-statistic (122) shows that the estimated relationship in the model is statistically significant at the 95% confidence level and that at least one of the coefficients of the independent variables within the model is not zero.

Table 7 Test Statistics — Bishopdale

	Adjusted R^2	AIC	BIC
Full Model	0.79	-927.48	-775.71
Sub Model	0.79	-929.32	-796.52

Table 7 summarizes the model selection test statistics. Based on the AIC and BIC, the regression that excludes the variable *ROOFCNX* and *CATGYX* is superior to the regression that includes it (AIC and BIC are minimized). For this reason, the model excluding these variables was selected for analysis.

Again, the most significant variables were *TIMESOLD.Q* and *MATFAX*; the variable of interest, *TOWER*, was not a significant variable in the model so it is not discussed further. The former two variables have a positive influence on price. The positive *TIMESOLD.Q* indicates that the market was increasing over time since the CPBS was built in 1994, but only at 0.98% per quarter. The positive coefficient for *MATFAX* indicates that, when all the other variables are held constant, the price would increase by $e^{0.0039665} \approx 1.004$ (0.40%), with increasing size.

Summary of Results

The above analysis shows that the most significant variables and their impact on price were similar between suburbs. This indicates the relative stability of the coefficients between each model. Interestingly, the impact of *TOWER* on price (a decrease of between 20.7% and 21%) was very similar in the two suburbs where the towers were built in the year 2000. This may be due to the much greater media publicity given to CPBSs after the two legal cases in Christchurch (*McIntyre* and *Shirley Primary School*

in 1996 and 1999, respectively). The two suburbs where *TOWER* was either insignificant or increased prices by around 12%, were suburbs where towers had been built in 1994, prior to the media publicity.

Limitations of the Research

The main limitation affecting this survey was in the selection of the case study areas. Specifically, the areas selected had CPBSs that were not highly visible to residents. If more-visible CPBSs had been selected, the results may have been quite different. Thus, caution must be used in making generalizations from this study or applying the results directly to other similar studies or valuation assignments. Factors that could affect results are the distance of homes from the CPBS, the style and appearance of the CPBS, how visible the CPBS is to residents, the type of home (single family, multifamily, rental, etc.), and the socioeconomic make-up of the resident population.

To help address the proximity factor, a study is in progress examining the role of distance to the CPBSs and price effects; that study uses GIS analysis to determine the impact this has on residential property prices. It is expected that this will provide a more precise estimation of the impact of a CPBS on price.

It must be kept in mind that these results are the product of only one case study carried out in a specific area (Christchurch) at a specific time (2003). The above results indicate that value effects from CPBSs may vary over time as market participants' perceptions change. Perceptions toward CPBSs can change either positively or negatively over time. For example, as the World Health Organization's ten-year study of the health effects from CPBSs is completed and becomes available, consumers' attitudes may become more positive or negative depending on the outcome of that study. Consequently, studies of the price effects of CPBSs need to be conducted over time.

Areas for Further Study

This research has focused on residents' perceptions of negative effects from proximity to CPBSs and how these impact property values, rather than the scientific or technological estimates of these risks. The technologists' objective view of risk is that risk is measurable solely in terms of probabilities and severity of consequences, whereas the public, while taking experts' assessments into account, view risk more subjectively, based on other factors. Further, the results of scientific studies about the health effects of radio frequency and microwave radiation from CPBSs are not consistent. Residents' perceptions and assessments of risk vary according to a wide range of psychological, social, institutional, and cultural processes, and this may explain why their assessments differ from those of the experts.

Given the public concerns about the potential risks arising from being located nearby a CPBS, it is important for future studies to focus more attention on the kinds of risks the public associates with CPBSs and the level of risk perceived. How far away from the CPBS do people feel they have to be to be safe? What CPBS design, size, and surrounding landscape would help CPBSs to be more publicly acceptable? What social, economic, educational, and other demographic variables influence how people perceive the risks from CPBSs? Do residents that are heavy users of cell phones have a different perception of CPBSs than residents who make little use of this technology? Are these perceived risks reflected in property values and to what extent? Do these perceived risks vary over time and to what degree?

Answers to these questions, if shared among researchers and made public, could lead to the development of a global database to assist appraisers in determining the perceived level of risk associated with CPBSs and other similar structures.[59] Knowledge of the extent that these risks are incorporated into property prices and how they vary over time will lead to more accurate value assessments of properties in close proximity to CPBSs and other similar structures.

Summary and Conclusions

Focusing on four case study neighborhoods in Christchurch, New Zealand, this article presents the results from both an opinion survey and market sales analysis undertaken in 2003 to determine residents' perceptions towards living near a CPBS and how this may impact property prices. From the results, it appears that people who live close to CPBSs perceive the sites less negatively than those who live farther away.

The issue of greatest concern for survey respondents in both the case study and control areas is the impact of proximity to CPBSs on future property values. Overall, respondents would pay from 10%–19% less to over 20% less for a property if it were in close proximity to a CPBS.

The opinion survey results were generally confirmed by the market sales analysis using a hedonic house price approach. The results of the sales analysis show prices of properties were reduced by around 21% after a CPBS was built in the neighborhood. How-

59. For example, high-voltage overhead transmission lines.

ever, this result varies between neighborhoods, with a positive impact on price being recorded in one neighborhood, possibly due to the CPBS being built in that suburb before any adverse media publicity about CPBSs appeared in the local Christchurch press.

Research to date reports no clearly established health effects from radio frequency emissions of CPBSs operated at or below the current safety standards, yet recent media reports indicate that people still perceive that CPBSs have harmful effects. Thus, whether or not CPBSs are proven to be free from health risks is only relevant to the extent that buyers of properties near CPBSs perceive this to be true. Even buyers who believe that there are no adverse health effects from CPBSs, knowing that other potential buyers might think the reverse, will probably seek a price discount for a property located near a CPBS.

The comments of survey participants indicate the ongoing concerns that residents have about CPBSs. There is the need to increase the public's understanding of how radio frequency transmitting facilities operate and the strict exposure-limit standards imposed on the telecommunication industry. As more information is discovered that refutes concerns regarding adverse health effects from CPBSs, and as information about the NZ safety standards are made more publicly available, the perception of risk may gradually change, eliminating the discounts for neighboring properties.

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Additional Reading

Appraisal Institute. *Proposed USPAP Statement on Appraisal Standards–First Exposure Draft: Utilization of Statistical and Market Survey Techniques in Real Estate Research, Appraising, Counselling, and Consulting Assignments.* Report of Task Group for the Development of Standards for Determining the Acceptability of Applications of Statistical and Market Survey Techniques to the Valuation of Real Property. Chicago: Appraisal Institute, 2000.

Burch, J. B., J. S. Reif, M. G. Yost, T. J. Keefe, and C.A. Pittrat. "Nocturnal Excretion of Urinary Melatonin Metabolite Among Utility Workers." *Scand J Work Environ Health* 24, no. 3 (1998): 183–189.

Christchurch City Council Web site, http://www.ccc.govt.nz/index.asp.

Fesenko, E. E., V. R. Makar, E. G. Novoselova, and V. B. Sadovnikov. "Microwaves and Cellular Immunity: Effect of Whole Body Microwave Irradiation on Tumour Necrosis Factor Production in Mouse Cells." *Bioelectrochem Bioenerg* 49, no. 1 (1999): 29–35.

Khudnitskii, S. S., E. A. Moshkarev, and T. V. Fomenko. "On the Evaluation of the Influence of Cellular Phones on Their Users." [In Russian] *Med Tr Prom Ekol* 9 (1999): 20–24.

International Commission on Non-Ionizing Radiation Protection. "Health Issues Related to the Use of Hand-Held Radio Telephone and Base Transmitters." *Health Physics* 70, no. 4 (April 1996): 587–593.

International Commission on Non-Ionizing Radiation Protection. "Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic, and Electromagnetic Fields (Up to 300 GHz)." *Health Physics* 74, no. 4 (April 1998): 494–522.

Priestley, T., and G. Evans. *Perception of a Transmission Line in a Residential Neighbourhood: Results of a Case Study in Vallejo, California.* San Francisco: Southern California Edison Environmental Affairs Division, December 1990.

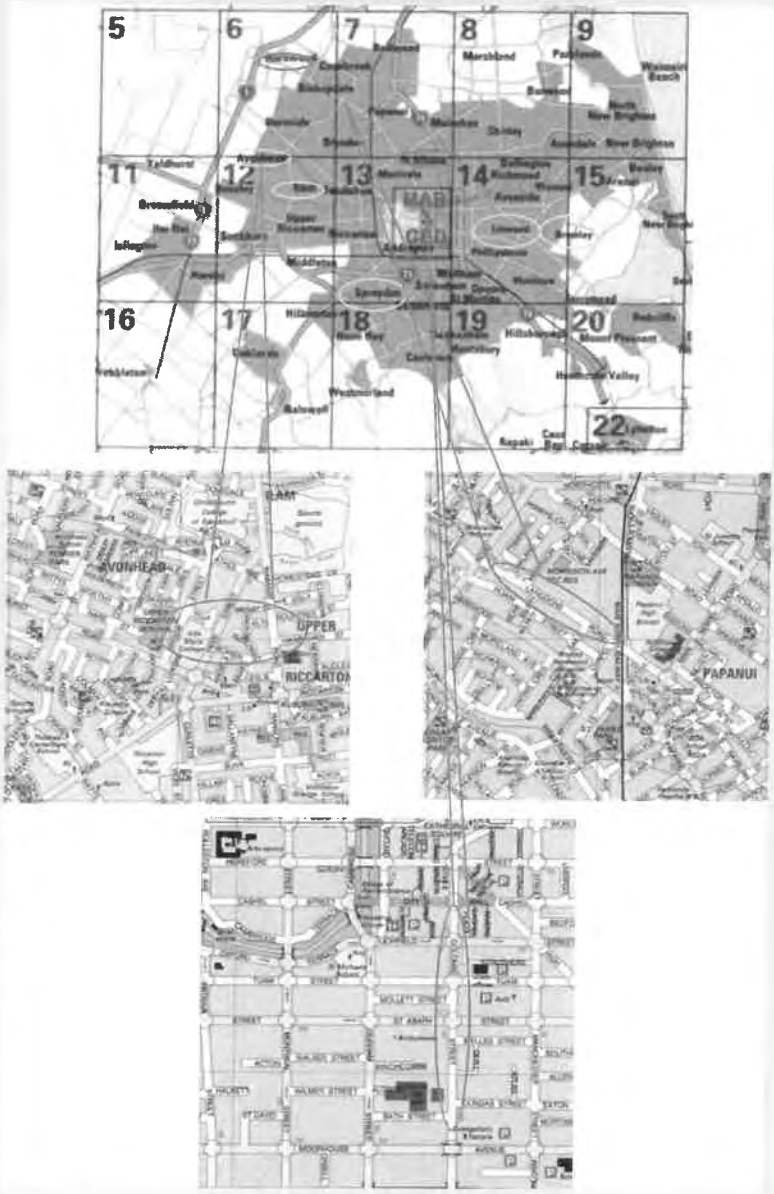
Priestley, T., and P. C. Ignelzi. *A Methodology for Assessing Transmission Line Impacts in Residential Communities.* Washington, DC: Edison Electric Institute, June 1989.

Repacholi, M. H., A. Basten, V. Gebski, D. Noonan, J. Finnie, and A. W. Harris. "Lymphomas in E mu-Pim1 Transgenic Mice Exposed to Pulsed 900 MHZ Electromagnetic Fields." *Radiat Res* 147, no. 5 (1997): 631-640.

Royal Society of Canada. *A Review of the Potential Health Risks of Radiofrequency Fields from Wireless Telecommunication Devices: An Expert Report Prepared at the Request of the Royal Society of Canada for Health Canada.* Ottawa, Ontario: Royal Society of Canada, March 1999. http://www.rsc.ca//files/publications/expert_panels/RF//RFreport-en.pdf.

World Health Organization. *Electromagnetic Fields (300 Hz to 300 GHz).* Environmental Health Criteria 137. Geneva: World Health Organization, 1993.

Appendix I Location Map



Areas circled in white at the top are without a cell phone tower, while areas circled in the bottom three maps have a cell phone tower.
Source: http://www.ccc.govt.nz/maps/Wises/

Appendix II Summary of the Survey Results

Variable	Responose	Valid Percent (%) Case Study	Valid Percent (%) Control
Occupancy	Homeowner	78.5	94.2
	Tenant	21.5	5.8
How long have you lived there?	Less than 6 months	8.0	2.6
	6 months–1 year	8.6	4.5
	1–4 years	25.1	27.7
	More than 5 years	58.3	65.2
How would you rate the desirability of your neighborhood?	Superior	27.4	30.9
	Above Average	37.4	36.8
	Average	28.5	27.0
	Below Average	5.6	4.6
	Inferior	1.1	0.7
Would you be opposed to construction of a cell phone tower nearby?	Yes		72.1
	No		27.9
When you purchased/began renting was the cell phone tower already constructed?	Yes	39.3	
	No	60.7	
Was the proximity of the cell phone tower a concern to you?	Yes	20.0	
	No	80.0	
Would you have gone ahead with rental/purchase if you had known a cell phone site was to be constructed?	Yes	73.9	
	No	26.1	
Is location of a cell phone tower a factor you would consider when moving?	Yes		83.4
	No		16.6
Is the cell phone tower visible from your house?	Yes	45.7	
	No	54.3	
If yes, how much does it impact on your view?	Very obstructive	9.6	
	Mildly obstructive	24.5	
	Barely noticeable	66.0	
In what way does it impact on the enjoyment of living in your house?	Views	11.8	
	Aesthetics	20.6	
	Health concerns	36.8	
	Change in property value	19.9	
	Other	11.0	
Effect a nearby cell phone tower would have on the price/rent you would pay for the property	Tower wasn't constructed	53.1	
	Pay substantially more	0.0	0.0
	Pay a little more	2.3	0.0
	Pay a little less	2.8	37.6
	Pay substantially less	0.6	45.4
	Not influence price	51.4	17.0
% Effect a nearby cell phone tower would have on the price/rent you would pay for the property	20% higher or more	5	3.2
	10–19% more	10	1.6
	1–9% more	14	2.4
	1–9% less	33	19.2
	10–19% less	24	36.0
	20% or a greater reduction	14	37.6
Concern about the possibility of harmful health effects in the future	Does not worry me	50.3	19.9
	Worries me somewhat	38.0	38.4
	Worries me a lot	11.7	41.7
Concern about the stigma associated with houses near the cell phone sites	Does not worry me	54.6	20.8
	Worries me somewhat	33.9	45.0
	Worries me a lot	11.5	34.2
Concern about the affect on your properties value in the future	Does not worry me	61.3	15.4
	Worries me somewhat	25.4	37.2
	Worries me a lot	13.3	47.4
Concern about the aesthetic problems caused by the tower	Does not worry me	63.3	18.2
	Worries me somewhat	25.4	37.0
	Worries me a lot	11.3	44.8

Appendix III Variable Codes

Category of Dwelling

Code	Definition
D	Dwelling houses are of a fully detached or semi-detached style situated on their own clearly defined piece of land.
E	Converted dwelling houses that are now used as rental flat.
F	Ownership home units which may be single storey or multi-storey and which do not have the appearance of dwelling houses.
H	Home and income. The dwelling is the predominant use, and there is an additional unit of use attached to or associated with the dwelling house that can be used to produce income.
R	Rental flats that have been purpose built.

Quality of the Principal Structure

Code	Definition
A	Superior design and quality of fixtures and fittings is first class.
B	The design is typical of its era and the quality of the fixtures and fittings is average to good.
C	The design is below the level generally expected for the era, or the level of fixtures and fittings is barely adequate and possibly of below average quality.

Building Materials: Walls and Roof

Code	Definition
W	Wood
B	Brick
C	Concrete
S	Stone
R	Roughcast
F	Fibrolite
M	Malthoid
P	Plastic
I	Iron
A	Aluminium
G	Glass
T	Tiles
X	*

Appendix IV Descriptive Statistics

Variable	Mean	Std. dev.	Median	Minimum	Maximum	Range
St Albans:						
Sale Price ($)	221,957	110,761	200,000	42,000	839,000	797,000
Land Area (ha)	0.0658	0.0331	0.0579	0.0261*	0.3794	0.3533
Floor Area (m^2)	161	70.40	150	50	450	400
Beckenham:						
Sale Price ($)	116,012	50,037	111,000	21,500	385,000	363,500
Land Area (ha)	0.0601	0.0234	0.0553	0.0164*	0.2140	0.1976
Floor Area (m^2)	115	32.50	110	40	340	300
Papanui:						
Sale Price ($)	127,661	51,114	119,000	43,000	375,000	332,000
Land Area (ha)	0.0685	0.0289	0.0675	0.0310	0.3169	0.2859
Floor Area (m^2)	122	34.60	110	56	290	234
Bishopdale:						
Sale Price ($)	136,786	41,390	134,500	56,000	342,000	286,000
Land Area (ha)	0.0679	0.0163	0.0653	0.0400	0.2028	0.1628
Floor Area (m^2)	125	31.20	118	64	290	226

* These small land areas are related to apartments or units in a block of apartments/units that have the land area apportioned on a pro rata basis.

Appendix V Regression Model: St Albans

log(*SLNETX*) = *TOWER* + *CATGYX2* + *CATGYX4* + *TIMESOLD.Q* + *AGE* + log(*LANDAX*) + *MATFAX* + *SITSTX*

Residuals:	**Min**	**1Q**	**Median**	**3Q**	**Max**
	-0.72855	-0.15032	0.01593	0.14263	0.72047

Coefficients:	**Estimate**	**Std. Error**	***t*-value**	**Pr(> |*t*|)**
(Intercept)	9.1781868	0.6769096	13.559	< 2e-16 ***
TOWER	**0.1133186**	0.0318188	**3.561**	0.000395 ***
CATGYX2D	0.1846417	0.0702520	2.628	0.008776 **
CATGYX2O	0.0334663	0.1008594	0.332	0.740134
CATGYX4B	-0.1551409	0.0245485	-6.320	4.75e-10 ***
CATGYX4C	-0.1483169	0.0722959	-2.052	0.040600 *
TIMESOLD.Q	**0.0136663**	**0.0008208**	**16.650**	< 2e-16 ***
AGE	0.0016408	0.0003521	4.660	3.81e-06 ***
log(LANDAX)	**0.3285367**	**0.0283610**	**11.584**	< 2e-16 ***
MATFAX	**0.0022314**	**0.0001962**	**11.373**	< 2e-16 ***
SITSTXAIKMANS RD	0.4029259	0.0533671	7.550	1.41e-13 ***
SITSTXBEVERLEY ST	0.2330787	0.0803137	2.902	0.003827 **
SITSTXBRISTOL ST	0.1706840	0.0521716	3.272	0.001124 **
SITSTXBROWNS RD	0.2492536	0.0720854	3.458	0.000579 ***
SITSTXCOX ST	0.3055798	0.0581672	5.253	2.00e-07 ***
SITSTXGORDON AVE	0.0823422	0.0679833	1.211	0.226236
SITSTXKNOWLES ST	0.1690979	0.0558911	3.025	0.002576 **
SITSTXMANSFIELD AVE	0.2954242	0.0652983	4.524	7.16e-06 ***
SITSTXMCDOUGALL AVE	0.3303105	0.0623720	5.296	1.60e-07 ***
SITSTXMURRAY PL	0.3613773	0.0629166	5.744	1.40e-08 ***
SITSTXOFFICE RD	0.3681146	0.0543368	6.775	2.71e-11 ***
SITSTX Other	0.0618491	0.0736629	0.840	0.401416
SITSTXPAPANUI RD	0.1940369	0.0560474	3.462	0.000570 ***
SITSTXRANFURLY ST	0.1701716	0.0617504	2.756	0.006012 **
SITSTXST ALBANS ST	0.1458665	0.0571172	2.554	0.010873 *
SITSTXWEBB ST	0.1895432	0.0725061	2.614	0.009143 **
SITSTXWESTON RD	0.2084419	0.0527555	3.951	8.60e-05 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
Residual standard error: 0.2175 on 677 degrees of freedom
Multiple *R*-Squared: 0.8253, Adjusted *R*-squared: 0.8186
F-statistic: 123 on 26 and 677 DF, *p*-value: < 2.2e-16

Appendix VI Regression Model: Papanui

In(formula = log(*SLNETX*) ~ *TOWER* + *SITSTX* + *TIMESOLD.Q* + *AGE* + log(*LANDAX*) + *MATFAX* + *WALLCNX* + *ROOFCNX* + *CATGYX4*, data = *Papanui.final*)

Residuals:	**Min**	**1Q**	**Median**	**3Q**	**Max**
	-0.484987	-0.098006	0.003859	0.106253	0.563126

Coefficients:	**Estimate**	**Std. Error**	***t*-value**	**Pr(> |*t*|)**
(Intercept)	5.9482316	0.6998186	8.500	< 2e-16 ***
TOWER	**-0.2339640**	0.0240908	**-9.712**	< 2e-16 ***
SITSTXHOANI ST	-0.1966982	0.0265429	-7.411	4.26e-13 ***
SITSTXLANGDONS RD	-0.1192547	0.0281242	-4.240	2.58e-05 ***
SITSTXLEANDER ST	0.0305555	0.0449437	0.680	0.496853
SITSTXMATSONS AVE	0.0949636	0.0292461	3.247	0.001231 **
SITSTXMORELAND AVE	-0.0892332	0.0397622	-2.244	0.025183 *
SITSTXMORRISON AVE	-0.1984492	0.0289772	-6.848	1.84e-11 ***
SITSTXOther	-0.1543194	0.0337436	-4.573	5.83e-06 ***
SITSTXSAILS ST	-0.0761412	0.0433455	-1.757	0.079490 .
SITSTXSAWTELL PL	0.1840793	0.0393904	4.673	3.66e-06 ***
SITSTXSAWYERS ARMS RD	0.0872393	0.0201388	4.332	1.73e-05 ***
SITSTXST JAMES AVE	0.2497688	0.0289940	8.615	< 2e-16 ***
TIMESOLD.Q	**0.0138914**	0.0004137	**33.575**	< 2e-16 ***
AGE	0.0029307	0.0003512	8.345	4.85e-16 ***
log(LANDAX)	0.0904764	0.0270812	3.341	0.000886 ***
MATFAX	**0.0042576**	0.0002410	**17.664**	< 2e-16 ***
WALLCNXC	0.0054100	0.0200666	0.270	0.787558
WALLCNXF	-0.0980851	0.0464442	-2.112	0.035106 *
WALLCNXO	-0.1158407	0.0468334	-2.473	0.013655 *
WALLCNXR	-0.0670051	0.0244382	-2.742	0.006291 **
WALLCNXW	-0.0679166	0.0192628	-3.526	0.000454 ***
WALLCNXX	-0.0571365	0.0358369	-1.594	0.111381
ROOFCNXI	0.1502973	0.1139845	1.319	0.187810
ROOFCNXO	0.0870092	0.1164152	0.747	0.455111
ROOFCNXT	0.0954874	0.1138506	0.839	0.401965
CATGYX4B	-0.0623758	0.0343487	-1.816	0.069872 .
CATGYX4C	-0.3669901	0.0905659	-4.052	5.74e-05 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
Residual standard error: 0.1579 on 604 degrees of freedom
Multiple *R*-Squared: 0.8718, Adjusted *R*-squared: 0.8661
F-statistic: 152.2 on 27 and 604 DF, *p*-value: < 2.2e-16

Holly Manion
Pacific Sotheby's International Realty
Rancho Santa Fe, California

August 20, 2019

City of Encinitas
Mayor Blakespear,
Deputy Mayor Hubbar
City Council Members- Kellie Shay Hinze, Tony Kranz, and Joe Mosca

Re: **Encinitas Small Cell Antenna Urgency Ordinance**

Dear Mayor, Deputy Mayor, and Members of the City Council:

I'm addressing you as a real estate broker of 40 years regarding my deep concern for property devaluation as 5G cell towers are permitted in and around residential areas without any substantial setbacks.

My experience, as well as the literature and increasing industry norms, suggest that any resident who faces a 5G – or any cell tower – near their property is going to experience devaluation of property and difficulty selling their home.

The 5G will not only negatively impact property values for health and safety concerns, but they will be a blight on the beauty tourists savour and expect to return to. Instead of scenic views of the mountains and sunsets over the Pacific Ocean, Encinitas will look like a pincushion of cell towers unless we are able to exercise some local control. Poles will scar our skyline, scenic highways, coastal roads.

Please include language in the ordinance that includes substantial setbacks from homes and residential properties. Without these setbacks, I'm afraid the real estate market in Encinitas will be diminished in terms of desirability, profitability, and there will be a taint to our local real estate industry that has long been an anchor of excellence in North San Diego County.

In a sense, municipalities across the country are holding their collective breath waiting for the 9th and 10th Circuits Courts to decide. In the meantime the FCC is driving forward with this goal to get millions of new cell towers in place across the country. Hopefully you have a mechanism in place in your current Ordinance to mandate the removal of cell towers that would have been installed after the FCC's Third Directive, but prior to a decision out of the 9th and 10th Circuit Courts. If those decisions favor the multiple counties and cities suing the FCC, Encinitas does not want to be left without removal options.

While all this plays out, please remember that what you do here tonight may have consequences that last 10 or 20 years for individual homeowners, if not a lifetime. What is it going to mean to

the woman who is pregnant, to the newborn baby, to the developing children, to the infirm, to the elderly, if they have a 5G tower on a lamppost 10 feet from a bedroom window? What impact is that going to have?

In my professional opinion we will lose real estate business if families cannot find what they consider to be safe homes and safe real estate investments in the City of Encinitas.

I believe the concern among the public with respect to 5G is so great that if a house has a 5G tower directly in front of it, that home will not be devalued by the usual 20%. My opinion as a professional realtor is this: A house with a 5G tower directly in front of it will be unmarketable. We MUST have significant setbacks from our homes.

I have attached three Declarations from real estate agents who presently sell in North San Diego County including the City of Encinitas. All three confirm that cell sites within close proximity to homes not only devalues the property, but the property will take longer to sell. Please consider keeping 5G cell sites out of residential areas.

Thank you,

Holly Manion

Holly Manion
DRE #00646025

Kathy Noel

From: Annemarie Clisby
Sent: Wednesday, August 28, 2019 3:31 PM
To: Roy Sapau
Subject: FW: Meeting on 5G

From: Ingrid Shequin <shequin@sbcglobal.net>
Sent: Wednesday, August 28, 2019 3:17 PM
To: Catherine Blakespear <cblakespear@encinitasca.gov>; Jody Hubbard <jhubbard@encinitasca.gov>; Council Members <council@encinitasca.gov>; Tony Kranz <tkranz@encinitasca.gov>; Joe Mosca <jmosca@encinitasca.gov>; Kellie Shay Hinze <khinze@encinitasca.gov>
Cc: mjschwaebe@gmail.com
Subject: Meeting on 5G

We are attending the City Council meeting tonight, because this is a very important issue., that requires more time, research and citizen's feedback.

We have attached a letter prepared by others, that 100% expresses our sentiment!

Ingrid & Steve Shequin
1301 Hymettus Ave.
Encinitas, CA

August 28th, 2019

City of Encinitas Council
Mayor Blakespear, Deputy Mayor Hubbard, and City Council Members Kellie Shay Hinze, Tony Kranz, and Joe Mosca

Re: Protective Small Cell Antenna Ordinance Needed Immediately

I am concerned about the timing of the urgency ordinance:

- scheduled for a City Council with three business days' notice;
- the last agenda item on an already full schedule;
- brought to the City Council many months after the FCC directive was issued and other local communities had implemented ordinances;
- the ordinance is not protective of sensitive and residential areas; and
- the ordinance provides a streamlined process for small cell antenna applications;

While I hope this is not true, I suspect that the urgency was a ploy to deflect and minimize the participation of citizens in Encinitas that are concerned about the environment in their community.

The urgency ordinance as it stands is not protective for sensitive areas and residential areas. There are no setbacks to sensitive areas which would be expected based on setbacks in the wireless ordinance for macro antennas. There is no protection of residential areas. And even though residential roads are one of the least preferred categories, the ordinance does not prevent Telecom installation of small cell antennas in front of our homes, which is most of Encinitas. (Note: there are 32 small cell antennas already installed on light poles in Encinitas residential areas via a business agreement that the City made with Crown Castle a few years ago. I suspect that this was organized without community participation.)

We want the ordinance to be more protective immediately, applied to all applications in process, before there is a flood of small cell antenna applications/installations in our neighborhoods. We can't wait for a small cell antenna community meeting.

I ask that the Encinitas small cell antenna ordinance incorporate the best practices of protective small cell antennas ordinances of the California Cities of Mill Valley and Los Altos; Calabasas; Fairfield, Petaluma and San Ramon; and Hercules.

- Mill Valley and Los Altos ordinances, prepared by Gail Karish – telecommunications attorney for Best Best & Krieger LLP, prohibit small cell antennas in residential areas.
- The Calabasas ordinance does not allow small cell antennas in residential areas.
- The Fairfield, Petaluma and San Ramon ordinances require substantial setbacks to sensitive area and residential areas and structures.
- The Hercules ordinance is the best administration for control of the application and shot clock process, requires ANSI 222 class III poles for all small cell installations, and prohibits new antenna support structures in residential areas.

For me and many of my friends and colleagues, there is a perception of harm associated with microwave antennas. We know this in our guts and this is validated by frequent news and science reports that show great biological harm from microwave radiation exposure. We are afraid for our property values.

Thank you for amending the Encinitas small cell antenna ordinance immediately for our collective safety.

Sincerely,

Ingrid & Steve Shequin

Kathy Noel

From: Annemarie Clisby
Sent: Wednesday, August 28, 2019 1:19 PM
To: Roy Sapau
Subject: FW: Cell towers proposal
Attachments: Encinitas 5G Letter Needed Immediately 8.27.19.docx

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From: Iris Peterson <ihpeterson@yahoo.com>
Sent: Wednesday, August 28, 2019 11:13 AM
To: Catherine Blakespear <cblakespear@encinitasca.gov>; Jody Hubbard <jhubbard@encinitasca.gov>; Council Members <council@encinitasca.gov>; Tony Kranz <tkranz@encinitasca.gov>; Joe Mosca <jmosca@encinitasca.gov>; Kellie Shay Hinze <khinze@encinitasca.gov>
Subject: Cell towers proposal

August 28, 2019

City of Encinitas Council
Mayor Blakespear, Deputy Mayor Hubbard, and City Council Members Kellie Shay Hinze, Tony Kranz, and Joe Mosca

Re: Protective Small Cell Antenna Ordinance Needed Immediately

I am concerned about the timing of the urgency ordinance:

- scheduled for a City Council with three business days' notice;
- the last agenda item on an already full schedule;
- brought to the City Council many months after the FCC directive was issued and other local communities had implemented ordinances;
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- the ordinance provides a streamlined process for small cell antenna applications;

While I hope this is not true, I suspect that the urgency was a ploy to deflect and minimize the participation of citizens in Encinitas that are concerned about the environment in their community.

The urgency ordinance as it stands is not protective for sensitive areas and residential areas. There are no setbacks to sensitive areas which would be expected based on setbacks in the wireless ordinance for macro antennas. There is no protection of residential areas. And even though residential roads are one of the least preferred categories, the ordinance does not prevent Telecom installation of small cell antennas in front of our homes, which is most of Encinitas. (Note: there are 32 small cell antennas already installed on light poles in Encinitas residential areas via a business agreement that the City made with Crown Castle a few years ago. I suspect that this was organized without community participation.)

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For me and many of my friends and colleagues, there is a perception of harm associated with microwave antennas. We know this in our guts and this is validated by frequent news and science reports that show great biological harm from microwave radiation exposure. We are afraid for our property values.

Thank you for amending the Encinitas small cell antenna ordinance immediately for our collective safety.

Sincerely,

Iris H. Peterson
245 Fraxinella St.
Encinitas, CA 92024

Kathy Noel

From: Annemarie Clisby
Sent: Monday, September 23, 2019 10:10 AM
To: Roy Sapau
Subject: FW: A vital movement update [new article to read]

From: Jack Cardoza <jackcardoza@gmail.com>
Sent: Saturday, September 21, 2019 10:29 AM
To: Jack Cardoza <jackcardoza@gmail.com>
Subject: Fwd: A vital movement update [new article to read]

Please click on Julian Grasser article.

Thanks,

Jack

Hello, Jack!

Josh here with a vital movement update.

My friend and colleague, Julian Gresser, is an attorney in California, who has specialized in environmental law for decades. **In a new article, he tackles two very important questions regarding the 5G "land grab" agenda**:

1) What if local governments DO have viable options, for countering the FCC's unlawful overreach (and that of federal agencies in other countries)?

2) HOW can municipalities negotiate more effectively and level the playing field, taking optimal advantage of federal and state law?

You may have received an email response from your elected reps -- if you've emailed them via our Instant Action tool -- basically saying, "We don't have any rights/responsibility/liability."

Julian's new article will help set the record straight, for all of our elected reps, and is a powerful guide for us moving forward:

--->>Read Julian Gresser's article, "Empowering Municipalities to Meet the 5G 'Land Grab' Challenge!"

As we develop the forthcoming "second phase", we'll continue to send you key updates. Exciting times!

We've had such incredible demand for the transcripts eBook, just want to let you know it's STILL available!

This 811-page, downloadable transcripts eBook is the literal transcription of the conversation between the experts, for every talk that was in the event schedule (all 42 of them!).

With a purchase of this eBook today for $24, you not only support the 8-month effort of more than 20 people that was *The 5G Crisis Summit*, but also the ongoing effort and what is yet to come!

[If you purchased a package from us, this eBook is already in your purchase bonuses!]

Stay tuned, there is much, much more coming from us!

Sincerely,
Josh del Sol

P.S. In Australia, the corporate media was forced to report on the 2,500 4G/5G cell sites that were stopped... and look how they spun it.

PRESENTED BY:

Click here to submit a support ticket.

Once the event starts, this "event" link will take you to each day's expert talks:
http://the5gsummit.com/event
(You may have to clear your browser history each day!)

Sent to: photojak@gmail.com

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Health Talks Online, 117 Deerfield Grove Way, St. Augustine, Florida 32086, United States

Jack Cardoza
photojak@gmail.com

TAKE BACK YOUR POWER

5G

Empowering Municipalities to Meet the 5G "Land Grab" Challenge

1 month ago / Julian Gresser / 8,583 views / 8 min read

20 COMMENTS

872

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[Disclaimer: For informational and educational purposes; personal opinion of the author; not to be construed as legal advice.]

Many municipalities are capitulating in negotiations with wireless companies when they are threatened or sued for wishing to protect their citizens from the harms of 5G EMF irradiation. Mayors and city councils across this country are convinced they do not have a right to say "no" to the dense cell towers and antennas being erected in public rights-of-way.

Download/print

What if in fact they have viable options? How can municipalities in the U.S. negotiate more effectively and level the playing field, taking optimal advantage of federal and state law?

A favored tactic now being deployed by the FCC and industry promoters of 5G is to attack the Mind by establishing false and invalid Assumptions. This tactic engenders fear, desperation, despair, resignation, and, most tragically, loss of hope. It is designed to squander municipalities' time and preciously scarce funds, and sap vital and creative energy. The antidote for mayors, city councils, and citizens is to cultivate integrity and resilience, and bring the power, wisdom, and intelligence of Heart and Mind effectively together ("Big Heart Intelligence").

The negotiation turns on three controlling assumptions.

1. The wireless industry and the FCC have a monopoly of legal authority, based on the Telecommunications Act of 1996 and reinforced by some state legislatures.
2. The current wireless environment (3G-4G), as well as the emergent 5G, is safe.
3. Mayors and council members are free from their own legal liability for acceding to the demands of the wireless companies and the FCC.

In fact, all three assumptions are highly questionable.

Assumption #1:

There is a reasonable chance that the authorizing provisions of the 1996 Telecommunications Act, and the overreaching FCC rules implementing them, will be held unconstitutional, in violation of home rule, separation of powers, due process, and uncompensated taking, under the 1st, 5th and 14th Amendments to the Constitution. The U.S. Supreme Court has already recognized the principle of "cooperative federalism," which will counterbalance the FCC's aggressive use of the preemption doctrine.[i] The California Supreme Court in *T-Mobile v. City and County of San Francisco* has also confirmed the fundamental right of local municipalities to protect the health and safety of their citizens.[ii] On August 9, 2019 the D.C. Circuit ruled that the FCC 5G Program must conform with the basic provisions of the National Environmental Policy Act (NEPA).[iii] And there are various federal laws protecting the public from false and misleading advertising, such as touting the benefits of 5G without warning of its attendant harms.

Assumption #2:

There is significant scientific evidence that EMFs associated with 3G and 4G wireless technologies are closely linked with cancer, damage to mitochondria and DNA, neurodegenerative illnesses, and cardiac disease, with significant data also on hazards to children, pregnant women, elderly persons, and people with special sensitivities and disabilities. In 2018, a National Toxicology Report on Cancer recognized that EMFs are the cause of malignant schwannomas in rats.[iv] Less well appreciated is the fact that 5G implementation is a form of government and industry enforced national addiction to faster

and faster internet speeds that may encourage opioid addiction, mental disease, and violence–all associated with sympathetic overdrive of the autonomic nervous system for large segments of the population.

LATEST POSTS

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6 days ago

Empowering Municipalities to Meet the 5G "Land Grab" Challenge
1 month ago

Assumption # 3:

Australian barrister, Raymond Broomhall, has implemented a powerful protocol based on the Precautionary Principle with great success. [Approximately 2,500 4G/5G cell sites have been halted in Australia. -Ed.] I believe this same protocol has a good chance of being adopted and applied in the U.S., if similarly effective alliances can be forged between citizens, attending physicians, and attorneys, as is currently happening in Australia. [illegible] Broomhall's Precautionary Rule– which I am calling the "Principle of Heightened Vigilanc[illegible]ort principles of foreseeability and duty of care, I predict that mayors and city cou[illegible]ay face civil and even criminal, liabilities for assault and related illegal activity. Mr. Broomhall's protocol is elegantly straightforward:

a) Document, organize, measure, collate, and publish all data on EMF exposures and harms.

b) Secure an Advisory Letter from an attending physician confirming the patient's own concerns and wishes not to be irradiated from a medical perspective (establishing a physician-patient confidentiality relationship).

5G CRISIS SUMMIT

c) Present a well-reasoned and d[illegible]rning from a licensed attorney, creating a record that the patient [illegible]eming a dismissal or ignoring of such Objection/Warning to be co[illegible]ar to Australian law, the California Penal Code explicitly i[illegible]e who assault children, elderly citizens, and people with special [illegible]on public spaces, municipal authorities and those immediatel[illegible]ctors, enablers, and accessories of the foreseeable harms alleged.

Practical Actions

Mayors and city council member[illegible]zens of my community?" What do I **really** want? If the answer is to s[illegible]wing actions should be considered under the Principle o[illegible]

- Immediately launch a ma[illegible]e Sample Kit soon to be downloadable from the 5G [illegible]
- Initiate monitoring of EMF irradiation, and equip citizens and local organizations with proper EMF monitoring devices.

- Instruct hospitals and health care providers to monitor, assess, and report on adverse health and environmental effects of 5G installations.
- Issue abatement orders recognizing uncontrolled EMFs above a safe irradiation standard as a public nuisance.
- Establish advisory guidelines based on this standard for school classrooms, hospitals, and workplaces.
- Document evidence of assaults and other illegal acts and collaborate with local prosecutors and state legislators.
- Hold town meetings where all stakeholders, including representatives of the wireless industry, are welcomed to present their case and openly debate the options.
- Call for a Referendum and invite the community to vote on whether it wants 5G; and if so, under what terms and conditions.
- Collaborate with thousands of other communities across the U.S. and abroad that are sharing data, scientific, technological, and legal expertise, and other assets, including financial resources.

A Viable Alternative

There is a viable and safer alternative to a ubiquitous wireless juggernaut. It is a predominantly wired/fiber optic infrastructure, which was nationally funded over a decade ago. A wired internet has significant advantages over wireless, in that it is more reliable, more secure from hacking, more energy efficient, faster, and essentially radiation-free. It has been shown that communities implementing a wired/fiber alternative not only realize a positive return on investment, but will also have a strategic economic advantage over wireless.[vi] "SafeG" communities will attract superior companies that are concerned with the health of their employees and the environment, and such companies will create local jobs and catalyze innovation. Of course, wireless can play an important role in these communities as well, because the public demands mobile devices. But at least the implementation of the wireless option can proceed with care, balance, and compassion and with the health and wellbeing of local communities as a top priority.

Acknowledgements

The author expresses his appreciation to his colleagues, Ben Levi, Trevor Marshall, Ph.D., William Moulton, Raymond Broomhall and Josh del Sol for their comments and background research.

ENDNOTES:

[i] The United States Supreme Court described the way that Congress intended the Telecommunications Act of 1996 to operate: "Congress ultimately rejected the national approach and substituted a system based on cooperative federalism… State and local authorities would remain free to make siting decisions. They would do so, however, subject to minimum federal standards—both substantive and procedural–as well as federal judicial review." (US Supreme Court 544 U.S. 113 (2005), 03-1601, City of Rancho Palos Verdes v. Abrams. See also TCA 332(c)7, and TCA section 255).

[ii] On April 4, 2019 the California Supreme Court handed down a unanimous decision in *T-Mobile v. City and County of San Francisco* upholding the San Francisco ordinance requiring telecommunications companies to get permits before placing antennas on city infrastructure. Note in particular that the Court affirmed that "inherent local police power includes broad authority to determine, for purposes of the public health, safety, and welfare, the appropriate uses of land within a local jurisdiction's borders" (pg. 5) and "…lines or equipment might generate noise, cause negative health consequences, or create safety concerns. All these impacts could disturb public road use, or disturb its quiet enjoyment" (pg. 9).

[iii] https://www.courtlistener.com/opinion/4647052/united-keetoowah-band-of-chero-v-fcc/

[iv] See https://www.emfscientist.org/index.php/science-policy/emf-science-and-related-policy-developments for more studies of EMF effects.

[v] A leading Japanese precedent applicable to Civil Code jurisdictions is the decision of the Yokkaiichi Court that recognized the individual liabilities of six petrochemical facilities for the bronchial illnesses of residents of the Yokkaiichi Village in Japan. The Court ruled that the burden of proof shifted when plaintiffs were able to show the: a) origin of the toxic substance, here NOx, Sox; b) the pathway of transmission; and c) the point of entry (lungs and skin), supported by clinical, experimental, and epidemiological evidence. See Julian Gresser, Koiichiro Fujikura, Akio Morishima, *Environmental Law in Japan* (MIT Press 1981). A seminal California court decision on multiple sources of pollution is Sommers v. Tice.

[vi] See for example https://www.businesswire.com/news/home/20180126005137/en/Wireless-Networks-Fast-Secure-Reliable-Energy-Efficient-Wired

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Julian Gresser

Julian Gresser is a licensed California attorney, and currently Chairman/CEO of **Big Heart Technologies, Inc.**, a California Benefit Corporation. He was twice Mitsubishi Visiting Professor at the Harvard Law School and was Chairman of the Japan Industrial Policy Group in the U.S. State Department during the Carter Administration, an interagency task which developed a national industrial policy in effective collaboration with the semiconductor industry. His online course, The Resilient Negotiator—Meeting the 5G Network Challenge, is available at: **https://resiliencemultiplier.com/5g-trn/**

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SUBMIT COMMENT

Shar

September 21, 2019 at 6:46 am

White spaces in every community are needed if public insists on wireless devices in this "safe-g" projection. Individuals experiencing pain and impairment must be able to live, work and go to school with equality. It is a basic human rights issue.

REPLY

Dawn

September 21, 2019 at 7:54 am

Good article, however, targeted at the US. I live in Canada and never received a response from my officials after sending the letter. I would forward this, but it is unlikely to get a

response since it is oriented towards the US.
Thanks for posting.

REPLY

E. Lyman
September 21, 2019 at 9:17 am

I am in Canada also, and did get the standard reply about our great SC6. I asked an expert on wireless, retired Capt. Jerry Flynn to answer Ms. Hart (govt official), which he did as follows:

September 9, 2019

Susan Hart
Director General
Spectrum Management Operations Branch
Spectrum and Telecommunications Sector
Innovation, Science and Economic Development Canada

Dear Ms. Hart,
Your reply to Ms. Eva … concerning Safety Code 6 and 5G technology has been forwarded to me for comment (my BIO is attached).
From your reply to …, one has to conclude that you know little about the hazards of pulsed NON-thermal EMFs and that you don't realize that Safety Code 6 protects industrial and commercial development – not Canada's people! Here are some facts which apply equally to you and to members of your own family, just as they do to all people living in Canada:

1. today's consumer wireless RF products, gadgets and devices (even baby monitors), and electric utility smart meters all emit pulsed NON-thermal EMFs!
2. pulsed modulation is more hazardous to the human body than is continuous wave (CW) – the latter of which is the kind emitted by microwave ovens!
3. The pulse repetition frequency (PRF) of any pulsed RF EMF, regardless of the carrier frequency, can cause serious damage to the human brain if the PRF conflicts with a nearby human's brainwave frequencies (typically up to 40 Hz, but they can be higher). https://www.curejoy.com/content/different-types-brain-waves/
4. EMFs are known to CAUSE (albeit not exclusively) autism, ADHD, memory and behavioural problems, leukemia, brain tumors and brain cancers, breast cancers, thyroid cancers, pancreatic cancers, testicular cancers, infertility, etc., Parkinson's, Alzheimer's, suicides, depression, miscarriages, SIDS (Sudden Infant Death Syndrome), ALS (lou Gehrig's Disease), asthma, tinnitus, cardiac problems, etc. https://www.emfanalysis.com/wp-content/uploads/2014/11/Powell-Bioinitiative-

Report-Smart-Meters.pdf
http://www.iemfa.org/seletun-statement/
http://www.stayonthetruth.com/neil-cherry.php https://oneradionetwork.com/all-shows/dr-sam-milham-the-state-of-electrical-pollution-garners-the-title-of-this-show-theres-nowhere-to-hide-june-4-2019/

5. The US Military knew in 1994 that the most dangerous frequencies to humans are those within the range 1 GHz to 5 GHz, because these frequencies penetrate all organ systems of the human body and therefore put all organs at risk. http://www.wernercairns.com/2015/05/why-do-we-have-so-much-illness-in-our.html

6. The Peoples Republic of China's Huawei is rolling out its '5G' network technology primarily using Sub6GHz frequencies (specifically 3300-4200 MHz and 4400-5000 MHz) – which are within the most dangerous band of frequencies known to humans! How can ISEDC / the Government of Canada condone / allow this? https://www-file.huawei.com/-/media/CORPORATE/PDF/public-policy/public_policy_position_5g_spectrum.pdf?la=en

7. In Canada, ISEDC has not yet said NO to Rogers and Telus, both of which are anxious to roll-out their Huawei-based 5G wireless networks. Again, how can ISEDC / the Government of Canada allow this to happen?

8. Safety Code 6 fails to admit that there are hazardous NON-thermal effects to RF. By doing so, it gives industry the green light to explore and exploit this vast new – never tested for safety to people – but which has already proven to be a trillion-to-multi-trillion dollar market!

9. Safety Code 6 fails to address the cumulative / aggregate amount of pulsed radiation people are chronically exposed to in their environments from all of their neighbors' multiple wireless devices all of which are simultaneously emitting pulsed NON-thermal EMFs on various radio / microwave frequencies.

10. Health Canada puts the onus on the PUBLIC to prove that RF EMFs are NOT SAFE, instead of making INDUSTRY prove that their products ARE safe

11. Since 1979, when Health & Welfare Canada's Dr. Michael Repacholi introduced Canada's first Safety Code 6, its 'safe' Exposure Limits for RF EMFs looked suspiciously similar to those established in 1953 for the US Navy (by former Nazi scientist, Dr. Herman P. Schwan), which were based strictly on the heating (thermal) effects. Safety Code 6 even had the same outrageously–high 'safe' Exposure Limit 10 mW/cm² (or 10,000,000 uW/m2), which enabled the US Navy to continue operating its long range radars at full power.

12. Although Health Canada never mentions it, their own former head EMF scientist, Dr. Michael Repacholi, also orchestrated things (while he was employed at the WHO) such that ICNIRP and the WHO both also had 'safe' Exposure Limits for RF that were very similar to those of the US Navy – and both agencies reflected it's thermal effects ONLY dogma!

13. Although not covered by Safety Code 6, it needs to be noted that the same notoriously corrupt Dr. Michael Repacholi also orchestrated – with the help of eight (8) industry representatives he had invited to assist him – 'safe' Exposure Limits for Power Line frequencies (50 Hz/60 Hz) for the world – except for the USA.
https://microwavenews.com/CT.html

Ms. Hart, contrary to your assertion that Safety Code 6 has a 'safety margin of some 50 times, the highly respected BioInitiative 2012 Report said that, in effect, Safety Code 6 needed to be lowered or reduced some 3-6 million times!
https://www.emfacts.com/2017/11/bioinitiative-report-medical-concerns-intensify-over-deadly-brain-tumors-from-cell-phone-use/

Safety Code 6 fails to recognize the condition known as Electro-hypersensitivity or EHS, first identified in 1932 by German scientists who then called it microwave sickness. The most celebrated person to acknowledge that she suffers from EHS is Dr. Gro Harlem Brundtland, MD, MPH, formerly the Director General of the WHO and, before that, three time Prime Minister of Norway. It is conservatively estimated that at least 3-5% of the world's total population suffer moderately from EHS.

Safety Code 6 does not even mention Power Line EMFs, yet Health Canada publicly endorses ICNIRP's outrageously-high 'safe' ambient level of magnetic field of 2,000 mG (which their own former Dr. Michael Repacholi) set for the Public (10,000 mG for Workers); even though non-industry scientists say that a safe ambient magnetic field level in a home, school, etc. should not exceed one mG (<1 mG).
https://bioinitiative.org/updated-research-summaries/
http://electromagnetichealth.org/electromagnetic-health-blog/the-seletun-statement/
[if !supportLists]· [endif]Not one single RF product, device or gadget has ever been made to first undergo independent testing (for safety to humans) by qualified experts having no ties to industry before being allowed to be used / sold on the Canadian market!
[if !supportLists]· [endif]Health Canada, throughout its corrupt history, has always been highly selective of the 'studies' it considers, i.e., it accepts just those that consider only the thermal effects of EMFs, ignoring the tens of thousands of studies (even the US Navy's own approximately 3,000 studies) that focused on the hazardous non-thermal effects!
[if !supportLists]· [endif]The studies Health Canada considers seldom, if ever, exceed six years duration; whereas it is known that cancer and other major diseases have latency periods of greater than 10 years, often up to 30 years and even longer! Hence, Health Canada and its corrupt allies are able to use the term 'Weight of Evidence' as opposed to the more meaningful, truthful 'Quality of Evidence.'
[if !supportLists]· [endif]With respect to 5G (fifth generation technology), even the US telecom industry executives themselves admitted to US Senator Blumenthal that not a single penny has been spent by any American telecom company to prove that the much

higher millimeter wave frequencies that will be used in 5G are safe to be used by, on and around people of all ages, of all sizes, on a 24/7/365 day basis in perpetuity.
https://mdsafetech.org/2019/02/13/no-research-on-5g-safety-senator-blumenthal-question-answered/
[if !supportLists]· [endif]Finally, world-class scientist, Dr. Martin Pall, Professor Emeritus of Biochemistry and Basic Medical Sciences, Washington State University, has said that: "If Man does not stop 5G, he won't have to worry about Climate Change." Dr. Pall has a free online book on the hazards of 5G.
https://www.5gexposed.com/2019/08/24/silent-invisible-odorless-and-tasteless-radiation-is-a-crime-against-humanity/
Sincerely,
J.G. Flynn, Captain (Retired)
Bowser, B.C. V0R 1G0

REPLY

JAMES BROEHL
October 11, 2019 at 8:08 am

Captain Flynn
Brilliant info concerning 5G. I only learned of dangers in last month, tried to alert my local health dept (Brookline,Ma) but there is no organized resistance. Take back your power is great site to know.
There is a greens group here but the chairman didn't want to participate. I have ALK non smokers cancer (have recovered well with medicine) and I don't want to go backwards in health. Who in Boston is working on this that I can join? Thank you for your great insight and info.
James

REPLY

Terri
September 21, 2019 at 6:45 pm

Dawn, have you seen Inpower episode 1 a mass action of liability?
https://www.youtube.com/watch?v=NtIYFCjUTSo

This is applicable to all countries.

Cal who is featured in this amazing short video is canadian and used this successfully in Canada, which he talks about. He took an extremely complex subject and made it very understandable.

Society has allowed lawlessness to flourish, and if we do not make it right, right now, there will be no second chance, and no future. I also made some comments which might inspire you below. It takes a lot of effort and time to reeducate ourselves and learn what has been hidden from us, but the alternative is a fate worse than death.

REPLY

Bruce Cain

September 21, 2019 at 10:36 am

Sadly I think the only way we Stop5G/Smart Meters is a global uprising that is actually developing. I also think the objectives of this uprising must be concise and clear:
1) Remove ALL 5G Antennas
2) Remove ALL Smart Meters and replace with Analog Meters
In the 90's I did start a Global Movement to Legalize Cannabis and I'd say we are winning. I'm growing my own Cannabis in my backyard. The formula is simple.

* Set up a web site to aggregate all events.
* Set a date: Saturday is probably best.
* Encourage local groups to have teachins, marches, protests.
* Keep updating the list as local groups set up a time and place for the events.

5G: An Existential threat to our Health, Privacy and Freedom
[This is the video of my testimony before the Dearborn Heights City Council, (7/23/2019) Approximately 40 minutes, 1600 views as of 08/10/2019]
https://www.youtube.com/watch?v=nPITup9oZRY&

A Global Strategy to Stop 5G and Smart Meters
A 20′ interview with Bruce Cain hosted by Sheena Alexandra (08/29/2019)
https://youtu.be/HjwGUF95DqQ
https://www.facebook.com/sheena.alexandra.1/videos/10156145589075946/

Fluoride, 5G and our Corporate Elites
BRUCE CAIN·MONDAY, SEPTEMBER 9, 2019
https://www.facebook.com/notes/bruce-cain/fluoride-5g-and-our-corporate-elites/3522224951136801

Bruce Cain's articles and videos on Stopping 5G and Smart Meters
WEDNESDAY, AUGUST 28, 2019

https://www.facebook.com/notes/bruce-cain/bruce-cains-articles-on-stopping-5g-and-smart-meters/3487060457986594/

A Primer on the threats of 5G/Smart Meters and the Internet of Things to our Health, Privacy and Freedom
https://www.facebook.com/notes/bruce-cain/a-primer-on-the-threats-of-5gsmart-meters-and-the-internet-of-things-to-our-heal/3383925891633375/

5G & Smart Meters are an Existential threat to our Health, Privacy and Freedom
BRUCE CAIN·TUESDAY, JULY 23, 2019 481 Reads
https://www.facebook.com/notes/bruce-cain/5g-smart-meters-are-an-existential-threat-to-our-health-privacy-and-freedom/3384442691581695/

REPLY

Terri
September 21, 2019 at 6:20 pm

Legal is not lawful. There is only one law, The Supreme Law of the Land. Our founding documents were written by, of and for the people and give our servants a short list of duties, clearly spelled out. If its not there, its not lawful.

There is only one question that all public servants should be asking: “Is this Constitutional?” The answer is simple; if in accordance to the Supreme Law of the Land, then it is permissible, if it is contrary to the Law, then it is strictly forbidden. 5G, AMI “smart meters” and “smart grids” are a total antithesis to the principles our Republic were founded on. Any statute, ordinance or regulation that is detrimental to the well-being of the people never can and never will be lawful or permitted under the Law. The Preamble to our national Constitution is very clear on the intentions of our founders in creating our Constitution, as follows:

We the People of the United States, in Order to form a more perfect Union, establish Justice, insure domestic Tranquility, provide for the common defense, promote the general Welfare, and secure the Blessings of Liberty to ourselves and our Posterity, do ordain and establish this Constitution for the United States of America.

Clearly, the imposition of “smart meters”, “smart grids” and the 5G network do not uphold the “general Welfare”, which means the general well-being of the people, and does not refer to government handouts.

The remedy has been given to right these egregious abuses and restore our Republic to what was intended. This was explained in Marbury vs Madison quite succinctly.

“No provision of the Constitution is designed to be without effect,” “Anything that is in conflict is null and void of law”, “clearly, for a secondary law to come in conflict with the supreme Law was illogical, for certainly, the supreme Law would prevail over all other laws

and certainly our forefathers had intended that the supreme Law would be the bases of all law and for any law to come in conflict would be null and void of law, it would bear no obligation to obey, it would purport to settle as if it had never existed, for unconstitutionality, would date for the enactment of such a law, not from the date so branded in an open court of law, no courts are bound to uphold it, and no Citizens are bound to obey it. It operates as a near nullity or a fiction of law."

If any statement, within any law, which is passed, is unconstitutional, the whole law is unconstitutional per Marbury v. Madison5 US 137 (1803).

The 1996 telecommunications act is obviously null, void, and without effect, but the people do not know this due to purposely corrupt "education", as well as ignorant lawyers who do not know the Law and ignore the Supremacy clause.

Yes, it is this simple. Here is more to empower the people against this takeover of our Constitutional Republic.

Pursuant to rights secured in the Constitution(s) and due process of law, American Citizens, can EXPECT their public officers to abide by their oaths in the performance of their official duties. This is a constitutional guarantee to the people. When public officers do not abide by their oaths, step outside the lawful scope of their LIMITED duties and authority, delegated to them by the people through the Constitution(s), violate their oaths, the Constitution(s), the people's secured rights and due process of law, then, the self-executing Sections 3 and 4 of the 14th Amendment to the National Constitution provide specific remedy for the people.

"The laws of nature are the laws of God, whose authority can be superseded by no power on earth. A legislature must not obstruct our obedience to him from whose punishments they cannot protect us. All human constitutions which contradict his cannot protect us. All human constitutions which contradict his (God's) laws, we are in conscience bound to disobey." 1772, Robin v. Hardaway, 1 Jefferson 109.

"The rights of the individual are not derived from governmental agencies, either municipal, state, or federal, or even from the Constitution. They exist inherently in every man, by endowment of the Creator, and are merely reaffirmed in the Constitution, and restricted only to the extent that they have been voluntarily surrendered by the citizenship to the agencies of government. The people's rights are not derived from the government, but the government's authority comes from the people. The Constitution but states again these rights already existing, and when legislative encroachment by the nation, state, or municipality invade these original and permanent rights, it is the duty of the courts to so declare, and to afford the necessary relief." City of Dallas, et al. v. Mitchell, 245 S. W. 944, 945-46 (1922).

They want you to play this evil, never ending, legal battle. They do not want you to find out they work for you, and you have all the power. They have usurped God's law to make you

slaves and victims with "privileges" while you gave up your God given rights and responsibilities and do not realize what you have lost.

Why do I call this evil? Because it is. Every bit of this transformation from God's law to collectivism and communism is the work of the Father of lies. When you participate, or aid and abet in the bastardization of Divine Law made manifest, you serve evil. Our founders knew of this great deception to corrupt and demean the covenant between the precious, loved beyond measure, people and subjugate them as beneath their human rulers. They were given the solution to reveal and remind the people of the Truth and were very clear about their inspiration. They gave their lives, fortunes, and their families suffered unimaginably, so they could give you, their posterity, something that made America great. An opportunity to go from serf to royalty as a son or daughter of God.

We are where we are today because of the silence, ignorance, apathy, cowardice, and corruption of society, rolled out by the followers of evil, for their god. All they needed was the acquiescence of the people. They received this in many ways, thru their silence, the abandonment of their children to be raised by the State, the participation in every plank of the communist manifesto, and all unlawful schemes which deny us our God given rights, and the cornerstone of these rights; due process.

We have a hard road ahead, and each generation is complicit in the fall. The question is, is anyone up to the challenge? As Yoda said, we must unlearn everything we have learned, and as it is said in 2Chronicles7:14 If my people, which are called by my name, shall humble themselves, and pray, and seek my face, and turn from their
wicked ways; THEN will I hear from heaven, and will forgive their sin, and will heal their land.

It really is this simple, the soulution is right in front of us, hidden in plain sight. May those who have eyes see, and may those who have ears hear.

5G is only the beginning of the planned, total annihilation of this precious world. It is a diabolical tool and if the people do not speak up, and take lawful action, and do whatever it takes to restore the Rule of Law, it will be the end.

REPLY

Natalie

September 22, 2019 at 2:17 pm

High-drama, apocalyptic religiosity is definitely not the answer to any of this. Lawyers, scientists, and clear-headed, determined citizens are the ones making headway … not end-times prozeltizers.

REPLY

Shar

September 22, 2019 at 7:48 pm

Connectors will include every person on board regardless of race, creed, etc. etc. . Please be a connector to fight this. Bringing up “science vs. faith-based beliefs” is divisive at a time like this. Thank you.

REPLY

Terri

September 27, 2019 at 5:40 pm

Natalie, Who is preaching end times high drama? I give lawful facts and evidence and draw logical conclusions. Where is your lawful action? I am sure my post was too long for the cognitively challenged, who due to communist public schools are functionally illiterate and lack reading comprehension.

Have you studied real history and our founders beliefs? Lawyers are liars who promote what is legal therefore inferior to lawful, as I stated above. Do you know what the bar is? Do you understand anything about titles of nobility? Funny how all these lawyers do not seem to accomplish anything, like the vaccine debacle in California. They are also not accomplishing anything for any of our inherent rights because that is not what they are taught. Removal from office for perjury of oath per article 14 is the lawful remedy, and in power offers similar remedies. It sounds like you think our founders were hysterical as well, since I quoted them, and talked about their inspiration to form our perfect union of the several states, under God. It is even in the pledge of allegiance.

Scientists as an authority? You mean the new priests in white coats who are responsible for almost as much death and suffering as communism? The real scientists against 5g and other abominations have already given their facts and evidence. This article was not about science, it was about how to apply the law. What does science have to do with this article? Why bring it up?

You do not have to be religious to see the writing on the wall. Just read Wes Penre’s documentary on Transhumanism. Have you heard of agenda 21 turned agenda 30? Listened to Bill Gates and his grand depopulation plan? Seen the Georgia guidestones? The list goes on and on. The green new deal? Monsanto’s goal to patent everything and remove all that is natural or made by God, and replace it? Read the deagle report? Read anything about what 5g does to life? Have you heard of Ray Kurzweil or Gordie Rose, founder and keeper of D wave? Do you know what cern is doing?

My post had nothing to do with “religion”. It was truth backed by legal and lawful facts and evidence and a solution for the challenges we face. I also gave my opinion about

evil. Why would you call me names and falsely denigrate me and my information just because you choose not to believe in a Creator and I use the word God? It is really sad that is all you have to say about my post, for you missed the whole point of it.

Ironic that you tell me to shut up and let the "authorities" take care of this on a site called take back your power in the Constitutional Republic of America, where the people are the authority, and retain all the power, not government or so called experts. You really need to look at how communism has infected you to seek to turn our founding documents and principles on their head, and advocate the worship and obedience of "authority", yet accuse me of being a religious nut? That is hypocrisy.

Humans and all life are sacred, but humans are the only ones who have forgotten this. Its past time for humans to stop wallowing as peasants, remember who they are, and save themselves from the destructive path they have chosen.

One more question, what is a prozeltizer?

REPLY

TERRI

September 23, 2019 at 9:12 am

Thank you Terri.
Put this out there , everywhere 💕🏠✨

REPLY

Audrey

October 3, 2019 at 2:26 pm

I completely agree; very well said. All of us as human beings have inherent rights; these derive from our birthright as divine souls created equally by God. Even scientists recognize that there is a non-material world out there that they do not understand yet.

Those of us who have never imagined ourselves in the front lines as activists are now becoming activists, not as an intellectual decision but from our consciences because we cannot do otherwise.

If Teri's language seems too "faith-based" for some readers, substitute your own language instead. The concepts she is enunciating are universal. Science and religion are explaining their world view in their own language. Eventually they will be more accepting of each other's language and respect it even though it may not be their way of communicating.

REPLY

TAKE BACK YOUR POWER

Lia
September 22, 2019 at 2:47 pm

Thank you very much for putting this out there. I've forwarded it to many. It brings light into this darkness of 5G.

REPLY

MJ
September 22, 2019 at 4:34 pm

It appears that the 5G hardware is going up without the knowledge of who's doing anything related in our area, though Verizon says they are in the process but the 'mysterious' towers that have been noticed are not 'their towers'.

Many towers are available to those who want to rent a mounting space, so not being 'theirs' is disengenuous possibly….

An energy engineer in his comments among friends said that the 'emergency responders communications' networks were being 'upgraded' in his area so that would explain some of what we were seeing conceivably as a FCC surreptitious FOUNDATION for phone companies to build on.

Under the disguise of improving 'safety', how does that affect your legal challenge against assault?

BEWARE overconfidence in logic for courts.

REPLY

IISHANA ARTRA
September 23, 2019 at 8:01 am

Great summary. I would like to be able to direct my legislators to the list of Australian cell sites that have been halted in Australia. You wrote, " [Approximately 2,500 4G/5G cell sites have been halted in Australia. -Ed.]" Where would I be able to find this list? Thank you!

REPLY

Josh del Sol Beaulieu
September 23, 2019 at 10:55 am

Iishana, for more info on this please contact Raymond Broomhall and his team at: https://EMRLegalEducation.com

REPLY

Danny

September 27, 2019 at 7:02 pm

There won't be any 5G in southern america, here's why:

The Psychopaths who are controlling this world via proxy, have planned their safe escape well in advance.

The Illuminati "elite" have already secured their own vast freshwater aquifers in their hideout country called "ANDINIA" in Patagonia. See "Zionists Set Their Sights on Patagonia" and "The Andinia Plan".

Patagonia in South America seems to be the refuge for the mega-elite. This is where some Nazis were said to have fled in 1945

While visiting her 11,000 acre estate with Ted Turner in Patagonia years ago, Jane Fonda said wouldn't it be nice if "something happened" in America so that she was forced to stay in Patagonia. Along with George Soros, who has bought nearly a million acres nearby, plus a Bariloche resort. Then there's Angela Merkel, who has bought an estate not far from George Bush's, and Sylvester Stallone, etc. Even the Queen owns an estate there called "Monte Dinero", and her grandchildren are being taught to speak Spanish by their Spanish nanny.

Luciano Benetton, the Italian textile magnate, spent $50 million a few years ago for nearly 2.2 million acres of sheep ranches, which sprawl along a 60-mile length of the Chubut River valley and supply his company's wool mills.

A land agent there said, "I have more demand for good ranches than I have ranches to sell," He spends most of his days trolling the region's dirt back roads in search of potential sellers and recently flew south to Patagonia's tip to scout for ranches there.

"I have orders to buy ranches with no price limit, and I can't find them," he says with a sigh.
"People say, 'Why in the world do you want to invest in something so far away?' "

Answer: The Illuminati have no intention of going into "Underground Bunkers". That's just disinformation for the peasants. They are running away to Andinia, to safe their own skin & ends.

REPLY

TAKE BACK YOUR POWER

CHEF

September 24, 2019 at 1:09 am

Thank you for "Empowering Municipalities to Meet the 5G 'Land Grab' Challenge"!

Did you know that Acts of Congress are limited in jurisdiction primarily to Federal property?
………
See: "Right Knowledge For American Law – Prt. III":
https://www.curezone.org/blogs/fm.asp?i=2265823

REPLY

GAIL JONES

September 24, 2019 at 1:27 pm

In a recent session of the UN, member Guterres admitted complete ignorance regarding 5G installations , and made light of the implications of the discussion by admitting to have installed them in his own home ! Was rewarded by guffaws and laughter by the members! How can we expect serious consideration of this EXTREMELY DANGEROUS 5G weapon from a group , totally uneducated on the subject! THE UN IS A JOKE , A ROOM FULL OF "SUITS"! BUFFOONS!☠☠☠☠👎

REPLY

Audrey

October 3, 2019 at 2:58 pm

I agree with most of Julian Gresser's recommended actions. The one I take exception with is the idea of holding a referendum to let the people decide. We can all come up with examples where that resulted in a very undesirable outcome. My top example is Brexit. What a mess that created when the UK allowed its citizens to vote on that very complicated issue.

Our founding fathers foresaw exactly that when they urged that we have a representative government. A populace that is not sufficiently informed can not vote intelligently on ANY issue.

Most people in the US are not sufficiently informed about the dangers of electromagnetic radiation (EMR). The reason is that they receive their information from mainstream media – TV, newspapers, radio, etc. – all of which have suppressed unbiased, factual information and research on the dangers of all EMR including smart meters, cordless phones, and all wireless devices and technology. Even the Internet's powerful interests like Google are suppressing

the unrestricted flow of information that has been part of the Internet since it began that they do not like.

What a disaster if we had a referendum even in our city of 60,000. Yes, more people are becoming aware of the dangers of electromagnetic radiation, but not yet enough. Back to my example, Brexit squeaked by by a 51% vote. That is too close to hold a referendum on this issue. That means 49% (rounded to a whole percent) voted against leaving the EU. 51% of the populace of the US does not understand the dangers of EMR even to any extent.

In short, referendums will only accomplish a desirable result IF the voters are WELL informed.

That said, I very much appreciate Mr. Gresser's efforts in condensing a complex issue down to three basic assumptions and actions to be taken. Our 5G rollout is just beginning here in the San Diego area, and his outline is an ideal, effective strategy for us to follow. Thank you, Mr. Gresser, for your research into Raymond Broomhall's successful methods. My husband and I are seniors, and he has Parkinson's, so I am going to pursue Mr. Broomhall's tactics.

REPLY

TAKE BACK YOUR POWER

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TAKE BACK YOUR POWER 2017 FINAL CUT

The award-winning documentary **Take Back Your Power** uncovers the shocking story behind why hundreds of local governments are standing against the multi-billion dollar rollout of 'smart' utility meters. Take a journey of revelation, examining evidence of in-home privacy invasions, systemic over-billing, extortion, health & environmental harm, fires and unprecedented hacking vulnerability. And be inspired by emerging solutions.

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FULLY BRIEFED

- **TPG chief operating executive Craig Levy has told the Federal Court that the telco pulled its plans to roll out a 5G network in Australia due to community fears regarding the health impact of the technology.**
- **Those fears have spiked despite bodies such as the World Health Organisation (WHO) stating there should be no risks to public health. In fact, 5G radiation should actually be safer than previous networks, according to research by Cornell University.**
- **Despite the science however, a small segment of the community appears concerned over the technology, as the number of social media groups spreading disinformation grow, galvanising opposition to the network.**

Australia has an unfortunate and chequered history of politics scuppering its national technology infrastructure.

The National Broadband Network (NBN) was kneecapped by a change of federal government and policy and has been a veritable trainwreck ever since.

In 2018, fears of Chinese espionage dashed Huawei's bid to help roll out the 5G network here. Now TPG is having to explain why it scrapped its own 5G aspirations and it appears its hand was forced – at least in part – by fears from the community about health impacts of the technology.

"If people have concerns about the impact on their health... they are not just looking at our model in a positive manner," chief operating

executive Craig Levy told the Federal Court on Tuesday, as reported by the Sydney Morning Herald.

TPG is in court fighting its blocked attempt by the ACCC to merge with Vodafone, and inadvertently, the case rests on whether or not TPG would build the important infrastructure without a merger going forward. The telco has flatly claimed it wouldn't, so far citing a lack of commercial viability, and now community opposition.

"You don't think there is any scientific rationale for this do you?" ACCC counsel Michael Hodge QC then asked Levy.

Levy responded that while it was "not his area of expertise...the equipment that we were using was well within the standard and it is very much acceptable in terms of the standards".

Hodge then asked if "there was some segment of the community that held an irrational concern about the effects" of the small cells used in a 5G network.

"I wouldn't call it irrational. I think people have rational concerns," Levy responded.

Rational – but perhaps a little unscientific.

The World Health Organisation (WHO) has stated "there should be no consequences for public health", while research from Cornell University shows the higher radio frequencies used by 5G networks are actually safer because they are less able to penetrate human skin.

That science appears to have done little to allay fears in some sections of the community, however.

Levy claimed that even the then-telecommunications minister Mitch Fifield wrote to TPG warning that community members had come to him with concerns, while A Current Affair segment had also helped galvanise opposition to 5G.

It's not the only one.

Russian state media outlet RT (formerly known as Russia Today) ran a segment titled '5G Wireless: A Dangerous Experiment on Humanity', has been viewed more than 1.8 million times on YouTube and claims that the technology's wireless radiation "can cause DNA damage, neuropsychiatric effects and other health problems".

America's Fox News ran a similar segment with host Tucker Carlson asking 'are 5G networks medically safe?'

Vision from both segments and other disinformation have helped spawn an online campaign against the 5G network. Worldwide, there are hundreds of these groups, according to online monitor the Global Disinformation Index (GDI) which identified that in the last few months alone, the activity and membership of these groups have swelled.

"As the blast radius of the payload expanded with every additional media mention, a loosely-organised social media network supporting the 'Stop 5G' narrative used it as daily algorithmic cannon fodder across Facebook, Twitter and Instagram," a recent GDI report said.

"Pages were created by groups and users in Australia, Denmark, UK, New Zealand, Scotland, Malta, Italy, Canada, Poland, Ireland, and the United States, among others."

Activity exploded on the 124 Facebook pages monitored by GDI in May after strong media coverage. In a single week, the number of new weekly posts climbed from around 200 to over 1000.

Certainly, in Australia there are now dozens of Facebook groups boasting thousands of active members protesting 5G's rollout in Australia. 'Stop5G Australia' has almost 6,000 members for example, while more specific areas like Adelaide and New South Wales' Mid North Coast and Northern Rivers each have their own following.

The growth of such groups has helped spread fears about 5G technology, with much smaller turnouts gathering offline for 'information' nights.

While TPG has listed several reasons for pulling the plug on its new network, it has now testified that those health fears were a major factor.

If that online momentum continues, it may not be the last to be stopped in its tracks by such groups.

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Jack Derwin
Business Insider 17 September 2019

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5G wireless… the industry HAS NOT shown it to be safe for your health or privacy – yet THOUSANDS of peer-reviewed, independent studies show the risks it presents. Learn about the dangers and find solutions in your community!

You may have heard of 5G, it stands for fifth-generation cellular wireless. In a February 2019 US Senate hearing, the wireless industry was forced to admit they have no safety studies on 5G, and don't plan to do any. Meanwhile, there are thousands of independent studies concluding that **wireless radiation causes biological harm.**

Despite this, the wireless industry is working with government to deploy 5G — it's a global, for-profit, human experiment... without our consent.

What does it mean? Millions of "small" cell towers will be added to every block (which is a serious privacy concern). Each tower emitting radiation at levels known to cause **cancer, sterility, DNA damage and other harm**... especially to our children, who are most at risk.

Dietrich Klinghardt, MD, PhD

Best Protection From EMFs and 5G

Devra Lee Davis, PhD, MPH

Science on 5G and Wireless Radiation

Martin Pall, PhD

Explaining the Mechanism of Wireless Harm (Part 1)

Robert F. Kennedy Jr.

Dangers of 5G to Children's Health

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Kathy Noel

From: Annemarie Clisby
Sent: Monday, September 9, 2019 9:26 AM
To: Roy Sapau
Subject: FW: How The 5G Roll Out WIll Affect Earth's Atmosphere

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From: Jack Cardoza <jackcardoza@gmail.com>
Sent: Thursday, September 5, 2019 7:45 PM
To: Council Members <council@encinitasca.gov>
Subject: How The 5G Roll Out WIll Affect Earth's Atmosphere

https://www.cellphonetaskforce.org/

On September 23, 1998, 66 satellites, launched into low orbit by the Iridium Corporation, commenced broadcasting to the first ever satellite telephones. Those phones would work equally as well in mid-ocean, and in Antarctica, as in the middle of Los Angeles—a remarkable achievement.

But telephone interviews revealed that on that day exactly, electrically sensitive people all over the world experienced stabbing pains in their chest, knife-like sensations in their head, nosebleeds, asthma attacks, and other signs of severe electrical illness. Many did not think they were going to make it. Statistics published by the Centers for Disease Control reveal that the national death rate rose 4 to 5 percent during the following two weeks. Thousands of homing pigeons lost their way during those two weeks, all over the United States.

Several companies are now competing to provide not just cell phone service, but Wi-Fi and the equivalent of 5G, to every square inch of the earth from satellites in space in low earth orbit. Their target dates are 2019 or 2020. They are planning not 66 satellites, but tens of thousands of satellites. There isn't much time to prevent a global ecological catastrophe.

The companies with the biggest schemes include:

SpaceX: 12,000 satellites

OneWeb: 4560 satellites

Boeing: 2956 satellites

Spire Global: 972 satellites

Honeywell has already has signed a memorandum of understanding to become OneWeb's first large customer—it plans to provide high-speed WiFi on business, commercial, and military aircraft throughout the world.

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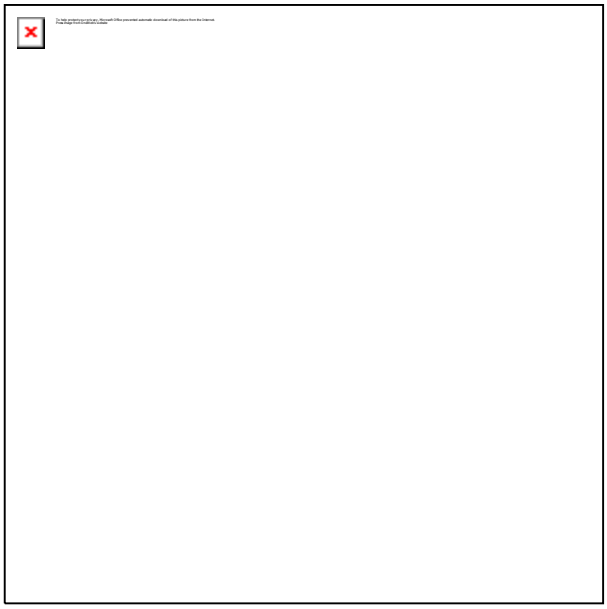

Press image from OneWeb's website

In addition to microwaving the Earth, **these plans have the potential to destroy the Earth's ozone layer and add to global warming.**

The New York Times (May 14, 1991, p. 4) quoted Aleksandr Dunayev of the Russian Space Agency saying "About 300 launches of the space shuttle each year would be a catastrophe and the ozone layer would be completely destroyed."

At that time, the world averaged only 12 rocket launches per year. Maintaining a fleet of 12,000 satellites, such as SpaceX is proposing to do, each with an expected lifespan of 5 years, will likely involve enough yearly rocket launches to be an environmental catastrophe.

Elon Musk's SpaceX, and probably the other huge satellite schemes, would require the launch of hundreds of kerosene-burning rockets annually.

It is a misconception that liquid fuels, such as kerosene, are environmentally friendly and destroy no ozone. This was analyzed in 2009 by scientists at the Aerospace Corporation in a paper titled "Limits on the Space Launch Market Related to Stratospheric Ozone Depletion." They found that although liquid fuels do not contain chlorine, they still produce significant amounts of nitrogen and hydrogen oxides, as well as water vapor and soot when burned, all of which destroy ozone. "The assumption that liquid rocket engines are green as far as ozone is concerned is not correct," they wrote. Even if liquid fuels optimistically destroyed only 2% as much ozone as solid fuels, a 50-fold increase in the rate of rocket launches, which is about to happen unless the world wakes up, would destroy just as much ozone. And the authors state that their 2% figure is little better than a guess because of "the nearly complete lack of data and models."

Martin Ross of the Aerospace Corporation was also the lead author of a paper published in 2010 titled "Potential climate impact of black carbon emitted by rockets." The authors developed a computer model to predict what would happen in different parts of the planet if the number of launches burning kerosene (then 25 annually) increased by a factor of 10. Their model predicts as much as a 4% loss of ozone over the tropics and subtropics, as much as a 3-degree Celsius summertime increase in temperature over the South Pole, more than a 1-degree Celsius overall increase in Antarctic temperature, and a decrease in Antarctic sea ice by 5% or more.

In a 2011 Aerospace article titled "Rocket Soot Emissions and Climate Change," Ross states "The Aerospace study shows that the radiative forcing of soot from a given hydrocarbon rocket scenario is as much as 100,000 times that of the carbon dioxide from the rockets." Obviously, the soot or black carbon emissions would be an important factor in accelerating climate change if the planned launches move forward.

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The recent finding, in 2018 , that stratospheric ozone is still declining despite the Montreal Protocol took everyone by surprise. The unrestrained proliferation of ever-more-powerful rocket launches may be one factor, but nobody is paying attention.

An international coalition, Global Union Against Radiation Deployment from Space (GUARDS) has been formed.

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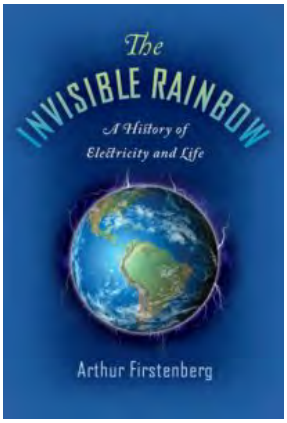

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– Sandy Ross, Ph.D.
President, Health and Habitat, Inc.

"As a medical doctor I found it hard to put down."

– Bradley Johnson, M.D.
Amen Center, San Francisco

"Just as Rachel Carson's *Silent Spring* warned the mid-twentieth century about the dangers of indiscriminate chemical and pesticide use, Arthur Firstenberg's *Invisible Rainbow: A History of Electricity and Life* provides a comprehensive analysis of the perils of electricity's proliferation and exposure to its electromagnetic radiation."

– Kate Showers, Ph.D., University of Sussex

Electricity is at once the spark of life and the undoing of it. To what extent is our present environmental crisis a result of this contradiction? Where, exactly, did the modern epidemics of cancer, diabetes, and heart disease come from, and why are they out of control? Just how dangerous are computers and cell phones? This groundbreaking book supplies the answers to these and other questions. It is a must-read that begins in the year 1746 and explains what has gone wrong and what must change if we are to survive. A breaker of taboos and an antidote to two centuries of denial, this book is uplifting. An entertaining tale and a resource for researchers, it is a road map to how we came to be where we are, and a window to a possible, necessary, more alive future.

OUR MISSION

The Cellular Phone Task Force is dedicated to halting the expansion of wireless technology because it cannot be made safe. We provide:

- education to the public concerning electromagnetic pollution (electrosmog)
- advocacy for an electromagnetically cleaner environment
- support for individuals disabled by radiation from wireless technology and other sources.

WI-FI IN THE SKY

"Just a little rain falling all around

The grass lifts its head to the heavenly sound

Just a little rain, just a little rain

What have they done to the rain?"

– Malvina Reynolds

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Original Articles

Limits on the Space Launch Market Related to Stratospheric Ozone Depletion

Martin Ross, Darin Toohey, Manfred Peinemann & Patrick Ross

Pages 50-82 | Published online: 11 Mar 2009
Download citation https://doi.org/10.1080/14777620902768867

Abstract

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ozone layer in various capacities. We estimate global ozone depletion from rockets as a function of payload launch rate and relative mix of SRM and LRE rocket emissions. Currently, global rocket launches deplete the ozone layer ~0.03%, an insignificant fraction of the depletion caused by other ozone depletion substances (ODSs). As the space industry grows and ODSs fade from the stratosphere, ozone depletion from rockets could become significant. This raises the possibility of regulation of space launch systems in the name of ozone protection. Large uncertainties in our understanding of ozone loss caused by rocket engines leave open the possibility that launch systems might be limited to as little as several tens of kilotons per year, comparable to the launch requirements of proposed space systems such as spaceplanes, space solar power, and space reflectors to mitigate climate change. The potential for limitations on launch systems due to idiosyncratic regulation to protect the ozone layer present a risk to space industrial development. The risk is particularly acute with regard to the economic rationale to develop low-cost, high flight rate launch systems.

Combustion emissions from rocket launches change the composition of the atmosphere. The changes can be divided into transient changes near the launch site that affect air quality in the lowermost troposphere and long-term global changes in the composition of the stratosphere. In this paper, we are concerned with the long-term impact of rocket emissions on the global ozone layer. Ozone depletion has been a critical concern of nations across the globe for many decades, and large-scale industrial processes that alter stratospheric composition are assessed with respect to the amount of ozone depletion they would cause. When an assessment suggests unacceptably large ozone loss for

be enacted to protect the ozone layer. In this paper, we consider rocket combustion emissions in the context of ozone layer protection over the next several decades. Our calculations are not a formal assessment, but are a preliminary evaluation to identify the main areas of concern for the space industry. These concerns include risks associated with overly conservative regulation and a suggestion for new research in order to reduce the likelihood of such regulation.

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Cicerone and Stedman [2] first considered rocket emissions as a source of ozone depletion. Subsequent studies have shown consistently that at current launch rates, ozone depletion from rocket exhaust is insignificant compared to other sources of ozone loss. [3] If launch rates and ozone depletion from other sources remain at current levels, this assessment will not change. The potential exists that the demand for launch services could increase significantly in the future. [4] Large (factors of ten or more) increases in launch demand could come about for a variety of reasons, including national decisions regarding security, enhanced space exploration, market forces associated with significant reductions in launch costs, or the emergence of new markets such as space tourism, manufacturing, or solar power. Analysts generally assume that if the cost of access to orbit is reduced sufficiently, then large, new markets will emerge for space industry and the launch market. This development would be considered revolutionary, and it is not clear when or if, this might occur. Nevertheless, if space transport follows the “normal” development path of transportation technology enters a period of continual expansion, it would be necessary to reconsider the environmental consequences of large rockets, launched often. In this paper, we consider the implication of such significant increase in demand for orbital launches on the global ozone layer.

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engines emit gases identified as contributing to climate change, the amount emitted globally is trivial compared to other sources and is likely to remain so. Annual CO_2 emissions from rockets, for example, are about several kilotons (kt) compared to emissions of several hundred kt from aircraft which, in turn, is only a few percent from all CO_2 sources. [5] Space launch emissions, even for the large growth scenarios discussed here, will not likely be significant in future greenhouse gas regulatory schemes. As a cautionary tale, we point out that even though aircraft are responsible for a few percent of all CO_2 emissions, the airline industry must contend with considerable attention and likely regulation or carbon taxation. [6] The message to the space industry should be clear: policy and media attention on high visibility propulsion emissions are often framed in ways that overemphasize the relative contribution. [7]

If rockets are a minuscule contributor to the problem of climate change, they do have a significant potential to become a significant contributor to the problem of stratospheric ozone depletion. This follows from three unique characteristics of rocket emissions:

1. Rocket combustion products are the only human-produced source of ozone-destroying compounds injected directly into the middle and upper stratosphere. The stratosphere is relatively isolated from the troposphere so that emissions from individual launches accumulate in the stratosphere. [8] Ozone loss caused by rockets should be considered as the cumulative effect of several years of all launches, from all space organizations across the planet.

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driven by only trace amounts of reactive gases and particles. Stratospheric concentrations of these reactive compounds are typically about one-thousandth that of ozone. Deposition of relatively small absolute amounts of these reactive compounds can significantly modify ozone levels.

3. Rocket engines are known to emit many of the reactive gases and particles that drive ozone destroying catalytic reactions. [10] This is true for all propellant types. Even water vapor emissions, widely considered inert, contribute to ozone depletion. Rocket engines cause more or less ozone loss according to propellant type, but every type of rocket engine causes some loss; no rocket engine is perfectly “green” in this sense.

Since 1987, the ozone layer has been protected by international agreements [11] that limit the production and use of substances that have been determined to cause ozone depletion. The Montreal Protocol on Substances That Deplete the Ozone Layer (and subsequent amendments), regulates the worldwide production and use of ozone depleting substances (ODSs), including the well-known chlorofluorocarbons (CFCs) and other halogen gases. The Montreal Protocol is widely considered a significant success and the global phase out of ODSs mandated by the Protocol is expected to allow the ozone layer to recover to pre-ODS levels by about 2040. In support of the Montreal Protocol, the stratospheric science community issues a quadrennial summary, the Scientific Assessment of Ozone Depletion, [12] describing the state of knowledge of stratospheric composition, the factors causing ozone depletion, and projections of the future ozone layer. The Quadrennial Ozone Assessments have occasionally addressed ozone depletion caused by rocket emissions and have determined that the current loss is “small” in comparison to other

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framework that protects the ozone layer. Later, we discuss the threshold level of ozone loss that might be considered "not small," as well as the level that might be considered "too large."

The recovery of the ozone layer, [13] while a favorable development, is motivation to be concerned about ozone depletion caused by rocket emissions over the next several decades. The eventual elimination of the major sources of ozone loss (that is, ODSs) raises the question: Will sources of ozone loss currently considered small, such as rocket emissions, eventually be scrutinized more closely by the stratospheric protection community? [14] This would particularly apply to rocket emissions if demand for launch services increases in coming decades, just as other sources of ozone loss decrease due to the success of the Montreal Protocol. In addition, revisions in our understanding of emissions, stratospheric processes, or the introduction of new propellants on a large scale (hybrid rockets, for example) may cause changes in the estimated ozone loss for a given launch rate.

In this paper, we examine the problem of rockets and ozone depletion from several new points of view. For the first time, we consider the problem in a long-term context that includes significant, sustainable, [15] growth in the space industry and evolving regulatory actions associated with the recovery of the ozone layer from past pollution. We apply the first plausible estimates of ozone loss caused by liquid propellant rockets, which will certainly play the major role in a significant expansion of the launch industry. We develop a parameterization of the steady-state global ozone loss caused by solid and liquid propellant rocket emissions and relate the ozone loss to amount of payload delivered to Low Earth Orbit (LEO). The model is limited by uncertainties in the actual composition of rocket emissions, and the

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used to draw conclusions of an order of magnitude. Nevertheless, the model is useful to examine long-term trends and investigate rocket emission ozone loss within the context of scenarios of large increases in launch rates, the recovery of the ozone layer, and conceptual analysis of the econometric effect of caps on rocket emissions that might be enacted to protect the ozone layer. We draw a number of conclusions for the global launch industry that have implications for policymakers for both strategic space transport planning and future protection of the ozone layer. Finally, we also identify the most important areas where new research could reduce the model uncertainties and so increase the ability to reliably plan for future space systems development.

STRATOSPHERIC OZONE AND REGULATORY PROTECTION

Ozone Chemistry

A detailed account of stratospheric chemistry is beyond the scope of this paper however, a few critical concepts need to be explained in order to justify our parameterization of rocket ozone loss. The stratospheric ozone (O_3) layer generally resides between 20–30 km altitudes, absorbing harmful solar ultraviolet radiation before it reaches the Earth's surface. Chemical and dynamical processes that are well understood determine the vertical and horizontal distributions of stratospheric ozone. The ozone layer results from a long-term balance between the vertical profile of ozone production, the vertical profile of ozone destruction, and the global circulation of stratospheric air.

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gases known as radicals. The highly reactive radicals—oxides of nitrogen, hydrogen, bromine, and chlorine—referred to as NOx, HOx, BrOx, and ClOx—control global ozone levels by tilting the long-term balance between ozone production and destruction in favor of the latter. Moreover, because the radical reactions are catalytic, only trace amounts, a few parts per billion, are able to control much greater amounts of stratospheric ozone. A single radical molecule emitted into the stratosphere, for example, can destroy up to ~10^5 ozone molecules before being deactivated and transported out of the stratosphere. Radicals react with ozone on very short time scales, minutes to hours, so that direct injection into the stratosphere over a limited area (a rocket plume, for example) will cause a prompt, localized, ozone "hole." [16]

Particles also play an important role in ozone destruction. Chemical reactions particle surfaces activate radicals from their reservoirs, shifting the balance toward lower ozone levels. The strong potential for particles to reduce ozone is demonstrated in the springtime south polar stratosphere, where photochemical reactions on ice particles efficiently liberate ClO_x from reservoirs [17] and so play a role in the formation of the infamous "Ozone Hole." Such reactions are known occur on the surface of alumina and, possibly, soot particles. [18] Particles with diameter less than about 1 micron (μm) remain suspended in the stratosphere for several years [19] and become mixed globally by the stratospheric circulation. This means that repeated injections of submicron particles into the stratosphere, as from global (~weekly) rocket launches for example, result in an accumulation of particles. The accumulated particle surfaces increase the rates that radicals "leak" from their reservoirs and so reduce ozone levels globally.

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reservoir gases. The sources and reservoirs can be thought of as a sort of chemical storage for the radicals, which leak photochemically from storage into the stratosphere, increasing the rate of ozone destruction. The concentrations of the sources and particularly reservoirs are determined by a steady state between fluxes across the tropopause, production from radical-radical reactions, loss from photolysis and radical-reservoir reactions, and direct injection from rocket engine emissions. H_2O, emitted by all rocket engines, is one of the most critical source gases. [20] H_2O is the source gas for HOx radicals but also contributes to the formation of the ice particles that cause the polar ozone hole. Small changes in middle atmosphere water vapor and temperature can cause large changes in stratospheric cloudiness. Ozone loss from water vapor emissions is highly nonlinear and difficult to predict.

As a foundation for further discussion, we proceed with the understanding that all types of rocket engines, solid rocket motors (SRMs) and liquid rocket engines (LREs), emit compounds that are known to reduce ozone to various degrees, depending on their various compositions. Rockets engines inject all of the types of compounds mentioned above associated with ozone loss—radicals, their sources and reservoirs, and reactive particles—throughout all levels of the stratosphere. They are the only ozone destroying, human-produced, compounds that are emitted into the stratosphere this way.

OZONE MEASUREMENT AND PROTECTION

Long-term global trends in global stratospheric ozone, the interest of this paper, are often considered using the quantity AAGTO, the averaged global

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stratospheric ozone into a single quantity to represent the total quantity of ozone in the stratosphere. The AAGTO, informally known as "global total ozone," is often the metric reported by models to compare predictions of the response of the stratosphere to different emission scenarios. Stratospheric models generally agree that the present day AAGTO (global total ozone) is about 4% smaller than the AAGTO in the era before significant ODS use, usually taken as 1980.

For this paper, we identify the term "global ozone loss" with a decrease in predicted AAGTO (or equivalently, the decrease in global total ozone) associated with a constant annual rate of rocket emissions. We further equate the term "global ozone loss" with the commonly used term "ozone depletion" in that it refers to the overall decrease in the total quantity of ozone in the stratosphere. We use ΔO_3 to represent the percentage global ozone loss, or ozone depletion, caused by human-produce compounds. As a matter of convenience, ΔO_3 is numerically positive but refers to a decrease in the total number of ozone molecules in the stratosphere. Because of the global phase-out of ODSs mandated by Montreal Protocol regulations, the ozone layer is expected to recover to pre-ODS levels by about 2040. Figure 1 shows how ΔO_3 is expected to approach zero as the ozone layer recovers. [21] The Montreal Protocol is widely seen as a great success; ΔO_3 would have reached 40% by 2010, with widespread and serious negative effects from increased solar ultraviolet radiation, without the regulation.

FIGURE 1 Anticipated recovery of global ozone assuming that the schedule of ODS phase-out required by the Montreal Protocol is carried out as currently planned. The shaded region represents the uncertainty over the details of the ozone layer recovery.

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The formalism for determining which gases must be phased-out is highly developed: widely accepted computer models of stratospheric composition and circulation are used to predict ΔO_3 per unit mass of a gas released at the earth's surface, and this result is used to determine the substance's Ozone Depletion Potential (ODP), its ability to cause steady-state global ozone loss compared to a well-understood reference gas (CFC-11). If there is widespread agreement among the various computer simulations of ozone response to a chemical perturbation that the ODP of a particular compound exceeds a critical value (0.2 or higher), then it is scheduled for reduction and elimination by the stratospheric protection community. The models used to calculate ODPs—and so identify compounds for phase-out—are updated routinely by the scientific and regulatory communities. Innovations have included using a time dependant ODP or evaluating the increase in effective equivalent chlorine (EECl) burden caused by a substance rather than simply calculating the steady state ODP. [22] For most gases released at the earth's surface, the regulatory process is fairly well defined and has been operating successfully for 25 years.

The Montreal Protocol formalism is not entirely free of ambiguity and controversy. Models do not always agree on the predicted ODP and so it is not always clear if the ODP of a particular substance exceeds the 0.2 trigger for phase-out. In addition, because Protocol signatories can request critical use exemptions (CUEs) and delay phase-out schedules, some compounds with an ODP unambiguously greater than 0.2 can nevertheless see continued use, delaying the final phase-out of an ODS. The case of methyl bromide (CH_3Br) is

bromide is the major source gas for the BrOx radical and has an ODP between 0.4–0.8. Accordingly, the gas was scheduled for global phase-out. Various considerations have caused some Protocol signatories to request continued use of methyl bromide, under the CUE process. One of the arguments for continued use is that despite its large ODP, the global ozone loss ΔO_3 caused by methyl bromide is "small," compared to other causes of ozone depletion. This line of argument, if accepted, might be seen set a precedent for an alternate regulatory scheme for ozone protection wherein, for some industrial compounds, the ODP value is less important than ΔO_3. The methyl bromide case suggests that 0.2% might reasonably be adopted as the upper limit of acceptable ΔO_3, regardless of a compound's ODP, if the compound in question has unique and significant economic value.

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ASSESSMENT OF ROCKET PROPULSION EMISSIONS

The Montreal Protocol assessment process is even less certain for compounds that are known to affect the ozone layer but do not fit into the ODP formalism, which is limited to gases released at the Earth's surface. [24] For compounds injected directly into the stratosphere, such as aircraft and rocket emissions, assessments are done with models that predict ΔO_3 for a range of "emissions scenarios." Scenarios are model inputs that follow from specification of the composition, altitude and latitude distribution, and absolute quantity (e.g., fleet flight rate) of the emission. The predicted fleet ΔO_3 is evaluated relative to the predicted ozone loss from other industrial sources. This process is not formally defined and the ambiguity invariably leads to subjective and vague assessments such as "small" or "large," "insignificant" or "significant," and

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definitions of these terms have not been determined. The level of global ozone loss ΔO_3 that would be considered significant enough to require phase-out or use limitation, that is to say an international benchmark that would invoke regulatory action, has not been specified. Assessments of aerospace combustion emissions are complicated further by uncertainty over who would have regulatory authority, the Montreal Protocol or the International Civil Aviation Organization (ICAO), which recommends environmental standards for aircraft emissions.

Subjective assessments have advantages and disadvantages for the regulatory process, especially for poorly understood emissions without feasible alternatives. The indeterminacy of subjective assessments provides flexibility, an important advantage for successful regulation. A disadvantage of subjective assessments is that the associated uncertainties, under the rubric of ozone protection, can lead to distortions of design or investment decisions. This could possibly even include exploitation of the uncertainty by proponents of one system in competition with another.

The case of supersonic transport (SST) aircraft emissions [25] is illustrative as a cautionary tale regarding lack of knowledge, exploitation of the uncertainties, and the resulting idiosyncratic behavior of the policy apparatus. Early research suggested that SSTs could cause a large global ozone loss and this claim was used by various factions to argue against full-scale SST development. Decades after the SST was cancelled, knowledge of turbine emissions and stratospheric processes improved to show how SST ozone loss concerns could be successfully mitigated with technology (low emission engines) and operations (cruise altitude). However, the lay perception has remained that the SST was cancelled because of “environmental” issues. (As an aside, global emissions

ozone and so are not of special concern from an ozone protection standpoint.)

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The point here is that the SST debate demonstrated how the reality of a public policy issue often equals the public perception. If the uncertainty in some environmental effect is only potentially large or the associated policy ambiguous, then the effect becomes a policy problem. Space launch systems represent a situation similar to that of SSTs with respect to ozone layer protection. [26] Ozone loss from rocket emissions could be large in some scenarios and rockets are not included in the present assessment and regulatory regime. Formal metrics such as ODP and EECl are not meaningful for rockets. These metrics do not account for direct emission into the stratosphere, particles, or gases other than chlorine or bromine compounds. Thus, as for SSTs in the past, computer models are used to predict the change in global total ozone for a particular rocket fleet scenario and are informally evaluated in a qualitative and subjective sense.

Compared to SST emissions however, the level of research applied to predict ozone loss from rocket emissions has been minuscule and out of balance with reality. Consider that the global space launch industry is well established and likely to grow while the SST industry is nil and unlikely to grow at all. The 2002 WMO Ozone Assessment briefly mentions (1) that SRM emissions at current launch rates likely have a “small” impact on ozone and (2) that LRE emissions may have some additional impact that is largely unknown. The wording of the 2002 Assessment implies that 0.1% can be taken as the threshold for “small” ozone loss, even less than the 0.2% implied by some arguments in the ongoing methyl bromide discussion.

In this work, we are interested in quantitatively evaluating different scenarios of launch activity so for the purpose of discussion we need to define the

there is currently no such designation formally. We consider 1% an unambiguous upper limit that defines unacceptably large ΔO_3. The upper limit could be smaller however. Following the methyl bromide arguments, the upper limit on ΔO_3 might be as low as 0.2%. We also note, for some environmental concerns the ICAO standard is “no worse than Concorde” the only supersonic transport to see operational status. Concorde's ΔO_3 at the peak of fleet operations was certainly small, [27] less than 0.01%. As we show below, the present day impact of many of the world's rocket systems likely exceeds the “Concorde” standard with regard to ozone loss. In order to compare different future launch market scenarios, we assume two values of ΔO_3, 1% and 0.2%, that represent a possible upper bound that defines the limit of “acceptable” ozone loss. If the predicted global ozone loss ΔO_3 does not exceed 0.2%, we assume regulatory concerns would be nil. In contrast, if predicted ΔO_3 exceeds 1%, we assume that regulatory factors would almost certainly limit launch operations. For launch systems, this regulation could take a number of forms such as caps on launch rates or limits on propellant type combinations. We emphasize that these trigger limits of 0.2% and 1% are theoretical and completely particular to this work; our purpose here is to foster discussion regarding the matter and show how a regulatory limit on global ozone loss from launch systems could affect space launch development.

STRATOSPHERIC IMPACT OF ROCKET EXHAUST

Overview and Methodology

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process rocket emissions into the global stratosphere is beyond the scope of this work. However, it is of interest to briefly review the available information on rocket emissions and how the ozone layer is affected. With this background, we present approximate descriptions of the global ozone loss ΔO_3 for rocket emissions based on available data and models. The available information is sparse and approximate; so our analysis must be considered in the context of large uncertainties. This is particularly so for liquid propellant engines. The alternative to our work is to make no progress at all. Accordingly, in addition to our conclusions, we highlight the many areas where further research is required.

To first order, rocket engine exhaust consists of chemically inert compounds (N_2 and CO_2), radicals (NO, OH, Cl), radical sources and reservoirs (HCl, H_2O), intermediate underoxidized compounds (H_2, CO) and alumina or soot. The relative combinations of these compounds in the exhaust depend on propellant type; four main propellant types are in wide use, one solid, and three liquid. We must distinguish between rocket exhaust (hot gases and particles at the nozzle exit) and rocket emissions (the cold plume wake that mixes into the stratosphere). In the lower stratosphere, fuel rich rocket exhaust is modified in the hot plume by intense secondary combustion reactions driven by atmospheric oxygen mixing into the plume. This "afterburning" governs the conversion of H_2 to H_2O, CO, and soot to CO_2, and net production of ozone destroying radicals. [28] Afterburning is vigorous in the lower stratosphere, lessens with altitude, and stops in the upper stratosphere and so rocket emissions are highly variable with altitude. Afterburning is not well understood—especially with respect to the minor components that most affect ozone.

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propellant types. Parentheses show the common names for the different propellant types. Table 1 acknowledges afterburning by reporting H_2 and CO in the exhaust as converted to H_2O and CO_2, respectively, and net production of radicals. We emphasize that plume models have never been validated with respect to the net emission of radicals, soot, or the details of the alumina particles sizes. One recent measurement suggests that the models in fact underestimate the production of NO in the Space Shuttle SRMs or LREs.

TABLE 1 Approximate Emission for the Four Main Propellant Types Given as Mass Fraction for each Component.

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The emissions presented in Table 1 cause prompt and deep ozone loss (approaching 100%) in the immediate plume wake, caused by the radical emissions, over areas of hundreds of square miles lasting several days after launch. These stratospheric “ozone mini-holes” have been well observed in situ by high altitude aircraft plume sampling campaigns. It is not known if the cumulative effect of the small “ozone holes” is significant compared to the global steady-state chemical effects of the emissions.

Beyond the prompt plume wake ozone destruction, second order processing of rocket combustion products occurs during the weeks and months after launch. The plumes are transported and mixed into the global stratosphere and lose their identity as distinct air masses. This intermediate mesoscale phase would be characterized by complex plume-atmosphere interactions among radicals, reservoirs, and sinks. Significant influences from alumina or

particles. The details of this processing will be highly variable according to altitude and even time of day of launch and certainly has a large influence on the steady-state global ozone loss. A few chance observations of aged plumes confirm the importance of the mesoscale processing. No studies have been done on this aspect of rocket emissions.

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One should now appreciate that rocket emissions are complex, variable, and not well understood. Global models of the stratospheric response to rocket emissions have not taken into account at all the influence of afterburning and mesoscale processing. This is because a rigorous analysis of these effects has never been done. The information in Table 1 should not be taken to predict the emission of a given rocket engine type. Rather, the main points of Table 1 are that (1) SRMs emit relatively large quantities of gases and particles that deplete ozone; (2) LREs emit smaller amounts of gases and particles that potentially deplete ozone; and (3) all rocket engines emit water vapor that will deplete ozone.

For our purposes, we make the problem tractable, at least to first order, by making several simplifications:

1. We ignore the prompt plume wake ozone “mini-holes” and the mesoscale mixing and processing. We only consider the situation presented in published models of rocket emissions, the long-term, cumulative, steady-state ozone loss ΔO_3 from all rocket launches.

2. We assume that ozone loss caused by SRMs is separable from ozone loss caused by LREs. As Table 1 shows, SRMs emit much greater amounts of reactive chemicals and particles. Thus, we can be certain (despite the

more significantly than emissions from any of the three LRE types.

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3. We consider LREs together as a class so that the ozone loss they cause can be described with a single parameter, representing the "characteristic" LRE impact. Each LRE type certainly reduces ozone uniquely and unequally, but all LREs cause some ozone loss that is an order of magnitude smaller than SRM ozone loss. This approximation is rough, but it is consistent with the sparse LRE emissions data, plume data, and model predictions.

4. We describe the ozone loss for SRMs and the LREs based on generalizations deduced from published models that describe perturbations to the global stratosphere from rockets and supporting plume measurements. While significant progress was made on the problem of rocket emissions in the 1990s, little additional work has been done since the 2002 WMO Ozone Assessment. The literature is sparse. Published calculations of ΔO_3 for rocket emissions are very limited—none account for variability associated with afterburning, mixed propellant types, chemical processing between the early plume wake and steady-state phases, and LRE emissions, in general.

5. We assume that the steady-state ozone loss ΔO_3 from rockets can be approximated by the linear addition of the long-term steady-state effects of all launches on a global basis. This simplification ignores several second order effects such as the effect of launching from different latitudes, seasons, times of day, and the changing background stratosphere.

6. We only consider rocket propulsion systems currently in wide use. We do not consider proposed propellant combinations such as LOX/methane,

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of the present day global emissions. They are likely to be more significant in coming decades, however. Air-breathing hypersonic systems in particular are of great interest for ozone loss since they would emit much of their combustion products directly into the peak of the ozone layer at altitudes near 20 miles and are often discussed as the first stage of proposed high flight rate, reusable launch systems. [29] A hypersonic-based launch system would deposit a larger fraction of the total combustion products into the stratosphere than rocket systems. Much research and development is currently being invested into hypersonic systems, without much regard to their impact on the ozone layer.

We emphasize the uncertainty in specification of rocket emissions and their effects on the stratosphere. This is especially true for the cryogenic and kerosene systems that are usually assumed harmless to the ozone layer. [30] Significant data collected in LRE plumes strongly suggest that LRE emissions contain significant amounts of reactive NO, OH, and particles; furthermore, they cause the formation of ice particles in the middle and upper atmosphere. [31] These data indicate that the assumption that “LREs are green” [32] as far as ozone is concerned are not correct.

PARAMETERIZATION OF GLOBAL OZONE LOSS ΔO_3

With the problem simplified, we write an expression for the global ozone loss ΔO_3 from rockets as the sum of the effects of SRM and LRE combustion emissions as

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atmosphere with rocket emissions compared to one without. M_S and M_L are the annual stratospheric emissions (kiloton) from SRMs and LREs, respectively. δ_S and δ_L are ozone loss coefficients that relate ΔO_3 and emission mass for SRMs and LREs, respectively. For convenience, we assume that the units of M and δ are kilotons (kt) and percent per kiloton (% per kt) of rocket combustion emitted into the stratosphere. M_S and M_L are assumed annual values. Both terms on the right-hand side implicitly include the effects of both gas and particle emissions of the two propellant types. The parameters δ_S and δ_L are admittedly not as sophisticated as the standard metrics for ozone depleting substances such as ODP or EECl but they can reasonably applied understand trends and comparisons to the major sources of ozone loss such as halogens. Indeed, one of the goals of this work is to argue the need for the creation of a more robust and considered formalism to assess rocket emissions.

We estimate the values for δ_S and δ_L by summarizing previous research on the emissions from rocket engines and the response of the stratosphere to those emissions. For some cases, the relevant research has not been done, and so we make use of general arguments to estimate the correct values for δ_S and δ_L. The emissions M_S and M_L are either specified explicitly or estimated as a function of LEO payload. The ozone loss coefficients δ_S and δ_L are acknowledged only an approximate description of the relationship between rocket emissions and global total ozone loss. Our definition of δ_S and δ_L averages out a number of second order variables including latitudinal and seasonal details of launches and nonlinear effects in stratospheric chemistry and dynamics. δ_S and δ_L are too coarse to be considered as an ODP analogue for rockets. As we point out below, much work lies ahead in order to derive a comprehensive and sensible way to compare the global total ozone loss from different rockets.

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have some confidence in our assumed value for δ_S of 1.5×10^{-2}% per kt. This value follows from a number of detailed steady-state stratospheric models that include SRM chlorine gas and alumina particle emissions. [33] The ozone loss from chlorine emissions from SRMs is well understood, however, the ozone loss from alumina particles is only poorly understood. Chemical reactions on alumina particles promote production of ClOx from its reservoirs, similar to reactions on certain ice particles that contribute to the south polar ozone hole. While the chemistry is known, the steady-state alumina loading is not. Only alumina particles smaller than ~1 μm remain in the stratosphere for years and contribute to the steady-state ozone loss. The fraction of SRM alumina particles that meet this criteria been variously reported as between 1% and 30%. [34] Here we assume the alumina sub-micron mass fraction equals 5%, in the middle of the range of possible values. The models show that for a mass fraction of 5%, the alumina and chlorine contribute about equally to SRM ozone loss. Our assumed value for δ_S of 1.5×10^{-2}% per kt can be considered moderately conservative.

Little work has been done to model LRE emissions or their effects on ozone. We have only moderate confidence in our assumed value for δ_L of 3×10^{-4} % per kt. This value follows from a detailed model of hypergolic emissions where the global ozone loss, almost completely due to NO emissions, approximately equaled 2% of the ozone loss from SRM emissions, suitably scaled by propellant mass. [35] We assume that all three LRE types can be characterized under the assumption that the ozone loss coefficient δ_L equals 2% of δ_S. This assumption is speculative, though plausible. OH and NO emissions from kerosene and cryogenic engines are unknown but are plausibly present at the percent level with after burning and are certainly present at the tens of percent level without afterburning. Soot from kerosene engines might also

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is not likely to exceed our assumed value greatly, but neither can we rule this out because of the nearly complete lack of data and models. In the event that additional data and model results show that after burning kerosene and cryogenic engines do not emit significant amounts of NO, OH, or chemically active particles, then the ozone loss would be determined by H_2O vapor alone. In that case, our calculations would overestimate ozone loss by about a factor of ten.

It is convenient to restate equation (1) in terms of the total annual mass of rocket exhaust emitted into the stratosphere M_T and the ratio f where:

where f represents the fraction of total stratospheric emission from SRMs. We then write the global ozone loss as

GLOBAL OZONE LOSS FOR VARIOUS LAUNCH FLEET SCENARIOS

Ozone Loss and Rate of Orbital Payload Delivery

We are interested in the global ozone loss caused by the total emissions from all launches from the earth's surface and so “fleet” refers to the total of all rocket types worldwide. The assumed values for δ_S and δ_L are used in equation (1) to calculate the global steady-state ozone as a function of the exhaust mass emitted annually above the tropopause. Figure 2 shows global ozone loss ΔO_3 for an SRM fleet and an LRE fleet; ΔO_3 from mixed fleets would lie between the two extremes. The ozone losses in Figure 2 require about three years of

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a steady state with stratospheric processes, a requirement that the global launch industry meets. Presently, SRMs contribute about one third of annual global rocket emissions and so they dominate current ozone loss. In recent years, the average of annual SRM emissions is about 3 kilotons per year so that Figure 2 shows that current launch related ozone loss is about 0.03%, well below the 0.2% loss threshold we assigned earlier to designate small (or equivalently, minor) ΔO_3. The figure makes clear that even the 1% loss threshold we assigned for unacceptably large ozone loss can be reached for sufficiently large emissions of either SRMs or LREs.

FIGURE 2 Global ozone loss ΔO_3 (%) as a function of annual rocket emission into the stratosphere (kt per year) for different values of *f*, the fraction of total stratospheric emissions from SRMs.

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In order to understand how rocket ozone loss relates to the annual, global weight of material placed into orbit, we must account for the relationship between launch emissions and payload weight. While each launch vehicle will have slightly different relationships between payload and emissions, detailed studies of several specific launch vehicles show that an approximate relationship between stratospheric emission M_S or M_L and first and second stage propellant masses M_1 and M_2 is given by

Figure 3 shows estimated stratospheric emission as a function of LEO payload mass for a variety of launch vehicles (active and inactive). The relative mix of

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is highly variable, from purely SRM to purely LRL. Since the engines used by the various launch vehicles have different efficiencies (e.g., specific impulse) and each launch vehicle has been designed for different missions (LEO, GEO transfer, high inclination, reusability) and has different launch site latitude, the definition of payload in this context is somewhat arbitrary. In addition, a given launch vehicle can take on different stage configurations (e.g., strap-on stages) so that the relationship shown is only approximate.

FIGURE 3 Stratospheric propulsion emission as a function of LEO payload for fourteen different launch vehicles. The line indicates stratospheric emission estimated according to equation (5).

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Application of the ideal rocket equation for a 5 kt payload, two stage vehicle with specific impulse of 300 sec and structural mass fraction of 0.1, along with equation (4), and consistent with the overall level of approximation for this discussion allows us to write

where M is the total stratospheric emission, and M_{LEO} is the LEO payload. Figure 3 shows that this relationship is consistent with estimated emission across a variety of launch vehicles and so represents the relationship between LEO payload and stratospheric emission in a robust, if coarse, manner. Note that for the Space Shuttle, we assume the useful payload rather than the total mass of the Orbiter with payload placed into orbit. This means that the Space Shuttle emits several times more stratospheric emission per payload mass than the general trend for other launchers. Greater stratospheric emission for

characteristic of RLV systems in general and so in this sense RLVs are more harmful to ozone than expendables.

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We can combine equations (3) and (5) to write an expression for global total ozone loss ΔO_3 as a function of mass placed into low earth orbit (LEO) M_{LEO} as

We apply equation (6) to investigate how much global ozone loss the current global launch market causes, how this fits into other sources of ozone loss, and how this might change in the future as the space industry grows. Figure 4 shows the range of global ozone loss for mixed SRM and LRE systems as a function of payload delivered to LEO. In recent years, the global launch industry has annually lifted nearly 1 kt into LEO and about one quarter of the stratospheric emission has been from SRMs. (Note that GEO payloads typically require about six times their final GEO weight to be placed into LEO parking orbits.) Like Figure 2, Figure 4 shows that the current ozone loss from the global launch fleet is about 0.03% with almost all of this is due to the SRM component of the exhaust. As discussed above the stratospheric protection community has deemed this level of ozone loss “not significant.”[6]

FIGURE 4 Steady-state ozone loss as a function of LEO payload rate for different values of *f*, the fraction of stratospheric emission from SRMs. The square shows the situation that would have emerged for the original Space Shuttle design goal. The circle illustrates the approximate situation for the global launch business in recent years.

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Space Shuttle met its original goal of weekly launches. In this case, ΔO_3 from Space Shuttle launches would have approached the 0.2% limit for small ozone loss. Designed and built prior to the era of international protection of stratospheric ozone and when the impact of SRM emissions on ozone was not understood, global ozone loss was not a factor in Space Shuttle design or operations planning. If weekly launches of the Space Shuttle were proposed now, it is not clear how the stratospheric protection community would respond. We point this out to emphasize that, as new discoveries improve our understanding of rocket emissions and stratospheric processes, ozone depletion considerations might influence launch systems design and operations during the typical multi-decade life of launch systems.

Global fleet launch rates sufficiently large to exceed the 0.2% threshold for any propellant type mix are not likely without revolutionary changes in the space industry. We cannot know when or how such changes might come about though serious planning and discussions are ongoing. [36] Various proposals for very large space infrastructure projects, space tourism, or RLVs with very high launch rates have been seriously proposed and significant resources have been invested. All of these proposals would result in large launch vehicles with very high launch rates (i.e., daily) and so it is of interest to evaluate them based on their impact on the ozone layer. One often discussed concept is the use of Solar Power Satellite (SPS) systems for electricity production. A recent study [37] indicates that the required annual launch demand for an economically viable SPS system would be about 25 kt per year, over many years, perhaps indefinitely. Figure 4 shows that this SPS launch system would be constrained to use liquid propellant systems in order to ensure that ΔO_3 remains below the 0.2% threshold; an SPS launch system could not make significant use of SRMs in the stratosphere. Since we are able to define LRE ozone loss in only

SPS launch rates might result in significant global total ozone loss, depending on the actual effect of a specific LRE type. The ambiguity of SPS launch illustrates the need for an improved understanding of rocket emissions of all types. With the current knowledge gaps, we cannot predict with any confidence which (indeed, any) large launch or space systems are plausible with respect to ozone depletion.

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THE CARRYING CAPACITY OF THE STRATOSPHERE

Figure 4 raises the notion that the stratosphere is characterized by a "carrying capacity" that represents an upper limit to the amount of material that can be placed into earth orbit using conventional rocket propulsion without causing excessive ozone loss. We have argued that the upper limit of acceptable ΔO_3 could reasonably be considered 0.2–1%, though we reiterate that there is no formally defined value or even a regulatory formalism to determine "too much ozone loss" for a particular global industrial process or system. For a value of ΔO_3 considered excessive as small as 0.2% our results show that upper limits on material that can be placed into earth orbit by conventional chemical propulsion systems are about 1 and 28 kt per year for SRM and LRE launch systems, respectively. Our ability to calculate the actual carrying capacity of the stratosphere is controlled by several poorly known parameters, the global ozone loss parameters δ for each propellant type and the maximum value of global ozone loss ΔO_3 allotted to launch systems by regulatory actions.

In the event that an upper limit on ΔO_3 is ever assigned to the global launch industry, the limit would necessarily be globally distributed, perhaps on a national basis. Any given nation then would have to operate under a limit that

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nation then would be determined by the mix of propellant types used by its launch systems. It is unlikely that the carrying capacity will be approached in the near or even intermediate future but it could be approached after several decades of significant launch market growth, especially for the scenarios of revolutionary changes in the space industry. The details of the true carrying capacity of the stratosphere for a given propellant (or combinations of propellants) will change as new models and data become available, however Figure 4 shows us that it is not possible, within the context of protecting the ozone layer from excessive loss, for the launch market to grow arbitrarily large. Given the anticipated recovery of the ozone layer, the potential for large scale space infrastructure projects, and the potential growth in non-traditional space markets (tourism, for example), policy makers should begin to consider how a vigorously growing launch market might affect the ozone layer. Further, they need to define a formalism for evaluating rocket emissions without prejudice with respect to any one nation's launch systems.

OZONE LOSS FOR VARIOUS LAUNCH MARKET SCENARIOS

In order to predict the relative contribution of rocket emissions to global total ozone loss from all sources, especially in view of the declining influence of ODSs (Figure 1), we must assume a scenario of future demand for launch capacity. Predicting launch demand, even in the near term, has proven difficult. Widespread expectations of a surge in commercial launch demand in the 1990s where overoptimistic and the demand did not materialize. Studies of long-term (e.g., decades) launch demand have been based on various

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such as railroads or aircraft and economic analysis of emerging market demand based on price and demand relationships One simple approach is to assume that the relative mix of SRM and LRE propulsion systems will not change significantly over time and apply a constant growth rate to the current value of global ozone loss of 0.03%.

Figure 5 shows the sum of global ozone loss from ODSs (declining leg) and space launch (increasing legs) for illustrative rates of launch demand increases: zero, doubling each decade, and tripling every decade. If such trends appear and persist over the next several decades, around 2035 rocket emissions would represent an ozone depletion mechanism comparable to the declining ODSs. Figure 5 makes the point that, while currently insignificant compared to ODSs, the very success of the Montreal Protocol increase the relative ozone depletion from rocket emissions.

FIGURE 5 Global ozone loss from 2005–2050 for different launch growth scenarios. The solid line show declining ozone loss from past ODS emissions. The dash-dot, dot, and dashed lines show increasing or stabilizing ozone loss from launch emissions for the cases of no growth, doubling per decade, and tripling per decade, respectively.

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A more sophisticated approach to predicting launch market growth links launch price ($ per pound launched into LEO) to the quantity of material launched into LEO (kt launched per year) and so allows us to predict how ΔO_3 from rockets might change as a function of launch price. A detailed

However, we can illustrate some basic notions of how limitation on the launch market associated with ozone depletion might affect the space economy. The organizing principal is that as launch price declines, new demand will appear and, over a sufficiently long time, launch capacity and demand are in equilibrium with an appropriate law of supply and demand. However, as we have seen launch rates cannot rise arbitrarily high without causing too much ozone loss. Thus, ozone depletion from rocket emissions could be considered a market externality that has the potential to lead to inefficient allocation of investments or failure of the launch market.

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SRMs cause so much ozone loss that if all launches were on SRMs, the market could not likely grow at all beyond the current situation, and so SRMs are not likely to play a major role when proposing large increases in payload delivered to orbit. Whether large growth comes about with expendable or reusable systems they will almost certainly have to be LRE systems, at least from an ozone loss point of view. Accordingly, we do not consider SRMs any further in this paper and concentrate our attention on LRE emissions for the remainder of this paper.

One measure of market performance is total revenue. In this case, we mean the combined revenue (in dollar terms) for launch providers worldwide, though it could mean an individual country or whatever organization is allotted the particular level of ozone loss (e.g., 0.2% or 1%). Assuming for the moment that launch price P and launch demand Q are independent, we write an expression for the total launch market revenue R, given by

where P is launch cost ($ per pound to LEO); and Q is identified with M_T, the total mass of payloads launched into LEO. The carrying capacity concept

to total revenue R for a given price?

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This limit on total launch market revenue R_{max} is shown in Figure 6 for an LRE-based launch fleet with Q_{max} determined for 0.2% and 1% maximum allowable ΔO_3. Figure 6 shows that for a launch price of 100 $ per lb, the maximum possible total revenue for a launch industry based on LRE systems equals about 15 and 70 G$, respectively. Also noted in Figure 6 is the approximate present day market condition with launch price of about 10,000 $ per lb and gross revenue of about 14 G$.

FIGURE 6 Revenue R (G$) as a function of launch price P ($ per lb) for an LRE based system (i.e., $f = 0$.) The solid and dashed lines show the maximum possible revenue for maximum permissible global ozone loss ΔO_3 of 1% and 0.2%, respectively. The current global launch market economic condition of 10,000 $ per lb and 20 G$ is indicated.

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In real-world markets operating near supply and demand equilibrium, Q can be related to P with an assumed specification of market elasticity E describing how demand changes with changing price. Various studies of the relationship between price P and quantity Q for the launch market have been done and one common result is that, at least near the current price of about 10,000 $ per lb, the launch demand is not very elastic with respect to changes in price.[38] The studies often conclude than the launch market is inelastic until some threshold price is reached, below which the demand for payload quantity will

rate of demand increase below the threshold are only speculation but the notion of a demand elasticity threshold seems widely accepted. Using these concepts, we relate launch quantity demand and price as

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where E is the elasticity of the launch market, and the constant Q_0 is determined assuming that Q does not increase until price falls below 2,000 $ per lb. E has the usual definition of fractional change in quantity per fractional change in price; $E = 1$ corresponds to an inelastic market. For discussion purposes we assume three levels of market elasticity, low, medium, and high elasticity $E = 1.5$, 2, and 2.5 respectively. Figure 7 shows the resulting equilibrium relationship between Q and P. This analysis does not address how the market gets to equilibrium, only that it does by the usual market forces and the assumption of equilibrium provides a reference for discussion. The values of E we assume are speculative but follow the results of other studies. One RLV cost study, for example, assumes elasticity between our high and medium cases. Another study assumes a demand curve that resembles our low case.

FIGURE 7 Equilibrium demand for launch quantity Q as a function of launch price P for three scenarios of launch market elasticity. Values of E equal to 1.5, 2, and 2.5 correspond to low, medium, and high elasticity, respectively. An inelastic market ($E = 1$) is assumed between 2,000 and 10,000 $ per lb.

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We are interested in how the market limitations implied by Figure 6 relate to total revenue. Figure 8 shows total launch market revenue as a function of

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ozone loss limitation indicated. Ignoring the global ozone loss limitations for the moment, Figure 8 shows that revenue decreases until the 2,000 $ per lb elasticity threshold is reached. This conundrum of a “trough” in launch market revenue has been previously cited in launch market studies. It means that the launch market will have to “jump over” a trough in revenue, near the price of 2,000 $ per lb, through technology investments that would be unprofitable for a long period of time. Investors financing such a jump would need high confidence that a predictable launch market, with known limitations including regulatory ones, will be found on the low price side of the trough.

FIGURE 8 Total revenue *R*(G$) as a function of launch price *P*($ per lb) at demand-price equilibrium. *R*(*P*) is shown for elasticity *E* values of 1.5, 2.0, and 2.5. The heavy solid, dashed, and dotted lines show *R*(*P*) for $\Delta O_3<0.2\%$, $1\% <\Delta O_3<0.2\%$, and $\Delta O_3>1\%$, respectively.

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Figure 8 shows that for LRE systems, total revenue can respond favorably for some combinations of elasticity and global ozone loss limits. However, the stratospheric carrying capacity limits how much revenue recovery is possible. For example, for a global ozone loss limit of 1% and medium elasticity, revenue can increase by a factor about 3 for a price of about 100 $ per lb. On the other hand, if the global ozone loss limit is only 0.2%, revenue can barely recover to the present day value of about 10 G$.

Our results have important implications for the development of the space and launch industry. Analysis of future launch markets (reusable launch systems

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technological or economic. Studies of launch economics typically assume that launch rates are free to rise to meet any quantity demand if launch costs can be reduced sufficiently to spur demand. Indeed, these analyses usually show that launch demand must increase by orders of magnitude in order to justify the development of a reusable system. Our analysis shows however that considerations of stratospheric ozone depletion represent a very significant factor that should be considered in econometric analysis of large-scale space systems.

While a detailed econometric analysis is beyond the scope of this work, reflecting on the development of a low-cost launch system against an evolving ozone regulatory environment illustrates our point. Our putative launch system is consistent with the scale of future launch systems often presented for econometric analysis. We suppose that a corporation decides to commit the financial resources to develop a low-cost launch system that could profitably operate in a launch market with medium quantity demand elasticity, $E = 2$. The objective of this new launch system is to "jump" across the trough in revenue and profitably operate at a price of 100 $ per lb, demand of 400 kt per year (10,000 flights per year), generating revenue of 80 G$ per year. Development would take about ten years and a positive return on investment would take even longer. The decision to proceed with decades long development and investment critically depends on (among other things) an assumption that normal market forces will freely respond to a low-cost launch service and modulate demand over several decade life-cycle of a launch system.

Consider, however, the implication of unanticipated ozone protection regulation for our conjectural launch system. Suppose that as the system

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strengthen protection of the ozone layer. Suppose that new regulations restrict the global total ozone loss ΔO_3 resulting from any particular industrial activity, including space launch, to not exceed 1%. Figure 8 shows that under this regulatory regime, the new launch system would be limited to launching only about 278 kt into orbit per year, much less than the design assumption of 400 kt per year. The new launch system could not reach the design economic state. To realize the design revenue of 80 G$, the launch price would have to rise to about 145 $ per lb, violating the original design assumption. If our conjectural launch system is limited by the lower maximum ΔO_3 equal to 0.2% (perhaps because a global launch limit of 1% is divided among the world's various national launch agencies) then the economic situation becomes very distorted. In this case, the new launch system is limited to launching 30 kt per year so that price must increase to about 1,300 $ per lb to realize the design revenue of 80 G$. This price is so high so as to completely obviate the need to invest resources to develop the 100 $ per lb system in the first place.

This launch market thought experiment clearly demonstrates that for plausible values of the two main uncertainties of concern, the amount of ozone loss caused by LRE exhaust (the value of δ_L) and the magnitude of maximum allowable global ozone loss (a cap on launches, for example) could have a significant impact on the economic viability of possible large-scale, low-cost launch systems. We emphasize that the value we assume for δ_L is only one plausible value from a range of possible values. It is also plausible, though perhaps less likely, that the actual value of δ_L is much smaller than the value we have assumed; we simply do not have sufficient data. For the best case with δ_L equal to the lower limit from H_2O emissions alone and an ozone loss limit of 1%, the launch limit is about 2500 kt per year. At this level, it is difficult to imagine that ozone loss regulation would play any role in space

an ozone loss limit of 0.27%, only about 30 kt could be placed into orbit per year, a level certain to have a strong influence on the economic and technological basis for large scale space systems.

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Our work shows that the commonly held assumption that LRE emissions have no environmental impact is not accurate. LREs, particularly kerosene and cryogenic systems, are often described as “environmentally friendly” or “green” propellants[52] and this is generally true compared to SRMs. SRM emissions are a fairly well known cause of global total ozone loss. We reiterate the point that emissions from all rocket propellant types cause some global total ozone loss, even if only from water vapor emissions. Further, even LRE ozone loss will be considered significant by the regulatory apparatus charged with protecting the ozone layer at high enough flight rates. Analysis of proposed launch systems or emerging space markets such as tourism or space power generation commonly assume that the only limit to the potential number of launches or the amount of material that can be launched into orbit is economic. This is not necessarily true. We have shown that protection of the ozone layer presents a potentially serious limit to growth of the space transportation market and that this limit might be low enough so as to influence the economic value of investments in new launch systems. The problem is that we do not have sufficient information on the actual effects of rocket emissions on ozone to eliminate this possibility. Challenges to the growth and sustainability of space exploration[51] need to consider the risk of overly conservative limits related to ozone depletion that might arise out of a lack of accurate information on rocket emissions.

How do rockets currently compare to existing aerospace propulsion emissions? We are sure that rockets cause ozone loss. We are relatively sure

making a comparison between them with regard to ozone depletion is not strictly meaningful. Rockets cause a few percent of all ozone depletion, about the same relative impact that aircraft have on radiative forcing of the atmosphere.[40] And as we noted, there is great policy pressure for aircraft to reduce their greenhouse gas emissions, possibly at great cost to the industry.[41]

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How do rockets currently compare to other ODS sources? As we have noted, ozone loss from rockets is currently small compared to all ODSs on a global basis. However, can also compare rockets, a specific industrial process, to specific applications of ODSs that require exemptions from Montreal Protocol phase-outs. One example is Metered Dose Inhalers (MDIs), handheld medical devices that historically used CFCs as a propellant. United States companies have been granted Essential Use Exemptions for CFC use in MDIs in recent years. In 2008, the exemption, obtained after much diplomatic negotiation, was for 0.03 kt [42] of CFCs. Now the annual emission of United States SRMs is about 3 kt into the stratosphere and while there is no common metric for comparison, there is little doubt that the integrated impact from SRMs was larger than the integrated impact from the CFCs covered under the MDI exemption.

In these two examples, we see that policies to protect the global atmosphere might be seen as having contradictory or inconsistent positions. A small contributor to climate change (air transport), might be regulated, while a small to ozone depletion (rockets) is not regulated. Montreal Protocol exemptions are required for one activity (CFC-based MDIs) while another activity with larger ozone loss (SRMs) is not subject to any regulatory attention. Indeed, new SRM-based launch vehicles are being developed by the European Space

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POLICY IMPLICATIONS

The purpose of space policy is to provide long-term direction for the space industrial base in order to support national interests and promote growth. Space policy should characterize opportunities and risks, with regard to the growth of the space transportation industry, as well as recommend steps to increase opportunity and reduce risk. We have demonstrated that the international imperative to protect the ozone layer presents a long-term risk to the space launch industry in coming decades. Should the space industry enter a phase of rapid growth, ozone loss caused by high launch rates could become large enough to attract the attention of the regulatory apparatus protecting stratospheric ozone. The risk of limitation on launch systems due to ozone depletion is certainly many decades away. Nevertheless, the risk is not zero, applies to all rocket engine types, and the timescale is no longer than typical launch systems design and life cycle timescales.

This risk of launch limitations comes about for two reasons: uncertainty of impact and uncertainty of regulation. The range of uncertainty regarding ozone loss from liquid propellant rocket engines is too large to support clear assessment of future launch systems. Plausible assumptions within the ranges of uncertainties can lead to the conclusion that excessive ozone loss might limit payload delivery rates to a level only a factor 30 greater than current rates. Meanwhile new rocket propulsion systems that could affect the ozone layer such as hybrid propellants and hypersonic propulsion are being developed and promoted without regard to ozone impacts. The level of ozone

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unacceptably large is also very uncertain. The international organizations that regulate ozone depleting substances and the environmental effects of aerospace systems have not addressed the issue in a quantitative way that planners can apply to analysis of space launch growth. Together, these uncertainties make it so that we cannot know what sort of space transportation infrastructure, launch rates and propulsion systems, will be acceptable several decades from now.

Even though the Montreal Protocol does not define the ODP for aerospace combustion emissions, some estimates of an equivalent SRM ODP have been proposed and depending on any of several assumptions in the model, the value can exceed 0.2 SRM emissions, and are therefore, in some sense, similar to methyl bromide in that the calculated ODP likely exceeds 0.2—the value that triggers regulatory action. Continued use of methyl bromide might indicate the success of arguments that as long as a compound's ΔO_3 is “small” compared to other sources, then continued use may be appropriate, irrespective of the calculated ODP. Such arguments might be applied SRM emissions in the future. The inherent weakness of this kind of argument is that if the comparison ΔO_3 shrinks or is eliminated then “small” may become “large.”

We wish to make clear that this work is not calling for limitation of any kind on the launch market. Rather we wish to point out that our current level of technical and regulatory understanding allows that such limitations are likely to emerge at some point in this century. Nor is this work considered overly alarmist regarding ozone depletion from rocket exhaust. Rather we wish to point out some of the long-term sensitivities and vulnerabilities of the space industry to ozone depletion considerations. Policy and investment decisions

recent past and our shows one way that this assumption could fail.

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Current United States policy regarding ozone loss from rockets is to accept that the Montreal Protocol does not require any action because rocket emissions are not on the list of proscribed substances. New space systems must only consider ozone loss as part of an Environmental Impact Analysis (EIS) required by the National Environmental Policy Act (NEPA). Under NEPA, which has no enforcement mechanism, each space system is considered independent of each other and there is no formal cumulative analysis. For example, one space system may require several launches over a number of years. The ozone loss from these few launches is, of course, insignificant and so the EIS for that system contains a finding of no significant stratospheric impact. Under NEPA, each system considers only its own contribution to ozone loss as insignificant and there is no accounting for the cumulative loss of all systems or programs, either nationally or globally. In addition, the EIS process does not require a peer reviewed consensus in the scientific community regarding predicted ozone loss as the Montreal Protocol does; NEPA only requires a period of public comment. Finally, a final EIS of record is not required until a system is essentially ready for deployment (long after development investments have been made) and so does not require consideration of the effects of proposed or in development systems whose ozone impact is in the (perhaps far) future.

The policies of other space faring countries regarding ozone loss from rocket emission are not as clear, except insofar as the Montreal Protocol does not require any action. In the early and mid 1990s, the impact of SRMs was much more uncertain than now and the issue was occasionally raised at the Meeting of the Parties to the Montreal Protocol, but it has not been subject to recent

emissions are much better understood than in the 1990s, the estimated upper limit in 1995 has been reduced by a factor of about ten since then. However, if the issue of rocket emissions becomes significant, the Parties to the Montreal Protocol might attempt to cap ozone loss from rocket emissions. It is not at all clear how such a cap might be configured or specified. The Montreal Protocol allocates ODS production and consumption on a "country" basis but this approach would be entirely inadequate for rocket emissions. Space launch is a globally integrated activity whereby a rocket produced in one country, launches from a site in a second country, using propellant produced in a third country, and carries the payload of a fourth country. A "by country" approach would be difficult to implement for rocket emissions.

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A related concern, illustrating the possibly contentious nature of the problem, is that the relative mixes of SRM and LRE emissions vary widely from country to country. The Russian Proton (hypergolic) and European Ariane V (SRM and cryogenic), for example, launched about the same orbital payload in 2007. However, the Ariane V likely causes about 25 times more (steady state) ozone loss than the Proton. Disparities such as this, coupled with the lack of validated models and undefined assessment metrics, raises the potential for economic competition to become conflated with regulatory actions.

The implications of our work for policy makers are two-fold:

1. Space policy should help establish the way for launch market development unfettered by uncertain regulatory concerns. The confused experience of the supersonic transport, where science and policy were not synchronized with engineering systems development, should be avoided for emerging space transportation technologies. Policy should establish the goal of obtaining a sufficiently robust scientific

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ozone to support analysis and development of large space systems. This includes in particular reusable launch vehicles, new propellants, and hypersonic systems. In order to achieve this goal, space policy should encourage research efforts to identify and close knowledge gaps regarding rocket emissions. Our work shows that some guidance is required from the technical side of the equation on the composition and impact of rocket emissions.

2. Policymakers in the stratospheric protection community should begin to consider how to assess rocket emissions formally, in comparison to each other and in comparison to other substances that deplete the ozone layer. It is unlikely that rocket emissions could be brought under any existing metric definition. Even the most fundamental definition of such a metric is not clear. The explicit coupling between economic gain (payload) and loss of ozone complicates the problem. Since each country places different emphasis on SRMs and LREs, a globally acceptable metric is needed before putative space industry growth raises rocket emissions above the minor category as far as ozone loss in concerned. Our work shows that some guidance is required from the ozone protection policy side of the equation on the level of acceptable ozone loss.

Policy makers in the space travel and stratospheric protection communities might begin to consider how the launch industry can best fit into whatever regulatory regime emerges as the earth's ozone layer recovers and the global demand for access to earth orbit grows. One direction that ozone protection could take is an emissions trading scheme in which each national space agency is allocated a certain quantity of ΔO_3 and can sell unused allocations or buy allocations as needed. Another direction would be an “ozone loss tax” on

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emerging in response to climate change with all transport providers possibly subject to a "carbon tax" that would have major impacts on their profitability and aircraft fleets. [43] In a future paper we will address potential methods to apportion or regulate launch ozone loss including accounting of ozone loss by launch provider and payload provider, especially in comparison to current ODS special use exemptions and possible ODS trading schemes.

Refinement in our understanding of ozone loss from rocket propulsion is critical for understanding the political economy of large scale growth in space transport. A systematic effort to accomplish this can be implemented at modest cost. A program of stratospheric plume measurements, plume wake and stratosphere model investigations, and laboratory measurements on alumina and soot particles can be effectively coordinated within existing NASA, NOAA, and USAF research efforts and research infrastructures. This notion was proven in the 1990s first by the Rocket Impacts on Stratospheric Ozone (RISO) [44] and Atmospheric Chemistry of Combustion Emissions Near the Tropopause (ACCENT) [45] efforts and most recently by the Plume Ultrafast Measurements Acquisition (PUMA) effort. [46] Prior to RISO, ACCENT, and PUMA, uncertainties regarding ozone loss from SRMs were much greater than present day uncertainties regarding LREs and these efforts returned high-value emissions data at relatively low cost. Renewed and vigorous rocket emissions research would have the goal of reducing the uncertainties of LRE ozone loss to the same level as SRMs and provide a predictive capability for evaluating the ozone loss associated with emerging propulsion technologies.

SUMMARY

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comparison to other industrial activities because rockets uniquely emit ozone destroying compounds throughout the stratosphere. Both solid and liquid fueled rockets cause ozone loss. Based on existing data, models, and general principals of rocket combustion and stratospheric chemistry we constructed a simple description of the relationship between rocket combustion emissions and ozone depletion and then related ozone depletion to the mass of payload placed into LEO. Because stratospheric rocket emissions are not fully understood, our description is necessarily uncertain, especially with respect to liquid propellant engines. Even so, we draw several conclusions and provide guidance for future work.

Present day global ozone loss caused by rocket emissions is dominated by SRM emissions and is almost certainly less than 0.1%, insignificant relative to other sources of ozone loss at the present time. The relative impact of rocket emissions will likely increase over the next several decades as the requirements of a growing space industry grow and the ozone layer recovers from past use of ozone depleting substances that have been now banned by international agreements.

Global ozone loss associated with space development scenarios that assume large increases of payload delivered to orbit could be significant, even using liquid propellants. Growth of a factor of one hundred could cause several percent global ozone losses, likely large enough to trigger attention by the international stratospheric protection community. Regulation of launches might take the form of limitation of the number of types of launches or mass of payloads and might apply globally or nationally. Such limits would present significant distortions in what is usually assumed to be an emerging free market for launch services. One implication of launch limits associated with

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reduce launch cost through increased launch rates. Because of the large uncertainty over the impacts of liquid propellant rockets on ozone, and the lack of a clear process to assess the ozone loss caused by rocket emissions, the potential for limitation of space transportation cannot be eliminated. This potential presents a long-term risk that space development could be hampered by overly aggressive ozone protection efforts that might arise from a lack of information on rocket emissions. Policy makers in both the space development and stratospheric protection communities should begin to better understand ozone loss from rocket emissions, how to quantify those losses, and how to manage the loss if the space transport business grows significantly in the future.

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Notes

Note: The Total Mass Fraction Exceeds Unity because of the assumption that air mixed into the plume oxidizes CO and H_2.

S. Anderson and K. Sarma, *Protecting the Ozone Layer*. (London, UK: United Nations Environment Program, 2002): 274–288.

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World Meteorological Organization, *Scientific Assessment of Ozone Depletion*, (Geneva, Switzerland, 2002).

A large body of literature explores the potential for large and accelerating growth in the space industry. Examples include: “Commercial Space Transportation Study,” CSTS Alliance (Langley, VA: NASA, 1994): 230–256; J. R. Wertz, “Economic Model of Reusable Vs Expendable Launch Vehicle,” IAF Congress, (Rio de Janeiro, Brazil, 2000); J. Penn and C. Lindley, “Spaceplane Design and Technology Considerations Over a Broad Range Of Mission Applications,” IEEE paper 0-7803-4311-5 (1998).

J. Penner et al., *Aviation and the Global Stratosphere*, (Cambridge, MA: Cambridge University Press, 1999): 176–225.

A number of news, analysis, and commentaries have noted that the public and regulatory attention focused on aviation emissions as a source of climate change is out of balance, on a percentage basis, with their actual contribution.

European Space Agency (ESA), “Suborbital Spaceflight ESA Position Paper 14,” (April 2008). It is interesting that ESA felt the need to discuss the environmental effects of so-called space tourism when the industry does yet even exist.

D. Waugh and T. Hall, “Age of Stratospheric Air: Theory, observations, and models,” *Revs. of Geophys.* (2002): 46–68. The washout rate of material deposited in the stratosphere is usually considered to be in the range of 3–5 years but this parameter is not clearly understood and is likely variable from year to year.

Press, 1999); chap. 10 is a good introduction to stratospheric chemistry.

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Farman, et al., "Large losses of total ozone in Antarctica reveal seasonal ClOx/NOx interaction," *Nature* 315 (1985) is a good in depth review of catalytic ozone loss.

M. N. Ross, et al., "Observation of stratospheric ozone depletion in rocket plumes," *Nature* 390, (1997): 62–65.

Andersen and Sarma (note 1).

World Meteorological Organization, *Scientific Assessment of Ozone Depletion*, (Geneva, Switzerland:WMO, 1990, 1994, 1998, 2002, and 2006).

Strictly speaking, ozone depletion has only stopped worsening. The stratospheric chlorine load is clearly decreasing approximately as expected. See Fahey et al., "Twenty Questions and Answers About the Ozone Layer: 2006 Update," (Geneva, Switzerland: World Meteorological Organization, 2007).

The Technology and Economic Assessment Panel of the Montreal Protocol meets on a regular basis to review new data and determine which substances are to be phased-out and to approve Special Use Exemptions requested by signatory countries.

J. A. Vedda, "Challenges to the Sustainability of Space Exploration," *Astropolitics* 6 (2008): 22–49.

Rocket plume ozone holes have been observed in situ and on the ground, minutes to hours after launch and have been predicted by plume wake models. These observations confirm that rocket engines emit significant quantities of radicals.

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R. Disselkamp, et al., Ozone Loss on Soot Aerosols," *J. Geophys. Res.*, 106 (1999): 14,551–14,571. The issue is unsettled however, especially for soot in the middle and upper stratosphere.

The actual steady state accumulation of particles depends on particle size, density, and assumed stratospheric circulation and average age of stratospheric air (see note 8).

D. Kirk-Davidoff, et al., "The effect of climate change on Ozone Depletion Through Changes in Stratospheric Water Vapor," *Nature* 402, (1999): 399–401.

Fahey et al., (note 13): 21–25.

D. Wuebbles, et. al., "New methodology for ozone depletion potentials of short-lived compounds: n-Propyl bromine as an example," *J. Geophys. Res.*, 106 (2004): 14,551–14,571.

M. K. Ko, et al., "The Ozone Depletion Potential of CH_3Br," *J. Geophys. Res.* 103 (1999): 28187–28199.

R. Kawa, et al., Assessment *of the Effects of High-Speed Aircraft in the Stratosphere*, (ASATP-1999-209237, 1998) and K. W. Ko, N. Sze, and M. J. Prather,"Better protection of the ozone layer," *Nature* 367 (1994): 305–309.

Penner et al., (note 5).

M. N. Ross, and R. F. Friedl, "The Impact of Solid and Liquid Propellant Rocket Engine Emissions on Stratospheric Ozone: Results from the RISO and ACCENT Plume Measurement Programs," Proc. of the 6th International Symposium on

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X. Tie, et al., "The impact of high altitude aircraft on the ozone layer in the stratosphere," *J. Atmo. Chem.* (1993).

F. Simmons, *Rocket Exhaust Plume Phenomenology*, (El Segundo, CA: The Aerospace Press, 2000).

V. Brinda, et al., "Trajectory Optimization and Guidance of an Air Breathing Hypersonic Vehicle," 14th AIAA/AHI Space Planes and Hypersonic Systems and Technologies Conference, Canberra, Australia, AIAA 2006-7997, 2006.

See for example D. Haeseler, et al., "Green Propellant Propulsion Concepts for Space Transportation and Technology Development Needs," Proc. 2nd Conf. Green Propellants, Sardinia, Italy, ESA SP-557, 2004. Water vapor emission in particular is often assumed to have no effect on the stratosphere. The effects are several orders of magnitude less than chlorine emissions from SRMs but it is not zero.

M. N. Ross, et al., "Observation of stratospheric ozone depletion associated with Delta II rocket emissions," *Geophys. Res. Lett.*, 27 (2000): 2209; M. H. Stevens, et al., "Polar mesospheric clouds formed from space shuttle exhaust," *Geophys. Res. Letts.*, 30 (2003): 1546, (10.1029/2003GL017249); P. A. Newman, et al., "Chance encounter with a stratospheric kerosene rocket plume from Russia over California," *Geophys. Res. Letts.*, 28 (2001): 959–962; Avalone et al., "Observation of Surprising Ozone Loss in a Nighttime Space Shuttle Plume," *EOS Transactions AGU*, *Fall Meet. Suppl.*, Abstract A343B-043 (2008): 553.

F. Sietzen, "The Greening of Rocket Propulsion," 2005, *Aerospace America*, AIAA (2005): 28–34.

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solid-fueled rocket motors," *J. Geophys. Res.*, 100 (2001): 12,727–12,735; C. H. Jackman, D. B. Considine, and E. L. Fleming, "A global modeling study of solid rocket aluminum oxide emission effects on stratospheric ozone," *Geophys. Res. Lett.*, 25 (1998): 907–910; C. H. Jackman, D. B. Considine, and E. L. Fleming, "Space Shuttle's Impact on the Stratosphere: An Update," *J. Geophys. Res.,* 101 (1996): 12,523–12-529; M. Y. Danilin, et al., "Global implications of ozone loss in a Space Shuttle wake," *J. Geophys. Res.*, 106 (2001): 3591–3601; A. E. Jones, S. Bekki, and J. A. Pyle, "On the atmospheric impact of launching the Ariane-V rocket," *J. Geophys. Res.* 100 (1995) 16,651–16,660.

P. Popp et al., "The emission and chemistry of reactive nitrogen species in the plume of an Athena II solid-fueled rocket motor," *Geophys. Res. Lett.,* 29 (2002): 2002GL015197; O. Schmid, et al., "Size-resolved measurements of particle emission indices in the stratospheric plume of a solid-fueled rocket motor," *J. Geophys. Res.*, 107 (2002): 2002JD002486; M. N. Ross, P. Whitefield, D. Hagen, and A. R. Hopkins, "In-Situ Measurement of the Aerosol Size Distribution in Stratospheric Solid Rocket Motor Exhaust Plumes," *Geophys Res Letts.,* 26 (1999): 819–822.

M. Ross, et al., "Ozone depletion caused by NO and H_2O emissions from hydrazine-fueled rockets," *J. Geophys. Res.,* 109 (2004): 21305–21314.

H. Hertzfeld and N. Peter, "Developing new launch vehicle technology: The case for multi-national private sector cooperation," *Space Policy* (2007): (81–89); H. Hertzfeld, R. Williamson, and N. Peter, *Launch Vehicles: An Economic Perspective* (The Netherlands: Space Policy Institute, September 2005): 123–128.

(Washington, D.C. National Security Space Office Interim Assessment Phase 0 Architecture Feasibility Study, 2007): 28–45.

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J. Penn and C. Lindley, “Spaceplane Design and Technology Considerations Over a Broad Range Of Mission Applications,” IEEE paper 0-7803-4311-5, (1998).

Penner et al., (note 5). Also see “Aviation Climate Change Research Initiative,” (Federal Aviation Administration, 2009). The increase is mainly in the northern hemisphere.

Ibid, 150.

US Airlines face $9 Billion Carbon Bill by 2020, *Flight International* 16 May, 18, 2008.

S. J. DeCanioa and C. Norman, “Economics of EUEs for metered-dose inhalers under the Montreal Protocol,” *Journal of Environmental Management* (October 2007): 1–8.

US Airlines face $9 Billion Carbon Bill by 2020, *Flight International*, 2 May 2008.

M. N. Ross, “Rocket Impacts on Stratospheric Ozone (RISO),” Symposium on the Effects of Aircraft in the Stratosphere, Paris, 14 October 1996, ONERA, Muedon, France.

M. N. Ross, et al., “Study blazing new trails into the effects of aviation and rocket exhaust in the atmosphere,” *EOS Trans. Am. Geophys. Soc.*, 80 (1999).

campaigns," *JBIS Transactions AIAA, Full meet. Suppl.*, Abstract AIAA-2005-

(2005).

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Potential climate impact of black carbon emitted by rockets

Martin Ross, Michael Mills, Darin Toohey

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Abstract

[1] A new type of hydrocarbon rocket engine is expected to power a fleet of suborbital rockets for commercial and scientific purposes in coming decades. A global climate model predicts that emissions from a fleet of 1000 launches per year of suborbital rockets would create a persistent layer of black carbon particles in the northern stratosphere that could cause potentially significant changes in the global atmospheric circulation and distributions of ozone and temperature. Tropical stratospheric ozone abundances are predicted to change as much as 1%, while polar ozone changes by up to 6%. Polar surface temperatures change as much as one degree K regionally with significant impacts on polar sea ice fractions. After one decade of continuous launches, globally averaged radiative forcing from the black carbon would exceed the forcing from the emitted CO_2 by a factor of about 10^5 and would be comparable to the radiative forcing estimated from current subsonic aviation.

1. Introduction and Motivation

[2] Surging investments in new rockets and spacecraft and new applications for these vehicles foretell that the number of launches and variety of rocket engines will increase in coming decades [*Ziliotto*, 2010]. One type of new launch market is suborbital spaceflight, with plans for many hundreds, perhaps thousands, of space tourism and scientific research flights annually. The new so-called “hybrid” rocket engine, which oxidizes a solid synthetic hydrocarbon (HC) fuel with N_2O, is the chosen propellant for a number of the suborbital spaceships that will be flying soon [*Chandler*, 2007]. While the stratospheric emissions from a single suborbital rocket will be small compared to an orbital rocket, total suborbital fleet emissions could become comparable

to present day rocket emissions within a decade. It is of interest therefore to consider what impact these rockets could have on stratospheric ozone and global climate.

[3] Rocket emissions have been studied previously [World Meteorological Organization (WMO), 2002], primarily within the context of chemical ozone loss caused by solid rocket motors that emit chlorine and alumina particles. None of the previous studies considered how rocket emissions might alter the radiative balance of the atmosphere. Particles emitted by rockets, on the other hand, might be expected to modify radiation fluxes in the stratosphere and have not been previously studied in this context. Particles emitted by rockets include alumina, metallic debris, and soot or black carbon (BC) particulate, in variable amounts depending on the engine and altitude.

[4] BC is known to modify the radiative properties of the atmosphere because it efficiently absorbs solar shortwave radiation [Balkanski et al., 2010; Crutzen, 2006]. The atmosphere may be particularly sensitive to BC emitted by HC-fueled rockets because they emit several orders of magnitude more BC (per unit propellant) than aircraft, directly into the upper stratosphere from fixed sites. Thus rocket BC has much longer lifetime and larger steady state stratospheric burden, at greater altitude, than aircraft burning the same amount of fuel. We estimate the globally averaged steady state direct radiative forcing (RF) from a uniformly distributed stratosphere black carbon layer from rockets as

$$\mathrm{RF} = \frac{\tau \sigma_m F_s (1 + A)\, N\, P\, \mathrm{EI_{BC}}}{S} \qquad (1)$$

where σ_m is the BC mass specific absorption efficiency, F_s is mean solar SW flux, τ is stratospheric lifetime, A is Earth albedo, N is number of launches per year, P is propellant burned in the stratosphere per launch, EI_{BC} is the rocket soot emission index, and S is Earth's surface area. For 0.1 μm BC particles σ_m equals 9 $m^2\ g^{-1}$ [Zhang et al., 2008] and using values of EI_{BC}, N, and P expected for the suborbital rocket fleet (discussed below), we find RF equals 43 mWm^{-2}, much larger than BC forcing from current aviation and comparable to BC forcing from the global road transport sector [Balkanski et al., 2010] and net forcing associated with the global air transport [Grewe et al., 2007]. The estimated rocket RF is large enough to motivate a more detailed look at the problem of rocket BC emissions using a detailed global climate model (GCM) to study changes in global patterns of circulation and climate and the distribution of important trace species, such as ozone.

[5] We report the result of a GCM simulation of the Earth's response to a layer of stratospheric BC that could be generated by a particular type of HC-fueled rocket system. There are two main types of BC-emitting rocket engines, one burning kerosene and liquid oxygen and another ("hybrid") burning solid HC (e.g. synthetic rubber or plastic) and N_2O [Sutton and Biblarz, 2010]. Currently, HC rockets are mainly kerosene-fueled but the hybrid has various technical and

economic advantages and could, according to various development plans become a significant fraction of all rocket activities by 2020. Hybrids are of special interest because they likely have larger BC emission index (EI_{BC}) than kerosene rockets and are of most interest to the nascent suborbital "space tourism" portion of the space industry, a potentially fast-growing segment of the space transportation sector [*Crouch et al., 2009*].

2. Model Description

[6] We model the response of the Earth system to rocket BC emissions using the Whole Atmosphere Community Climate Model, Version 3 (WACCM3). WACCM3 is a comprehensive model that simulates the chemical, dynamical and radiative coupling of the atmosphere between the surface and ~145 km [*Garcia et al., 2007*] and has been used in a wide variety of applications to investigate the response of the global Earth system to natural and human produced changes in atmospheric composition and radiation [*Garcia and Randel, 2008*; *Tilmes et al., 2009*]. WACCM3 was recently coupled with the Community Aerosol and Radiation Model for Atmospheres (CARMA), a three-dimensional microphysics package adapted for the treatment of BC aerosol to study the global effects of stratospheric soot loading from fires ignited by a nuclear conflict [*Mills et al., 2008*]. For this calculation, we adopt the treatment of BC developed for the nuclear conflict investigation by *Mills et al. [2008]*, a log-normal distribution centered on 0.1 μm diameter with σ_m equal 9 $m^2\ g^{-1}$ (at 0.6 μm). Because of a lack of in situ measurements, the microphysical properties of rocket BC are poorly understood and we acknowledge significant uncertainties concerning size distributions, surface coatings, coagulation rates, and aging tendencies. However, our representation is broadly consistent with rocket BC characteristics derived from engine combustion models and plume remote sensing [*Simmons, 2000*]. We coupled a slab ocean and simple sea ice model, controlled only by heat and moisture fluxes, [e.g., *Tilmes et al., 2009*] to WACCM3 in order to calculate surface temperature and ice fraction changes. We include only the radiative effects of BC and do not consider any chemically active (i.e. H_2O, HO_X, and NO_X) gaseous species in the exhaust; these could modify the results reported here.

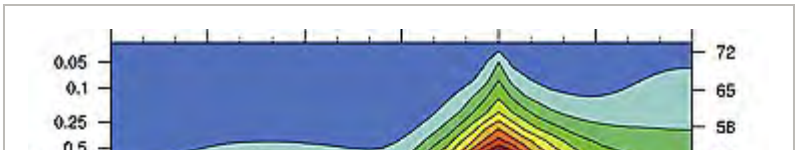
[7] Based on detailed plans for space tourism and science flights using suborbital hybrid rockets [*Sanderson, 2010*], we assume N equals 1000 launches per year and P equals 10^4 kg propellant per launch. EI_{BC} for kerosene engines is 20–40 g kg^{-1}, depending on engine model and altitude [*Byun and Back, 2007*]. EI_{BC} for hybrid engines is expected to be larger than for kerosene engines because of lower carbon particulate oxidation rates in the hot plume [*Sutton and Biblarz, 2010*; *Simmons, 2000*]. Accordingly, we assume hybrid rocket EI_{BC} equals 60 g kg^{-1} while noting it is a provisional, though plausible, value. The annual stratospheric BC emission for our scenario equals 600 metric tons (t). This compares to 5000 t emitted by subsonic aircraft into the troposphere [*Balkanski et al., 2010*] and 500 t emitted into the lower stratosphere by hypothetical supersonic transport fleets [*Lee et al., 2009*]. Currently, the global

fleet of orbital kerosene rockets (N ~25 yr^{-1} and P ~10^5 kg) emits ~75 t of BC into the stratosphere, so our scenario could coarsely be interpreted as an order of magnitude increase in kerosene orbital launches, with no hybrids. This might come about, for example, if large kerosene rockets were developed for ambitious space exploration goals. In any case, given the lack of detailed knowledge of the microphysical properties of rocket BC and unknown growth rate of the space transport sector, we cannot place a formal uncertainty on our scenario. We assume a vertical distribution of BC emission that would be typical for a suborbital rocket air launched at 16 km, with burnout at 70 km, shown in Figure 2a. The BC is injected at 33°N, 107° W, near a potential launch site for high flight rate suborbital rockets.

[8] Two 40-year climate simulations were carried out: (a) a control case and (b) a case that includes the rocket BC scenario. Ignoring the first ten years for model spin-up and numerical convergence, we calculate the 30-year average atmospheres for the two cases and compare them. Formal significant statistical differences were determined using the Student's t-test; a difference is considered significant at the 95% confidence level. In the interest of simplicity, these initial rocket BC simulations do not account for expected future increases in (greenhouse gases) GHGs or decreases in ozone depleting halogens. Relaxing these constraints should not greatly affect our main conclusions, though future models should examine how changes in stratospheric composition from rocket emissions might interact with changes in GHGs, stratospheric chlorine, and background BC.

3. Results and Discussion

[9] Figure 1 shows the calculated distribution of the BC enhancement due to the rockets after the simulation reaches a quasi-steady state. The annually averaged total stratospheric loading is 2600 t, 4.4 times the annual emission. The load is mostly carried in a thin persistent northern hemisphere (NH) BC layer between 25°N–45°N. Only 20% of the steady state BC load is in the southern hemisphere (SH), so the layer maintains a strong hemispherical asymmetry (see Animation S1 of the auxiliary material). Whereas natural aerosol injections into the stratosphere (e.g., volcanoes or surface fires) are episodic and decay within a few years, the continuous nature of rocket emissions means that the rocket stratospheric BC layer becomes a constant, asymmetric feature of Earth's atmosphere for as long as the launches continue. Figure 2b shows the vertical distribution of the BC layer, with a peak enhancement of 8 ng per kg of air at 25 km, above the main part of the emission. In comparison, the BC loading of a fleet of future supersonic aircraft is predicted to reach 0.8 ng per kg of air at an altitude of 16 km [e.g. *Grewe et al.*, 2007].



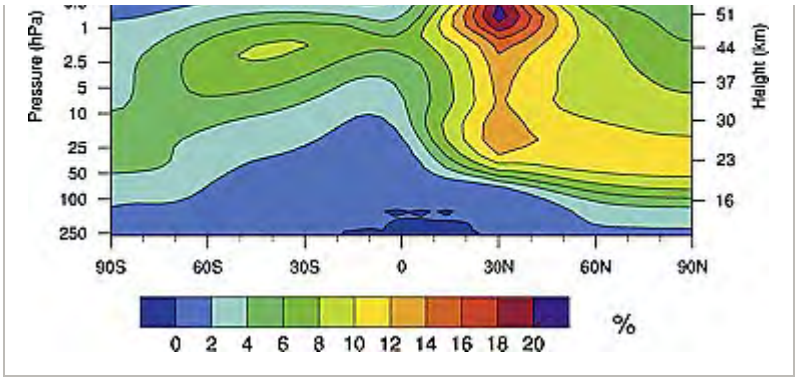


Figure 1

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Thirty-year-average percent enhancement in BC loading relative to background calculated for the assumed scenario of continuous rocket launches, following 10 years of model spin-up.

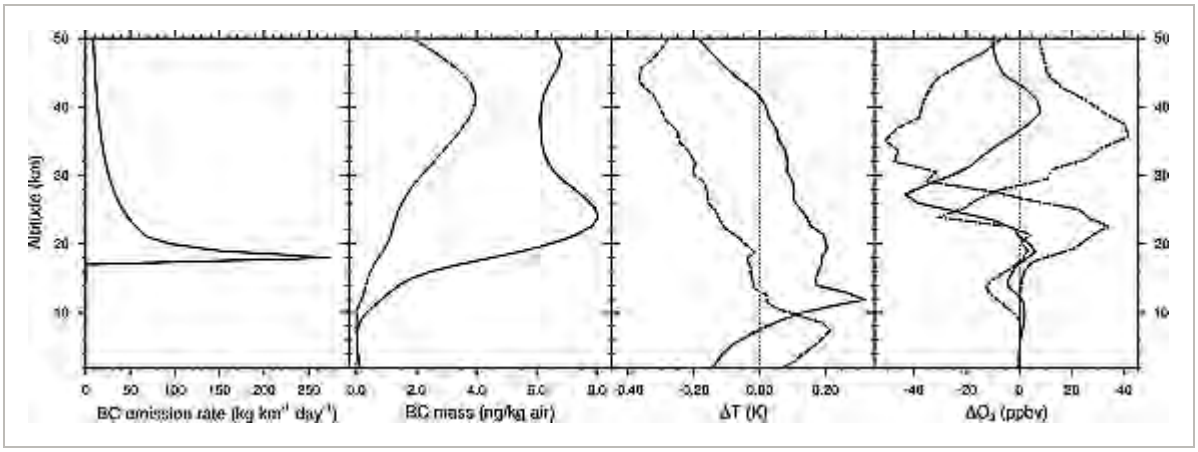

Figure 2

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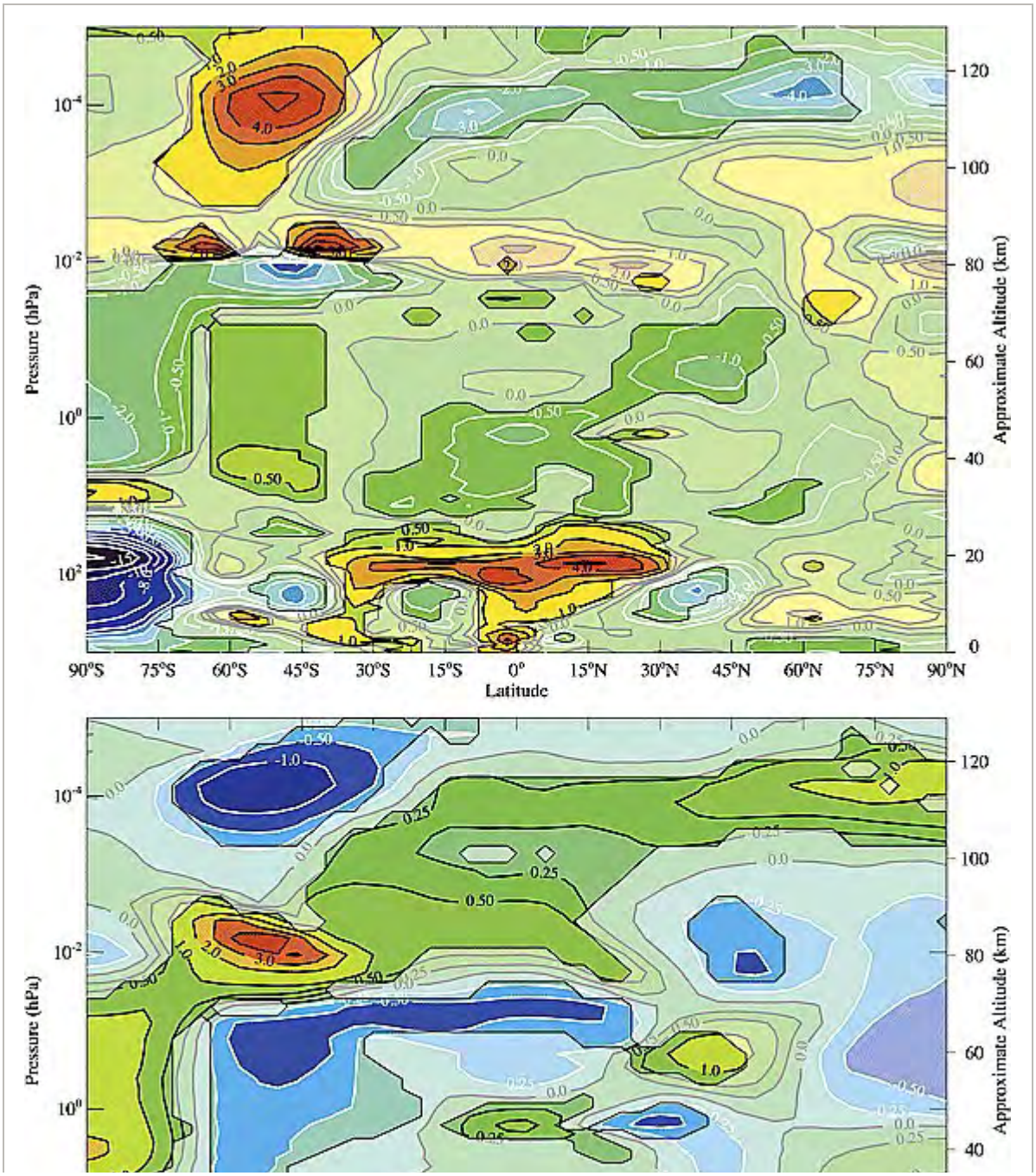
Vertical distribution of zonally averaged (a) rocket BC emission, (b) steady state annually averaged BC loading at 45–60°N (solid) and 45–60°S (dashed), (c) annually averaged change in temperature at 60–75°N (solid) and 40–60°S (dashed), and (d), change in ozone mixing ratio in DJF at 45–60°N (solid), 15°S–15°N (dashed), and 45–60°S (dot-dashed).

[10] Figure 3 shows the model change in zonally averaged ozone concentration and temperature. Ozone declines in the tropics and subtropics by up to several percent, depending on season and location. These changes are exceptional in that they are comparable to present day ozone depletion there due to chlorofluorocarbons (CFCs) and other compounds restricted by the Montreal Protocol [*WMO*, 2006]. Ozone is predicted to change by 5–6% in the high mid-latitudes and polar regions, particularly over the Antarctic. This is comparable to the observed high-latitude ozone response to CFCs so that the rocket BC will influence ozone recovery, at

least at the poles. The change in annually averaged global total ozone is small (0.1%) and not statistically significant, suggesting that dynamical and chemical processes that may be responsible for the large regional changes offset each other globally. Alternatively, dynamical processes alone might dominate the ozone response. Support for the latter notion is found in a positive correlation between ozone and temperature changes in the tropical stratosphere (Figure 3 and Figure S1 in Text S1 of auxiliary material), opposite of climate-ozone connections mediated by the temperature dependence of ozone chemistry reaction rates [*WMO*, 2006]. On the other hand, the changes in polar ozone positively correlate with temperature change, suggesting transport dominates over chemical processes there. Further model studies will be required to fully understand the issue.



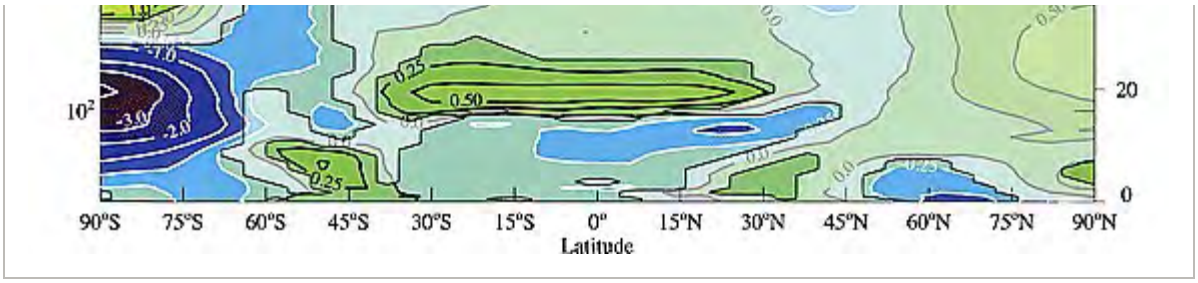


Figure 3

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Change in calculated 30-year zonally averaged distribution of (a) ozone concentration (%) and (b) temperature (K) in DJF due to the prescribed BC emission. Dark (high contrast) regions show a change significant at the 95% level.

[11] Importantly, the global pattern of ozone changes displayed by the model – tropical decrease and high-latitude increase – is characteristic of an acceleration of the global Brewer-Dobson (BD) circulation seen in other studies of climate forcing by GHGs [*Garcia and Randel*, 2008; *Tilmes et al.*, 2009]. In these cases, strengthening BD circulation increases the rate of ozone transport out of the tropical source region and toward high latitudes. Although the exact model mechanisms that enhance the BD circulation have yet to be fully understood, it is thought that changes in the middle atmosphere thermal and wind structure modify the wave propagation characteristics of the stratosphere, changing the global pattern of momentum transport [*Calvo and Garcia*, 2009]. With the rocket BC, model zonal winds decrease by ~2 m s^{-1} in the high latitude middle stratosphere, a similar pattern to GCMs with increased GHG concentrations (see Figure S2 in Text S1 of the auxiliary material).

[12] While the global response to the rocket BC emission resembles a GHG response (strengthened BD circulation), Figure 2 shows a key difference from GHG cases with respect to heating. For the rocket emission case, the annual zonal mean temperature in the BC layer increases by 0.2 K, a feature absent in the southern hemisphere. Because little BC is transported into the SH, thermal forcing there is nil and the associated temperature changes are small. Previous models have shown that small hemispherical asymmetries in thermal forcing can cause relatively large changes in the BD circulation [*Lindzen and Hou*, 1988] and this sensitivity may help explain the disproportionately large magnitude of the model response to relatively small amounts of rocket BC. Further numerical experiments with this and other climate models will help reveal the mechanisms for these changes and the relative sensitivity of the climate system to soot emitted by rockets versus GHG emissions by those same rockets.

[13] The predicted changes in circulation and distribution of radiatively important species have significant consequences for regional patterns of surface temperatures and climate. Figure 3b shows the predicted change in the NH winter temperature distribution. South polar

stratospheric temperatures increase by ~2 K during the austral summer and remain elevated by >1 K throughout the year (Figure S1 in Text S1 of auxiliary material.) While it is beyond the scope of this paper to explore all of the details of the perturbed thermal and kinetic energy flows, model diagnostics indicate that movement of the subtropical jets and regional changes in cloudiness, albedo, oceanic heat content, and longwave atmospheric transmissivity all contribute. Model SH extra-tropical regional RF ~0.1 W m^{-2}, generally consistent with the earlier estimate of the globally averaged RF. Figures 2c and 3b show that the NH mid-latitude surface cools by a few tenths K in some seasons, consistent with the reduction in solar intensity beneath the shading BC layer above. Taken together, these results clearly demonstrate that the accumulation of BC from the modeled suborbital rocket fleet launched 1000 times per year (or orbital rocket equivalent) will influence global climate about as much as the world's fleet of subsonic aircraft [*Lee et al.*, 2009]. The details of the changes caused by aircraft and rockets will certainly differ, but rocket emissions on this scale clearly cross a threshold to be considered a human-influenced climate impact of global importance.

[14] A number of potentially important earth system changes associated with the rocket BC-induced circulation changes are predicted by the model. We take special note of perturbations to model polar sea ice amounts in both hemispheres. Through ice-albedo feedback, sea ice serves a critical role in the Earth's climate system and biosphere. Observed losses of north polar summer sea ice exceed model predictions [*Serreze et al.*, 2009; *Screen and Simmonds*, 2010], indicating a greater sensitivity to RF changes than is currently understood. In our model, total sea ice coverage changes in both hemispheres by significant amounts. Antarctic sea ice area changes by 5% or more, generally consistent with the polar temperature changes. Arctic ice shows much smaller changes, less than 5% seasonally, and no significant secular change.

[15] Overall, these results should not be taken as a precise forecast of the climate response to a specific launch rate of a specific rocket type. Rather, the simulation should be taken as a gauge of the large sensitivity of the atmosphere to a persistent stratospheric BC layer caused by HC-fueled rockets, for which suborbital hybrids are a particular, though not exclusive, concern. The results clearly indicate areas for further investigation such as considering the gaseous components of HC rocket emissions (emitted H_2O, for example, will also accumulate in the stratosphere), including reactions on BC surfaces (that may offset or exacerbate the response reported here), investigating the non-linearity of the response with respect to launch rate, and determining the relative importance of launch site location. Most importantly, an ensemble of GCMs should be applied to determine the sensitivity of the response to model specific assumptions and parameterizations.

[16] Particulate emissions from rockets have historically been considered short-lived, but this is so only in the sense that they wash out from the stratosphere within a decade of stopping launches. As long as HC rocket launches continue, the associated BC load effectively acts as a

GHG with disproportionately large warming potential, one that far exceeds that of CO_2 emitted by the rockets. Assuming EI_{CO2} of 300 g kg^{-1}, we estimate that after one decade of suborbital hybrid rocket launches at the assumed rate, RF from the accumulated BC for these 10,000 launches will exceed RF from the associated CO_2 emissions by a factor of about 10^5. As long as the launch rate is maintained, the CO_2 climate forcing for this fleet would be minuscule compared to the BC forcing. Accordingly, assessments of climate forcing for passenger and cargo rockets that consider only CO_2 emissions [*Fawkes*, 2007] underestimate rockets' contribution to climate change by many orders of magnitude.

4. Summary

[17] We have performed the first model of global change caused by particles emitted by rockets. The model predicts that the climate and ozone impacts of BC soot emissions from planned air-launched suborbital (space tourism and scientific) launches are likely to be significant regionally, possibly comparable to the impact of present day global aviation and CFCs. Absorption of solar radiation in a BC layer that accumulates over several years of launching causes changes in the global atmospheric circulation that resemble the global scope of BD circulation changes caused by increasing GHGs, ozone recovery, and geoengineering schemes based on stratospheric particles. We estimate that for HC-fueled rockets, the climate impact of BC soot emissions dominates over CO_2 emissions by a factor of about 10^5, for as long as the launches continue. The strong response likely results from unique altitude, persistence, and asymmetric nature of the rocket-produced BC soot layer. Further sensitivity and ensemble studies and measurement of emissions from HC-fueled rockets are required to verify and provide confidence in our results. Our result, if confirmed, could have important climate and ozone related regulatory or economic implications for HC-fueled rockets [*Ross et al.*, 2009].

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Supporting Information

Auxiliary material for this article contains links to Web sites, figures of WACCM3 model results, and an animation of the seasonal evolution of soot density.

Auxiliary material files may require downloading to a local drive depending on platform, browser, configuration, and size. To open auxiliary materials in a browser, click on the label. To download, Right-click and select "Save Target As..." (PC) or CTRL-click and select "Download Link to Disk" (Mac). Additional file information is provided in the readme.txt.

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References

Balkanski, Y., G. Myhre, M. Gauss, G. Radel, E. J. Highwood, and K. P. Shine (2010), Direct radiative effect of aerosols emitted by transport: From road, shipping, and aviation, *Atmos. Chem. Phys.*, **10**, 4477– 4489, doi:10.5194/acp-10-4477-2010 .
Crossref | CAS | ADS | Web of Science® | Google Scholar

Byun, D., and S. W. Back (2007), Numerical investigation of combustion with non-gray thermal radiation and soot formation effect in a liquid rocket engine, *Int. J. Heat Mass Transfer*, **50**, 412– 422, doi:10.1016/j.ijheatmasstransfer.2006.09.020 .
Crossref | CAS | Web of Science® | Google Scholar

Calvo, N., and R. R. Garcia (2009), Wave forcing of the tropical upwelling in the lower stratosphere under increasing concentrations of greenhouse gases, *J. Atmos. Sci.*, **66**, 3184– 3196, doi:10.1175/2009JAS3085.1 .
Crossref | ADS | Web of Science® | Google Scholar

Chandler, D. (2007), Space: Dreams of a new space race, *Nature*, **448**, 988– 991, doi:10.1038/448988a .
Crossref | CAS | ADS | PubMed | Web of Science® | Google Scholar

Crouch, G., T. Devinneyb, J. Louvierec, and T. Islamd (2009), Modeling consumer choice behaviour in space tourism, *Tour. Manage.*, **30**, 441– 454, doi:10.1016/j.tourman.2008.07.003 .
Crossref | Web of Science® | Google Scholar

Crutzen, P. (2006), Albedo enhancement by stratospheric sulfur dioxide, *Clim. Change*, **77**, 211– 220, doi:10.1007/s10584-006-9101-y .
Crossref | CAS | ADS | Web of Science® | Google Scholar

Fawkes, S. (2007), Carbon dioxide emissions resulting from space tourism, *J. Br. Interplanet. Soc.*, **60**, 409– 413.
ADS | Web of Science® | Google Scholar

Garcia, R., and W. J. Randel (2008), Acceleration of the Brewer-Dobson circulation due to increases in greenhouse gases, *J. Atmos. Sci.*, **65**, 2731– 2739, doi:10.1175/2008JAS2712.1 .
Crossref | ADS | Web of Science® | Google Scholar

Garcia, R. R., D. R. Marsh, D. E. Kinnison, B. A. Boville, and D. Sassi (2007), Simulation of secular trends in the middle atmosphere, *J. Geophys. Res.*, **112**, D09301, doi:10.1029/2006JD007485 .
Wiley Online Library | CAS | ADS | Web of Science® | Google Scholar

Grewe, V., et al. (2007), Climate impact of supersonic air traffic: an approach to optimize a potential future supersonic fleet – Results from the EU-project SCENIC, *Atmos. Chem. Phys.*, **7**, 5129– 5145, doi:10.5194/acp-7-5129-2007 .
Crossref | CAS | ADS | Web of Science® | Google Scholar

Lee, D., D. Fahey, P. Forster, P. Newton, R. Wit, L. Lim, B. Owen, and R. Sausen (2009), Aviation and global climate change in the 21st century, *Atmos. Environ.*, **43**, 3520– 3537, doi:10.1016/j.atmosenv.2009.04.024 .
Crossref | CAS | ADS | Web of Science® | Google Scholar

Lindzen, R., and A. Hou (1988), Hadley circulation for zonally averaged heating centered off the equator, *J. Atmos. Sci.*, **45**, 2416– 2427, doi:10.1175/1520-0469(1988)045<2416:HCFZAH>2.0.CO;2 .
Crossref | ADS | Web of Science® | Google Scholar

Mills, M., O. Toon, R. Turco, D. Kinnison, and R. Garcia (2008), Massive global ozone loss predicted following nuclear conflict, *Proc. Natl. Acad. Sci. U. S. A.*, **105**, 5307– 5312, doi:10.1073/pnas.0710058105 .
Crossref | CAS | ADS | PubMed | Web of Science® | Google Scholar

Ross, M., D. Toohey, M. Peineman, and P. Ross (2009), Limits on the launch market related to stratospheric ozone depletion, *Astropolitics*, **9**, 33– 54.
Google Scholar

Sanderson, K. (2010), Science lines up for a seat to space, *Nature*, **463**, 716– 717, doi:10.1038/463716a .
Crossref | CAS | PubMed | Web of Science® | Google Scholar

Screen, J., and I. Simmonds (2010), The central role of diminishing sea ice in recent Arctic temperature amplification, *Nature*, **464**, 1334– 1337, doi:10.1038/nature09051 .
Crossref | CAS | ADS | PubMed | Web of Science® | Google Scholar

Serreze, M., A. Barrett, J. Streve, D. Kindig, and M. Holland (2009), The emergence of surface based Arctic amplification, *The Cryosphere*, **3**, 11– 19, doi:10.5194/tc-3-11-2009 .
Crossref | ADS | Web of Science® | Google Scholar

Simmons, F. (2000), *Rocket Exhaust Plume Phenomenology*, chap. 9, pp. 174– 190, Aerosp. Press, El Segundo, Calif.
Google Scholar

Sutton, G. P., and O. Biblarz (2010), Hybid propellant rockets, in *Rocket Propulsion Elements*, pp. 594– 621, John Wiley, Hoboken, N. J.
Google Scholar

Tilmes, S., R. Garcia, D. Kinnison, A. Gettelman, and P. Rasch (2009), Impact of geoenineered aerosols on the troposphere and stratosphere, *J. Geophys. Res.*, **114**, D12305, doi:10.1029/2008JD011420 .
Wiley Online Library | CAS | ADS | Web of Science® | Google Scholar

World Meteorological Organization (2002), Scientific assessment of ozone depletion, *Rep. 47*, Geneva, Switzerland.
Google Scholar

World Meteorological Organization (2006), Scientific assessment of ozone depletion, *Rep. 50*, Geneva, Switzerland.
Google Scholar

Zhang, R., A. F. Khalizov, J. Pagels, D. Zhang, H. Xue, and P. McMurray (2008), Variability in morphology, hygroscopicity, and optical properties of soot aerosols during atmospheric processing, *Proc. Natl. Acad. Sci. U. S. A.*, **105**, 10,291– 10,296, doi:10.1073/pnas.0804860105 .
Crossref | CAS | ADS | Web of Science® | Google Scholar

Ziliotto, V. (2010), Relevance of the Futron/Zogby survey conclusions to the current space tourism industry, *Acta Astronaut.*, **66**, 1547– 1552, doi:10.1016/j.actaastro.2009.08.027 .
Crossref | ADS | Web of Science® | Google Scholar

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Evidence for a continuous decline in lower stratospheric ozone offsetting ozone layer recovery

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Abstract. Ozone forms in the Earth's atmosphere from the photodissociation of molecular oxygen, primarily in the tropical stratosphere. It is then transported to the extratropics by the Brewer–Dobson circulation (BDC), forming a protective "ozone layer" around the globe. Human emissions of halogen-containing ozone-depleting substances (hODSs) led to a decline in stratospheric ozone until they were banned by the Montreal Protocol, and since 1998 ozone in the upper stratosphere is rising again, likely the recovery from halogen-induced losses. Total column measurements of ozone between the Earth's surface and the top of the atmosphere indicate that the ozone layer has stopped declining across the globe, but no clear increase has been observed at latitudes between 60° S and 60° N outside the polar regions (60–90°). Here we report evidence from multiple satellite measurements that ozone in the lower stratosphere between 60° S and 60° N has indeed continued to decline since 1998. We find that, even though upper stratospheric ozone is recover-

ing, the continuing downward trend in the lower stratosphere prevails, resulting in a downward trend in stratospheric column ozone between 60° S and 60° N. We find that total column ozone between 60° S and 60° N appears not to have decreased only because of increases in tropospheric column ozone that compensate for the stratospheric decreases. The reasons for the continued reduction of lower stratospheric ozone are not clear; models do not reproduce these trends, and thus the causes now urgently need to be established.

1 Introduction

The stratospheric ozone layer protects surface life from harmful solar ultraviolet radiation. In the second half of the 20th century, halogen-containing ozone-depleting substances (hODSs) resulting from human activity, mainly in the form of chlorofluorocarbons, led to the decline of the ozone layer (Molina and Rowland, 1974). The ozone hole over the South Pole was the clearest example of ozone depletion, but total column ozone was declining between 60° S and 60° N (Farman et al., 1985; WMO/NASA, 1988; WMO, 2011, 2014). The Montreal Protocol came into effect in 1989, banning multiple substances responsible for ozone layer depletion, and by the mid-2000s it had become apparent that a decline in total column ozone had stopped at almost all non-polar latitudes since around 1997 (WMO, 2007).

The general expectation is that global mean stratospheric column ozone will increase as hODSs continue to decline, but increasing total column ozone due to decreasing ODSs has not yet been reported (WMO, 2014); a cooling stratosphere is also thought to aid the recovery of ozone by slowing temperature-dependent reaction rates and by accelerating ozone transport through the meridional Brewer–Dobson circulation (BDC). Chemistry–climate models (CCMs) predict that mean total column ozone will increase, but this also remains uncertain since projections rely substantially on the CO_2, N_2O, and CH_4 emissions scenarios (Revell et al., 2012; Nowack et al., 2015).

Only recently has a total column ozone recovery been detected over Antarctica during the austral spring (Solomon et al., 2016). However, non-polar ($< 60°$) total column ozone levels have remained stable since 2000 (WMO, 2014), with most latitudes displaying a positive, but non-significant, decadal trend (WMO, 2014). Results from Frith et al. (2014) and Weber et al. (2017) suggest a potential peak in positive trends around 2011, after which positive trends decreased, and while uncertainties shrink, significance remains elusive.

Despite a lack of clear recovery in total column ozone, ozone appears to be significantly recovering in the upper stratosphere above 10 hPa in multiple ozone composites that merge observations from various space missions, especially at mid-latitudes (Kyrölä et al., 2013; Laine et al., 2014; WMO, 2014; Tummon et al., 2015; Harris et al., 2015; Steinbrecht et al., 2017; Ball et al., 2017; Frith et al., 2017; Sofieva et al., 2017; Bourassa et al., 2017). Trends are almost always presented as percentage change per decade, which does not illuminate the contribution to the column ozone changes. Thus, a recovery in upper stratospheric ozone does not mean that stratospheric ozone as a whole is recovering. Indeed, if total column ozone does not display any significant changes since 1997, while the upper stratosphere displays significant increases, then either the uncertainties due to unattributed dynamical variability interfere in the significance of the trend determined through regression analysis, or there are counteracting trends at lower levels of the stratosphere or in the troposphere.

Suggestions of a decrease in lower stratospheric ozone have been presented elsewhere (Kyrölä et al., 2013; Gebhardt et al., 2014; Sioris et al., 2014; Nair et al., 2015; Vigouroux et al., 2015). However, it has been difficult to confirm (WMO, 2014; Harris et al., 2015; Steinbrecht et al., 2017) because (i) ozone is typically integrated over wide latitude bands and/or total column ozone is considered, both of which may lead to cancellation of opposing trends; (ii) large dynamical variability unaccounted for in regression analysis together with shorter time series lead to higher uncertainties (Tegtmeier et al., 2013); (iii) below 20 km there are large ozone gradients, with low ozone concentrations close to the tropopause; and (iv) composite-data merging techniques have hindered identification of robust changes (Harris et al., 2015; Ball et al., 2017).

In addition to only reporting decadal percentage changes, most studies typically do not consider altitudes below 20 km ($\sim$ 60 hPa), missing stratospheric changes down to 16 km in the tropics (30° S–30° N) or $\sim$ 12 km at mid-latitudes (60–30°), regions that contain a large fraction of, and drive most sub-decadal variability in, total column ozone. Absolute uncertainties between limb sounding instruments have been reported to be up to $\sim$ 10–15 % near 16 km (Tegtmeier et al., 2013), which should be accounted for from bias corrections when composites are constructed, but which may also reduce confidence in variability and trends in the lower stratosphere. Nevertheless, a recent study by Bourassa et al. (2017) extended their analysis of the SAGE-II/OSIRIS ozone composite down to 18 km, where widespread, partially significant, negative ozone trends (1998–2016) can be seen at all latitudes from 50° S to 50° N. Models do predict a future decline in tropical lower stratospheric ozone (Eyring et al., 2010; WMO, 2011), but evidence for recent BDC-driven ozone decreases remain weak, and decreases identified at 32–36 km (near 10 hPa) are largely thought to be due to high ozone levels over 2000–2003 (WMO, 2014), and thus may be an artefact of the analysis period rather than a BDC change.

Finally, issues remain in the attribution and identification of ozone recovery usually performed through multiple linear regression (MLR) analysis that can lead to biased trend estimates (Damadeo et al., 2014; Ball et al., 2017) due to geolocation biases (Sofieva et al., 2014), vertical resolution

(Kramarova et al., 2013), and satellite drifts and biases from merging data into composites (WMO, 2014; Tummon et al., 2015; Harris et al., 2015; Ball et al., 2017). Most studies consider either piecewise linear trends (PWLTs) or the equivalent effective stratospheric chlorine (EESC) proxy to represent the influence of hODSs on long-term ozone changes (Newman et al., 2007). Chehade et al. (2014) and Frith et al. (2014) both concluded that total column ozone trends up to 2012 and 2013 estimated from PWLTs or EESC prior to 1997 agree well, but post-1997 the EESC proxy implies significant and positive increases, while PWLTs are generally smaller and non-significant at most non-polar latitudes. This suggests that post-1997 changes in total column ozone may no longer be well represented by an EESC regressor. Since PWLT represents the overall trend without any specific physical attribution, the total column ozone may indeed be increasing at a slower rate than EESC estimates suggest, or not at all.

Here, we quantify the absolute changes in ozone in different regions of the stratosphere and troposphere and their contributions to total column ozone since 1998 at different latitudes and between 60° S and 60° N using a robust regression analysis approach (Sect. 2.1): dynamical linear modelling (DLM) (Laine et al., 2014; Ball et al., 2017). DLM provides a major step forward by estimating smoothly varying, non-linear background trends, without prescribing an EESC explanatory variable or restrictive piecewise linear assumptions. Although this precludes a clear physical attribution, similar to PWLT, it allows for an assessment of how ozone is evolving on decadal and longer timescales and to identify if and when an inflection in ozone occurs. We use updated ozone composites extended to 2015–2016 (Sect. 3) and put the DLM results of the longer time series in the context of previously reported percentage change trends, usually reported from 20 km upwards, but here extended down to the tropopause (Sect. 4.1). We then consider the absolute contribution to total column ozone of partial column ozone from the upper, middle, lower, and whole stratosphere (Sect. 4.2), and then the tropospheric contribution (Sect. 4.3). We finally show results from two CCMs in specified dynamics mode (Sect. 4.4), and in Sect. 5 we discuss our findings and conclude.

2 Methods

2.1 Regression analysis

The standard method to estimate decadal trends or changes in ozone, MLR, is known to have estimator bias and regressor aliasing (Marsh and Garcia, 2007; Chiodo et al., 2014). To minimise these effects we use a more robust method using a Bayesian inference approach through DLM (Laine et al., 2014; Ball et al., 2017; see Laine et al., 2014 for a detailed description of the DLM model and implementation). DLM is similar to MLR in that the same regressors (see Sect. 2.2, below) are used for known drivers of ozone variability, and an autoregressive term is included. However, the trend is not predetermined with a linear, or piecewise linear, model, but is allowed to smoothly vary in time, and the degree of trend non-linearity is an additional free parameter to be jointly inferred from the data. We infer posterior distributions on the non-linear trends by Markov chain Monte Carlo (MCMC) sampling; the background trend levels at every month are included as free parameters, with a data-driven prior on the smoothness of the month-to-month trend variability. DLM analyses have more principled uncertainties than MLR since they are based on a more flexible model and formally integrate over uncertainties in the regression coefficients, (non-stationary) seasonal cycle, autoregressive coefficients, and parameters characterising the degree of non-linearity in the trend. The time-varying background changes are inferred rather than specified by, for example, an estimate of EESC (Newman et al., 2007) or PWLT; there is no need for assumptions about when and where a decline in hODSs occurs.

2.2 Regressor variables

Similar to MLR, we use regressor time series that represent known drivers of stratospheric ozone variability. These include the 30 cm radio flux ($F30$) as a solar proxy (as it better represents UV variability than the commonly used $F10.7$ cm flux; Dudok de Wit et al., 2014), a latitudinally resolved stratospheric aerosol optical depth for volcanic eruptions (Thomason et al., 2017), an ENSO index (NCAR, 2013) representing El Niño–Southern Oscillation variability[1], and the Quasi-Biennial Oscillation at 30 and 50 hPa[2]. For total column ozone and partial column ozone trend estimates, we also use the Arctic and Antarctic Oscillation[3] proxy for the Northern and Southern hemispheres. We use a second order autoregressive (AR2) process (Tiao et al., 1990) to avoid the autocorrelation of residuals. We remove the 2-year period following the Pinatubo eruption, i.e. June 1991 to May 1993, from the analysis to avoid problems related to impacts of satellite ozone retrieval due to stratospheric aerosol loading (Davis et al., 2016), and aliasing between regressors within the regression analysis (Chiodo et al., 2014; Kuchar et al., 2017); the volcanic aerosols still show slowly varying changes, which are important to consider as a regressor since volcanic aerosols have a larger impact on ozone in the lower stratosphere than the upper.

[1]From NOAA: http://www.esrl.noaa.gov/psd/enso/mei/table.html.

[2]From Freie Universität Berlin: http://www.geo.fu-berlin.de/en/met/ag/strat/produkte/qbo/index.html.

[3]From http://www.cpc.ncep.noaa.gov/products/precip/CWlink/daily_ao_index/teleconnections.shtml.

2.3 Statistics

We do not apply any statistical tests and therefore avoid making assumptions about the (posterior) distributions. The posterior distributions that represent the change since January 1998 are formed from the ($n = 100\,000$) DLM samples from the MCMC exploration of the model parameters (see Sect. 2.1). Then, probability density functions (PDFs) are estimated as histograms of the sampled DLM changes from 1998. Finally, the probabilities represent the percentage of the posteriors that are negative; therefore, the posteriors and probabilities presented in all figures represent the full information about the change in ozone since 1998 obtained from the DLM analysis; these are not always normally distributed. Positive increases have values less than 50 % and therefore increases at 80, 90, and 95 % probabilities are indicated by their respective contours in Fig. 1 and have values less than or equal to 20, 10, and 5 % in Fig. 2 (see also Figs. S1, S3, S4, S6, S9, and S10 in the Supplement).

3 Ozone data

3.1 Satellite ozone composites

A summary of the ozone merged datasets – SWOOSH (Davis et al., 2016), GOZCARDS (Froidevaux et al., 2015), SBUV-MOD (Frith et al., 2017), SBUV-Merged-Cohesive (Wild and Long, 2018), SAGE-II/CCI/OMPS (Sofieva et al., 2017), and SAGE-II/OSIRIS/OMPS (Bourassa et al., 2014) – and an intercomparison of the publicly available data up to 2012 can be found in Tummon et al. (2015); data up to 2016 are available upon request from composite principal investigators (see also Steinbrecht et al., 2017). These data are monthly, zonally averaged, homogenised, and bias-corrected ozone datasets. Nevertheless, merged product uncertainties remain large in the upper troposphere and lower stratosphere (UTLS) region in merged products, with estimated monthly uncertainties of 3–9 % in SAGE-II-CCI-OMPS (Sofieva et al., 2017) and drifts of ~ 1 % per decade in the OSIRIS period of SAGE-II-OSIRIS-OMPS (Bourassa et al., 2017). Although data quality degrades in the UTLS, biases are still removed through the same procedure as other parts of the stratosphere and are thought to be performed optimally (Sofieva et al., 2014); results agree with studies focused on the tropical UTLS (Sioris et al., 2014). Additional uncertainties remain unquantified, such as those in the SBUV (vertically resolved) composites due to very low resolution in the lower stratosphere (Frith et al., 2017) and uncertainties that result from the unit conversion from number density to volume mixing ratio in the SWOOSH and GOZCARDS composites that require information about local temperature. We note, however, that formal definitions and calculations of uncertainties vary between composites and cannot necessarily be directly compared (Harris et al., 2015; Ball et al., 2017).

We consider the period 1985–2016 in all cases, except SAGE-II/CCI/OMPS up to 2015, as it ends in July 2016. We consider the latitudinal range 60° S to 60° N where all composites have latitudinal coverage and from 13 to 48 km in SAGE-II/CCI/OMPS and SAGE-II/OSIRIS/OMPS, the approximately equivalent pressure range of 147–1 hPa that we consider in SWOOSH, GOZCARDS, and Merged-SWOOSH/GOZCARDS; for SBUV-NOAA, SBUV-NASA, and Merged-SBUV we consider 50–1 hPa. SWOOSH, SBUV-Merged-Cohesive, and GOZCARDS have been updated since previous intercomparisons (Tummon et al., 2015; Harris et al., 2015); see Table 1 for more information. GOZCARDS v2.20, used here, includes SAGE-II v7.0 and has a finer vertical resolution than earlier versions. It must be stressed that the resolution of SBUV instruments below 25 km (22 hPa) is low (McPeters et al., 2013; Kramarova et al., 2013); thus, linear trends estimated at 25–46 hPa also encompass altitudes lower than those that they formally represent (see Sect. 4 for a discussion on this).

3.2 Merged-SWOOSH/GOZCARDS and Merged-SBUV

SWOOSH and GOZCARDS are composites constructed with similar instrument data (Tummon et al., 2015; Ball et al., 2017) but with different preprocessing and merging techniques; the same is true for SBUV-MOD and SBUV-Merged-Cohesive, which are constructed using nadir-viewing backscatter instruments. The Merged-SWOOSH/GOZCARDS and Merged-SBUV results presented here combine these two pairs of composites (Alsing and Ball, 2017), which show slightly different spatial variability (see Fig. S1) (Tummon et al., 2015; Harris et al., 2015; Steinbrecht et al., 2017; Frith et al., 2017). Part of the reason is related to offsets and drifts in the data that continue to be one of the largest remaining sources of uncertainty within, and between, ozone composites (Harris et al., 2015; Ball et al., 2017; Frith et al., 2017). These artefacts can be largely accounted for using the Bayesian integrated and consolidated (BASIC) methodology developed by Ball et al. (2017), which we apply to both pairs of data separately; examples of corrected time series in the lower stratosphere are given in Fig. S2, and others can be found in Ball et al. (2017). This method also fills data gaps, which is reasonable if they are discontinuous for only a few months. This is true for these datasets but is not for the SAGE-II/CCI/OMPS and SAGE-II/OSIRIS/OMPS.

3.3 Total column ozone

We use merged SBUV v8.6 (Frith et al., 2014) for comparison of results with total column ozone observations, which are available on a 5° latitude grid from 1970 onwards. We verify the stability of SBUV total column ozone after 1997 by comparing SBUV total column ozone overpass data

Table 1. List of datasets and coverage considered in this study; some data products cover ranges outside those quoted/used here. Data units are either Dobson units (DU), volume mixing ratio (vmr) in parts per million (ppm), or number density (n-den) in cm^{-3}.

Name	Region	Alt. or press. range	Location	Version	Units	Merged?
SBUV-MOD[1]	Total column	0–400 km	Space	v8.6	DU	No
Arosa[1]	Total column	0–400 km	Ground	–	DU	No
SBUV-MOD	Stratosphere	50–1 hPa	Space	v8.6[2]	vmr	Yes[3]
SBUV-Mer. Coh.	Stratosphere	50–1 hPa	Space	LOTUS[2]	vmr	Yes[3]
GOZCARDS	Stratosphere	147–1 hPa	Space	v2.20[2]	vmr	Yes[4]
SWOOSH	Stratosphere	147–1 hPa	Space	v2.6	vmr	Yes[4]
SAGE-II-OSIRIS-OMPS	Stratosphere	13–48 km	Space	LOTUS[2]	n-den	No
SAGE-II-CCI-OMPS[1]	Stratosphere	13–48 km	Space	Sofieva et al. (2017)	n-den	No
OMI/MLS	Troposphere	0–16 km	Space	v9/v4.2	DU	No
WACCM-SD	All	0–120 km	Model	v4	vmr	No
SOCOL-SD	All	0–80 km	Model	v3	vmr	No

[1] All data consider the January 1985–December 2016 period, except SAGE-II-CCI-OMPS (1985–2015), Arosa (1970–2015), and SBUV-MOD total column ozone (1970–2016). [2] All marked datasets were made available through the SPARC Long-term Ozone Trends and Uncertainties in the Stratosphere (LOTUS) activity; unmarked datasets are publicly available. [3] SBUV-MOD and SBUV-Merged-Cohesive were merged to form Merged-SBUV using the BASIC algorithm laid out in Ball et al. (2017). [4] GOZCARDS and SWOOSH were merged to form Merged-SWOOSH/GOZCARDS using the BASIC algorithm laid out in Ball et al. (2017).

with the independent Arosa ground measurements, which are available from 1926 to present (Scarnato et al., 2010).

3.4 Tropospheric column ozone

For tropospheric ozone, we consider Aura satellite Ozone Monitoring Instrument and Microwave Limb Sounder (OMI/MLS) tropospheric column ozone measurements, discussed by Ziemke et al. (2006). The tropospheric ozone is estimated through a residual method that derives daily maps of tropospheric column ozone by subtracting MLS stratospheric column ozone from co-located OMI total column ozone. The OMI/MLS data, including data quality and data description, are publicly available[4]. Coverage of the OMI/MLS ozone is monthly (October 2004–present) and at $1° \times 1.25°$ horizontal resolution, which we have zonally averaged to make comparisons here.

4 Results

4.1 Post-1997 ozone changes resolved by latitude and altitude

Concentrations of active stratospheric hODSs reached a maximum in $\sim$1997 (Newman et al., 2007), and vertically resolved satellite measurements show evidence that upper stratospheric ozone (10–1 hPa; $\sim$32–48 km) started recovering soon after (WMO, 2014). Figure 1 presents post-1998 ozone changes from four ozone composites that combine multiple satellite instruments (see Sect. 3). The Merged-SBUV and Merged-SWOOSH/GOZCARDS composites show 95 % probability that upper stratospheric ozone at almost all latitudes between 60° S and 60° N has increased. This is less robust in SAGE-II/CCI/OMPS and SAGE-II/OSIRIS/OMPS, which show differences at equatorial latitudes (10° S–10° N). The reason for the difference is not clear, but we note that in this region nearly 50 % of the data are missing in the first 5 years (1998–2002), while Merged-SWOOSH/GOZCARDS and Merged-SBUV have no missing data (Harris et al., 2015).

In contrast to the upper stratosphere, all four composites show a consistent ozone decrease below 32 hPa and 24 km at all latitudes (Fig. 1). The regions where probabilities are high (> 80, 90, and 95 %; see legend) are similar in all composites, except for Merged-SBUV, which has a lower vertical resolution. Right of Fig. 1a are two examples of the Merged-SBUV vertical resolution, indicating the contribution to ozone at a particular layer at tropical (solid) and northern mid-latitudes (dashed) (Kramarova et al., 2013). The profiles peaking at 3 hPa (red) span $\sim$1–8 hPa and contain only upper stratospheric changes. However, while changes at 25 hPa (blue) show insignificant changes in the other higher-resolution composites, the Merged-SBUV profile ranges between $\sim$15 and 100 hPa, thus including the lowest part of the stratosphere where changes in the other composites are negative. We cannot use Merged-SBUV for comparison of resolved ozone changes, although a total column ozone product based upon these data can be used for comparison later (Sect. 4.3). While Merged-SBUV has a different spatial pattern, the increases in the upper, and decreases in the lower, stratosphere qualitatively agree with the other composites.

[4] From the NASA Goddard website https://acd-ext.gsfc.nasa.gov/Data_services/cloud_slice/.

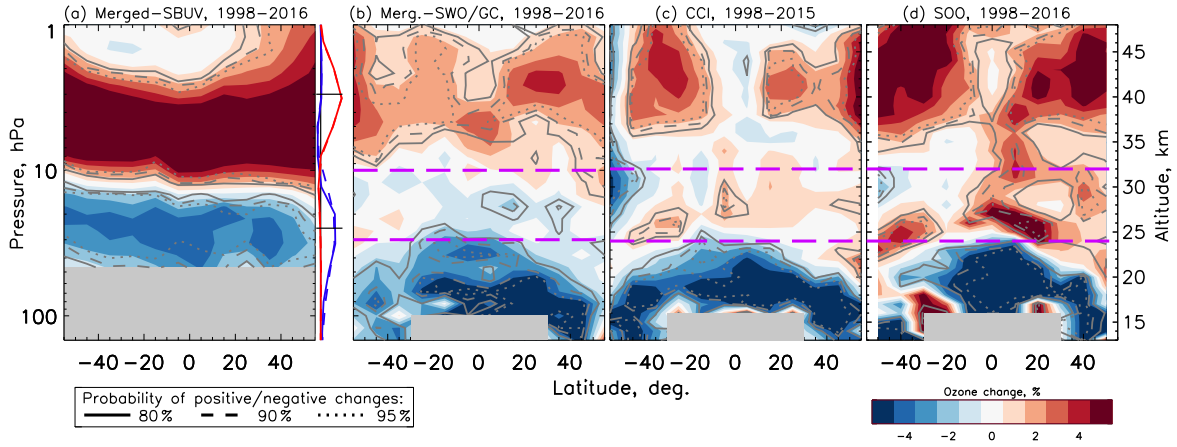

Figure 1. Zonally averaged change in ozone between 1998 and 2016. From **(a–d)** the Merged-SBUV, Merged-SWOOSH/GOZCARDS, SAGE-II/CCI/OMPS (CCI), and SAGE-II/OSIRIS/OMPS (SOO) composites. Red represents increases, blue decreases (%; see right legend). Contours represent probability levels of positive or negative changes (see left legend). Grey shaded regions represent unavailable data. Pink dashed lines delimit regions integrated into partial ozone columns in Fig. 2 (and Figs. S3, S4, S6, S9, and S10). To the right of Merged-SBUV are the instrument observing profiles centred at 3 hPa (red, upper) and 25 hPa (blue) at northern mid-latitudes (dashed) and in the tropics (solid) from Kramarova et al. (2013). SAGE-II/CCI/OMPS changes are for 1998–2015.

These results strongly indicate that ozone has declined in the lower stratosphere since 1998.

We note that our spatial results (Figs. 1 and S1) show similar patterns and changes to those presented in other studies, (e.g.WMO, 2014, Bourassa et al., 2014, Sofieva et al., 2017, Steinbrecht et al., 2017), though these typically do not extend below 20 km and thus often do not show the extensive decrease in lower stratospheric ozone that we do. Bourassa et al. (2017) extend down to 18 km and, indeed, show a larger region of decreasing ozone trends, but even this does not extend as far down as our results, i.e. ∼17 km for 30° S–30° N and 13 km outside this region. Our results do not qualitatively disagree with previous studies and approaches (WMO, 2014). However, 4 additional years of data (Tummon et al., 2015; Harris et al., 2015), an improved regression analysis method (Laine et al., 2014; Ball et al., 2017) (see Sect. 2), and techniques to account for data artefacts (Ball et al., 2017) increase our confidence in the identified changes in the lower stratosphere.

4.2 Stratospheric and total column ozone post-1997 changes

The spatial trends presented in Fig. 1 are informative for understanding where, and assessing why, changes in stratospheric ozone are occurring. However, stratospheric ozone changes are usually reported as decadal percentage change vertical profiles or spatial maps (e.g. as in Fig. 1), which hides the absolute changes in ozone and the contribution to the total column, which are almost never reported. A recovery in the upper stratosphere is important to identify, but this region contributes a smaller fraction to the total column than the middle and lower stratosphere. Thus, smaller percentage changes over a reduced altitude range in the lower stratosphere can actually produce larger integrated changes than in the more extended regions higher up.

In Fig. 2 we present changes in partial column ozone in Dobson units (DU) from Merged-SWOOSH/GOZCARDS for the whole stratospheric column and for the upper (10–1 hPa) and lower stratosphere (147–32 hPa or 13–24 km at $>30°$; 100–32 hPa or 17–24 km at $<30°$). We note that the tropopause, the boundary layer between the troposphere and stratosphere, varies seasonally but is on average around 16 km (tropics) and 10–12 km (mid-latitudes); our conservative choice of slightly higher altitudes ensures that we avoid including the troposphere. Due to the near-complete temporal and vertical coverage, we focus on the Merged-SWOOSH/GOZCARDS composite (SAGE-II/OSIRIS/OMPS and SAGE-II/CCI/OMPS are provided in Figs. S3 and S4, respectively[5]). Figure 2 shows posterior distributions of the 1998–2016 ozone changes, with black numbers representing the percentage of the distribution that is negative, in 10° bands (left) and integrated into a "global" (defined as 60° S–60° N) partial column ozone (right), along with the total column ozone observed by SBUV (red curves and numbers; upper row).

[5]It should be noted that while each latitude band partial column ozone of SAGE-II/OSIRIS/OMPS and SAGE-II/CCI/OMPS typically has between 60 and 90 % of months where data are available for 1985–2015/2016, integrating bands across all latitudes leads to a reduction of available months (see Fig. S5), though estimates of the change since 1998 can still be made and uncertainties due to the reduced data are captured in the posteriors given in Figs. S3 and S4; this does not affect SBUV total column ozone or Merged-SWOOSH/GOZCARDS.

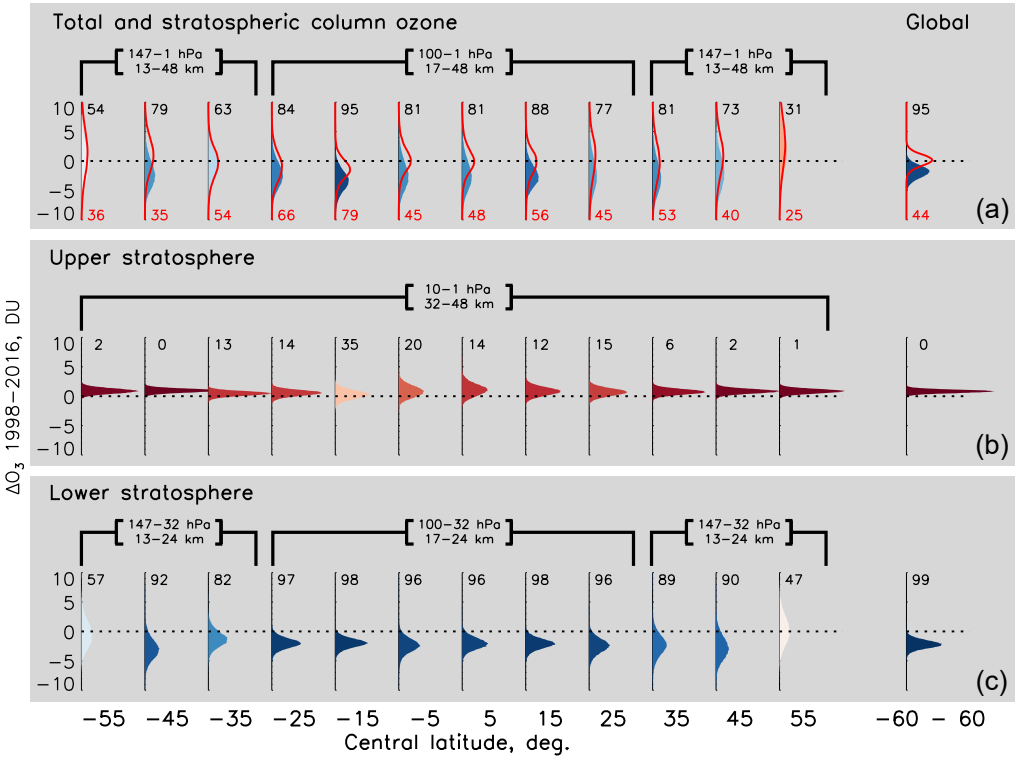

Figure 2. Merged-SWOOSH/GOZCARDS posterior distributions (shaded) for the 1998–2016 total and partial column ozone changes. **(a)** Whole stratospheric column and **(b)** upper and **(c)** lower stratosphere in 10° bands for all latitudes (left) and integrated from 60° S to 60° N ("Global", right). The stratosphere extends deeper at mid-latitudes than equatorial latitudes (marked above each latitude). Numbers above each distribution represent the distribution percentage that is negative; colours are graded relative to the percentage distribution (positive, red-hues, with values < 50; negative, blue). SBUV total column ozone (red curves) is given in the upper row and negative distribution percentages are given as red numbers.

Upper stratospheric ozone (Fig. 2, middle row) has increased since 1998 in almost all latitude bands, in half the cases at $> 90\,\%$ probability and $> 95\,\%$ at 40–60° in both hemispheres. Integrated between 60° S and 60° N, the probability exceeds 99 % that upper stratospheric ozone has increased, confirming that the Montreal Protocol has indeed been successful in reversing trends in this altitude range.

Changes in the lower stratosphere (Fig. 2, lower row) show ozone decreases, typically exceeding 90 % probability (50° S–50° N). There is a 99 % probability that lower stratospheric ozone integrated over 60° S–60° N has decreased since 1998; SAGE-II/OSIRIS/OMPS and SAGE-II/CCI/OMPS both support this result with 87 and 99 % probabilities, respectively (see Figs. S3 and S4).

Integrating the whole stratosphere vertically to form the stratospheric column ozone (Fig. 2, upper row), we see that all distributions imply a decrease (i.e. values $> 50\,\%$); probability is generally higher in tropical latitudes (30° S–30° N). Integrating over all latitudes, stratospheric column ozone between 60° S and 60° N (right) indicates that stratospheric ozone has decreased with 95 % probability. We compare the Merged-SWOOSH/GOZCARDS change with SBUV total column ozone (total column ozone posteriors shown as red lines in Fig. 2a), the latter of which includes both the troposphere and stratosphere. The SBUV total column ozone integrated over 60° S–60° N indicates that total column ozone has, in contrast to the stratospheric column ozone, changed little compared to 1998.

We note that uncertainty remains in the middle stratosphere (see Fig. S6), with Merged-SWOOSH/GOZCARDS, SAGE-II/CCI/OMPS, and SAGE-II/OSIRIS/OMPS displaying different changes. SAGE-II/OSIRIS/OMPS, in particular, shows a significant positive trend, which leads to the 60° S–60° N integrated stratospheric column ozone indicating no change since 1998 (see Fig. S3). This is likely a result of how the data were merged to form composites (see examples in Fig. S7) at 30 km for northern mid-latitudes and 17 km for southern mid-latitudes, where steps and drifts can be seen in different composites and is an issue that remains to be resolved (Harris et al., 2015; Ball et al., 2017; Steinbrecht et al., 2017). Nevertheless, the changes in the upper and lower stratosphere are consistent in all ozone composites, and a latitudinally integrated stratospheric column ozone de-

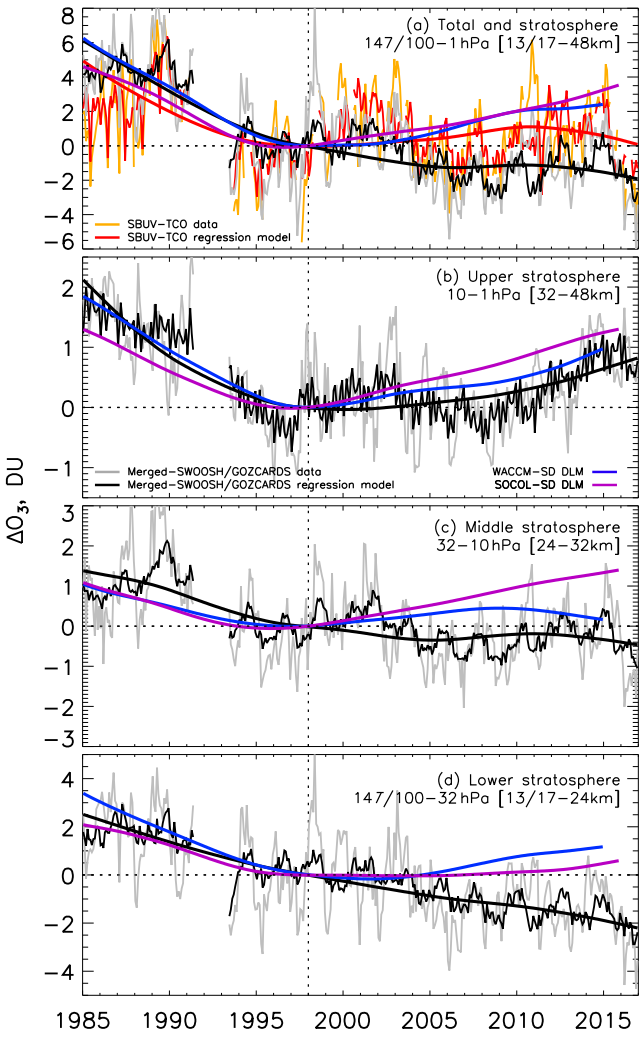

Figure 3. Total and partial column ozone anomalies integrated over 60° S–60° N between 1985 and 2016. Deseasonalised and regression model time series are given for the Merged-SWOOSH/GOZCARDS composite (grey and black, respectively) for **(a)** the whole stratospheric column and **(b)** upper, **(c)** middle, and **(d)** lower stratospheric partial column ozone. The DLM non-linear trend is the smoothly varying thick black line. In **(a)**, the deseasonalised SBUV total column ozone is also given (orange), with the regression model (red) and the non-linear trend (thick, red). Data are shifted so that the trend line is zero in 1998. DLM results for WACCM-SD (blue) and SOCOL-SD (purple) from Fig. S11 are also shown; model results in **(a)** are for the stratospheric column.

cline is indicated by both Merged-SWOOSH/GOZCARDS and SAGE-II/CCI/OMPS.

To make these latitudinally integrated (60° S–60° N) results clear, we show the SBUV total column ozone (orange and red represent deseasonalised time series and regression model fit, respectively) and Merged-SWOOSH/GOZCARDS stratospheric column ozone (grey and black) in Fig. 3a; in all of the panels in Fig. 3, the time series are bias-shifted so that the smoothly varying non-linear trend crosses the zero line in January 1998, so that relative changes can be clearly compared. It is interesting to note here that the SBUV total column ozone non-linear trend initially increases from 1998 and then peaks around 2011, before decreasing. Frith et al. (2014) and Weber et al. (2017) found similar behaviour when applying linear trend fits to SBUV total column ozone, fixing the start date in January 2000 and incrementally increasing the end date, i.e. the largest positive trend was found for the period 2000–2011 and thereafter trends decreased. Their analyses ended in 2013 and 2016, and the non-linear trend from our DLM analysis here shows identical behaviour and shows a continued decrease until 2016, which suggests that total column ozone has now returned to 1998 levels despite an initial upward trend. Qualitatively similar behaviour is seen in the Merged-SWOOSH/GOZCARDS stratospheric column ozone, though less pronounced because of its larger overall downward behaviour (see below, Sect. 4.3), which lends supporting, independent evidence that such a turnover in ozone trends might be real. The stratospheric column ozone from Merged-SWOOSH/GOZCARDS continued to decrease after 1998 and, while this decline stalled in the late 2000s, since 2012 it has continued to decrease. The overall result is that stratospheric column ozone is on average lower today than in 1998 by ~ 1.9 DU.

The different stratospheric regimes that contribute to the stratospheric column ozone behaviour can be see in Fig. 3b–d, where we show upper, middle (10–32 hPa), and lower stratospheric ozone time series from Merged-SWOOSH/GOZCARDS. A recovery is clear in the upper stratosphere in Fig. 3b, increasing by a mean of $\sim$0.8 DU, and trends have been relatively flat since 1998 in the middle stratosphere (Fig. 3c), with a mean decrease of ~ 0.4 DU. However, the result from Merged-SWOOSH/GOZCARDS in the lower stratosphere (Fig. 3d) indicates not only that ozone there has declined by ~ 2.2 DU since 1998, and has been the main contributor to the stratospheric column ozone decrease, but that the lower stratospheric ozone has seen a *continuous and uninterrupted decrease*. We note that a large proportion of the post-1997 decline occurred between 2003 and 2006, during which overlaps and switchovers between different combinations of instrument data were used to form the composites, most notably from the low-sampling SAGE-II instrument that ended operation in 2005; that said, all composites display similar behaviour, and overlaps and switchovers between different instrument data occur at different times (see Fig. 1 in both Tummon et al., 2015, and Sofieva et al., 2017).

4.3 Tropospheric ozone contribution to total column ozone

The stratosphere accounts for the majority ($\sim 90\,\%$) of total column ozone; thus, intuitively attribution to total column

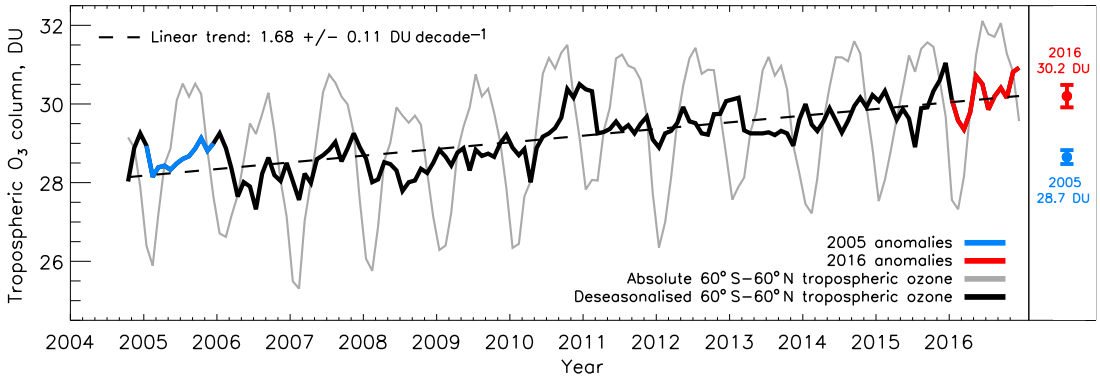

Figure 4. The 60° S–60° N total tropospheric column ozone between 2004 and 2016. OMI/MLS integrated ozone (grey line) and deseasonalised time series (black) are shown. The 2005 and 2016 periods are plotted in blue and red, respectively, and the mean and two standard errors on the mean for these two years are plotted on the right, with the mean value given alongside. The mean linear trend estimate (dashed line) and the 1 standard deviation uncertainty are also provided.

ozone changes would be expected to come primarily from this region. However, the results in Figs. 2 and 3 suggest a discrepancy between stratospheric column ozone and total column ozone. Despite this, there is no serious conflict between the different changes indicated by integrated 60° S–60° N stratospheric column ozone and total column ozone distributions (Fig. 2a) and trends (Fig. 3a) when the remaining 10 % of the total column ozone, i.e. tropospheric ozone, is considered, as we show in the following.

First, it is important to establish confidence in the SBUV total column ozone observations. These have been very stable since 1998 when comparing SBUV total column ozone overpass data to the independent ground-based Arosa total column ozone observations (see Fig. S8). This, therefore, provides confidence in the result that there is little net change in total column ozone since 1998. Additionally, Chehade et al. (2014) reported that other total column ozone composites agree very well with the SBUV total column ozone and there is little difference between the various total column ozone composites when performing trend analysis (see also Garane et al., 2017).

In a second step, we consider 60° S–60° N latitudinally integrated tropospheric ozone changes. In Fig. 4, we present recent estimates from OMI/MLS measurements (60° S–60° N) of tropospheric column ozone from 2004 to 2016 (grey), along with deseasonalised anomalies (solid black); the deseasonalised years 2005 and 2016 are indicated in blue and red – the means (right) indicate a significant increase in ozone. A linear fit to the deseasonalised time series indicates an increase in tropospheric ozone of 1.68 DU per decade; if this has held true for the entire 19-year period (1998–2016) it implies a mean increase of ∼ 3 DU, which would more than account for the difference between the 60° S–60° N stratospheric column ozone and total column ozone peaks (∼ 2 DU) in the right of Fig. 2a.

Supporting evidence for tropospheric ozone increases comes from work reconstructing stratospheric ozone changes in a CCM. Shepherd et al. (2014) indicate that tropospheric ozone in the northern (35°–55° N) and southern mid-latitudes (35°–55° S) ozone may have increased by ∼ 1 DU (1998–2011), while equatorial (25° S–25° N) may have increased by ∼ 1.5 DU. While we consider a longer period, this qualitatively agrees with the latitude-resolved distributions in Fig. 2, which shows that all total column ozone posteriors indicate smaller probabilities of a decrease, or larger increases, compared to the Merged-SWOOSH/GOZCARDS stratospheric column ozone changes.

Returning to the OMI/MLS tropospheric column ozone, latitudinally resolved 2005–2015 changes show significant increases everywhere, except a non-significant increase at 50–60° S (see Fig S13). The latitudinal structure, with peaks at ∼ 30° in both hemispheres and minima at southern equatorial and high latitudes, bears resemblance to the piecewise linear post-1998 total column ozone trends in Fig. 9 of Chehade et al. (2014) and Fig. 10 of Frith et al. (2014), although more detailed comparisons should be made. OMI/MLS results are not independent from Merged-SWOOSH/GOZCARDS as Aura/MLS forms a part of this composite post-2005 but is independent from SBUV total column ozone. McPeters et al. (2015) state that OMI total column ozone is stable enough for trend studies, with a drift of less than 1 % per decade compared to SBUV total column ozone and is one of the highest-quality ozone datasets. Ziemke and Cooper (2017) found no statistically significant drift with respect to independent measures or between MLS and OMI stratospheric column ozone residuals, although a small drift of +0.5 DU per decade was detected in OMI/MLS tropospheric column ozone caused by an error in the OMI total ozone, which was rectified for the version we consider here.

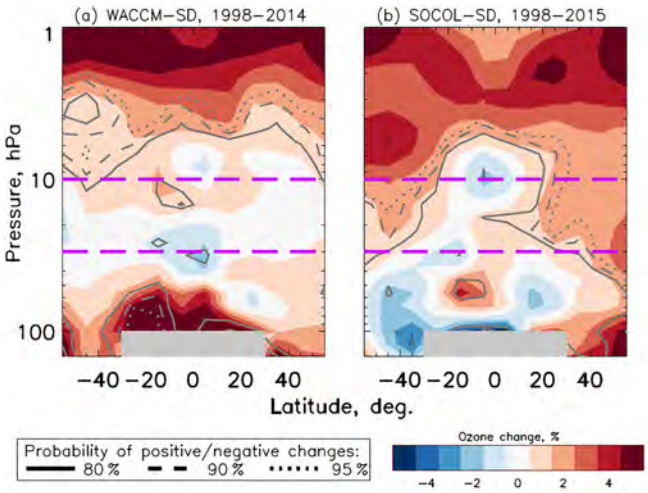

Figure 5. As for Fig. 1 but for **(a)** WACCM-SD and **(b)** SOCOL-SD.

A deeper investigation is needed to understand the contributions of tropospheric column ozone and stratospheric column ozone to total column ozone, especially considering uncertainties carefully, but this is beyond the scope of this work. We note that studies using various data sources show less significant regional increases (and some decreases), with global estimates ranging from 0.2 to 0.7 % per year (∼ 0.6–2 DU per decade) (Cooper et al., 2014; Ebojie et al., 2016; Heue et al., 2016), though these estimates considered different time periods. This suggests a large range of uncertainty, but even the lower end of the estimated increases in tropospheric column ozone are in line with the missing part of the total column ozone change, after considering stratospheric column ozone that we estimate here. Tropospheric ozone is not the main focus of the study here, but the evidence presented overall suggests that the missing component in the declining stratospheric column ozone distributions and trends, with respect to constant total column ozone, is indeed from increasing tropospheric ozone.

4.4 Comparison of stratospheric spatial and partial column ozone trends with models

The observational results for the lower, and whole, stratosphere presented thus far have not been previously reported. However, it is not clear that this represents a departure from our understanding of stratospheric trends as presented in modelling studies. We present the percentage ozone change from two state-of-the-art CCMs in Fig. 5: (a) the NCAR Community Earth System Model (CESM) Whole Atmosphere Community Climate Model-4 (WACCM; Marsh et al., 2013) and (b) the SOlar Climate Ozone Links (SOCOL; Stenke et al., 2013) model. Both simulations were performed with the Chemistry Climate Model Initiative phase 1 (CCMI-1) boundary conditions in specified dynamics (SD) mode (see Morgenstern et al., 2017, for information on CCMI and boundary conditions used in models). SD uses reanalysis products to constrain model dynamics towards observations so as to best represent the dynamics of the atmosphere, while leaving chemistry to respond freely to these changes. Such an approach has proven highly accurate at reproducing ozone variability on monthly to decadal timescales in the equatorial upper stratosphere (Ball et al., 2016). WACCM-SD uses version 1 of the Modern-Era Retrospective Analysis for Research and Analysis (MERRA-1; Rienecker et al., 2011) reanalysis[6], while SOCOL-SD uses ERA-Interim (Dee et al., 2011). Thus, the two models are both independent in terms of how they are constructed and the source of nudging fields used but have similar boundary conditions as prescribed by CCMI-1.

In Fig. 5 both models display broadly similar behaviour in the upper stratosphere above 10 hPa, roughly in line with the observations (Fig. 1). Spatially, in the middle stratosphere there are differences in sign, but generally significance is low: WACCM-SD displays broadly positive changes except in the tropics at 10 and 30 hPa, SOCOL-SD displays a negative spot centred in the tropics at 10 hPa, and mid-latitudes are often positive and significant. In the lower stratosphere, SOCOL-SD displays negative trends in the Southern Hemisphere lower stratosphere but positive trends in the Northern Hemisphere, while WACCM-SD is generally positive everywhere and significant at the lowest altitudes, except at 30–40 hPa in the tropics where a negative tendency is seen. In both SOCOL-SD and WACCM-SD, trends in the lower stratosphere are generally not significant and do not display the clear and significant decreases found in the observations. Posterior distributions similar to those of Fig. 2 are presented for SOCOL-SD and WACCM-SD in Figs. S9 and S10, respectively. The displayed behaviour is spatially similar to that described here for the models in Fig. 5, and no significant decreases are found (two SOCOL-SD latitude bands display negative changes in the lower stratosphere with ∼ 75 % probability: 30–40° S and 10–20° N). It is worth noting that in both cases the integrated, 60° S–60° N, trends in the stratospheric column ozone and upper stratosphere are all positive with probabilities of an increase exceeding 95 % and positive in the lower stratosphere, with 69 and 85 % probability of an increase in SOCOL-SD and WACCM-SD, respectively. The non-linear DLM trends (Fig. 3) of WACCM-SD (blue) and SOCOL-SD (purple) emphasise the behaviour clearly differs from the observations, especially in the lower stratosphere (the deseasonalised and regression model time series are omitted from Fig. 3 for clarity but are provided

[6]Use of MERRA-2 reanalysis (Gelaro et al., 2017) makes little difference, except in the upper stratosphere after 2004, where positive trends are larger when using MERRA-2 (see Fig. S12). The WACCM-SD run with MERRA-2 uses CESM 1.2.2 at 1.9 × 2.5 horizontal resolution and 88 vertical layers up to 140 km, using prescribed aerosols from the RCP8.5 scenario.

in Fig. S11). It is worth mentioning that the behaviour of stratospheric column ozone from the models was similar to SBUV total column ozone (Fig. 3a) until around 2012, after which modelled ozone continued to increase while observations show a gradual decline until 2016 (see discussion in Sect. 4.2).

The CCMVal-2 (SPARC, 2010) multi-model-mean 2000–2013 ozone changes in the WMO (2014) ozone assessment (chap. 2, Fig. 10) show a positive, but insignificant, change in the lower stratosphere at mid-latitudes, which suggests models may not be simulating that region correctly, consistent with the two models ending in 2014–2015. While CCMs capture historical ozone behaviour in the upper stratosphere well, it is less clear in the UTLS region. Fig. 7.27–7.28 of the SPARC (2010) report indicate large differences compared to observations in winter–spring, perhaps related to factors affecting model transport (e.g. resolution, and gravity wave parameterisations). Whether these differences result from model design, incorrect boundary conditions (e.g. underestimated anthropogenic (Yu et al., 2017) or volcanic (Bandoro et al., 2018) aerosol contributions), or missing chemistry remains an open question.

5 Conclusions

Following the successful implementation of the Montreal Protocol, total column ozone stabilised at the end of the 1990s, but the search for the first signs of recovery in total column ozone integrated between 60° S and 60° N have not yet been successful (Weber et al., 2017; Chipperfield et al., 2017). The lower stratosphere, below 24 km ($\sim$ 32 hPa), contains a large fraction of the total column ozone and is a region of large natural variability that has previously inhibited detection of significant trends (Weatherhead and Andersen, 2006). With longer time series, improved composites, and integration of the lower stratospheric column, we can now detect statistically significant trends in this region. We find that the negative ozone trend within the lower stratosphere between 1998 and 2016 is the main reason why a statistically significant recovery in total column ozone has remained elusive. Our main findings are as follows:

i. We further confirm other studies that the Montreal Protocol is successfully reducing the impact of halogenated ozone-depleting substances as indicated by the highly probable recovery ($>$ 95 %) measured in upper stratospheric regions (1–10 hPa or 32–48 km).

ii. Lower stratospheric ozone (between 147 and 32 hPa (13–24 km) at mid-latitudes, or 100 and 32 hPa (17–24 km) at tropical latitudes) has continued to decrease since 1998 between 60° S and 60° N, with a probability of 99 % in two of the three analysed datasets and 87 % in the third.

iii. The main stratospheric dataset considered indicates a highly probable (95 %) decrease in the ozone layer since 1998, i.e. in stratospheric ozone (between 147 and 1 hPa (13–48 km) at mid-latitudes, or 100 and 1 hPa (17–48 km) at tropical latitudes) integrated over latitudes 60° S–60° N – the other composites support this result when considering the associated caveats of each.

iv. There is no significant change in total column ozone between 1998 and 2016, which includes both tropospheric ozone and the stratospheric ozone layer – indeed no change is the most probable result indicated, which our findings imply is a consequence of increasing tropospheric ozone, together with the slowed rate of decrease in stratospheric ozone following the Montreal Protocol.

v. State-of-the-art models, nudged to have historical atmospheric dynamics as realistic as possible, do not reproduce these observed decreases in lower stratospheric ozone.

We posit several possible explanations for the continuing decline in lower stratospheric ozone, beginning with those related to dynamics. First, part of the tropical and subtropical ($<$ 30°) lower stratospheric decline may be linked to a greenhouse-gas-related BDC acceleration (Randel and Wu, 2007; Oman et al., 2010; WMO, 2014) indicated from CCM simulations, although observational evidence remains weak, and a faster BDC in general would slow ozone destruction cycles and hence mid-latitude ozone would increase and overcompensate for the tropical ozone reduction (WMO, 2014). Second, a rise in the tropopause (Santer et al., 2003), due to the warming troposphere, could lead to a decrease in ozone at mid-latitudes (Steinbrecht et al., 1998; Varotsos et al., 2004), but the tropopause rise is also affected by the ozone loss itself (Son et al., 2009), rendering its attribution difficult. Third, here we hypothesise a so-far-not-discussed mechanism: an acceleration of the lower stratosphere BDC shallow branch (Randel and Wu, 2007; Oman et al., 2010) might increase transport of ozone-poor air to the mid-latitudes from the tropical lower stratosphere (Johnston, 1975; Perliski et al., 1989). The quality of the applied dynamical fields in the specified dynamics models considered in this study, or the way models handle transport in the lower stratosphere (SPARC, 2010; Dietmüller et al., 2017), may be dynamically related reasons why models do not reproduce the observed lower stratospheric ozone changes.

While dynamically driven explanations may be fully responsible for tropical lower stratospheric ozone changes, at mid-latitudes additional chemically driven contributions from increasing anthropogenic and natural very-short-lived substances (VSLSs) containing chlorine or bromine may play a role (Hossaini et al., 2015). Modelling studies imply that VSLSs preferentially destroy lower stratospheric ozone, though the effect outside of the polar latitudes is expected to be small (Hossaini et al., 2015, 2017). While VSLSs are

thought to delay the recovery of the ozone layer, much uncertainty remains since observations and reaction rate kinetics are only available for some VSLSs (Oram et al., 2017). The uncertainties in model chemical boundary conditions, e.g. the prescribed emissions of VSLSs, therefore, may also be a reason why models do not reproduce the trends we report here.

The Montreal Protocol is working, but if the negative trend in lower stratospheric ozone persists, its efficiency might be disputed. Restoration of the ozone layer is essential to reduce the harmful effects of solar UV radiation (WMO, 2014) that impact human and ecosystem health (Slaper et al., 1996). Presently, models do not robustly reproduce the decline in lower stratospheric ozone identified here. This will be imperative, both to predict future changes and to determine if it is possible to prevent further decreases.

Data availability. Merged-SWOOSH/GOZCARDS and Merged-SBUV, named "$BASIC_{SG}$" and "$BASIC_{SBUV}$" following the merging method used from Ball et al. (2017), are available for download from https://data.mendeley.com/datasets/2mgx2xzzpk/2 (Alsing and Ball, 2017).

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Competing interests. The authors declare that they have no conflict of interest.

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References

Alsing, J. and Ball, W. T.: BASIC-SG (Merged-SWOOSH-GOZCARDS) for "Evidence for a continuous decline in lower stratospheric ozone offsetting ozone layer recovery", https://doi.org/10.17632/2mgx2xzzpk.1, 2017.

Ball, W. T., Haigh, J. D., Rozanov, E. V., Kuchar, A., Sukhodolov, T., Tummon, F., Shapiro, A. V., and Schmutz, W.: High solar cycle spectral variations inconsistent with stratospheric ozone observations, Nat. Geosci., 9, 206–209, https://doi.org/10.1038/ngeo2640, 2016.

Ball, W. T., Alsing, J., Mortlock, D. J., Rozanov, E. V., Tummon, F., and Haigh, J. D.: Reconciling differences in stratospheric ozone composites, Atmos. Chem. Phys., 17, 12269–12302, https://doi.org/10.5194/acp-17-12269-2017, 2017.

Bandoro, J., Solomon, S., Santer, B. D., Kinnison, D. E., and Mills, M. J.: Detectability of the impacts of ozone-depleting substances and greenhouse gases upon stratospheric ozone accounting for nonlinearities in historical forcings, Atmos. Chem. Phys., 18, 143–166, https://doi.org/10.5194/acp-18-143-2018, 2018.

Bourassa, A. E., Degenstein, D. A., Randel, W. J., Zawodny, J. M., Kyrölä, E., McLinden, C. A., Sioris, C. E., and Roth, C. Z.: Trends in stratospheric ozone derived from merged SAGE II and Odin-OSIRIS satellite observations, Atmos. Chem. Phys., 14, 6983–6994, https://doi.org/10.5194/acp-14-6983-2014, 2014.

Bourassa, A. E., Roth, C. Z., Zawada, D. J., Rieger, L. A., McLinden, C. A., and Degenstein, D. A.: Drift corrected Odin-OSIRIS ozone product: algorithm and updated stratospheric ozone trends, Atmos. Meas. Tech. Discuss., https://doi.org/10.5194/amt-2017-229, in review, 2017.

Chehade, W., Weber, M., and Burrows, J. P.: Total ozone trends and variability during 1979–2012 from merged data sets of various satellites, Atmos. Chem. Phys., 14, 7059–7074, https://doi.org/10.5194/acp-14-7059-2014, 2014.

Chiodo, G., Marsh, D. R., Garcia-Herrera, R., Calvo, N., and García, J. A.: On the detection of the solar signal in the tropical stratosphere, Atmos. Chem. Phys., 14, 5251–5269, https://doi.org/10.5194/acp-14-5251-2014, 2014.

Chipperfield, M. P., Bekki, S., Dhomse, S., Harris, N. R. P., Hassler, B., Hossaini, R., Steinbrecht, W., Thiéblemont, R., and Weber, M.: Detecting recovery of the stratospheric ozone layer, Nature, 549, 211–218, https://doi.org/10.1038/nature23681, 2017.

Cooper, O. R., Parrish, D. D., Ziemke, J., Balashov, N. V., Cupeiro, M., Galbally, I. E., Gilge, S., Horowitz, L., Jensen, N. R., Lamarque, J.-F., Naik, V., Oltmans, S. J., J., S., T., S. D., Thompson, A. M., Thouret, V., Wang, Y., and Zbinden, R. M.: Global distribution and trends of tropospheric ozone: An observation-based review, Elem Sci Anth., p. 29, https://doi.org/10.12952/journal.elementa.000029, 2014.

Damadeo, R. P., Zawodny, J. M., and Thomason, L. W.: Reevaluation of stratospheric ozone trends from SAGE II data using a simultaneous temporal and spatial analysis, Atmos. Chem. Phys., 14, 13455–13470, https://doi.org/10.5194/acp-14-13455-2014, 2014.

Davis, S. M., Rosenlof, K. H., Hassler, B., Hurst, D. F., Read, W. G., Vömel, H., Selkirk, H., Fujiwara, M., and Damadeo, R.: The Stratospheric Water and Ozone Satellite Homogenized (SWOOSH) database: a long-term database for climate studies, Earth Syst. Sci. Data, 8, 461–490, https://doi.org/10.5194/essd-8-461-2016, 2016.

Dee, D. P., Uppala, S. M., Simmons, A. J., Berrisford, P., Poli, P., Kobayashi, S., Andrae, U., Balmaseda, M. A., Balsamo, G., Bauer, P., Bechtold, P., Beljaars, A. C. M., van de Berg, L., Bidlot, J., Bormann, N., Delsol, C., Dragani, R., Fuentes, M., Geer, A. J., Haimberger, L., Healy, S. B., Hersbach, H., Hólm, E. V., Isaksen, L., Kållberg, P., Köhler, M., Matricardi, M., McNally, A. P., Monge-Sanz, B. M., Morcrette, J.-J., Park, B.-K., Peubey,

C., de Rosnay, P., Tavolato, C., Thépaut, J.-N., and Vitart, F.: The ERA-Interim reanalysis: configuration and performance of the data assimilation system, Q. J. Roy. Meteor. Soc., 137, 553–597, https://doi.org/10.1002/qj.828, 2011.

Dietmüller, S., Garny, H., Plöger, F., Jöckel, P., and Cai, D.: Effects of mixing on resolved and unresolved scales on stratospheric age of air, Atmos. Chem. Phys., 17, 7703–7719, https://doi.org/10.5194/acp-17-7703-2017, 2017.

Dudok de Wit, T., Bruinsma, S., and Shibasaki, K.: Synoptic radio observations as proxies for upper atmosphere modelling, J. Space Weather Spac., 4, A06, https://doi.org/10.1051/swsc/2014003, 2014.

Ebojie, F., Burrows, J. P., Gebhardt, C., Ladstätter-Weißenmayer, A., von Savigny, C., Rozanov, A., Weber, M., and Bovensmann, H.: Global tropospheric ozone variations from 2003 to 2011 as seen by SCIAMACHY, Atmos. Chem. Phys., 16, 417–436, https://doi.org/10.5194/acp-16-417-2016, 2016.

Eyring, V., Cionni, I., Bodeker, G. E., Charlton-Perez, A. J., Kinnison, D. E., Scinocca, J. F., Waugh, D. W., Akiyoshi, H., Bekki, S., Chipperfield, M. P., Dameris, M., Dhomse, S., Frith, S. M., Garny, H., Gettelman, A., Kubin, A., Langematz, U., Mancini, E., Marchand, M., Nakamura, T., Oman, L. D., Pawson, S., Pitari, G., Plummer, D. A., Rozanov, E., Shepherd, T. G., Shibata, K., Tian, W., Braesicke, P., Hardiman, S. C., Lamarque, J. F., Morgenstern, O., Pyle, J. A., Smale, D., and Yamashita, Y.: Multi-model assessment of stratospheric ozone return dates and ozone recovery in CCMVal-2 models, Atmos. Chem. Phys., 10, 9451–9472, https://doi.org/10.5194/acp-10-9451-2010, 2010.

Farman, J. C., Gardiner, B. G., and Shanklin, J. D.: Large losses of total ozone in Antarctica reveal seasonal ClO_x/NO_x interaction, Nature, 315, 207–210, https://doi.org/10.1038/315207a0, 1985.

Frith, S. M., Kramarova, N. A., Stolarski, R. S., McPeters, R. D., Bhartia, P. K., and Labow, G. J.: Recent changes in total column ozone based on the SBUV Version 8.6 Merged Ozone Data Set, J. Geophy. Res.-Atmos., 119, 9735–9751, https://doi.org/10.1002/2014JD021889, 2014.

Frith, S. M., Stolarski, R. S., Kramarova, N. A., and McPeters, R. D.: Estimating uncertainties in the SBUV Version 8.6 merged profile ozone data set, Atmos. Chem. Phys., 17, 14695–14707, https://doi.org/10.5194/acp-17-14695-2017, 2017.

Froidevaux, L., Anderson, J., Wang, H.-J., Fuller, R. A., Schwartz, M. J., Santee, M. L., Livesey, N. J., Pumphrey, H. C., Bernath, P. F., Russell III, J. M., and McCormick, M. P.: Global OZone Chemistry And Related trace gas Data records for the Stratosphere (GOZCARDS): methodology and sample results with a focus on HCl, H_2O, and O_3, Atmos. Chem. Phys., 15, 10471–10507, https://doi.org/10.5194/acp-15-10471-2015, 2015.

Garane, K., Lerot, C., Coldewey-Egbers, M., Verhoelst, T., Zyrichidou, I., Balis, D. S., Danckaert, T., Goutail, F., Granville, J., Hubert, D., Koukouli, M. E., Keppens, A., Lambert, J.-C., Loyola, D., Pommereau, J.-P., Van Roozendael, M., and Zehner, C.: Quality assessment of the Ozone_cci Climate Research Data Package (release 2017): 1. Ground-based validation of total ozone column data products, Atmos. Meas. Tech. Discuss., https://doi.org/10.5194/amt-2017-378, in review, 2017.

Gebhardt, C., Rozanov, A., Hommel, R., Weber, M., Bovensmann, H., Burrows, J. P., Degenstein, D., Froidevaux, L., and Thompson, A. M.: Stratospheric ozone trends and variability as seen by SCIAMACHY from 2002 to 2012, Atmos. Chem. Phys., 14, 831–846, https://doi.org/10.5194/acp-14-831-2014, 2014.

Gelaro, R., McCarty, W., Suárez, M. J., Todling, R., Molod, A., Takacs, L., Randles, C. A., Darmenov, A., Bosilovich, M. G., Reichle, R., Wargan, K., Coy, L., Cullather, R., Draper, C., Akella, S., Buchard, V., Conaty, A., da Silva, A. M., Gu, W., Kim, G.-K., Koster, R., Lucchesi, R., Merkova, D., Nielsen, J. E., Partyka, G., Pawson, S., Putman, W., Rienecker, M., Schubert, S. D., Sienkiewicz, M., and Zhao, B.: The Modern-Era Retrospective Analysis for Research and Applications, Version 2 (MERRA-2), J. Climate, 30, 5419–5454, https://doi.org/10.1175/JCLI-D-16-0758.1, 2017.

Harris, N. R. P., Hassler, B., Tummon, F., Bodeker, G. E., Hubert, D., Petropavlovskikh, I., Steinbrecht, W., Anderson, J., Bhartia, P. K., Boone, C. D., Bourassa, A., Davis, S. M., Degenstein, D., Delcloo, A., Frith, S. M., Froidevaux, L., Godin-Beekmann, S., Jones, N., Kurylo, M. J., Kyrölä, E., Laine, M., Leblanc, S. T., Lambert, J.-C., Liley, B., Mahieu, E., Maycock, A., de Mazière, M., Parrish, A., Querel, R., Rosenlof, K. H., Roth, C., Sioris, C., Staehelin, J., Stolarski, R. S., Stübi, R., Tamminen, J., Vigouroux, C., Walker, K. A., Wang, H. J., Wild, J., and Zawodny, J. M.: Past changes in the vertical distribution of ozone – Part 3: Analysis and interpretation of trends, Atmos. Chem. Phys., 15, 9965–9982, https://doi.org/10.5194/acp-15-9965-2015, 2015.

Heue, K.-P., Coldewey-Egbers, M., Delcloo, A., Lerot, C., Loyola, D., Valks, P., and van Roozendael, M.: Trends of tropical tropospheric ozone from 20 years of European satellite measurements and perspectives for the Sentinel-5 Precursor, Atmos. Meas. Tech., 9, 5037–5051, https://doi.org/10.5194/amt-9-5037-2016, 2016.

Hossaini, R., Chipperfield, M. P., Montzka, S. A., Rap, A., Dhomse, S., and Feng, W.: Efficiency of short-lived halogens at influencing climate through depletion of stratospheric ozone, Nat. Geosci., 8, 186–190, https://doi.org/10.1038/ngeo2363, 2015.

Hossaini, R., Chipperfield, M. P., Montzka, S. A., Leeson, A. A., Dhomse, S., and Pyle, J. A.: The increasing threat to stratospheric ozone from dichloromethane, Nat. Commun., 8, 15962, https://doi.org/10.1038/ncomms15962, 2017.

Johnston, H. S.: Global ozone balance in the natural stratosphere, Rev. Geophys. Space Ge., 13, 637–649, https://doi.org/10.1029/RG013i005p00637, 1975.

Kramarova, N. A., Bhartia, P. K., Frith, S. M., McPeters, R. D., and Stolarski, R. S.: Interpreting SBUV smoothing errors: an example using the quasi-biennial oscillation, Atmos. Meas. Tech., 6, 2089–2099, https://doi.org/10.5194/amt-6-2089-2013, 2013.

Kuchar, A., Ball, W. T., Rozanov, E. V., Stenke, A., Revell, L., Miksovsky, J., Pisoft, P., and Peter, T.: On the aliasing of the solar cycle in the lower stratospheric tropical temperature, J. Geophys. Res.-Atmos., 122, 9076–9093, https://doi.org/10.1002/2017JD026948, 2017.

Kyrölä, E., Laine, M., Sofieva, V., Tamminen, J., Päivärinta, S.-M., Tukiainen, S., Zawodny, J., and Thomason, L.: Combined SAGE II-GOMOS ozone profile data set for 1984–2011 and trend analysis of the vertical distribution of ozone, Atmos. Chem. Phys., 13, 10645–10658, https://doi.org/10.5194/acp-13-10645-2013, 2013.

Laine, M., Latva-Pukkila, N., and Kyrölä, E.: Analysing time-varying trends in stratospheric ozone time series using the

state space approach, Atmos. Chem. Phys., 14, 9707–9725, https://doi.org/10.5194/acp-14-9707-2014, 2014.

Marsh, D. R. and Garcia, R. R.: Attribution of decadal variability in lower-stratospheric tropical ozone, Geophys. Res. Lett., 34, L21807, https://doi.org/10.1029/2007GL030935, 2007.

Marsh, D. R., Mills, M. J., Kinnison, D. E., Lamarque, J.-F., Calvo, N., and Polvani, L. M.: Climate Change from 1850 to 2005 Simulated in CESM1(WACCM), J. Climate, 26, 7372–7391, https://doi.org/10.1175/JCLI-D-12-00558.1, 2013.

McPeters, R. D., Bhartia, P. K., Haffner, D., Labow, G. J., and Flynn, L.: The version 8.6 SBUV ozone data record: An overview, J. Geophys. Res.-Atmos., 118, 8032–8039, https://doi.org/10.1002/jgrd.50597, 2013.

McPeters, R. D., Frith, S., and Labow, G. J.: OMI total column ozone: extending the long-term data record, Atmos. Meas. Tech., 8, 4845–4850, https://doi.org/10.5194/amt-8-4845-2015, 2015.

Molina, M. J. and Rowland, F. S.: Stratospheric sink for chlorofluoromethanes: chlorine atomc-atalysed destruction of ozone, Nature, 249, 810–812, https://doi.org/10.1038/249810a0, 1974.

Morgenstern, O., Hegglin, M. I., Rozanov, E., O'Connor, F. M., Abraham, N. L., Akiyoshi, H., Archibald, A. T., Bekki, S., Butchart, N., Chipperfield, M. P., Deushi, M., Dhomse, S. S., Garcia, R. R., Hardiman, S. C., Horowitz, L. W., Jöckel, P., Josse, B., Kinnison, D., Lin, M., Mancini, E., Manyin, M. E., Marchand, M., Marécal, V., Michou, M., Oman, L. D., Pitari, G., Plummer, D. A., Revell, L. E., Saint-Martin, D., Schofield, R., Stenke, A., Stone, K., Sudo, K., Tanaka, T. Y., Tilmes, S., Yamashita, Y., Yoshida, K., and Zeng, G.: Review of the global models used within phase 1 of the Chemistry-Climate Model Initiative (CCMI), Geosci. Model Dev., 10, 639–671, https://doi.org/10.5194/gmd-10-639-2017, 2017.

Nair, P. J., Froidevaux, L., Kuttippurath, J., Zawodny, J. M., Russell, J. M., Steinbrecht, W., Claude, H., Leblanc, T., van Gijsel, J. A. E., Johnson, B., Swart, D. P. J., Thomas, A., Querel, R., Wang, R., and Anderson, J.: Subtropical and midlatitude ozone trends in the stratosphere: Implications for recovery, J. Geophys. Res.-Atmos., 120, 7247–7257, https://doi.org/10.1002/2014JD022371, 2015.

NCAR: The Climate Data Guide: Multivariate ENSO Index, available at: https://climatedataguide.ucar.edu/climate-data/multivariate-enso-index (last access: 11 May 2017), 2013.

Newman, P. A., Daniel, J. S., Waugh, D. W., and Nash, E. R.: A new formulation of equivalent effective stratospheric chlorine (EESC), Atmos. Chem. Phys., 7, 4537–4552, https://doi.org/10.5194/acp-7-4537-2007, 2007.

Nowack, P. J., Luke Abraham, N., Maycock, A. C., Braesicke, P., Gregory, J. M., Joshi, M. M., Osprey, A., and Pyle, J. A.: A large ozone-circulation feedback and its implications for global warming assessments, Nature Climate Change, 5, 41–45, https://doi.org/10.1038/nclimate2451, 2015.

Oman, L. D., Plummer, D. A., Waugh, D. W., Austin, J., Scinocca, J. F., Douglass, A. R., Salawitch, R. J., Canty, T., Akiyoshi, H., Bekki, S., Braesicke, P., Butchart, N., Chipperfield, M. P., Cugnet, D., Dhomse, S., Eyring, V., Frith, S., Hardiman, S. C., Kinnison, D. E., Lamarque, J.-F., Mancini, E., Marchand, M., Michou, M., Morgenstern, O., Nakamura, T., Nielsen, J. E., Olivié, D., Pitari, G., Pyle, J., Rozanov, E., Shepherd, T. G., Shibata, K., Stolarski, R. S., TeyssèDre, H., Tian, W., Yamashita, Y., and Ziemke, J. R.: Multimodel assessment of the factors driving stratospheric ozone evolution over the 21st century, J. Geophys. Res.-Atmos., 115, D24306, https://doi.org/10.1029/2010JD014362, 2010.

Oram, D. E., Ashfold, M. J., Laube, J. C., Gooch, L. J., Humphrey, S., Sturges, W. T., Leedham-Elvidge, E., Forster, G. L., Harris, N. R. P., Mead, M. I., Samah, A. A., Phang, S. M., Ou-Yang, C.-F., Lin, N.-H., Wang, J.-L., Baker, A. K., Brenninkmeijer, C. A. M., and Sherry, D.: A growing threat to the ozone layer from short-lived anthropogenic chlorocarbons, Atmos. Chem. Phys., 17, 11929–11941, https://doi.org/10.5194/acp-17-11929-2017, 2017.

Perliski, L. M., London, J., and Solomon, S.: On the interpretation of seasonal variations of stratospheric ozone, J. Geophys. Res., 37, 1527–1538, https://doi.org/10.1016/0032-0633(89)90143-8, 1989.

Randel, W. J. and Wu, F.: A stratospheric ozone profile data set for 1979-2005: Variability, trends, and comparisons with column ozone data, J. Geophys. Res.-Atmos., 112, D06313, https://doi.org/10.1029/2006JD007339, 2007.

Revell, L. E., Bodeker, G. E., Huck, P. E., Williamson, B. E., and Rozanov, E.: The sensitivity of stratospheric ozone changes through the 21st century to N_2O and CH_4, Atmos. Chem. Phys., 12, 11309–11317, https://doi.org/10.5194/acp-12-11309-2012, 2012.

Rienecker, M. M., Suarez, M. J., Gelaro, R., Todling, R., Bacmeister, J., Liu, E., Bosilovich, M. G., Schubert, S. D., Takacs, L., Kim, G.-K., Bloom, S., Chen, J., Collins, D., Conaty, A., da Silva, A., Gu, W., Joiner, J., Koster, R. D., Lucchesi, R., Molod, A., Owens, T., Pawson, S., Pegion, P., Redder, C. R., Reichle, R., Robertson, F. R., Ruddick, A. G., Sienkiewicz, M., and Woollen, J.: MERRA: NASA's Modern-Era Retrospective Analysis for Research and Applications, J. Climate, 24, 3624–3648, https://doi.org/10.1175/JCLI-D-11-00015.1, 2011.

Santer, B. D., Wehner, M. F., Wigley, T. M. L., Sausen, R., Meehl, G. A., Taylor, K. E., Ammann, C., Arblaster, J., Washington, W. M., Boyle, J. S., and Brüggemann, W.: Contributions of Anthropogenic and Natural Forcing to Recent Tropopause Height Changes, Science, 301, 479–483, https://doi.org/10.1126/science.1084123, 2003.

Scarnato, B., Staehelin, J., Stübi, R., and Schill, H.: Long-term total ozone observations at Arosa (Switzerland) with Dobson and Brewer instruments (1988-2007), J. Geophys. Res.-Atmos., 115, D13306, https://doi.org/10.1029/2009JD011908, 2010.

Shepherd, T. G., Plummer, D. A., Scinocca, J. F., Hegglin, M. I., Fioletov, V. E., Reader, M. C., Remsberg, E., von Clarmann, T., and Wang, H. J.: Reconciliation of halogen-induced ozone loss with the total-column ozone record, Nat. Geosci., 7, 443–449, https://doi.org/10.1038/ngeo2155, 2014.

Sioris, C. E., McLinden, C. A., Fioletov, V. E., Adams, C., Zawodny, J. M., Bourassa, A. E., Roth, C. Z., and Degenstein, D. A.: Trend and variability in ozone in the tropical lower stratosphere over 2.5 solar cycles observed by SAGE II and OSIRIS, Atmos. Chem. Phys., 14, 3479–3496, https://doi.org/10.5194/acp-14-3479-2014, 2014.

Slaper, H., Velders, G. J. M., Daniel, J. S., de Gruijl, F. R., and van der Leun, J. C.: Estimates of ozone depletion and skin cancer incidence to examine the Vienna Convention achievements, Nature, 384, 256–258, https://doi.org/10.1038/384256a0, 1996.

Sofieva, V. F., Kalakoski, N., Päivärinta, S.-M., Tamminen, J., Laine, M., and Froidevaux, L.: On sampling uncertainty of satellite ozone profile measurements, Atmos. Meas. Tech., 7, 1891–1900, https://doi.org/10.5194/amt-7-1891-2014, 2014.

Sofieva, V. F., Kyrölä, E., Laine, M., Tamminen, J., Degenstein, D., Bourassa, A., Roth, C., Zawada, D., Weber, M., Rozanov, A., Rahpoe, N., Stiller, G., Laeng, A., von Clarmann, T., Walker, K. A., Sheese, P., Hubert, D., van Roozendael, M., Zehner, C., Damadeo, R., Zawodny, J., Kramarova, N., and Bhartia, P. K.: Merged SAGE II, Ozone_cci and OMPS ozone profile dataset and evaluation of ozone trends in the stratosphere, Atmos. Chem. Phys., 17, 12533–12552, https://doi.org/10.5194/acp-17-12533-2017, 2017.

Solomon, S., Ivy, D. J., Kinnison, D., Mills, M. J., Neely, R. R., and Schmidt, A.: Emergence of healing in the Antarctic ozone layer, Science, 353, 269–274, https://doi.org/10.1126/science.aae0061, 2016.

Son, S.-W., Polvani, L. M., Waugh, D. W., Birner, T., Akiyoshi, H., Garcia, R. R., Gettelman, A., Plummer, D. A., and Rozanov, E.: The Impact of Stratospheric Ozone Recovery on Tropopause Height Trends, J. Climate, 22, 429–445, https://doi.org/10.1175/2008JCLI2215.1, 2009.

SPARC: SPARC CCMVal Report on the Evaluation of Chemistry-Climate Models, edited by: Eyring, V., Shepherd, T., and Waugh, D., SPARC Report No. 5, WCRP-30/2010, WMO/TD – No. 40, available at: http://www.sparc-climate.org/publications/sparc-reports/sparc-report-no5/ (last access: 24 January 2018), 2010.

Steinbrecht, W., Claude, H., Köhler, U., and Hoinka, K. P.: Correlations between tropopause height and total ozone: Implications for long-term changes, J. Geophys. Res., 103, 19183–19192, https://doi.org/10.1029/98JD01929, 1998.

Steinbrecht, W., Froidevaux, L., Fuller, R., Wang, R., Anderson, J., Roth, C., Bourassa, A., Degenstein, D., Damadeo, R., Zawodny, J., Frith, S., McPeters, R., Bhartia, P., Wild, J., Long, C., Davis, S., Rosenlof, K., Sofieva, V., Walker, K., Rahpoe, N., Rozanov, A., Weber, M., Laeng, A., von Clarmann, T., Stiller, G., Kramarova, N., Godin-Beekmann, S., Leblanc, T., Querel, R., Swart, D., Boyd, I., Hocke, K., Kämpfer, N., Maillard Barras, E., Moreira, L., Nedoluha, G., Vigouroux, C., Blumenstock, T., Schneider, M., García, O., Jones, N., Mahieu, E., Smale, D., Kotkamp, M., Robinson, J., Petropavlovskikh, I., Harris, N., Hassler, B., Hubert, D., and Tummon, F.: An update on ozone profile trends for the period 2000 to 2016, Atmos. Chem. Phys., 17, 10675–10690, https://doi.org/10.5194/acp-17-10675-2017, 2017.

Stenke, A., Schraner, M., Rozanov, E., Egorova, T., Luo, B., and Peter, T.: The SOCOL version 3.0 chemistry-climate model: description, evaluation, and implications from an advanced transport algorithm, Geosci. Model Dev., 6, 1407–1427, https://doi.org/10.5194/gmd-6-1407-2013, 2013.

Tegtmeier, S., Hegglin, M. I., Anderson, J., Bourassa, A., Brohede, S., Degenstein, D., Froidevaux, L., Fuller, R., Funke, B., Gille, J., Jones, A., Kasai, Y., Krüger, K., Kyrölä, E., Lingenfelser, G., Lumpe, J., Nardi, B., Neu, J., Pendlebury, D., Remsberg, E., Rozanov, A., Smith, L., Toohey, M., Urban, J., Clarmann, T., Walker, K. A., and Wang, R. H. J.: SPARC Data Initiative: A comparison of ozone climatologies from international satellite limb sounders, J. Geophys. Res.-Atmos., 118, 12229–12247, https://doi.org/10.1002/2013JD019877, 2013.

Thomason, L. W., Ernest, N., Millán, L., Rieger, L., Bourassa, A., Vernier, J.-P., Manney, G., Luo, B., Arfeuille, F., and Peter, T.: A global, space-based stratospheric aerosol climatology: 1979 to 2016, Earth Syst. Sci. Data Discuss., https://doi.org/10.5194/essd-2017-91, in review, 2017 (data available at: https://doi.org/10.5067/GloSSAC-L3-V1.0).

Tiao, G. C., Xu, D., Pedrick, J. H., Zhu, X., and Reinsel, G. C.: Effects of autocorrelation and temporal sampling schemes on estimates of trend and spatial correlation, J. Geophys. Res., 95, 20507–20517, https://doi.org/10.1029/JD095iD12p20507, 1990.

Tummon, F., Hassler, B., Harris, N. R. P., Staehelin, J., Steinbrecht, W., Anderson, J., Bodeker, G. E., Bourassa, A., Davis, S. M., Degenstein, D., Frith, S. M., Froidevaux, L., Kyrölä, E., Laine, M., Long, C., Penckwitt, A. A., Sioris, C. E., Rosenlof, K. H., Roth, C., Wang, H.-J., and Wild, J.: Intercomparison of vertically resolved merged satellite ozone data sets: interannual variability and long-term trends, Atmos. Chem. Phys., 15, 3021–3043, https://doi.org/10.5194/acp-15-3021-2015, 2015.

Varotsos, C., Cartalis, C., Vlamakis, A., Tzanis, C., and Keramitsoglou, I.: The Long-Term Coupling between Column Ozone and Tropopause Properties, J. Climate, 17, 3843–3854, https://doi.org/10.1175/1520-0442(2004)017<3843:TLCBCO>2.0.CO;2, 2004.

Vigouroux, C., Blumenstock, T., Coffey, M., Errera, Q., García, O., Jones, N. B., Hannigan, J. W., Hase, F., Liley, B., Mahieu, E., Mellqvist, J., Notholt, J., Palm, M., Persson, G., Schneider, M., Servais, C., Smale, D., Thölix, L., and De Mazière, M.: Trends of ozone total columns and vertical distribution from FTIR observations at eight NDACC stations around the globe, Atmos. Chem. Phys., 15, 2915–2933, https://doi.org/10.5194/acp-15-2915-2015, 2015.

Weatherhead, E. C. and Andersen, S. B.: The search for signs of recovery of the ozone layer, Nature, 441, 39–45, https://doi.org/10.1038/nature04746, 2006.

Weber, M., Coldewey-Egbers, M., Fioletov, V. E., Frith, S. M., Wild, J. D., Burrows, J. P., Long, C. S., and Loyola, D.: Total ozone trends from 1979 to 2016 derived from five merged observational datasets – the emergence into ozone recovery, Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2017-853, in review, 2017.

Wild, J. D. and Long, C. S.: A Coherent Ozone Profile Dataset from SBUV, SBUV/2: 1979 to 2016, in preparation, 2018.

WMO (World Meteorological Organization): Scientific Assessment of Ozone Depletion: 2006, Global Ozone Research and Monitoring Project – Report No. 50, 572 pp., Geneva, 2007.

WMO (World Meteorological Organization): Scientific Assessment of Ozone Depletion: 2010, Global Ozone Research and Monitoring Project-Report No. 52, 516 pp., Geneva, Switzerland, 2011.

WMO: Scientific Assessment of Ozone Depletion: 2014 Global Ozone Research and Monitoring Project Report, World Meteorological Organization,Geneva, Switzerland, p. 416, 2014.

WMO/NASA: International Ozone Trends Panel Report, Report, https://www.esrl.noaa.gov/csd/assessments/ozone/1988/report.html (last access: 24 January 2018), 1988.

Yu, P., Rosenlof, K. H., Liu, S., Telg, H., Thornberry, T. D., Rollins, A. W., Portmann, R. W., Bai, Z., Ray, E. A., Duan, Y., Pan, L. L., Toon, O. B., Bian, J., and Gao, R.-S.: Efficient transport of tropospheric aerosol into the stratosphere via the Asian summer

monsoon anticyclone, P. Natl. Acad. Sci. USA, 114, 6972–6977, https://doi.org/10.1073/pnas.1701170114, 2017.

Ziemke, J. R., and Cooper, O. R.: Tropospheric ozone, in State of the Climate in 2016, B. Am. Meteorol. Soc., 98, S52–S54, 2017.

Ziemke, J. R., Chandra, S., Duncan, B. N., Froidevaux, L., Bhartia, P. K., Levelt, P. F., and Waters, J. W.: Tropospheric ozone determined from Aura OMI and MLS: Evaluation of measurements and comparison with the Global Modeling Initiative's Chemical Transport Model, J. Geophys. Res.-Atmos., 111, D19303, https://doi.org/10.1029/2006JD007089, 2006.

Global Union Against Radiation Deployment from Space (GUARDS)

GUARDS is an international coalition against global WiFi from space, a complex technology of radiation and toxic chemicals endangering all life on Earth

Planned Global WiFi from Space Will Destroy Ozone Layer, Worsen Climate Change, and Threaten Life on Earth

Thirteen companies are competing to cover the entire Earth with high-speed wireless Internet from low-orbit satellites within one to two years. This would be an ecological and public health nightmare. The biggest players are SpaceX (12,000 satellites), OneWeb (4,560 satellites) and Boeing (2,956 satellites).

The recent finding, in 2018, that stratospheric ozone is still declining despite the Montreal Protocol took everyone by surprise. The increasing pace of ever-more-powerful rocket launches is a likely factor. Imminent plans for beaming high-speed Internet from space would require the launching of large rockets almost daily. This is expected to alter, if not destroy, the ozone layer and contribute significantly to climate change. Although many new rockets burn liquid fuel containing no ozone-destroying chlorine, the assumption that this is environmentally friendly is proving wrong.

Martin Ross and colleagues at the Aerospace Corporation have been sounding the alarm. Their 2009 paper, *"Limits on the Space Launch Market Related to Stratospheric Ozone Depletion,"* pointed out that although liquid fuels do not contain chlorine, they produce

significant amounts of nitrogen and hydrogen oxides, as well as water vapor and soot, when burned. All of those destroy ozone.

Martin Ross of the Aerospace Corporation was also the lead author of a paper published in 2010 titled *"Potential climate impact of black carbon emitted by rockets."* The authors developed a computer model to predict what would happen in different parts of the planet if the number of launches burning kerosene (then 25 annually) increased by a factor of ten. His model predicts as much as a 4% loss of ozone over the tropics and subtropics, as much as a 3-degree Celsius summertime increase in temperature over the South Pole, more than a one-degree overall increase in Antarctic temperature, and a decrease in Antarctic sea ice by 5% or more.

In a 2011 Aerospace article titled "*Rocket Soot Emissions and Climate Change*", Ross states "The Aerospace study shows that the radiative forcing of soot from a given hydrocarbon rocket scenario is as much as 100,000 times that of the carbon dioxide from the rockets." Obviously, the soot or black carbon emissions would be an important factor in accelerating climate change if the planned launches move forward.

Solid state rocket exhaust is no better. It contains ozone-destroying chlorine, water vapor (a greenhouse gas), and aluminum oxide particles, which seed stratospheric clouds. Complete ozone destruction is observed in the exhaust plumes of solid state rockets.

The New York Times (May 14, 1991, p. 4) quoted Aleksandr Dunayev of the Russian Space Agency saying "About 300 launches of the [space] shuttle each year would be a catastrophe and the ozone layer would be completely destroyed."

At that time, the world averaged only 12 rocket launches per year. Maintaining a fleet of (ultimately) 4,000 satellites, each with an expected lifespan of five years, will likely involve enough yearly rocket launches to be an environmental catastrophe.

Project Loon utilizes a scarce resource - helium - with reckless abandon. Helium is key to the function and manufacture of many technologies. Helium also has important scientific and hospital uses. It is a scarce fossil resource (http://phys.org/news/2010-08-world-helium-nobel-prize-winner.html) and should be conserved, not squandered. The balloons used by Project Loon are inflated with helium which is released into the atmosphere when the balloons are grounded. Furthermore, the balloons are made of polyethylene plastic which is not biodegradable, yet the balloons are only expected to have a life-span of 10 months. Our best estimate is that it would take 100,000 balloons to provide wireless to landmasses worldwide. This a lot of polyethylene to discard and a lot of helium to waste.

Contrary to popular perception, wireless technology is not a sustainable or environmentally friendly technology because wireless connectivity uses far more energy than wired connectivity. According to *Energy Consumption in Wired and Wireless Access Networks*, "**Wireless technologies will continue to consume at least 10 times more power than wired technologies** when providing comparable access rates and traffic volumes. PON [passive optical networks] will continue to be the most energy-efficient access technology." (http://people.eng.unimelb.edu.au/rtucker/publications/files/energy-wired-wireless.pdf), even as technology becomes more energy efficient. A higher amount of energy is consumed in transmitting large amounts of information through the air (a medium that has high resistance and high level of signal absorption) compared to transmission via various corded communication connections (e.g., copper or fiber optic based). In fact, in a paper looking at the energy consumption of cloud computing, the authors state, "**Our energy calculations show that by 2015, wireless cloud will consume up to 43 TWh**, compared to only 9.2 TWh in 2012, an increase of 460%. This is an increase in carbon footprint from 6 megatonnes of CO2 in 2012 to up to 30 megatonnes of CO2 in 2015, **the equivalent of adding 4.9 million cars to the roads**. Up to **90% of this consumption is attributable to wireless access network technologies**, data centres account for only 9%." (http://www.ceet.unimelb.edu.au/publications/ceet-white-paper-wireless-cloud.pdf) While the article discusses cloud computing as though it is an energy saver, it is clear from the discussion that those energy savings are only realized if the cloud replaces individual computing power. Otherwise, cloud computing only causes additional energy consumption and should not be promoted as an environmentally-friendly technology. The energy wastefulness of wireless technology should cause national and international governments everywhere serious pause in their promotion of wireless technology.

A second area of concern is wireless itself. Although widely perceived as an unqualified good, wireless operates using extremely rapid pulses of microwave radiation - the same radiation used in microwave ovens. And a parade of studies continue to be published and ignored implicating wireless technology in the die-off of forests, the demise of frogs, bats, and honey bees, the threatened extinction of the house sparrow, and damage to the DNA of the human species. It is vital to the continuation of life that large parts of the earth be spared from the incessant radiation that accompanies wireless technologies.

"The human body", says Dr Gerard J. Hyland, of the University of Warwick, UK, "is an electrochemical instrument of exquisite sensitivity", noting that, like a radio, it can be interfered with by incoming radiation. If a signal can operate a mechanical device, it can disturb every cell in the human body.

On February 7, 2014, the U.S. Department of Interior stated that "the electromagnetic radiation standards used by the Federal Communications Commission (FCC) continue to

be based on thermal heating, a criterion now nearly 30 years out of date and inapplicable today" in reference to guidelines governing WiFi radiation frequencies.

In 2011 the World Health Organization classified radiation emitted by cell phones, and other wireless commercial infrastructure such as WiFi and smart meters as a Class 2B possible human carcinogen, along with lead, engine exhaust, and DDT. Yet, the global WiFi projects would make this exposure ubiquitous and inescapable.

A recent letter sent by 88 organizations, representing over a million people, to the European Economic and Social Committee outlines how governments are betraying the public trust by ignoring the hazards of radio frequency/microwave (RF/MW) radiation.

Studies show wireless radiation can adversely affect fetal brain development, in addition to causing double-stranded DNA breaks and causing a wide spectrum of illnesses. GUARDS believes that continuing and expanding involuntary exposure of the public to this known toxin violates the Nuremberg Code of Human Rights for non-consensual experimentation.

Satellite Deployment Plans

The eight companies seeking to provide global WiFi radiation include:

- SpaceX: 12,000 satellites, 1,200 km and 340 km high http://www.spacex.com/
- OneWeb: 2,000 satellites at 1,200 km and 2560 satellites at 8,500 km http://www.oneweb.world and http://www.cnbc.com/id/102340448
- Boeing: 2,956 satellites, 1,000 km high
- Samsung: 4,600 satellites, 930 miles high http://arxiv.org/ftp/arxiv/papers/1508/1508.02383.pdf
- Google: Approximately 100,000 high altitude balloons (62,500 feet) to achieve global coverage ("Project Loon") http://www.google.com/loon/
- Telesat Canada: 117 satellites, multiple orbits http://spacenews.com/telesat-prepares-shareholder-payday-outlines-117-satellite-constellation/
- Theia Holdings: 120 satellites, low earth orbit https://www.fiercewireless.com/wireless/from-boeing-to-spacex-11-companies-looking-to-shake-up-satellite-space
- LeoSat MA: 108 satellites, low-earth orbit http://leosat.com/
- Iridium Next: 66 satellites, 483 miles high. An existing slow speed system. Launching of the "next generation" (higher speed) satellites is scheduled to begin in October 2015 and to be completed by 2017. https://www.iridium.com/about/IridiumNEXT.aspx
- Astrocast: 64 satellites for M2M/IoT https://advanced-television.com/2017/12/15/swiss-else-to-build-64-satellites-for-m2m-iot/

- O3b Networks: Has 16 satellites with aims to add more https://www.ses.com/networks/
- Kepler Communications: Planning satellites for a variety of wireless communication applications with polar orbits http://www.keplercommunications.com/about
- ViaSat: add 24 satellites, 8,200 km high https://www.fiercewireless.com/wireless/viasat-expects-viasat-2-to-make-it-more-competitive-cellular-s-unlimited-offerings
- Globalstar: 24 satellites, 880 miles high. Already in operation at slow data speeds. http://www.globalstar.com/en/index.php?cid=8200
- Karousel LLC: 4 satellites. http://assets.fiercemarkets.net/public/007-Telecom/karousel.pdf.
- Space Norway: 2 satellites. Deliver service to arctic region, including Alaska https://www.fiercewireless.com/wireless/from-boeing-to-spacex-11-companies-looking-to-shake-up-satellite-space.
- Audacy Corp.: Undetermined number of satellites at this time. https://audacy.space/.

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Contact us at info@stopglobalwifi.org
Last updated March 20, 2018

Kathy Noel

From: Annemarie Clisby
Sent: Wednesday, August 21, 2019 4:11 PM
To: Roy Sapau
Subject: FW: Please STOP or SLOW the 5G roll out in ENcinitas

-----Original Message-----
From: Jack Cardoza <jackcardoza@gmail.com>
Sent: Wednesday, August 21, 2019 4:04 PM
Subject: Please STOP or SLOW the 5G roll out in ENcinitas

Dear Council ember,

5G is an untested telecom frequency to carry more data to our electronic devices. 4G has been proven to have unwanted health effects.
The claim from the telecom industry is that they have not done and will not let us consider health effects as a reason to stop the 5G roll out.

THIS IS A VERY CURIOUS STANCE. WHY ARE THEY DOING THIS? WOULDN'T YOU LIKE TO KNOW. I KNOW THAT I SURELY DO.

Let's slow them down. Other cities have, it is time to take a deep breath on this and join with Los Altos, Palo Alto, Calabasas and others to adopt safety ordancnces for Encinitas that we can all live with.

Sincerely,

Jack Cardoza

Kathy Noel

From: Annemarie Clisby
Sent: Thursday, September 5, 2019 10:01 AM
To: Roy Sapau
Subject: FW: T-Mobile slowing 5G roll out

From: Jack Cardoza <jackcardoza@gmail.com>
Sent: Wednesday, September 4, 2019 6:29 PM
To: Council Members <council@encinitasca.gov>
Subject: T-Mobile slowing 5G roll out

Here is more information of how even telecom companies are slowing the pace of 5G expansion:

https://www.activistpost.com/2019/09/t-mobile-cancels-5g-installation-nationwide-anonymous-employee-blames-15-states-lawsuits-against-sprint-merger.html

As you read through this information please click on the links and videos included.

I suggest*: Having a listen to the Danville City Council meeting.*

There is some foundational comments on the health hazards of EMF and RF exposures.

Thanks,

Jack Cardoza

T-Mobile Cancels 5G installation Nationwide. Anonymous Employee Blames 15 States' Lawsuits Against Sprint Merger

TOPICS: 5G BN Frank Consumer Rights Telecom

SEPTEMBER 2, 2019

By **B.N. Frank**

Activist Post has already reported about states filing lawsuits against the proposed Sprint / T-Mobile merger (see **1**, **2**, **3**).

According to the **Wireless Estimator**, T-Mobile is postponing new builds and 5G upgrades at least for now. A construction manager who wants to remain anonymous blames the 15 state attorneys general for filing lawsuits against the T-Mobile / Sprint Merger. Lawsuits have also been filed against the Federal Communications Commission (FCC) for **promoting and forcing 5G installation** throughout American communities (see **1**, **2**, **3**, **4**, **5**).

Anyone who lives where T-Mobile planned to start operating 5G can breathe a sigh of relief – at least for now. The **American Academy of Pediatrics** and other health experts warn that children are more susceptible to illness from exposure to **all sources of wireless** radiation. Warnings about widespread 5G installation have been issued for a variety of reasons by

- Doctors and scientists (see **1**, **2**, **3**)
- Environmentalists (see **1**, **2**, **3**)
- Engineers (see **1**, **2**)
- **Meteorologists, NASA, NOAA, the U.S. Navy**
- **Security experts**
- **Utility companies**

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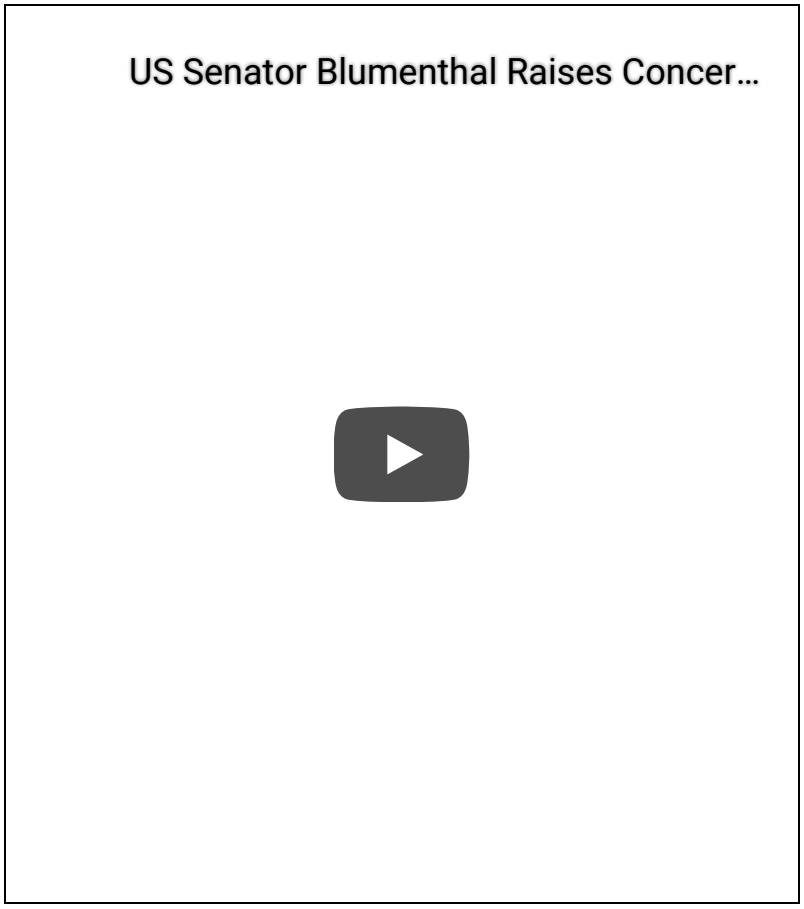
5G is already operating in some communities and adults, kids, and **pets** are suffering from exposure (see **1**, **2**, **3**).

In February, telecom executives gave congressional testimony that they had NO scientific evidence that exposure isn't harmful.



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OCTOBER 23, 2019

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Activist Post reports regularly about 5G risks, research and opposition. For more information **visit our archives** and the following websites:

- **Wireless Information Network**
- **Americans for Responsible Technology**
- **5GCrisis**
- **5GExposed**
- **5G Information**
- **Environmental Health Trust**
- **Last Tree Laws**
- **Parents for Safe Technology**
- **Physicians for Safe Technology**
- **SafeG**
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- **TelecomPowerGrab.org**
- **The People's Initiative**
- **Whatis5G.Info**

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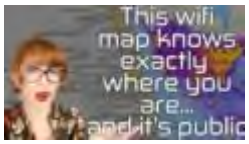

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Kathy Noel

From: Annemarie Clisby
Sent: Monday, September 23, 2019 10:15 AM
To: Roy Sapau
Subject: FW: How EMFs affect our health on a cellular level: Dr. Martin Pall

-----Original Message-----
From: Jack Cardoza <jackcardoza@gmail.com>
Sent: Saturday, September 21, 2019 7:41 PM
To: Jack Cardoza <jackcardoza@gmail.com>
Subject: How EMFs affect our health on a cellular level: Dr. Martin Pall

This is a bit dense but will educate us on how EMFs are weakening our immune systems and why they need to be mitigated.

Thanks for watching.

Jack Cardoza

Please slick here:
> https://vimeo.com/132870272

Kathy Noel

From: Annemarie Clisby
Sent: Monday, September 16, 2019 8:14 AM
To: Roy Sapau
Subject: FW: NO Cell Towers in our back yard!

Follow Up Flag: Follow up
Flag Status: Flagged

From: Jane Spencer <j.spencer@cox.net>
Sent: Saturday, September 14, 2019 11:29 AM
To: Council Members <council@encinitasca.gov>
Subject: NO Cell Towers in our back yard!

City of Encintas, I voice my concern, do not put my health at risk, so we can have a faster down loads. It's not worth it!

Thank you,

Jane Spencer

Cell tower health dangers

The cellular phone industry continues to maintain that cell phone towers pose no health risk, but fewer people believe that these days. Almost all scientists in this field would disagree that cell towers are safe, except those employed by the industry, perhaps.

There is strong evidence that electromagnetic radiation from cell phone towers is damaging to human (and animal) health.

Example: A study into the effects of a cell tower on a herd of dairy cattle was conducted by the Bavarian state government in Germany and published in 1998.

The erection of the tower caused adverse health effects resulting in a measurable drop in milk yield.

Relocating the cattle restored the milk yield. Moving them back to the original pasture recreated the problem. DairyCowStudy.pdf.

A human study (Kempten West) in 2007 measured blood levels of seratonin and melatonin (important hormones involved in brain messaging, mood, sleep regulation and immune system function) both before, and five months after, the activation of a new cell site.

Twenty-five participants lived within 300 metres of the site. Substantial unfavourable changes occurred with respect to both hormones, in almost all participants. Kemptem West Study.

Can Cell Towers Cause Cancer?

A study performed by doctors from the German city of Naila monitored 1000 residents who had lived in an area around two cell phone towers for 10 years. During the last 5 years of the study they found that those living within 400 meters of either tower had a newly-diagnosed cancer rate three times higher than those who lived further away.

Breast cancer topped the list, but cancers of the prostate, pancreas, bowel, skin melanoma, lung and blood cancer were all increased. NailaStudy.pdf

Very few studies have specifically concentrated on cancer risk from cell phone towers. This lack of studies is in itself a cause for concern, especially since anecdotal evidence is plentiful.

For example, in a case known as "Towers of Doom", two cell masts were installed (in 1994) on a five story apartment building in London. Residents complained of many health problems in the following years. Seven of them were diagnosed with cancer.

The cancer rate of the top floor residents (closest to the tower) was 10 times the national average. Further info.

Even the World Health Organisation has conceded that radio-frequency radiation may cause cancer. See this report.

If cell towers are causing cancer, you would expect it to occur after several years of exposure, because damage from radiation exposure accumulates over time. Cancer only occurs when all body defences and repair mechanisms have been exhausted and overwhelmed.

During those years, our bodies would be stressed by that radiation every day. This affects our health in other ways, too.

Other Cell Tower Health Effects

Individuals differ in their response to electromagnetic radiation.

For some people, short term effects from cell tower radiation exposure may include headaches, sleep disorders, poor memory, mental excitation, confusion, anxiety, depression, appetite disturbance and listlessness.

A small group of doctors from Bamberg, Germany, conducted their own study in 2005. They found increasing levels of both minor and serious health problems in patients exposed to higher radiation levels.

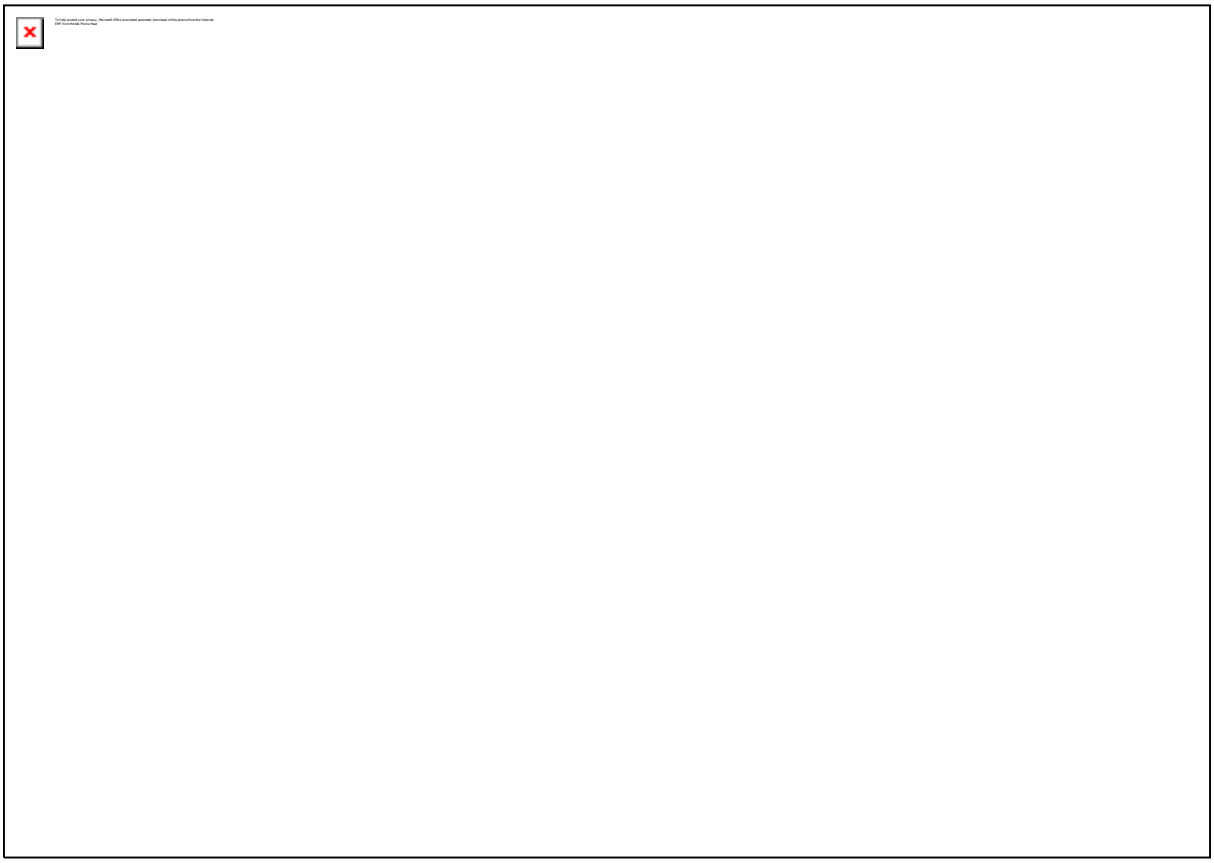
These health problems included tumours, diabetes, heart rhythm disturbances, inflammatory conditions, joint and limb pains, frequent infections, headaches, sleep disturbances, depression and memory problems.

Makes you wonder how much more information would be revealed by a well-designed and well-funded government study!

So don't just worry about cancer. Those doctors found that all kinds of illnesses showed a similar pattern: a higher incidence in patients with higher radiation exposure.

The American Academy of Environmental Medicine reports that studies demonstrate "significant harmful biological effects occur from non-thermal RF exposure", and these effects may include genetic damage, reproductive defects, cancer, neurological degeneration and nervous system dysfunction, immune system dysfunction, cognitive effects, protein and peptide damage, kidney damage, and developmental effects – all of which have been reported in peer-reviewed scientific literature. Further Info.

Legal Cell Tower Radiation Levels



The current legal limit for cell site radiation in the US and the UK is 1000 microwatts per square centimetre.

Other countries have set limits as low as 1 microwatt per square centimetre! Switzerland, Italy, China and others manage perfectly well with a limit of 10 microwatts per square centimetre.

Why such a huge difference? It appears that some governments are more concerned about EMF safety than others.

The truth is that no one really knows what level of cell tower radiation will prove to be safe in the long term.

But isn't that a good reason to set a low limit, not a high one?

It appears that current EMF limits in the US and UK may have been influenced more by economic and political motives than by health and safety concerns.

Cell towers safe distance

It is hard to predict how much radiation you will experience in your house or workplace.

- Different cell sites emit different amounts of radiation.
- Radiation levels from a single cell site also vary, depending on usage at different times of the day.
- Radiation from a single cell tower may be different in different directions.
- Radiation is affected by the lie of the land too, and by shielding and reflections from buildings.
- And finally, the construction of your house affects its resistance to radio-frequency EMF.

It can also happen that the cell tower you are aware of in your neighbourhood is not actually the closest cell site to your house.

Cell sites are often disguised. And many units are much smaller than the old familiar towers (though not necessarily less potent), and installed in unexpected locations.

So start off by making a careful check of your area, to find all the cell sites. Then use a map to work out the distance from each cell site to your house.

If the closest cell site is more than 400 metres away, you are probably not being harmed by it – although high risk groups and electro-sensitive people may need to be more cautious.

Cell tower – Personal Protection

If you are still concerned, try to get hold of an RF (radio frequency) gauss meter designed for measuring electromagnetic radiation in the cell phone frequency (microwave) range.

Another alternative is to order an EMF survey of your property. (EM Watch conducts EMF surveys in the southern half of England.)

Be aware that in every house there are rooms (and areas within rooms) where EMF radiation is higher or lower, just as some parts of your house may be brighter or darker because of window placement.

An EMF meter, or a survey will tell you which places in your home are safe, and which are not ideal for spending lots of time in.

When you next change your job or your house, find out how far away you are going to be from the nearest cell site, and let that influence your decision. Do the same when you decide where to send your child to school.

If you are still worried about cell tower radiation – here are some things you can do

- Spend less time in rooms where you can see the tower from a window. Rooms on the far side of the house from the tower will usually have lower EMF levels.
- EMFs are cumulative. You can't control the radiation coming from the cell tower, but do what you can to reduce EMF from other sources.
- Get a radio-frequency EMF meter and measure the radiation levels in different parts of your house. (Measurement with a suitable meter is the only sure way to know how much radiation you are receiving at any particular spot.)
- Consider shielding to reduce cell tower EMF – it can be shielded with special window film, metallic mesh curtaining, EMF paint, and metal foil in the roof.

EMF Shielding Video

High EMF levels are but one source of stress to the body. If your options for reducing EMF are limited, you can help your body in other ways, for example by minimizing exposure to other kinds of pollution in your air, water and food.

Good nutrition, exercise, and plenty of quality sleep will help your body repair radiation damage.

For more suggestions see our page EMF Protection Tips.

In the long term, we need to find ways of providing cell phone services without exposing people to high levels of cell tower and cell phone radiation.

(**3** votes, average: **5.00** out of 5)

You may find these articles helpful:

Power Lines and Sub-Stations

EMF Protection Tips

EMF Health Effects

Cell Phones

Smart Meters

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photos by: busyPrinting & K.Wiklund, Leszek.Leszczynski, garryknight, satguru, Ron Cogswell

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In 2011, 30 international scientists, who are part of the working group of the International Agency for Research on Cancer (IARC), met to assess the risk of developing cancer as a result of exposure to RF-EMFs.

Further experimental and epidemiologic studies are urgently needed in order to better and fully explore the health effects caused in humans by the exposure to generic or specific [...] RF-EMF frequencies in different age groups and with increasing exposure density."

Dr. Agostino Di Ciaula

The Influence of Being Physically Near to a Cell Phone Transmission Mast on the Incidence of Cancer

Horst Eger, Klaus Uwe Hagen, Birgitt Lucas, Peter Vogel, Helmut Voit

Published in *Umwelt·Medizin·Gesellschaft* 17,4 2004, as:
'Einfluss der räumlichen Nähe von Mobilfunksendeanlagen auf die Krebsinzidenz'

Summary

Following the call by Wolfram König, President of the Bundesamt für Strahlenschutz (Federal Agency for radiation protection), to all doctors of medicine to collaborate actively in the assessment of the risk posed by cellular radiation, the aim of our study was to examine whether people living close to cellular transmitter antennas were exposed to a heightened risk of taking ill with malignant tumors.

The basis of the data used for the survey were PC files of the case histories of patients between the years 1994 and 2004. While adhering to data protection, the personal data of almost 1,000 patients were evaluated for this study, which was completed without any external financial support. It is intended to continue the project in the form of a register.

The result of the study shows that the proportion of newly developing cancer cases was significantly higher among those patients who had lived during the past ten years at a distance of up to 400 metres from the cellular transmitter site, which has been in operation since 1993, compared to those patients living further away, and that the patients fell ill on average 8 years earlier.

In the years 1999-2004, *ie* after five years' operation of the transmitting installation, the relative risk of getting cancer had trebled for the residents of the area in the proximity of the installation compared to the inhabitants of Naila outside the area.

Key words: cellular radiation, cellular transmitter antennas, malignant tumours

The rapid increase in the use of mobile telephony in the last few years has led to an increasing number of cell phone transmission masts being positioned in or near to residential areas. With this in mind, the president of the German governmental department for protection against electromagnetic radiation (Bundesamtes für Strahlenschutz) Wolfram König, has challenged all doctors to actively help in the work to estimate the risks from such cell phone masts. The goal of this investigation was therefore to prove whether on not people living near to cell phone masts have a higher risk of developing cancerous tumours.

The basic data was taken from the medical records held by the local medical authority (Krankenkasse) for the years 1994 to 2004. This material is stored on computer. In this voluntary study the records of roughly 1,000 patients from Naila (Oberfranken) were used, respecting the associated data protection laws. The results from this study show a significantly increased likelihood of developing cancer for the patients that have lived within 400 metres of the cell phone transmission mast (active since 1993) over the last ten years, in comparison to those patients that live further away. In addition, the patients that live within 400 metres tend to develop the cancers at a younger age. For the years 1999 to 2004 (*ie* after five or more years of living with the cell phone transmission mast), the risk of developing cancer for those living within 400 metres of the mast in comparison to those living outside this area, was three times as high.

Introduction

A series of studies available before this investigation provided strong evidence of health risks and increased cancer risk associated with physical proximity to radio transmission masts. Haider *et al.* reported in 1993 in the Moosbrunn study frequent psychovegetive symptoms below the current safety limit for electromagnetic waves (1). In 1995, Abelin *et al.* in the Swiss- Schwarzenburg study found dose dependent sleep problems (5:1) and depression (4:1) at a shortwave transmitter station that has been in operation since 1939 (2).

In many studies an increased risk of developing leukaemia has been found; in children near transmitter antennas for Radio and Television in Hawaii (3); increased cancer cases and general mortality in the area of Radio and Television transmitter antennas in Australia (4); and in England, 9 times more leukaemia cases were diagnosed in people who live in a nearby

area to the Sutton Coldfield transmitter antennas (5). In a second study, concentrating on 20 transmitter antennas in England, a significant increased leukaemia risk was found (6). The Cherry study (7) indicates an association between an increase in cancer and living in proximity to a transmitter station. According to a study of the transmitter station of Radio Vatican, there were 2.2 times more leukaemia cases in children within a radius of 6 km, and adult mortality from leukaemia also increased (8).

In 1997 Goldsmith published the Lilienfeld-study that indicated 4 times more cancer cases in the staff of the American Embassy in Moscow following microwave radiation during the cold war. The dose was low and below the German limit (9).

The three studies of symptoms indicated a significant correlation between illness and physical proximity to radio transmission masts. A study by Santini *et al.* in France resulted in an association between irritability, depression, dizziness (within 100m) and tiredness within 300m of a cell phone transmitter station (10).

In Austria there was an association between field strength and cardiovascular symptoms (11) and in Spain a study indicates an association between radiation, headache, nausea, loss of appetite, unwellness, sleep disturbance, depression, lack of concentration and dizziness (12).

The human body physically absorbs microwaves. This leads to rotation of dipole molecules and to inversion transitions (13), causing a warming effect. The fact that the human body transmits microwave radiation at a very low intensity means that since every transmitter represents a receiver and transmitter at the same time, we know the human body also acts as a receiver.

In Germany, the maximum safe limit for high frequency microwave radiation is based on purely thermal effects. These limits are one thousand billion times higher than the natural radiation in these frequencies that reaches us from the sun.

The following study examines whether there is also an increased cancer risk close to cellular transmitter antennas in the frequency range 900 to 1800 MHz. Prior to this study there were no published results for long-term exposure (10 years) for this frequency range and its associated effects to be revealed. So far, no follow-up monitoring of the state of health of such a residential population has been systematically undertaken.

Materials and Methods

Study area

In June 1993, cellular transmitter antennas were permitted by the Federal Postal Administration in the Southern German city of Naila and became operational in September 1993.

The GSM transmitter antenna has a power of 15 dbW per channel in the 935MHz frequency range. The total

Fig. 1: Schematic plan of the antenna sites

transmission time for the study period is ca. 90,000 hours. In December 1997 there followed an additional installation from another company. The details are found in an unpublished report, appendix page 1-3 (14).

To compare results an 'inner' and 'outer' area were defined. The inner area covered the land that was within a distance of 400 metres from the cellular transmitter site. The outer area covered the land beyond 400 metres. The average distance of roads surveyed in the inner area (nearer than 400m) was 266m and in the outer area (further than 400m) 1,026m. Fig. 1 shows the position of the cellular transmitter sites I and 2, surrounded by circle of radius 400 metres. The geographical situation shows the transmitter sites (560m) are the highest point of the landscape, which falls away to 525m at a distance of 450m. From the height and tilt angle of the transmitter it is possible to calculate the distance where the transmitter's beam of greatest intensity strikes the ground (see Fig. 2).

The highest radiation values are in areas of the main

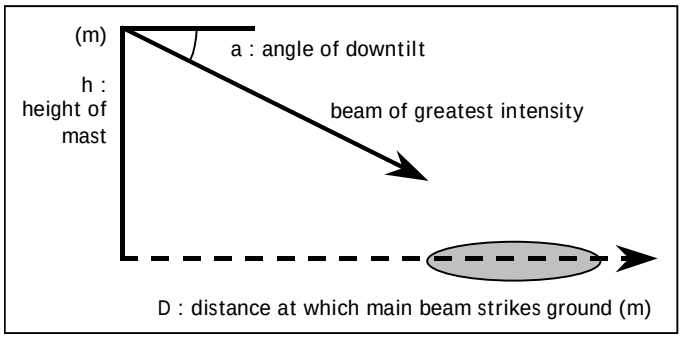

Fig. 2: From the mast height h and the downtilt angle a, the distance D at which the main beam reaches ground is given by D = tan(90-a) × h

beam where it hits the ground and from the expected associated local reflection; from this point the intensity of radiation falls off with the square of the distance from the transmitter.

In Naila the main beam hits the ground at 350m with a beam angle of 6 degrees (15). In the inner area, additional emissions are caused by the secondary lobes of the transmitter; this means in comparison that from purely mathematical calculations the outer area has significantly reduced radiation intensity.

The calculations from computer simulations and the measurements from the Bavaria agency for the environmental protection, both found that the intensity of radiation was a factor of 100 higher in the inner area as compared to the outer area. The measurements of all transmitter stations show that the intensity of radiation from the cell phone transmitter station in Naila in the inner area was higher than the other measurement shown in the previous studies of electromagnetic fields from radio, television or radar (14).

The study StSch 4314 from the ECOLOG Institute indicates an association between a vertical and horizontal distance from the transmitter station and expected radiation intensity on the local people (16). The reason for setting a distance of 400m for the differentiation point is partly due to physical considerations, and partly due to the study of Santini *et al.* who chose 300m (10).

Data Gathering

Similar residential streets in the inner area and outer areas were selected at random. The large old people's home in the inner area was excluded from the study because of the age of the inhabitants. Data gathering covered nearly 90% of the local residents, because all four GPs in Naila took part in this study over 10 years. Every team researched the names of the patients from the selected streets that had been ill with tumours since 1994. The condition was that all patients had been living during the entire observation time of 10 years at the same address.

The data from patients was handled according to data protection in an anonymous way. The data was evaluated for gender, age, tumour type and start of illness. All cases in the study were based on concrete results from tissue analysis. The selection of patents for the study was always done in exactly the same way. Self-selection was not allowed. Also the subjective opinion of patients that the radio mast detrimentally affected their health has not affected this study. Since patients with cancer do not keep this secret from GPs, it was possible to gain a complete data set.

Population study

In the areas where data was collected 1,045 residents were registered in 31.12.2003. The registration statistics for Naila at the beginning of the study (1.1.1994) show the number of old people in the inner and outer areas, as shown in Table 1. The average age at the beginning of the study (1.1.1994) in both the inner and outer areas was 40.2 years. In the study period between 1994-2004, 34 new cases of cancer where documented out of 967 patients (Table 3). The study covered nearly 90% of local residents.

	female	male	total
Inner area	41.48	38.70	40.21
Outer area	41.93	38.12	40.20
Naila total	43.55	39.13	41.45

Table 1 : Overview of average ages at the beginning of the study in 1994

1994	inner 22.4%	outer 2.8%	Naila total 24.8%
2004	inner 26.3%	outer 26.7%	

Table 2 : Proportion of patients aged over 60

The average age of the residents in Naila is one year more than that of the study due to the effects of the old people's home. From the 9,472 residents who are registered in Naila, 4,979 (52.6%) are women and 4,493 (47.4%) are men. According to the register office, in 1.1.1994 in the outer area, the percentage was 45.4% male and 54.5% female, and in the inner area 45.3% male and 54.6% female. The number of people who are over 60 years old is shown in Table 2.

The social differences in Naila are small. Big social differences like in the USA do not exist here. There is also no ethnic diversity. In 1994 in Naila the percentage of foreigners was 4%. Naila has no heavy industry, and in the inner area there are neither high voltage cable nor electric trains.

Results

Results are first shown for the entire 10 year period from 1994 until 2004. Secondly, the last five-year period 1999 to 2004 is considered separately.

Period 1994 to 2004

As a null hypothesis it was checked to see if the physical distance from the mobile transmission mast had no effect on the number cancer cases in the selected population, *ie* that for both the group nearer than 400 metres and the group further than 400 metres the chance of developing cancer was the same. The relative frequencies of cancer in the form of a matrix are shown in Table 3. The statistical test method used on this data was the chi-squared test with Yates's correction. Using this method we obtained the value of 6.27, which is over the critical value of 3.84 for a

Period 1994-2004	Inner area	Outer area	total
new cases of cancers	18	16	34
with no new cancer	302	631	933
total	320	647	967

Table 3 : numbers of patients with and without cancers, 1994-2004

statistical significance of 0.05).

This means the null hypothesis that both groups within the 400-metre radius of the mast and beyond the 400 metre radius, have the same chance of developing cancer, can be rejected with a 95% level of confidence. With a statistical significance of 0.05, an even more significant difference was observed in the rate of new cancer cases between the two groups.

Calculating over the entire study period of 1994 until 2004, based on the incidence matrix (Table 3) we arrive at a relative risk factor of 2.27 (quotient of proportion for each group, *eg* 18/320 in the strongly exposed inner area, against 16/647 in the lower exposed comparison group). If expressed as an odds ratio, the relationship of the chance of getting cancer between strongly exposed and the less exposed is 2.35.

The following results show clearly that inhabitants who live close to transmitter antennas compared to inhabitants who live outside the 400m zone, double their risk of developing cancer. In addition, the average age of developing cancer was 64.1 years in the inner area whereas in the outer area the average age was 72.6 years, a difference of 8.5 years. That means during the 10 year study that in the inner area (within 400 metres of the radio mast) tumours appear at a younger age.

In Germany the average age of developing cancer is approximately 66.5 years, among men it is approximately 66 and among women, 67 (18).

Over the years of the study the time trend for new cancer cases shows a high annual constant value (Table 4). It should be noted that the number of people in the inner area is only half that of the outer area, and therefore the absolute numbers of cases is smaller.

Table 7 shows the types of tumour that have developed in the cases of the inner area.

Period 1994 to 1999

No. of cases of tumours per year of study	inner area: of the 320 people		outer area: of the 647 people	
	total cases	per 1,000	total cases	per 1,000
1994	—	—	I	1.5
1995	—	—	—	—
1996	II	6.3	I	1.5
1997	I	3.1	III	4.6
1998	II	6.3	III	4.6
1999	II	6.3	I	1.5
2000	IIIII	15.6	I	1.5
2001	II	6.3	II	3.1
2002	II	6.3	II	3.1
2003-3/2004	II	6.3	II	3.1

Table 4 : Summary of the total tumours occurring per year (no. and per thousand)

Period 1994-1999	Inner area	Outer area	total
new cases of cancers	5	8	13
with no new cancer	315	639	954
total	320	647	967

Table 5 : numbers of patients with and without cancers, 1994-1999

For the first five years of the radio transmission mast operation (1994-1998) there was no significant increased risk of getting cancer within the inner area as compared to the outer area (Table 5).

Period 1999 to 2004

Under the biologically plausible assumption that cancer caused by detrimental external factors will require a time of several years before it will be diagnosed, we now concentrate on the last five years of the study between 1999 and 2004. At the start of this period the transmitter had been in operation for 5 years. The results for this period are shown in Table 6. The chi-squared test result for this data (with Yates's correction) is 6.77 and is over the critical value of 6.67 (statistical significance 0.01). This means, with 99% level of confidence, that there is a statistically proven difference between development of cancer between the inner group and outer group. The relative risk of 3.29 revealed that there was 3 times more risk of developing cancer in the inner area than the outer area during this time period.

Period 1999-2004	Inner area	Outer area	total
new cases of cancers	13	8	31
with no new cancer	307	639	946
total	320	647	967

Table 6 : numbers of patients with and without cancers, 1999-2004

The odds-ratio 3.38 (VI 95% 1.39-8.25, 99% 1.05-10.91) allows us with 99% confidence to say that the difference observed here is not due to some random statistical effect.

Discussion

Exactly the same system was used to gather data in the inner area and outer areas. The medical chip card, which has been in use for 10 years, enables the data to be processed easily. The four participating GPs examined the illness of 90% of Naila's inhabitants over the last 10 years. The basic data for this study were based on direct examination results of patients extracted from the medical chip cards, which record also the diagnosis and treatment. The study population is (in regards to age, sex and cancer risk) comparable, and therefore statistically neutral. The study deals only with people who have been living permanently at the same address for the entire study period and therefore

Type of tumour (organ)	no. of tumours found	total expected	incidence per 100,000	ratio inner: outer
breast	8	5.6	112	5:3
ovary	1	1.1	23	0:1
prostate	5	4.6	101	2:3
pancreas	m 3 f 2	0.6 0.9	14 18	2:1 1:1
bowel	m 4 f 0	3.7 4.0	81 81	2:2 0:0
skin melanoma	m 1 f 0	0.6 0.7	13 14	1:0 0:0
lung	m 3 f 0	3.6 1.2	79 24	2:1 0:0
kidney	m 2 f 1	1.0 0.7	22 15	1:1 1:0
stomach	m 1 f 1	1.2 1.1	27 23	0:1 0:1
bladder	m 1 f 0	2.0 0.8	44 16	0:1 0:0
blood	m 0 f 1	0.6 0.7	14 15	0:0 1:0

Table 7 : Summary of tumours occurring in Naila, compared with incidence expected from the Saarland cancer register

have the same duration of exposure regardless of whether they are in the inner area or outer area.

The result of the study shows that the proportion of newly developing cancer cases was significantly higher ($p<0.05$) among those patients who had lived during the past ten years within a distance of 400 metres from the cellular transmitter site, which has been in operation since 1993, in comparison to people who live further away. Compared to those patients living further away, the patients developed cancer on average 8.5 years earlier. This means the doubled risk of cancer in the inner area cannot be explained by an average age difference between the two groups. That the transmitter has the effect that speeds up the clinical manifestations of the illness and general development of the cancer cannot be ruled out.

In the years 1999-2004, *ie* after five years and more of transmitter operation, the relative risk of getting cancer had trebled for the residents of the area in the proximity of the mast compared to the inhabitants of Naila in the outer area ($p>0.01$). The division into inner area and outer area groups was clearly defined at the beginning of the study by the distance to the cell phone transmission mast. According to physical considerations people living close to cellular transmitter antennas were exposed to heightened transmitted radiation intensity.

Both calculated and empirical measurements revealed that the intensity of radiation is 100 times higher in the inner area compared to the outer area. According to the research StSch 4314 the horizontal and vertical position in regards to the transmitter antenna is the most important criterion in defining the radiation intensity area on inhabitants (16).

The layered epidemiological assessment method used in this study is also used in assessment of possible chemical environmental effects. In this case the layering is performed in regards to the distance from the cell phone transmitter station. Using this method it has been shown that there is a significant difference in probability of developing new cancers depending on the exposure intensity.

The number of patients examined was high enough according to statistical rules that the effects of other factors (such as use of DECT phones) should be normalised across the inner area and outer area groups. From experience the disruption caused by a statistical confounding factor is in the range between 20% and 30%. Such a factor could therefore in no way explain the 300% increase in new cancer cases. If structural factors such as smoking or excessive alcohol consumption are unevenly distributed between the different groups this should be visible from the specific type of cancers to have developed (*ie* lung, pharyngeal or oesophageal). In the study inner area there were two lung cancers (one smoker, one non-smoker), and one in the outer area (a smoker), but no oesophageal cancers. This rate of lung cancer is twice what is statistically to be expected and cannot be explained by a confounding factor alone. None of the patients who developed cancer was from a family with such a genetic propensity.

Through the many years experience of the GPs involved in this study, the social structures in Naila are well known. Through this experience we can say there was no significant social difference in the examined groups that might explain the increased risk of cancer.

The type and number of the diagnosed cancers are shown in Table 7. In the inner area the number of cancers associated with blood formation and tumour-controlling endocrine systems (pancreas), were more frequent than in the outer area (77% inner area and 69% outer area).

From Table 7, the relative risk of getting breast cancer is significantly increased to 3.4. The average age of patients that developed breast cancer in the inner area was 50.8 years. In comparison, in the outer area the average age was 69.9 years, approximately 20 years less. In Germany the average age for developing breast cancer is about 63 years. The incidence of breast cancer has increased from 80 per 100,000 in the year 1970 to 112 per 100,000 in the year 2000. A possible question for future research is whether breast cancer can be used as a 'marker cancer' for areas where there is high contamination from electromagnetic radiation. The report of Tynes *et al.* described an increased risk of breast cancer in Norwegian female radio and telegraph operators (20).

To further validate the results the data gathered were compared with the Saarland cancer register (21). In this register all newly developed cancers cases since 1970 are recorded for each Bundesland. These data are accessible via the Internet. Patents that suffer two separate tumours were registered twice, which increases the overall incidence up to 10%. In this

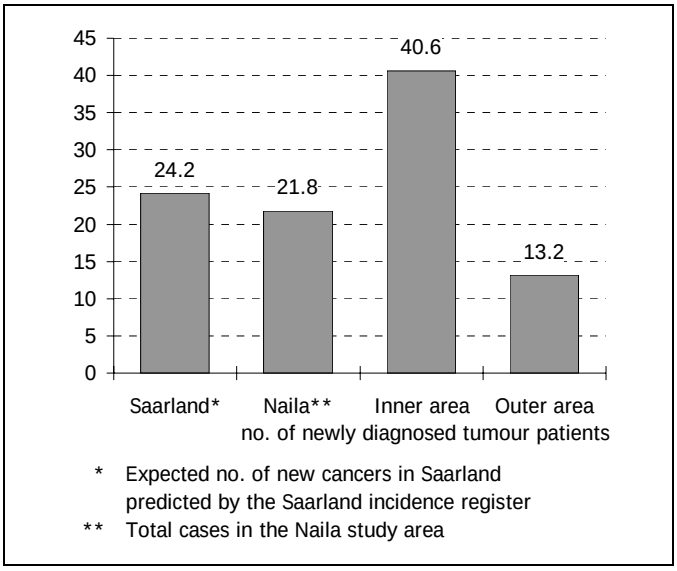

Fig. 3 : Number of new cancer cases 1999 to 2004, adjusted for age and gender, calculated for the 5,000 patient years

register there is no location-specific information, for instance proximity to cell phone transmission masts. The data in the cancer register therefore reflect no real control group but rather the effect of the average radiation on the total population.

From the Saarland cancer register for the year 2000 the incidence of new cancer cases was 498 per 100,000 for men and 462 per 100,000 for women. When adjusted for age and sex one would expect a rate of between 480 and 500 per 100,000 in Naila. For the years 1999 to 2004 there were 21 new cases of cancer among 967 patients. The expected number was 24 cases per 1,000 patients.

The results of the study are shown graphically in Fig. 3. The bars of the chart represent the number of new cancer cases per 1,000 patients in the separate areas, over the five years (bars 2 to 4). The first bar represents the expected number from the Saarland cancer register.

In spite of a possible underestimation, the number of newly developed cancer cases in the inner area is more than the expected number taken from the cancer register, which represents the total population being irradiated. The group who had lived during the past five years within a distance of 400 m from the cellular transmitter have a two times higher risk of developing cancer than that of the average population. The relative risk of getting cancer in the inner area compared with the Saarland cancer register is 1.7 (see to Table 7).

Conclusion

The result of this retrospective study in Naila shows that the risk of newly developing cancer was three times higher among those patients who had lived during past ten years (1994-2004), within a distance of 400m from the cellular transmitter, in comparison to those who had lived further away.

Cross-sectional studies can be used to provide the decisive empirical information to identify real problems. In the 1960s just three observations of birth deformities were enough to uncover what is today an academically indisputable Thalidomide problem.

This study, which was completed without any external financial support is a pilot project. Measurements of individual exposure as well as the focused search for further side effects would provide a useful extension to this work, however such research would need the appropriate financial support.

The concept of this study is simple and can be used everywhere, where there it a long-term electromagnetic radiation from a transmitting station.

The results presented are a first concrete epidemiological sign of a temporal and spatial connection between exposure to GSM base station radiation and cancer disease.

These results are, according to the literature relating to high frequency electromagnetic fields, not only plausible and possible, but also likely.

From both an ethical and legal standpoint it is necessary to immediately start to monitor the health of the residents living in areas of high radio frequency emissions from mobile telephone base stations with epidemiological studies. This is necessary because this study has shown that it is no longer safely possible to assume that there is no causal link between radio frequency transmissions and increased cancer rates.

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Footnotes

(1) HAIDER, M., KUNDI, M., KNASMÜLLER. S., HAIDER,T., GROLL KNAPP, E. & G. OBERMEIER (1993): Medizinisch-hygienische Untersuchungen und Beurteilungen der Kurzwellensendeanlage Moosbrunn, Institut für Umwelthygiene,Universität Wien.

(2) ABELIN, T., ALTPETER, E.S., PFLUGER, D.H., KREBS, T., KÄNEL, J.V., STÄRK, K. & C. GRIOT (1995): Gesundheitliche Auswirkungen des Kurzwellensenders Schwarzenburg, BEW Schriftenreihe Studie Nr. 56 (BEW: Bundesamt für Energiewirtschaft).

(3) MASKARINEC, G., COOPER, J. & L. SWYGERT (1994): Investigation of increased incidence in childhood leukemia near radio towers in Hawaii: Preliminary observations, J. Environ. Pathol.Toxicol. and Oncol. 13: 33-37.

(4) HOCKING, B., GORDON, IR., GRAIN HL. et al. (1996): Cancer Incidence and Mortality and Proximity to TV-Towers. Med. J. Australia 165, 11-12: 601-605.

(5) DOLK, H., SHADDICK, G.,WALLS, P., GRUNDY, C., THAKRAR, B., KLEINSCHMIDT, I. & P. ELLIOT (1997a):Cancer Incidence Near Radio and Television Transmitters in Great Britain, Part 1. Sutton Coldfield Transmitter, Am. J. Epidemiol. 145: 1-9.

(6) DOLK, H., ELLIOT, G., SHADDICK, G., WALLS, P. & B. THAKRAR (1997b): Cancer Incidence Near Radio and Television Transmitters in Great Britain, Part 2. All High Tower Transmitters, Am. J. Epidemiol. 145: 10-17.

(7) CHERRY, N. (1999): Critism of the proposal to adopt the ICNIRP guidelines for cellsites in New Zealand, ICNIRP Guideline Critique, Lincoln University, Environmental Management and Design Division, Canterbury, NZ.

(8) MICHELOZZI, P., CAPON, A., KIRCHMAYER, U., FORASTIERE, F., BIGGERI, A., BARCA, A. & C.A.PERUCCI (2001):Department of Epidemiology.Local Health Authority RME Rom, Italy.

(9) GOLDSMITH, JR. (1997): European EpiMarker 2(4): 4-7; Lilienfeld 1978 Final report US Dept. of State, NTIS PB-288163, 1978.

(10) SANTINI, R., SANTINI, P., DANZE, J. M., LE RUZ, P. & SEIGNE,M. (2002): Symptoms experienced by people living in vicinity of cell phone base stations: I. Incidences of distance and sex, Pathol. Biol. 50: 369-373.

(11) KUNDI, M. (2002): Erste Ergebnisse der Studie über Auswirkungen von Mobilfunk-Basisstationen auf Gesundheit und Wohlbefinden. Bericht des Instituts für Umwelthygiene der Universität Wien.

(12) NAVARRO EA., SEGURA J., PORTOLES M., GOMEZ-PERRETTA de MATEO C. (2003): Das Mikrowellensyndrom: Eine vorläufige Studie in Spanien. Electromagnetic Biology an Medicine (früher: Electro- and Magnetobiology) 22(2): 161-169,www.grn.es/electropolucio/TheMicrowaveSyndrome.doc.

(13) BROCKHAUS (1973): abc Physik, VEB F.A. Brockhaus Verlag, Leipzig: 991 ff.

(14) EGER, H., HAGEN, K.U., LUCAS, B., VOGEL, P. & H. VOIT (2004): Einfluss der räumlichen Nähe von Mobilfunk-sendeanlagen auf die Krebsinzidenz,Tabellarischer Teil, unveröffentlicht, Naila

(15) Regulierungsbehörde für Post und Telekom (oJ): Standortbescheinigungen,

(16) ECOLOG-INSTITUT (2003): Bestimmung der Exposition von Personengruppen, die im Rahmen des Projektes "Querschnitts-studie zur Erfassung und Bewertung möglicher gesund-heitlicher Beeinträchtigungen durch die Felder von Mobilfunkbasisstationen" untersucht werden, Berichtszeitraum: 1.2.2003 bis 31.5.2003, Förderkennzeichen: StSch 4314, ECOLOG-Institut für sozial-ökologische Forschung und Bildung gGmbH, Hannover.

(17) KLEINBAUM, D.G., KLEIN, M. (2002): Logistic Regression - A. Self - learning text, Springer Verlag

(18) AG BEVÖLKERUNGSBEZOGENER KREBSREGISTER IN DEUTSCHLAND (Hrsg.) (2004):Krebs in Deutschland, 4. überarb., akt.Ausgabe, Arbeitsgemeinschaft bevölkerungs-bezogener Krebsregister in Deutschland in Zusammenarbeit mit dem Robert Koch-Institut, Saarbrücken.

(19) LEGATOR, M.S. & B. STRAWN (1998): Umwelt-Risiko: Chemie, Haug-Verlag.

(20) TYNES, I., HANNEVIK, M., ANDERSEN, A., VISTNES, AI. & HALDORSEN T. (1996): Incidence of breast cancer in Norwegian female radio and telegraph operators. Cancer Causes Control 7: 197-204.

(21) www.krebsregister.saarland.de

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Evening Standard.
WEBSITE OF THE YEAR

News

Orange to remove mobile mast from ’tower of doom’, where cancer rate has soared

Monday 6 August 2007 23:37 |

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John Llewellin: Died last month

Three have died and another four have battled the disease since two masts were erected on the roof of the five-storey block which has become known locally as the Tower of Doom.

The cancer rate on the top floor - where residents of five of the eight flats have been affected and the three who died all lived - is 20 per cent, ten times the national average.

Residents of Berkeley House in Staple Hill, Bristol, also complain of terrible headaches and other ailments which they blame on radiation from the masts.

Evening Standard.
WEBSITE OF THE YEAR

Orange has agreed to remove its mast after a five-year campaign by residents and pressure from the local authority. But it has caused anger with plans to move it to a residential street nearby.

The other mast belongs to Vodafone, which has no plans to move it.

The most recent death was that of John Llewellin, 63, who lost his battle against bowel cancer two weeks ago.

Scroll down for more

Anger: The mast (circled) on the block known to locals as the Tower of Doom

Two years ago, Barbara Wood died in her 70s from breast cancer. Two years earlier Joyce Davies died, also from breast cancer.

Danger zone: Residents at this Bristol flat have suffered illness and death

The other victims on the top floor are Hazel Frape, 63, who has had breast cancer, and 89-year-old Phyllis Smith who moved out after she contracted the same disease.

On the fourth floor Bernice Mitchell, 69, has battled womb cancer. On the second floor, 78-year-old Barbara Watts, who has lived in the block for 31 years, is in remission from breast cancer.

Many of the 110 residents, including Doreen Sheppard, 74, have complained of headaches and other health problems.

She said: "The masts are bound to be doing something. I get terrible headaches and I've started suffering from Meniere's disease, where I lose my balance. I'm worried about the children on the estate as there are so many of them now."

Both masts were erected in 1994. South Gloucestershire Council served a notice asking for them to be removed when the ten-year contract expired three years ago.

But because current guidelines say there is no risk from radiation the council does not have a legal right to force their removal.

Evening Standard.
WESTFIELD STRATFORD CITY

After a long legal battle Orange has submitted a planning application to put the mast on top of a shopping precinct in a street near homes, a primary school and a public library.

Left alone: Moira Llewellin's husband died of cancer, one of three flat residents to die

Jeanette McCormack, 69, who has led a campaign against the mast, said a petition against the new location had gathered more than 200 names.

She added: "People of all ages who live and work near the mast will be exposed to the radiation and so there's a lot of anger about it."

World Health Organisation guidelines have dismissed the risks of masts despite other evidence which has found they are harmful.

A spokesman for Orange said the company takes health and safety very seriously.

Evening Standard.
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He added that the company was satisfied its mobile phone base stations do not present a health risk.

Vodafone is working on a new longterm lease from South Gloucestershire Council. A spokesman said the company took residents' concerns "extremely seriously" and would continue to work with them and the council to provide reassurance.

Up, up and away: Orange's controversial mobile phone mast will be no longer be a blot on the landscape

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Powerwatch is a small non-profit independent organisation with a central role in the UK EMF and Microwave Radiation health debate. We work with other like-minded groups and with decision-makers in government and business, promoting policies for a safer environment. We have been researching EMF effects on health for over 20 years, and provide information to help people understand these complex issues.

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Children with Cancer UK are holding a three day conference in September on the causes of child, teenage and young adult cancer, and the way forward regarding both its treatment and prevention.
2018-08-29

Internal science database made available

We had added a link to a search facility that is integrated with our science database
2018-07-16

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Legal precedent challenges legal status quo on mast planning permissions

A landmark high court judgment has been made this month finding that pole mounts for mobile antennae are to be classified as masts and as such require specific planning permission.
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Exposure Limits for Radiofrequency Energy: Three Models

Kenneth R. Foster
Department of Bioengineering, University of Pennsylvania, Philadelphia PA 19104 USA

Introduction

This Conference is entitled "Criteria for EMF Standards Harmonization". Harmonization, used in the present context, is the process of reducing the large discrepancies in EMF exposure standards that are in effect throughout the world.

For many years, these differences were most apparent between limits of Russia and most of Eastern Europe (which originated in the days of the Soviet Union and the Warsaw Pact) and those of the United States and West Europe. This situation has become even more complicated with the recent adoption of "precautionary" limits by Switzerland, Italy, and a few other countries. Behind these differences are large differences in perception of science and health protection.

Before any "harmonization" can succeed, it is necessary first to understand the differences among these approaches. I focus on exposure guidelines to radiofrequency (RF) energy in the range around 1-2 GHz, which is used by mobile telephones (and a host of other applications).

Science-Based vs. Precautionary Limits

The Table below compares five different exposure limits for RF energy at 2000 MHz (similar to that used by many cellular telephones throughout the world). The limits are for long-term exposure to the general population.

Country	Limit for general public exposure to RF fields (2000 MHz) for extended periods of exposure, W/m^2 (applies to far-field exposure, extended duration)	Basis
ICNIRP (adopted in numerous countries worldwide)	10	Science-based
U.S. Federal Communications Commission (FCC)	10	Science-based
Bulletin 65, "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields", Washington DC 1997.		
Generally follows IEEE C95.1-1999 with some modifications		
China	0.1	Science-based

UDC 614.898.5 GB 9175 –88		
Russia	0.1	Science-based
Sanitary Norms and Regulations 2.2.4/2.1.8.055-96		
Switzerland	0.1	Precautionary
Ordinance on Protection from Non-ionising Radiation (NISV) of 23 December 1999		
Typical Maximum Exposure from Cellular Base Station Mounted on 50 m tower (assuming a total effective radiated power of 2500 watts in each sector, summed over all channels)	0.01	

Limits in the United States, most Western European countries, and many countries in other parts of the world follow IEEE C95.1-1999[1] or the (quite similar) ICNIRP limits.[2] Those in the Russian Federation, (together with most of its former Warsaw Pact allies), China, Switzerland, and a few other countries are as much as a hundred times lower. I identify these limits as "science-based" and "precautionary", reflecting major differences in philosophy and approach.

Science-based limits are based on expert evaluation of the scientific literature to identify potential adverse effects of exposure. The resulting limits are designed to exclude identified hazards with an appropriate margin of safety. I have identified three of the limits in the Table as science-based, in this sense.

- US and most Western European limits (IEEE C95.1-1999 and ICNIRP). The rationale for these limits has been spelled out at length in the documentation accompanying the standards. These limits were based on an extensive review of the scientific literature to identify potentially hazardous effects and their thresholds. For example, in designing IEEE C95.1, "the most sensitive measures of potentially harmful biological effects were based on the disruption of ongoing behavior associated with an increase of body temperature in the presence of electromagnetic fields." Because of the "paucity of reliable data on chronic exposures", most of the literature concerned short-term (hours or less) exposure to RF energy. The hazards that are identified in the documentation are, for the most part, thermal in nature. The "averaging times" in the limits are short (6 to 20 minutes) and reflect thermal considerations.[3]
- Russian, Chinese, and most East European limits The Table shows a major Russian limit (Sanitary Norms and Regulations 2.2.4/2.1.8.055-96). The rationale for these limits is not described in the standard itself.[1] There is, however, a considerable body of commentary about the Russian and Eastern European standards by scientists who have been professionally involved in RF health and safety studies, including some by Russian and East European scientists (e.g. [4 5 6 7 8 9]).

[1] I thank Dr. A.G. Pakhomov for providing an English translation of the present Russian standard (SanPin 2.2.4/2.1.8.055-96).

The Russian (and several Eastern European) limits are clearly not designed principally to protect against thermal hazards. Their limits are far below thermally significant levels. More strikingly (from the perspective of Western limits) they embody the concept of dose, i.e. the incident power density multiplied by time, in a way that is unrelated to any conceivable thermal hazard. One Russian authority indicated that the limits of the Russian Federation for RF exposure at the frequencies used by wireless communications were set on the basis of biological experiments that found that a 3-hr daily exposure at 250 $\mu W/cm^2$ (950 MHz) could be regarded as a threshold for harmful physiological effects in experimental animals.[10]

Thus, Russian (and Eastern European) limits clearly reflect the conviction that long-term (hours or more) exposures at levels far below Western limits result in adverse health effects. Indeed, the Russian and Eastern European medical literature contains many reports of health effects from low-level exposure to RF energy. These include, for example, nonspecific problems (such as headaches, fatigability, irritability, sleep disorders, and dizziness) in workers in radio factories, who are exposed to RF energy at undetermined levels[11 12]. The Chinese literature contains similar reports.[13] The Russian literature contains references to a "microwave disease" characterized by "asthenic, asthenovegetatic, and hypothalamic syndromes"[14] The disease is not recognized in Western medicine, and its diagnostic criteria would undoubtedly strike many Western physicians as vague and nonfalsifiable. Even some Eastern European physicians have complained about the nonspecificity of these criteria as well.[15 16]

The large difference, between Russian and Eastern European exposure limits and those in the U.S. and most of Western Europe, is of longstanding duration. The latest Russian exposure standards (1996, 1997) are essentially identical to previous ones (1976, 1978, 1984). While IEEEC95.1 has evolved over the years, this has largely been a result of engineering calculations and a desire to provide a higher level of protection to nonoccupational groups, and not as a result of changes in the scientific understanding of the hazards involved.

Precautionary limits. Recently, Italy, Switzerland, and a few other countries have instituted exposure limits that are based on a totally different approach, the precautionary measures. Unlike science-based standards such as IEEE C95.1-1999, the ICNIRP limits, or the Russian limits (which are designed to avoid identified hazards), the Swiss limits were, in the words of the explanatory document accompanying the limits, "specifically intended to minimise the yet unknown risks" of RF and power-frequency electromagnetic fields.

The Swiss exposure guidelines were set at the lowest levels that were felt to be technically and economically feasible. In practice, that meant reducing the ICNIRP limits by a factor of 10 (in field strength) or 100 (in power density). (The law, however, is quite complex, with distinctions between "immissions" and "emissions", identification of places of sensitive use, new and old installations, etc. The limits in the table above would apply to most residential areas and near schools and hospitals.)

The Swiss law appears to result, at least in part, from concerns of the public about the safety of mobile telephone base stations. Its limits are somewhat above the levels of RF energy exposure from typical base stations mounted on towers at conventional heights, but might exclude base stations mounted at lower elevations on buildings (not to mention many broadcast facilities, airport radars, and other high-powered transmitters). The Swiss limits do not apply to wireless handsets, or to medical or industrial exposures – all potential sources of far exposures than wireless base stations.

“Harmonization” – Can It Be Done?

“Harmonizing” RF exposure limits has long been a perceived need among standards setting committees, and is one major goal of the World Health Organization’s EMF Project. Such harmonization would help meet a variety of needs. It addresses the desire of the World Health Organization to provide a consistent level of health protection to different people around the world (WHO). It would also minimize some practical problems in implementing the limit. Not least, bringing exposure limits around the world into line would help reduce some of the political controversy connected with RF fields.

However, given the very large differences in different national guidelines, “harmonization” will be a difficult task – if it can be accomplished at all. At least two separate issues can be identified:

1. Harmonization of Science-Based Limits.

The most longstanding and best documented issue related to “harmonization” is the large difference between the groups of exposure limits of the West (such as ICNIRP and IEEE C95.1-1999) and those of the Russian Federation and Eastern Europe. The comments below are offered from a Western perspective.

Evaluating the Russian and East European scientific literature in this field has posed great problems for Western scientists, for at least two reasons apart from the obvious language issue.

One problem is the brevity of the descriptions of many reports of the studies. The research reports often lack crucial information such as the frequency and intensity of exposure, SAR, or descriptions of aspects of experimental design that would be needed to ensure the validity of the findings. Western health agencies and standards setting bodies generally consider only studies that meet minimum standards of reporting and methodology. For example, IEEE C95.1-1999 says that “only peer-reviewed reports of studies at SAR = 10 W/kg, which had received favorable engineering and biological validation, should be considered relevant to the assessment of risk from exposure to electromagnetic fields.” Thus, whatever the quality of the original studies may have been, many Russian and Eastern European studies would be excluded from consideration in the Western risk assessment process by virtue of inadequate documentation.

But also, many of the Russian and Eastern European studies appear to suffer from serious flaws and for that reason would carry little weight in the Western risk assessment process. For example, many of the Russian occupational health studies involving EMF are little more than case reports, as opposed to well-controlled studies that tested specific hypotheses. Many more suffer from extensive use of post hoc data analysis. That is, the investigators applied large batteries of tests to their subjects, and assumed that any variation in the results between the “exposed” and “control” individuals was a direct effect of RF exposure. (That may or not may be the case, depending on a host of considerations.) Of course, many Western studies contain similar flaws, and also have carried little weight in standards setting processes. But the combination of uncertain quality, together with inadequate reporting, is an impossible barrier.

Finally, many of the Russian and East European studies employ concepts that are unusual in Western medicine. For example, Vasilevskii et al[11] conclude, on the basis of EEG (electroencephalogram) and other tests, that workers exhaust the “functional reserves” of their central nervous system after 14 years of work with microwaves and other electromagnetic fields. The document that promulgates the Russian standard lists asthenic, astheno-vegetative, and hypothalamic syndromes as “clinical disorders resulting

from EMR [electromagnetic radiation] RF exposure".[17] Most Western health agencies would undoubtedly consider a "temporary disturbance in the homeostasis" of an individual to be vague and unquantifiable, and the criteria that have been used to diagnose it (eg. subtle changes in heart rate variability or EEG) to be nonspecific and having no clear health significance. But such concepts are familiar in Russian medicine, and the Russian and Eastern European literature on health effects of RF energy abounds with such concepts. Such differences stem in part from very different views about health and medicine.

Clearly, "harmonizing" Russian and US limits (for example) will be far more than a technocratic exercise. The differences between these science-based standards involve different medical traditions with different concepts of health and disease, and different standards of proof.

One useful first step would for different standards groups to sit down and decide on a uniform set of criteria for accepting scientific reports (publication in peer reviewed journals, appropriate exposure assessment, blinded study design, etc.), and then evaluate specific reports for inclusion or exclusion from consideration. Achieving convergence even in this preliminary step would be a worthwhile accomplishment.

A second useful step would be to identify Russian (and Chinese and other) studies that scientists involved with national standards setting process regard as demonstrating health effects of RF energy. These studies (which might be unpersuasive to Western risk assessors) should then be followed up by stronger studies with appropriate design and standards of reporting. Followup studies with superior design would be needed for any study, wherever in the world it was conducted, that suggested the existence of health hazards. Such studies, in the case of Russia, would probably have to be funded by Western health agencies, but should meet internationally accepted standards of design and reporting. Everybody would benefit from such studies.

Even more difficult will be reconciling "precautionary" limits in Switzerland and other countries, with science-based limits. The precautionary principle is well established in international law and enjoys widespread political support. However, it remains elusive in meaning and easily misused.[18] . And by their very nature, precautionary policies are set in the absence of scientific knowledge, not on the basis of such knowledge.

In a "Backgrounder" on the precautionary principle[19], the World Health Organization recommended that precautionary policies "be adopted only under the condition that scientific assessments of risk and science-based exposure limits should not be undermined by the adoption of arbitrary cautionary approaches. That would occur, for example, if limit values were lowered to levels that bear no relationship to the established hazards or have inappropriate arbitrary adjustments to the limit values to account for the extent of scientific uncertainty."

WHO noted that a variety of "precautionary" approaches (such as improved risk communication) can be taken to EMF regulation, apart from setting mandatory limits. WHO also noted that some European "precautionary" policies about EMF field regulation would seem to be inconsistent with recent commentary by the European Commission on the proper use of the principle.[20]

In the end, harmonization may come about from political and economic pressures rather than from scientific data. Recently, the Czech Republic revised its limits upwards, to those of ICNIRP, as part of the process of integration into the European Union. Other Eastern European nations, in their bids to join the EU, are considering similar changes.

References

[1] IEEE Standards Coordinating Committee 28 on Non-Ionizing Radiation Hazards: Standard for Safe Levels With Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 KHz to 300 GHz (ANSI/IEEE, 1999), The Institute of Electrical and Electronics Engineers, New York, 1992

[2] International Commission on Non-Ionizing Radiation Protection (1996) Health issues related to the use of hand-held radiotelephones and base transmitters. Health Phys. 70:587-593

[3] Foster KR, Lozano-Nieto A, Riu PJ, Ely TS (1998) Heating of tissue by microwaves: a model analysis. Bioelectromagnetics 19: 420-428

[4] McRee DI (1979) Review of Soviet/Eastern European research on health aspects of microwave radiation. Bull N Y Acad Med 55:1133-1151

[5] Szmigielski S (1989) Eastern European RF protection guides and rationales. In Lin JC (ed) Electromagnetic interaction with biological systems. Plenum Press: New York, pp. 221-244

[6] Sliney DH, Wolbarsht ML, Muc AM (1985) Differing radiofrequency standards in the microwave region --implications for future research. (Editorial) Health Phys 49:677-683

[7] Gajšek P, Pakhomov AG, Klauenberg BJ (2002) Electromagnetic field standards in Central and Eastern European countries: current state and stipulations for international harmonization. Health Phys. 82: (April 2002).

[8] Grigoriev Yu (1998) The Russian standards. In: Inaugural Round Table on World EMF Standards Harmonization, 18 Nov. 1998, Zagreb, Croatia, published by the WHO International EMF Project (available on the Internet at http://www.who.int/peh-emf/publications/standards_harmonization/zagreb_minutes_1998.pdf

[9] Marha K (1971) Microwave radiation safety standards in Eastern Europe. IEEE Trans Microw Theory Tech MTT-19:165-168

[10] Grigoriev YuG, Grigoriev OA, Nikonova KV, Pal'tsev YuP, Stepanov VS, Tischenko VA (1998) Standardization of EMFs from mobile radio communication systems: the state of the problem and rationale. Electromagnetic Fields: Biological Effects and Hygienic Standards. Abstracts of the International Meeting, 18-22 May, Moscow, Russia, p. 68

[11] Bielski J (1994) Bioelectrical brain activity in workers exposed to electromagnetic fields. Ann NY Acad Sci 724:435-437

[12] Vasilevskii NN, Suvorov NB, Sidorov YuA, Zueva NG (1994) Neurophysiological mechanisms of ecological stability:prognosis and biorhythm correction. Vestn Ross Akad Med Nauk (2):40-44

[13] Huai C (1983) Assessment of health hazard and standard promulgation in China. In: Biological effects and dosimetry of nonionizing radiation. Radiofrequency and microwave energies. Grandolfo M, Michaelson SM, Rindi A (eds) Plenum Press: New York, pp. 627-644

[14] Suvorov IM (1989) Clinical variants of the disease caused by exposure to radio-frequency electromagnetic fields. Gig Tr Prof Zabol 10:19-22

[15] Gluszcz M (1979) Difficulties in the certification of microwave disease. Med Przemyslowa 30:147-150

[16] Djordjevic Z, Kolak A, Djokovic V, Ristic P, Kelecevic Z (1983) Results of our 15-year study into the biological effects of microwave exposure. Aviat Space Environ Med 54:539-42

[17] Sanitary Rules and Norms (SanPin 2.2.4/2.1.8.055-96) (1996) Radiofrequency electromagnetic radiations (2.2.4. physical factors of industrial surroundings. 2.1.8. physical factors of the environment) p. 28

[18] Foster KR, Vecchia P, Repacholi MH (2000) Science and the precautionary principle. Science 288: 979-980

[19] World Health Organization (March 2000) Electromagnetic fields and public health cautionary policies (available on the WWW at http://www.who.int/peh-emf/publications/facts_press/EMF-Precaution.htm).

[20] Foster KR, Vecchia P, Repacholi MH (2000) Science and the precautionary principle. Science 288: 979-980

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EM Watch

Electromagnetic Radiation Health and Safety

EMF Survey Services

An EMF Survey is a thorough inspection of your home – or a house or flat you wish to buy or rent – for low-frequency and radio-frequency radiation.

The surveyor takes EMF measurements in each room in the house, especially where people spend most of their time bedrooms, sitting rooms, kitchens, dining rooms, and children's play areas.

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EMF hotspots indoors are often very localized, so they can affect one part of a house much more than another. Sometimes locations a foot or two apart can experience very different EMF levels.

Why Order an EMF Survey?

High EMF levels are associated with many undesirable health effects and more people are becoming aware of them.

The main advantage of an EMF survey is that it gives you dependable information you can take action on. It is your first step towards reducing biological stress on your family from harmful radiation.

Ideally, your home should be a low-EMF zone, a refuge from the high EMF levels found everywhere today, in public and private places.

But this is not always easy. You first need to know exactly where EMF levels are too high – and why – so that you can reduce the radiation (if this is possible) or take other steps to limit your exposure.

When to order an EMF Survey

One really good time to order an EMF survey is when you are thinking of buying a house, before you are committed to the contract.

There are also very strong reasons for ordering an EMF survey for a property you wish to sell, because it reduces buyer uncertainty and increases confidence.

But if you have not yet had your property tested for radiation, maybe now is the right moment?

It is important to spend most of your time in a place where EMF levels are low, because health effects from EMF exposure are cumulative.

Unfortunately, many people don't think about EMF levels in their home until someone in the household experiences an unexplained decline in health.

Who should perform your electromagnetic radiation survey?

You could do it yourself if you have suitable meters and are technically inclined, but a professional EMF surveyor may be better able to identify radiation sources and suggest how to deal with them.

There is no professional qualification or body which regulates electromagnetic radiation inspectors, so you will want to be confident that the person you choose is up to the job. Experience is the best teacher – so if you can, find someone who has done more than a few.

So how would we handle your EMF survey?

The EM Watch approach to EMF Surveys

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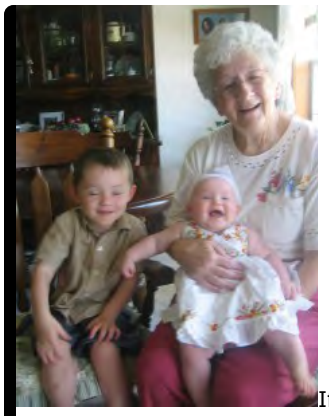
 If our client is the property owner or occupier, we will take measurements with radio-frequency transmitting devices switched on, and then switched off, to get a full picture of internal and external radiation sources.

If we are surveying a property on behalf of a buyer, we will request that all radio-frequency transmitting devices (such as mobile phones, wi-fi or cordless phones) be switched off, to allow us to concentrate on external sources.

The assessment will include these steps

- Check each room in the house for radio-frequency radiation
- For any hotspot found, consider EMF protection options, including radiation shielding
- Check each room for low-frequency radiation.
- Determine the source and extent of any EMF detected
- Check certain appliances for radiation
- Note any low-frequency EMF caused by wiring issues
- Check for EMFs from lighting and heating circuits, if appropriate
- Check for smart meter transmissions – if a smart meter is installed
- Check the garden for low-frequency and radio-frequency radiation.

An EMF survey can take up to two hours on site for a medium-sized (3-4 bed) house.

EMF Survey Report

Most of our clients require a written EMF Survey report. Often this is because they want to use the report and its conclusions to help them with an important decision, for example a property purchase.

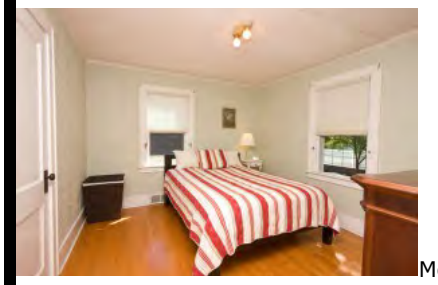
Our report will show all recorded radiation measurements, and indicate a level of concern for each one. These measurements serve as a useful record of the survey findings, and make future comparisons possible.

We also comment on any EMF levels which are unusually high or low. And where EMF levels could represent a health hazard, we are often able to recommend action to reduce exposure.

We email the survey report to our client, usually on the day after inspection.

We also answer any questions arising out of the survey or the report, until the client is satisfied.

Common EMF Survey Findings

 More often than not, when we perform an EMF home survey, we find elevated radiation levels in some parts of the home.

Sometimes these hotspots can be eliminated by switching off appliances or electronic devices – at least at night when they are not in use.

Where radio-frequency radiation enters from outside (for example from a mobile phone mast), it may be possible to screen certain windows with special net curtain material, or window film, to reduce the penetration.

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Radio-frequency sources inside the house can often be re-positioned or partially screened to reduce radiation to more acceptable levels.

Low-frequency radiation can't be screened, but it is still helpful to know about it, and how far it extends from the source – so that exposure can be minimised.

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EMF Survey Enquiry Form

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Please enter answer below: 11 + 12 = ?

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Here are some of the major population centres in the areas we service.

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Arun	West Sussex
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Barking and Dagenham	Greater London
Barnet	Greater London
Basildon	Essex
Basingstoke and Deane	Hampshire
Bath and North East Somerset	Somerset
Bedford	Bedfordshire

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Camden	Greater London
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Chelmsford	Essex
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Colchester	Essex
Crawley	West Sussex
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Please don't ignore high EMF levels in your home. You need to measure them so that you can deal with them. Use the contact form above to request your free UK Home EMF Survey quotation with no obligation.

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Testimonials

Just a quick note to say thanks very much for conducting the EMF survey. The content of the report is thorough and gives us peace of mind regarding the risks of the sub station. We would definitely recommend you to others!

Susan S. *Surrey*

I had concerns about a property we were thinking of moving to as there was an electricity pole nearby, so I contacted EM Watch for a survey. I found them very helpful over the phone, explaining what the procedure would be and what the survey would show. I was present during the survey and Robert patiently showed me the readings and explained what they meant. The whole service from beginning to end was efficient and fast and I understood the written report that was sent to me the next day. I wholeheartedly recommend EM Watch and the service they provided.

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Sarah M *Kent*

Thank you for the reports you e-mailed yesterday. We are very happy with the prompt service and thorough survey. Much appreciated.

Colin W. *London*

Thank you for carrying out this survey, and for the comprehensive write up. It has been very helpful. The detailed info provided makes it worth the money. I appreciated that it was arranged promptly and with no hassles. Thanks again for a great service – sorry we didn't get to meet but I would not hesitate to recommend you to anyone else with interest in these kinds of evaluations.

Julian *Buckinghamshire*

As a couple with a very young son, we were very concerned whilst buying our first home to discover from the conveyancing searches just how close both our house-to-be and our son's nursery-to-be was to both electricity pylons and a mobile phone mast. We were a phone call away from aborting the entire purchase until we contacted EM Watch, more out of hope than expectation, or indeed any knowledge of EMF surveys, that they might be able to help in the short time available.

Robert was more than helpful in arranging a visit with the selling estate agent himself, travelling to the property (and even the two nurseries that we had in mind in the area), and performing a very thorough inspection and explaining the results to us laymen in a very easily digested way with practical suggestions for mitigating the (thankfully minimal) risks to our health. Much to our relief, the results gave us enough peace of mind to continue with the purchase.

Henry W. *Surrey*

Robert came out to survey the property I wanted to buy very promptly. He is extremely knowledgeable about emf and produced a comprehensive report about emf readings in the house (as I was concerned about the impact of a substation close by). He answered the many, many questions I had. I would definitely call Robert again if ever I am concerned about emf.

Carol J. *London*

Many thanks for sending the report across so promptly. I have read through all the documents you have sent through and I have no further questions - it is all very helpful and very useful for putting the mind at ease, particularly as house buying can be so stressful! And I can also see the value of having this report if/when we come to sell the property.

Jenny B *Berkshire*

I was very happy with the service that I received from EM Watch. The response to my enquiries was exceptionally quick and the EMF survey was organised very promptly without me having to do that much co-ordinating. After the survey was carried out, Robert called me to take my through his findings prior to sending the report across. This offered further peace of mind which is so important when you are going through the house-buying process! I would definitely use Robert again if I ever needed an EMF survey again.

Adelle F. *Berkshire*

More Testimonials

This was a fantastic service and testing that I am so glad I decided to have done. Robert was brilliant, explaining exactly what he was doing and what the readings meant. I think it is important that people are aware and informed about what they are exposing themselves to and the potential consequences. His findings helped me in difficult decisions about whether to buy a property or not and I am very grateful.

Nancy R. *London*

I contacted EM Watch because I was worried about levels of EMF from a nearby power line. Robert carried out the survey, explained the results and made recommendations which were very practical and easy to implement. (Fortunately the power line was not a concern.)
I am very happy with the survey and now sleep much easier. I have no hesitation in recommending EM Watch to others who are concerned about EMF.

Dorothy L. *Gloucestershire*

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Thank you for your great work this week and for so quickly sending through the survey report, the knowledge you patiently imparted has helped me to feel a lot better about the whole area of EMF and I look forward to planning and implementing a comprehensive strategy to reduce all risk areas identified.

Simon H. *Surrey*

We found the service provided by EM Watch-Site Surveys as very thorough, informative and competitively priced. We had concerns around the proximity of an electrical sub-station to our potential house purchase. Robert was prompt, responsive and went above and beyond to ensure our satisfaction regarding an EMF survey. He provided a very detailed report with clear advice and recommendations. Would highly recommend to anyone with concerns over EMF.

Ian R. *Portsmouth*

Thank you very much for your very detailed report. I was impressed by your professionalism and prompt undertaking of this survey. My wife and I were slightly worried about the nearby substation and its possible impact with regard to EMF's on the property for ourselves (and our grandchildren who sometimes stay with us) that we were contemplating purchasing. Your survey has served to place our minds at rest and therefore we consider your fee good value for money removing any nagging doubt about this property. In addition I have printed it so it can be used when we come to sell the property. Thank you also for your telephone call on the afternoon of the visit, much appreciated.

James L. *Dorset*

I am very satisfied with the service offered by Robert at EM Watch. Having done some research online, we decided to get a EMF survey at a property we were in the process of purchasing because it had a substation located at the bottom of the garden. The process was very straightforward - Robert answered my questions quickly and clearly, and was able to book the appointment within a few days. On the day of the survey he telephoned to let me know how it had gone and provided the report the next day.

In our case, some of the readings were higher than we would have liked (owing to the cable running next to the house), so we needed a few days to reflect on this new information and in the end decided not to pursue the purchase. This was obviously very disappointing, but we are glad we had this information before exchanging contracts / completing the purchase, as it would have been very worrying to realise the potentially harmful levels of radiation once we were already living there. Thanks Robert for your prompt and professional service.

Melissa K. *London*

Thank you very much for doing our EMF survey yesterday. It has given us a lot of reassurance about the phone masts and electricity pylons near us and we will certainly make some changes inside the house as you suggested to reduce radiation where we can.

Georgina L. *Surrey*

Thank you very much for your quick response. You are very kind and patient to give me information about EMF. I will read the report and go back to you if I don't understand but I am sure it is fine. Thank you for coming yesterday. I feel much better to purchase this property.

Yanisa C. *Kent*

EM Watch responded in a very timely fashion to our request for a survey, and this was much appreciated as time was of the essence prior to exchange of contracts. Robert was very professional and thorough in his approach to completing the EMF survey, and his findings helped to put our minds at ease regarding our planned house move.

Mary W. *Surrey*

I have read the survey thoroughly now, and don't have any follow up questions. You have made the complicated world of EMF a little easier to understand, so thank you for that. Your professionalism in this area is clear, and I would recommend your services to anyone without hesitation

Elliot T. *Norfolk*

In my communications with EM Watch I have found them to be prompt, courteous and helpful, and competitive in their pricing. The EMF report they produced for me for a house purchase was comprehensive, clearly written and reassuring. It was supported by sufficient background information to enable me to understand the implications of the report whilst managing to avoid the type of technical detail that would have made the report less transparent. I would happily recommend EM Watch.

Peter E. *Bristol*

Thanks for the visit yesterday and the prompt follow up - your report is most useful in helping us to understand the interpretation of the EMF readings. And I certainly found it helpful that we were able to discuss the implications of the readings as we went around with you. In general the results were reassuring but with the proviso that certain measures can be taken, particularly when it comes to the design of the house, to minimize EMF exposure.

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Thomas L. *Buckinghamshire*

Wow what an informative and detailed response. Thank you so much for taking the time to send this email to me. I appreciate the speed of your response too. As you know... when purchasing a property it really does help to keep things moving quickly. Thanks again for your help and for pointing us in the right direction.

Mike D. *Staffordshire*

Completely worthwhile, many thanks. I have read the report through and do find these readings most helpful in terms of making small changes which could make a difference. And thanks for getting this to me so quickly.

Amelia D. *Bristol*

We asked for an EMF Survey to be done as we were in the process of buying a property whose garden backs on to an Electric Substation. The Survey and Report was done very quickly. The Report contained readings from every room in the house and all points in the garden along with information to interpret the data. In addition there was a practical summary of the conclusions and recommendations. The Report put our minds at rest and we recommend doing this Survey if you have concerns about EMF.

Brennan C. *Hampshire*

Good to meet you too and thank you very much for your help it is greatly appreciated. I will definitely recommend you to friends. We have decided with heavy hearts to withdraw our offer from the house as it's a risk we don't need to take. The estate agent isn't very happy and says it's not that big of a deal but it is to us. Like you said in life you have to choose which risks to take and this isn't one of them! So thanks again for your words of wisdom also.

Jamie S *London*

I much enjoyed your visit to see me at home, and to conduct the EMF survey I requested. Thank you for your prompt follow up results of the findings you discovered in my property. I am looking forward to reading the report I have just printed. Once I have digested the information I may well come back to you with some follow up questions. With my best wishes and thanks for your help and advice with my queries about this property, I have already moved my modem successfully, to the new position suggested! I will see how things develop.

Roxanne C. *Shropshire*

I was extremely satisfied with the service and rapid response that I received from Robert at EM Watch. He reassured me that the substation next to my potential property was safe and I can now purchase the property with confidence!
Thank you once again.

Kevin H. *London*

Robert undertook an EMF survey for a prospective home purchase, specifically with regard to measuring low frequency radiation from a nearby electrical sub-station.
He carried out the survey promptly and explained the process and measurements in a clear way both during the survey and in the subsequent report.
I am extremely pleased with Robert's service. I have no hesitation in recommending him.

Kevin R. *Dorset*

The service EM Watch has provided was invaluable and has helped us make sensible decisions when buying a house. The survey was extremely high quality and professional. I believe people should be more aware of their environment and EM Watch has given me confidence to relax in the home I will purchase. I would use EM Watch in any future move and highly recommend the service.

Abigail C *Gloucestershire*

Robert was very informative and completed our EMF survey quickly.
He was able to reassure us about the purchase of a new property and any possible levels of radiation to worry about. Thank you Robert for all of your help.

Maria F. *London*

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Thank you very much for the EMF survey and report, which has been very helpful. I would definitely recommend the service provided by EM Watch. They carried out the survey and provided the report very quickly, and gave me all the information on EMF levels that I needed to make an informed decision about the house.

Julian M. *West Sussex*

Thank you, Robert. I found your service to be courteous, helpful, and efficient. The report itself is clear and informative and puts our mind at rest. Unfortunately, at the end of a busy week of liaising with several professional people including your good self, we have at the moment decided not to continue with our purchase, not because of the EMF report but because of other information we have garnered concerning the property. I am most happy to recommend your service to others.

Peter H. *West Sussex*

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EM Watch
Electromagnetic Radiation Health and Safety

Six EMF Protection Tips

How can you best protect yourself and your loved ones from unwanted electromagnetic fields?

As people spend over half of their time at home, this is where you may absorb more electromagnetic radiation than anywhere else. So for best EMF protection, make your home a low-EMF zone.

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Most of the EMF that people experience at home does NOT come from external sources (power lines, electrical sub-stations, cell phone towers and suchlike) but from electrical equipment and radio transmitting devices INSIDE their home.

These are the kinds of harmful EMF you may experience at home:

Low-frequency EMF comes mainly from mains electrical appliances and house wiring. Mains electricity alternates (cycles) 50 or 60 times a second, or Hertz (Hz).

That sounds fast, but in electromagnetic terms, it is very slow – and that is why it is called low-frequency EMF, or very low frequency (VLF), or extremely low frequency (ELF).

On this website, we just refer to it as low-frequency EMF.

Radio frequency EMF is mainly used for radio communications. These are energy waves which alternate very rapidly, often faster than 1,000,000,000 cycles per second, or 1 Gigahertz (GHz).

EMF Protection Tip 1 – Understand about EMF Penetration

Different EMF frequencies have different penetration qualities.

- Low frequency radiation does not bounce off walls or floors – it just goes straight through. In fact, it will penetrate anything – brick, metal, concrete, and you – without any trouble. Nothing blocks low-frequency EMF.
- Radio frequency radiation is blocked by many materials. A thick brick wall will stop most of it, a metal sheet will stop it completely. So it can be shielded.

But if you just put a metal sheet between two computers that are communicating wirelessly (by radio) they will still be able to talk to each other.

That's because radio waves bounce off surfaces which they cannot penetrate, like walls, floors and metal sheets, so the message will still get through, unless you block every possible path.

EMF Protection Tip 2 – EMF Gets Weaker with Distance

All EMF gets weaker with increasing distance, but with low-frequency EMF it gets weaker very rapidly. This is important because it means that you can often protect yourself against low-frequency EMF by simply getting a little further away from it.

Even a few inches can make a big difference with household electrical equipment.

Radio frequency EMF also gets weaker with increasing distance, only much more slowly. That is why radio frequencies are used for communication over a distance.

Moving a little further away is sometimes not a good option with radio-frequency EMF, because you can't get far enough away. In these circumstances it may be better to consider screening options.

EMF Protection Tip 3 – Keep 3 Feet Away from Appliances

Don't ignore the EMF which comes from electric appliances nearby. You may not be able to do anything about the power lines down the street, but you can make sure you stand further from the stove when cooking!

Assume that all electrical appliances, power tools, computers, motors, chargers, TVs etc. radiate low-frequency EMF. Small appliances can make large EMFs. For example, most battery chargers pack a powerful punch. This includes your cellphone charger.

Large appliances, such as refrigerators, may create a small or large EMF. Ovens, stoves, electric heaters and washing machines generally produce the most.

Here's a quick rule of thumb: expect a low-frequency EMF from a source within your house to extend 3 feet in all directions, unless you know otherwise. (Don't forget, this radiation goes through walls too.)

So keep three feet away from electrical wiring and appliances, where possible. (It is not always possible. An electric shaver is pretty useless when you hold it two feet away from your skin!)

EMF Protection Tip 4 – Switch OFF When Not in Use

Devices that generate radio waves have a much greater range – so expect that radio-frequency EMF from a source within your house will FILL your house!

We are talking about digital phones, wireless routers, wireless computers, and printers. Also microwave ovens, which in my experience, always leak substantial radio-frequency EMF.

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The Golden Rule here is to Switch Off When Not in Use.

Think about the electrical devices polluting your home with EMF right now. Are you actually using them right now?

Are your digital phones, wi-fi, computers and printers all chattering to each other, but doing nothing for you? Switch 'em off!

And please remember to turn everything off before you go to bed at night. That's good housekeeping, good for your budget, good for the planet, and good for your health!

EMF Protection Tip 5 – Stay Wired

Consider using wired phones in your house! For some people this is very difficult. We don't like to be constrained by wires. Some people like to walk around while talking on the phone!

But for the sake of your health it is worth it.

How about a wired computer network instead of wireless? My office is all wired. It's really not too bad, if you keep the wires tidy. But we may use wireless if we need to use a computer in an unusual location for a short while.

I have often been called in to do an EMF survey of a house which was close to a cell tower, or power lines, so the owners were anxious about EMF. Sure enough, I usually find plenty of EMF to warrant their concern, but most of it was coming from appliances INSIDE their house! Ironic, isn't it?

At least the cell towers go quiet during the night! But most types of digital phone never stop transmitting. So rather manage without them.

EMF Protection Tip 6 – Get an EMF Meter

People naturally find it very hard to be concerned about something that they can't see or feel, and doesn't seem to be doing them any harm.

The best tip I know for reducing your EMF exposure is to get an EMF meter. When you see your meter responding to radiation in your home it suddenly becomes much more real.

You can SEE the effect of switching on various appliances, or switching them off, or moving from one spot in your house to another.

Once you have a meter, you have a tool for monitoring and managing your EMF exposure. It is a pity that radio-frequency meters are relatively expensive, and not within everyone's reach. But if you can, make a plan to get one.

And most people can afford a low-frequency EMF meter. They can be had for as little as $30, although the best ones cost more.

Don't just think of how much you are spending. Also consider that you will be making an investment in your health.

And a meter helps you apply the first four EMF Protection Tips above.

More EMF Protection Tips

Each EMF Source has its own page on this site. There you will find more information about how to protect yourself, and your loved ones. And soon there will be reviews of shielding products that really work to reduce radio-frequency EMF.

So don't become a victim of EMF pollution. Reduce electromagnetic exposure!

And while we are talking about not becoming a victim, beware of gadgets that are claimed to reduce the harm done by electromagnetic radiation, including pendants, broaches, attachments for your cellphone and the like.

Nothing can soak up the radiation from a room either. That would be like putting something in a room and expecting it to absorb all the light and leave the room in darkness!

It sound ridiculous when you put it in those terms, but these gadgets are marketed very skilfully and convincingly, by experts in human psychology (not human biology).

Remember, anything which will genuinely benefit you must actually reduce your exposure to electromagnetic radiation. So only be convinced by test results that show a big reduction in EMF – performed and published by an independent lab.

Or if you are as sceptical as I am, take the measurements yourself.

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The city should buy this 811 page document download on 5G and be fully informed before you make a decision of placing them in our neighborhoods.

Hello, Jane!

There was such an outpouring of support for the PRINTED transcripts book (over 3,100 books ordered!), **we've decided to offer the eBOOK (PDF) version** -- this has never been offered before!

This 811-page, downloadable transcripts eBook is the literal transcription of the conversation between the experts, for every talk that was in the event schedule (all 42 of them!).

With a purchase of this eBook today for $24, you not only support the 8-month effort of more than 20 people that was *The 5G Crisis Summit*, but also the ongoing effort and what is yet to come!

We hope you take this opportunity to own the online, written version (PDF) of this event, not just for the incredibly important information it contained, but as an easy way to reference it for friends, family members and your community.

As you now know, the 5G wireless industry HAS NOT shown it to be safe for your health or privacy -- while THOUSANDS of peer-reviewed, independent studies show otherwise -- and they're building it anyway.

This information-packed eBook will not only remind you of the dangers 5G wireless

presents, but help you show your community that there are better solutions!

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Thank you for your tremendous support!

Your hosts,
Josh del Sol & Sayer Ji

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5G wireless… the industry HAS NOT shown it to be safe for your health or privacy – yet THOUSANDS of peer-reviewed, independent studies show the risks it presents. Learn about the dangers and find solutions in your community!

You may have heard of 5G, it stands for fifth-generation cellular wireless. In a February 2019 US Senate hearing, the wireless industry was forced to admit they have no safety studies on 5G, and don't plan to do any. Meanwhile, there are thousands of independent studies concluding that **wireless radiation causes biological harm.**

Despite this, the wireless industry is working with government to deploy 5G — it's a global, for-profit, human experiment... without our consent.

What does it mean? Millions of "small" cell towers will be added to every block (which is a serious privacy concern). Each tower emitting radiation at levels known to cause **cancer, sterility, DNA damage and other harm**... especially to our children, who are most at risk.

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IARC: Cell Phone Radiation Is a Possible Human Carcinogen

Small Group Will File Minority Opinion

June 3, 2011
Last updated November 25, 2015

It's not easy to reach unanimous agreement on anything to do with cell phone radiation. And when it comes to cell phones and cancer, forget about it. But the International Agency for Research on Cancer (IARC) nearly pulled it off. On Tuesday, May 31, more than two dozen scientists and doctors from 14 countries —a group IARC Director Christopher Wild called "the world's leading experts"—issued a joint statement that cell phone and other types of radiofrequency (RF) and microwave radiation might cause cancer.

Near the close of the eight-day meeting, there were six holdouts, but by the end only one dissenting voice remained in the room. (The group agreed that the person's name should remain secret.) IARC released the news: Long-term use of a cell phone might lead to two different types of tumors, glioma, a type of brain cancer, and acoustic neuroma, a tumor of the auditory nerve.

Another member of the working group would have also dissented had he not walked out of the meeting before the final vote. *Microwave News* has learned that Peter Inskip of the U.S. National Cancer Institute (NCI) left early and did not return. Aleea Farrakh Khan of the NCI Office of Media Relations confirmed that Inskip missed the final vote and said that he will join a "small group" of members of the working group in a "minority opinion."

"[Our] conclusion means that there could be some risk, and therefore we need to keep a close watch for a link between cell phones and cancer risk," said Jonathan Samet, who served as the chairman of the IARC RF working group. Samet, a professor at University of Southern California in Los Angeles, was appointed to the National Cancer Advisory Board by President Obama earlier this year.

The decision "brings it to a new level," said Kurt Straif, the head of the agency's monograph program, who helped organize the

meeting —the first ever on RF and microwave cancer risks. Many members of the panel agreed.

"Before this, the view that there might be a cancer risk from cell phones was widely argued as being implausible," said Ron Melnick, who led one of the subgroups at the IARC meeting. "Now the World Health Organization has put its official stamp on this possibility." Melnick, a former senior official at the U.S. National Toxicology Program until he retired two years ago, designed the world's largest study to see whether cell phone radiation can lead to cancer in rats and mice. Those results are not expected for a couple more years.

"The possible risk cannot be dismissed anymore, at least until we get credible new evidence to the contrary," said Dariusz Leszczynski of the Finnish Radiation and Nuclear Safety Authority (STUK) in Helsinki, a member of the IARC subgroup on mechanisms.

The IARC news was a sensation. Many stories were featured on the front pages of the world's leading newspapers, such as the *Washington Post*, the *New York Times* and the *Wall Street Journal,* the *Sydney Morning Herald*, *Le Monde,* and the U.K.'s *Daily Telegraph*. Within 24 hours of the IARC press conference there were some three thousand stories on Google News and that was only in English. Many of the stories were among the most read and most e-mailed on any number of Internet news sites around the world.

NCI's Peter Inskip: Odd Man Out

A number of those in Lyon said that Inskip appeared uncomforable during the meeting. "Throughout the plenary sessions, he was silent and did not comment on anything," said someone who was in the room and who asked not to be identified by name. "He seemed angry, upset and in a bad mood."

There are also reports that he actively sought to persuade other members of the epidemiology panel to discount the studies by Sweden's Lennart Hardell —at times, in direct and personal ways.

Inskip is well known for his opinion that cell phone radiation does not cause cancer. He published one of the first epidemiological studies on cell phones back in 2001: It showed no association with brain tumors (see *MWN,* J/F01, p.1). He has never wavered since.

Inskip is said to have acted on his conviction that cell phone radiation is harmless at least once before. A few years ago during a planning session for a meeting of the Brain Tumor Epidemiology Consortium (BTEC), Inskip argued strongly against a planned discussion of the possible risks. He was very emotional, said someone who was there but asked not to be named. The talks were cancelled.

Members of IARC working groups do not necessarily represent the views of the organizations they work for. Yet, NCI, where Inskip works, has deep pockets and few are willing to challenge the views of its professional staff and risk being cut off. The institute's 2010 budget, for instance, was in excess of $5 billion. Some of that

money goes to IARC. Last year, NCI made a five-year grant to support the agency's monograph program. The U.S. National Institute of Environmental Health Sciences (NIEHS) also supports the program.

After the IARC meeting, NCI issued a news release that played down the cancer risks and noted that "brain cancer incidence and mortality rates in the population have changed little in the past decade" —a time during which cell phone use grew rapidly.

Inskip did not respond to phone and e-mail messages asking for comment. Neither Nicolas Gaudin, head of IARC communications, nor Kurt Straif, head of the agency's monograph program, replied to requests for clarification.

Building a Consensus

The decision to classify RF/microwave radiation as a possible carcinogen was by no means a foregone conclusion. In fact, on the opening day of the meeting, May 24, many speculated that the final verdict would be that there's not enough evidence to allow any conclusion on cancer risks.

IARC puts chemical and physical agents into one of five categories. A possible carcinogen is labeled "2B" and one that cannot be classified is a "3." The others are: "1" for a known carcinogen; "2A," for "probable" carcinogen; and "4," for "probably not carcinogenic." In the forty year history of the IARC monograph program, more than 900 agents have been evaluated and only one —caprolactam— has ever been classified as not carcinogenic; 107 have been put in group 1, 59 in group 2A, and 266 in group 2B. The majority (508) was deemed to be unclassifiable, group 3. (Click here for examples from each group.)

As the meeting progressed, there was a sure but gradual shift to a 2B designation. "The most compelling evidence supporting the classification came from the epidemiological studies," according to Samet. Two sets of studies tipped the balance, he added: those from the Interphone project —which is an IARC project— and those from the group led by Lennart Hardell of Sweden's Örebro University. Both point to an increased incidence of gliomas and acoustic neuromas among long-term users of mobile phones.

"As the voting went on, people came together and it became clear that the likely decision would be 2B," said Carl Blackman, a member of the IARC panel. "But this was not a sure thing when we arrived in Lyon. Rather it evolved out of a very serious evaluation of the evidence." Blackman is with the U.S. Environmental Protection Agency in North Carolina.

A few members of the working group said that there was some sentiment on the panel for 2A, but this did not go very far.

In the end there was just one vote against 2B —though there would have been a second if Inskip had stayed longer. "It was an extremely impressive consensus," said Hardell when he got back to Sweden after the meeting.

In addition to the epidemiological evidence, the working group concluded that there is "some evidence" for carcinogenicity from animal studies, according to IARC's Straif. As for genotoxicity, he said that the subgroup on mechanisms found "weak" supporting evidence.

Straif pointed out that not all of IARC's 266 possible carcinogens were designated 2B based on the same types of evidence. Some were labeled 2B because of animal studies, he said. Among those designations based on human studies, as in the case of cell phone radiation, were talc-based body powder, herbicides and ELF magnetic fields (see *MWN,* J/A01, p.1).

The 2B designation was not limited to cell phones. It has "broad applicability" to all sources of RF radiation, Samet said.

The View from Outside Lyon

There was the expected wide range of opinions away from the IARC meeting rooms. Many of the usual talking heads reaffirmed their long-held views. On one side, neurosurgeons like Keith Black in Los Angeles said: "What microwave radiation does in most simplistic terms is similar to what happens to food in microwaves, essentially cooking the brain" and Charlie Teo in Australia said, "There is an increasing body of evidence that there is an association between brain tumors and mobile phones." And on the other side, Rodney Croft, the head of the soon-to-be defunct Australian RF research group, said, "Further research will prove there is no need for alarm."

Maria Feychting of the Karolinska Institute in Stockholm soon registered her opposition to the IARC designation. The studies are "far too uncertain" to support it, she told the press. Feychting is a protégée and colleague of Anders Ahlbom, who was slated to be a member of the working group but was removed when IARC learned that he was a director of his brother's telecom consulting firm. Both have long sought to play down the possibility of tumor risks. Some are speculating whether the IARC panel would have reached the same decision had Ahlbom been there to argue his case. Most suggested that outcome would have been the same. "The dynamic might have been different," said one member of the working group, "but I think it would still have been 2B." Another pointed out that Stan Szmigielski was also not in Lyon, due to health problems, and he would have balanced Ahlbom's opposition.

David Savitz, an epidemiologist at Brown University, is in the Feychting camp. “I would likely be hovering between inadequate and no association,” he told us in an interview. “I find the conclusions surprising, given that there is increasingly strong evidence that cell phone use has no association with brain cancer,” Savitz said to the *Los Angeles Times*.

Similarly, Meir Stampfer of the Harvard School of Public Health told the *New York Times,* that when you put the IARC decision into perspective, the evidence doesn't support the likelihood that this is “really something to be concerned about.” The *Times* identified Stampfer as a "paid advisor for the cell phone industry.”

Others were disappointed that IARC panel had not taken a stronger stand and labeled RF a probable human carcinogen. “We lost,” said Annie Sasco, an epidemiologist who spent 22 years at IARC before moving back to INSERM in Bordeaux. “I had hoped it would be 2A," she told *Microwave News*. “There is certainly enough evidence for a 2A designation.” By the time she left IARC, Sasco was the leader of the team on epidemiology for cancer prevention.

On the whole, many long-time EMF observers said that the 2B designation was the right choice. “2B is the best that the current evidence could support," said David Gee, a senior adviser at the European Environment Agency (EEA) in Copenhagen. And Tony Miller of the University of Toronto commented that he is not surprised by the panel’s decision.

Reactions from Industry and Cancer Societies

IARC monographs are considered the gold standard the world over for what is or may be a cancer agent. And for this reason, the working group's decision will carry a lot of weight. “Nobody is going to question this result,” said one panelist.

This may be why the cell phone industry was somewhat muted in its statements to the press. Trade groups appeared to be trying to put the best face on the panel's decision. “The IARC classification suggests that a hazard is possible but not likely,” said Jack Rowley of the GSM Association. Rowley attended the IARC panel meeting as an observer.

The Mobile Manufacturers Forum (MMF) took a similar tack. “It is significant that IARC has concluded that RF EMFs are not a definite nor a probable human carcinogen,” its press release stated. “IARC has only concluded that it may still be possible that RF fields are carcinogenic." The MMF sent Joe Elder to the meeting as its observer.

Cancer societies on both sides of the Atlantic were also quick to issue their opinions: For the most part, they read more like a reluctant acknowledgment of the IARC verdict than an endorsement. “It is critical that its findings be interpreted with great care,” cautioned the American Cancer Society. “The bottom line is the evidence is enough to warrant concern, but it is not conclusive,” said Otis Brawley, its chief medical officer.

Ed Yong, the head of Cancer UK's health evidence and information team interpreted the IARC decision to mean that “there is some evidence linking mobile phones to cancer, but it is too weak to make any strong conclusions.” He went on: "the published studies do not show that mobile phones could increase the risk of cancer.” His blog post was praised by other commentators and widely circulated on the Web, but was condemned as “exceptionally misleading” by Powerwatch, a U.K. EMF group.

What Now?

At the press conference, IARC staff resisted suggesting how people might protect themselves. “It is always a tricky question at this stage what to do as a consumer,” Straif said. “The strength of

this program also results from the fact that we do not make any strong recommendations as to regulation. This is in the domain of national and international agencies."

On the other hand, Christopher Wild, the IARC director, said, "It is important to take pragmatic measures to reduce exposures such as hands-free devices or texting."

In the U.S., three senior members of Congress —Reps. Ed Markey (D-MA), Henry Waxman (D-CA) and Anna Eshoo (D-CA)— have asked the General Accounting Office (GAO) to carry out a "thorough review" of the status of existing health research and the "adequacy" of the FCC safety standards for cell phones.

The WHO announcement "makes clear that additional research is needed to fully understand the long-term impact of mobile phone use on the human body, particularly in children," said Markey in a press release.

Samet closed the press conference by stating that he expects "with certainty that there probably will be another IARC evaluation of RF radiation in the future."

Details and Resources

The chair of the meeting:
Jonathan Samet, University of Southern California, USA

The heads of the four subgroups:
• Animal Cancer Studies: David McCormick, IIT Research Institute, USA
• Epidemiology: Jack Siemiatycki, University of Montreal, Canada
• Exposure: Ronald Melnick, Ron Melnick Consulting, USA
• Mechanistic and Other Relevant Data: Christopher Portier, Centers for Disease Control and Agency for Toxic Substances and Disease Registry, USA

A condensed summary of the working group's decision, including one from the each of the four subgroups, will appear soon in *Lancet Oncology*.
[The summary was posted on June 22 and appears in the July issue. The full text is open access.]
The IARC monograph will appear next year. (Later: It is now available here.)

It is not yet clear where and when the minority opinion will be published.

Now available from IARC and WHO:
• Audio of the May 31 "virtual" press conference;
• IARC's May 31 press release;
• Final list of participants (p.3);
• Introduction to the IARC RF Monograph (Volume 102);
• Podcast by Christopher Wild Introduction to RF Monograph Meeting;
• Christopher Wild, IARC Director, answers a few questions on the IARC Monographs;
• WHO Declaration of Interests for RF Monograph.

See also, our exclusive daily coverage of the meeting.
And these related stories:
• IARC Drops Anders Ahlbom from RF–Cancer Panel;
• French TV Documentary Links IARC RF Panelist to Industry Interference
• IARC Welcomes Industry to RF–Cancer Review;
• Joachim Schüz Moves to IARC.

IARC, Christopher Wild, NCI, Interphone, Anders Ahlbom, Maria Feychting, David McCormick, Ron Melnick, Kurt Straif, Peter Inskip, Edward Markey, Rodney Croft, David Savitz, Annie Sasco, Meir Stamfer, Joe Elder, MMF,

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Kathy Noel

From: Annemarie Clisby
Sent: Tuesday, September 3, 2019 11:46 AM
To: Roy Sapau
Subject: FW: NO on 5G

-----Original Message-----
From: Jayme <jayme@consciousnestdesign.com>
Sent: Sunday, September 1, 2019 1:07 PM
To: Council Members <council@encinitasca.gov>
Subject: NO on 5G

Dear Encinitas Council,
We are residents of Encinitas and have been born and raised here. Please Do Not allow the 5G into our home or our beloved town.

Sincerely,

Jayme and Michael Amorillo

1070 Urania ave
Encinitas
760-519-6617

Kathy Noel

From: Annemarie Clisby
Sent: Wednesday, August 21, 2019 8:12 AM
To: Roy Sapau
Subject: FW: Encinitas Small Cell Antenna Urgency Ordinance

From: Jeanette Alexander <jnetalexander@gmail.com>
Sent: Tuesday, August 20, 2019 11:21 PM
To: Catherine Blakespear <cblakespear@encinitasca.gov>; Jody Hubbard <jhubbard@encinitasca.gov>; Council Members <council@encinitasca.gov>; Tony Kranz <tkranz@encinitasca.gov>; Joe Mosca <jmosca@encinitasca.gov>; Kellie Shay Hinze <khinze@encinitasca.gov>
Subject: Encinitas Small Cell Antenna Urgency Ordinance

Jeanette O. Alexander
P.O. Box 230644
Encinitas, CA 92023

August 20, 2019

City of Encinitas Council
Mayor Blakespear, Deputy Mayor Hubbard, and City Council Members Kellie Shay Hinze, Tony Kranz, and Joe Mosca

Re: Encinitas Small Cell Antenna Urgency Ordinance

I have a perception of harm from microwave antennas in close proximity to my home and to the businesses I frequent in Encinitas. I'm afraid for my physical well-being, for my family, and for my property value should an antenna be placed in front of my home. The FCC exposure limits protect us from adverse thermal effects such as shock, burns and being heated, but not from the harmful biological effects known by our scientists for more than 50 years. I implore you to protect me, us.

I perceive that small cell antenna in the right-of-way in front of a home means 20 percent devaluation in property value a**nd sickness** and untold suffering to one or more members of that household.

The city of Encinitas needs a small cell ordinance immediately so that there is oversight about placement of small cell antennas in our community and especially our sensitive and residential areas.

As written this urgency ordinance provides a convenient administrative process for the Telecom to put small cell antennas anywhere they want. I say this because there is an absence of administrative teeth that would empower the city of Encinitas to enforce the location preference (e.g. prevent small cell antenna installation in front of homes), control the application and shot clock process and installation quality.

My request for the City of Encinitas is that this ordinance be sent back to staff for major upgrade that would reflect the protective aspects of the Calabasas and Hercules ordinances that are part of this record. Please note that these ordinances have been certified by their city councils to meet all requirements of the FCC directives, and therefore serve as appropriate baselines for

our community. **Let's not open the door to indiscriminate placement of small cell antennas in our residential areas and the cluttering of our visual space.**

If the city deems it necessary to have an ordinance in place immediately, then please make approval conditional on adding the following protective features garnered from the Calabasas municipal code section 17.12.050(C) and Hercules Title 10 Chapter 16 ordinances as a condition of approval. These are a few of many important examples from these ordinances.

Location Preference: remove the residential areas from Encinitas Section 10.a. This would be consistent with Calabasas 17.12.050(C) 3. "Preferred Zones and Locations" which does not include residential areas. (Note: Calabasas ordinance re-enforces this zoning preference in sections that specifically address small cell location in right of way… and asserts in the preamble that the ordinance is compliant to FCC directives.)

Application Process:

- Require a pre-application site inspection and pre-application meeting for verification that all application requirements have been met before accepting an application (Hercules Section 10-16.108 General Policies, General Application Process, para 8)
- Require that all support structures are certified to meet ANSI 222 as part of the application process (Hercules Section 10-16.113.E.14 Small Cell and Small Wireless Facilities).

Controlling the Shot Clock: Add these notes from Hercules, with edits applicable to Encinitas

Section 10-16.108 General Policies: (policy 19) *To prevent confusion and any loss of the City's rights under the FCC's 'Shot Clock' rule pursuant to the FCC Report and Order 14-153 as reference to the date an Application was officially filed and the start of the Shot Clock regarding the limited time allowed to determine if an Application is complete, at the time of the initial filing of an Application, it must contain a cover letter stating i) whether the Application is filed as an 'Eligible Facility' Application including the justification for such, or a 'Substantial Modification', or involves a new support structure; and ii) a statement that the Application contains all of the information required under Section 10.16 of the City's Code for that type of Application, and be signed by a person with first-hand personal knowledge of such.*

Section 10-16.113 Batched Applications: *An Applicant, or its agent of record, may submit Applications for multiple facilities or locations with the following conditions that are intended in order to assure compliance with the FCC's 'Shot Clock' requirements:*

a. No single batched submittal shall contain more than five (5) Applications;
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Stealth Installations: the Encinitas ordinance displays pictures of approved small cell antenna installations that include telephone poles with small cell antennas, radio boxes and all the supporting cabling attached to the poles when Encinitas favors stealth

installation and could require metal poles with attractive features. Require that all small cell antennas on light poles and power poles be stealth installations. This is consistent with both the Calabasas and Hercules ordinances, and the existing Encinitas ordinance for macro antenna installations. Remove all of the preapproved telephone pole installation examples from the Encinitas ordinance since these increase visual clutter and are not stealth.

Add definitions: "least intrusive means", "significant gap", "stealth facility" and "reasonable and compelling evidence".

I believe that our ordinance can be more protective. I ask that as a condition of approval of the ordinance that the Council orders a community meeting ASAP for the purpose of bringing together the citizens of Encinitas with the staff to review every available option that would make the ordinance more protective. It would be appropriate to have other legal opinions as inputs to our ordinance; we don't want to be less conservative than we have to especially when the safety of our community is at stake. There are aspects of the Calabasas ordinance, the Hercules ordinance, and ordinances from other cities that are more protective and we should consider these in the Encinitas ordinance.

Thank you for being proactive for all of our safety.

Sincerely,

Jeanette O. Alexander

Kathy Noel

From: Annemarie Clisby
Sent: Tuesday, September 3, 2019 11:48 AM
To: Roy Sapau
Subject: FW: 5G small cell towers

From: Jesse Giessow <jessgiess@cox.net>
Sent: Friday, August 30, 2019 3:58 PM
To: Council Members <council@encinitasca.gov>
Subject: 5G small cell towers

Dear City Councilmembers
I strongly oppose the building of 5G towers in our neighborhoods.
I am a scientist so I like to make decisions based on facts, and as far as I understand, there are no studies yet that prove that this technology is safe. Placing towers in neighborhoods will expose everyone to something that we do not yet understand.
I think that we should be cautious and err on the side of safety until we understand more.

Thanks for listening-
Jesse Giessow
Encinitas resident since 1996

Virus-free. www.avast.com

Kathy Noel

From: Annemarie Clisby
Sent: Wednesday, August 21, 2019 8:08 AM
To: Roy Sapau
Subject: FW: Encinitas Small Cell Antenna Urgency Ordinance

From: Joseph Manfredi <jmanfre2@san.rr.com>
Sent: Wednesday, August 21, 2019 6:54 AM
To: Catherine Blakespear <cblakespear@encinitasca.gov>; Jody Hubbard <jhubbard@encinitasca.gov>; Council Members <council@encinitasca.gov>; Tony Kranz <tkranz@encinitasca.gov>; Joe Mosca <jmosca@encinitasca.gov>; Kellie Shay Hinze <khinze@encinitasca.gov>
Subject: Encinitas Small Cell Antenna Urgency Ordinance

August 20, 2019

Joseph Manfredi
1381 Caminito Batea
La Jolla, California, 92037

City of Encinitas Council
Mayor Blakespear, Deputy Mayor Hubbard, and City Council Members Kellie Shay Hinze, Tony Kranz, and Joe Mosca

Re: Encinitas Small Cell Antenna Urgency Ordinance

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Thank you for being proactive for all of our safety.

Sincerely,

Joseph Manfredi

Kathy Noel

From: Annemarie Clisby
Sent: Thursday, August 29, 2019 10:52 AM
To: Roy Sapau
Subject: FW: are you aware of this 5G Summit?

From: Julie Briggs <juliesbriggs@gmail.com>
Sent: Thursday, August 29, 2019 10:21 AM
To: Council Members <council@encinitasca.gov>
Subject: are you aware of this 5G Summit?

https://the5gsummit.com/sgwzgh/?inf_contact_key=1&utm_source=ActiveCampaign&utm_medium=email&utm_content=Day+4%3A+How+the+system+has+failed+us&utm_campaign=5G19

5G CRISIS
AWARENESS & ACCOUNTABILITY

Day 4: How the System Has Failed Us

Sharon Goldberg, MD

Science About Wireless and 5G

01:03:03

Watch Now!

Kevin Mottus

Complete Regulatory Failure of 5G

59:44

Watch Now!

Theodora Scarato, MSW

Local Government and Community Actions

01:01:45

Watch Now!

Raphael Mahaim

Regional Governments Standing Against 5G

53:05

Watch Now!

Ronald L Melnick, PhD

"Clear Evidence of Cancer:" The $30M NTP Study

01:01:41

Watch Now!

Trevor Marshall, PhD

Debunking 7 Myths About 5G

41:21

Watch Now!

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Always seek the advice of your physician or other qualified health provider with any questions you may have regarding a medical condition.

Kathy Noel

From: Annemarie Clisby
Sent: Wednesday, August 28, 2019 4:11 PM
To: Roy Sapau
Subject: FW: No 5G

From: Julie Briggs <juliesbriggs@gmail.com>
Sent: Wednesday, August 28, 2019 3:50 PM
To: Council Members <council@encinitasca.gov>
Subject: No 5G

You are my elected representative. This legal notice of liability is designed to be used as evidence in court if needed and intends to enlighten you and to protect you from attracting civil and criminal liability in relation to your actions and/or omissions surrounding the deployment of 5G technology within your constituency. 4G/LTE small cells form an integral part of the 5G deployment. This 5G technology will cause me to be exposed to wireless non-ionizing electromagnetic radiation against my consent and in my home.

Contamination of my home with 5G may cause damage to my home if it becomes a health risk to me and thus render my home uninhabitable. Irradiating me with wireless non-ionizing electromagnetic radiation against my consent would be an application of force against my person and which causes fear of bodily injury and could be classed as a civil trespass and/or a criminal assault.

Any level of exposure of man-made non-ionizing electromagnetic radiation can be diagnosed by my medical practitioner as an adverse health effect pursuant to the WHO's International Classification of Diseases ICD-10, code W90 thus rendering any safety limit as set by the government safety standards obsolete as to protecting my health. As needed, I may see my doctor for advice on the 5G issue.

If 5G technology is deployed within your constituency, I expect that you as my elected representative will exercise due diligence to certify that all parties deploying 5G technologies have sufficient insurance cover to compensate for damage or harm caused by the emission of wireless non-ionizing electromagnetic radiation. Please note that this could be a problem, since underwriters such as Lloyds of London do not insure for such harm and damage.

I urge you, as my elected official, to act in the public interest by addressing the potential cumulative harms of densification (the crowding of small cells into a limited area to enable 5G) and insisting that public safety regulatory authorities need to prove that such densification of 5G technology is safe and that any deployment of 5G, Artificial Intelligence (AI), and/or the Internet of Things (IoT), is regulated appropriately to ensure that the national security and the safety and privacy of the public and myself is not compromised.

You need to protect the public from other harmful wireless technologies such as Wi-Fi in schools, “smart” meters on dwellings, and the like, and to replace those technologies with safe and efficient wired technologies, such as Ethernet and/or fiber optics, as the end-nodes of internet delivery systems to dwellings, schools and commercial buildings. Forward-thinking cities are already doing this.

I implore you, as my elected official, to act in the public interest by protecting the public and myself from being persecuted by the passing of laws that restrict the Courts, law enforcement agencies, municipal councils and local governments from taking action to protect the public from harm to health and damage, caused by 5G and other wireless technologies.

I am genuinely concerned for your welfare, the general public and mine, and this is a situation of the utmost urgency. I have studied the relevant facts and am thus aware of the danger. As a result I am in fear and I take the risk of harm and damage to me very seriously.

To help bring you up to speed on this extremely important topic, please go to the5Gsummit.com, and listen for free to what 40 highly regarded experts inclusive of scientists, medical practitioners and lawyers from around the world have to say on the 5G subject. Experts who are not censored by the telecommunications industry, nor their captured governments, nor the captured media. Further, to assist with your education, please look at the Bio-initiative Report 2012 (updated 2017) - A Rationale for Biologically-based Public Exposure Standards for Electromagnetic Fields (ELF and RF) bioinitiative.org and Physicians for Safe Technology – 5G Mobile Communications mdsafe.org.

I implore you as my civic leader, and as my elected representative to get educated on this important topic, and show me by your decisions, actions and omissions that you are taking precautionary steps to address the risk of harm to me and all the people within your constituency.

As an elected official you are deemed accountable if you do not take appropriate action to attempt to abate, or prevent such harm, to me or the public. Therefore you attract liability in either the civil or criminal jurisdiction.

Your people are rising up and I implore you to take leadership and be a champion for the health and safety of all of us. If you do, many voters, legislators and I will wholeheartedly support and campaign for you.

[Settled by Ray Broomhall, Barrister-at-Law]

BioInitiative 2012

A Rationale for Biologically-based Exposure Standards for Low-Intensity Electromagnetic Radiation

Report Updated in 2014 and 2017

THE BIOINITIATIVE REPORT 2012

A Rationale for Biologically-based Public Exposure Standards for Electromagnetic Fields (ELF and RF)

READ THE REPORT

DOWNLOAD THE REPORT

WHO WE ARE

The BioInitiative 2012 Report has been prepared by 29 authors from ten countries, ten holding medical degrees (MDs), 21 PhDs, and three MsC, MA or MPHs. Among the authors are three former presidents of the

CONCLUSIONS

Bioeffects are clearly established to occur with very low exposure levels (non-thermal levels) to electromagnetic fields and radiofrequency radiation exposures.

READ MORE

Reported Biological Effects

Henry Lai's Research Summaries

These are invaluable resources that can are searchable by key words. These abstracts cover the relevant peer-reviewed, published literature documenting biological effects of non-ionizing radiation (ELF-EMF, Static Fields and RFR).

Since 2017, the large number of newly published studies on neurological effects; and on free radical damage (oxidative effects) has warranted updating our research summaries again in 2019. The graphics showing percent 'effect vs no

Bioelectromagnetics Society, and five full members of BEMS.

READ MORE

effect' are also brought current for the 2019 research summaries.

- ELF-EMF and Static Field Free Radical (Oxidative Effects) Abstracts
  - (229 studies, 203 (89%) E, 26 (11%) NE)
- RFR Free Radical (Oxidative) Abstracts
  - (225 studies, 203 (89%) E, 26 (11%) NE)
- ELF-EMF Neurological Effects abstracts
  - 229 studies, 208 (91%) E; 21 (9%) NE
- RFR Neurological Effects abstracts
  - (305 studies, 222 (72%) E, 83 (28%) NE)

The RFR abstracts collection (1990-2017), the Comet Assay Abstracts (2017) and the Electrosensitivity Abstracts (2017) remain the same.

DOWNLOAD SUMMARIES

DOWNLOAD SUMMARIES

WHY WE CARE

The stakes are very high. Human beings are bioelectrical systems. Our hearts and brains are regulated by internal bioelectrical signals. Environmental exposures to artificial EMFs can interact with fundamental biological processes in the human body.

READ MORE

DO WE KNOW ENOUGH?

There is more evidence than we need. The last five years worth of new scientific studies tell us the situation is much worse than in 2007 and yet people around the world have so much more daily exposure than even five years ago.

READ MORE

RF Color Charts

The RF Color Charts summarize many studies that report biological effects and adverse health effects relevant for cell towers, WI-FI, 'smart' wireless utility meters, wireless laptops, baby monitors, cell phones and cordless phones.

DOWNLOAD RF CHARTS

DOWNLOAD RF CHARTS

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Kathy Noel

From: Annemarie Clisby
Sent: Monday, September 23, 2019 11:00 AM
To: Roy Sapau
Subject: FW: Concern about 5G installation in residential neighborhoods

From: Julie Ryan <julieryan012@gmail.com>
Sent: Monday, September 23, 2019 9:19 AM
To: Council Members <council@encinitasca.gov>
Subject: Concern about 5G installation in residential neighborhoods

Hello,

I'm writing about my concern regarding the installation of 5G towers in Encinitas. I am grateful for the amount of effort and time you guys are putting into thoughtfully moving forward on this matter. I don't want to write a long-form note, I just wanted to let you know that I and many others are concerned. I was unable to attend the first late-night meeting, but I did watch that online. I will do my best to be there tonight.

I hope that we are able to figure out a way that we can keep the towers out of residential neighborhoods.

Thank you again.

Warmly,

--

Julie Ryan, Realtor
Compass
Cell: 858-703-7856
Julieryan012@gmail.com
Cal DRE #01905433

Kathy Noel

From: Annemarie Clisby
Sent: Thursday, August 29, 2019 10:05 AM
To: Roy Sapau
Subject: FW: Make the Encinitas Small Cell Antenna Ordinance Protective for Our Residential Areas Immediately

From: Kalli Holmes Sorensen <kallihs@gmail.com>
Sent: Thursday, August 29, 2019 9:56 AM
To: Catherine Blakespear <cblakespear@encinitasca.gov>; Jody Hubbard <jhubbard@encinitasca.gov>; Council Members <council@encinitasca.gov>; Tony Kranz <tkranz@encinitasca.gov>; Joe Mosca <jmosca@encinitasca.gov>; Kellie Shay Hinze <khinze@encinitasca.gov>; Christian Sorensen <ccs@seasidecenter.org>
Subject: Make the Encinitas Small Cell Antenna Ordinance Protective for Our Residential Areas Immediately

Dear City Council Members:

My husband, Rev. Christian Sorensen, and I have been living in and serving the Encinitas community for over 20 years. Encinitas has always been known as a health conscious and environmentally aware community. People live here and visit Encinitas and North County to seek relaxation, peace, and health for body-mind-spirit. Our *Seaside Center for Spiritual Living* community has been serving and supporting this life style for over 2 decades.

We are extremely concerned about the possibility of 5G being rolled out into our communities. I urge you to protect us from the dangers of this huge increase in wireless transmissions. There has not been adequate long term testing or research to determine the safety and results of 5 G on humans, animals, water, food and the environment.

We know that there have been numerous studies about the health hazards of 5G in Europe. The Netherlands is one country that has banned it. It's also significant to note that cities in Northern California, and communities in the heart of the Tech Industry have blocked 5G.

I'm sure that you personally know people who are struggling with cancer and other chronic diseases. Almost every family has had a death and has lost

someone they love because of cancer. If we choose to add this intense radiation to every person and animal, to our water and food supply there would be a tragic impact on our lives and well being.

There are reports and mounting scientific evidence that 5G impacts the health of the most sensitive among us. Children and seniors would be among the most vulnerable. My son Trevor is on the Autism spectrum and very sensitive to EMF exposure. Installing 5G anywhere near our neighborhood or community would potentially be very harmful.

We need to stop this crisis from entering our community. Resist the political and economic pressures to push this through. Have the courage to stand up for us! Please use your legislative and representative powers to refuse to permit small cell antennas in residential areas. Declare an "Urgency Ordinance" such as Mill Valley, Marin County, and San Anselmo, CA recently did, that prevents 5G cells in residential neighborhood.

We demand the "Urgency Ordinance" to be more protective immediately, applied to all applications in process, before there is a flood of small cell antenna applications/installations in our neighborhoods. We can't wait for a small cell antenna community meeting.

We ask that the Encinitas small cell antenna ordinance incorporate the best practices of protective small cell antennas ordinances of the California Cities of Mill Valley and Los Altos; Calabasas; Fairfield, Petaluma and San Ramon; and Hercules.

For many of us there is a perception of harm associated with microwave antennas. This perception includes de-valuation of a home with a mobile antenna in the yard. Our concerns are validated by documents prepared by Martin Paul PhD and Beatrice Golomb MD.

Thank you for caring about our lives, our property, our health, and our future!

Respectfully,
Kalli Holmes Sorensen and Rev. Christian Sorensen
Seaside Center for Spiritual Living

Seaside Sisters Women's Ministry
Kalli Holmes Sorensen
"A new and growing sisterhood of women are awakening to their power to transform the world."

To help protect your privacy, Microsoft Office prevented automatic download of this picture from the Internet.

Seaside Center for Spiritual Living
SeasideSisters4Change@gmail.com
Follow us on Facebook for updates on gatherings
Visit our website page here

Kathy Noel

From: Annemarie Clisby
Sent: Wednesday, August 21, 2019 8:16 AM
To: Roy Sapau
Subject: FW: Encinitas Small Cell Antenna Urgency Ordinance

From: Karen Rich <karenlorainerich@gmail.com>
Sent: Tuesday, August 20, 2019 8:02 PM
To: Catherine Blakespear <cblakespear@encinitasca.gov>; Jody Hubbard <jhubbard@encinitasca.gov>; Council Members <council@encinitasca.gov>; Tony Kranz <tkranz@encinitasca.gov>; Joe Mosca <jmosca@encinitasca.gov>; Kellie Shay Hinze <khinze@encinitasca.gov>
Subject: Encinitas Small Cell Antenna Urgency Ordinance

August 20, 2019

FROM:
Karen Rich
1964 Swallow Lane
Carlsbad CA 92009

TO:
City of Encinitas Council
Mayor Blakespear, Deputy Mayor Hubbard, and City Council Members Kellie Shay Hinze, Tony Kranz, and Joe Mosca

Re: Encinitas Small Cell Antenna Urgency Ordinance

I have a perception of harm from microwave antennas in close proximity to my home in Carlsbad and to the businesses I frequent in Encinitas. **I'm afraid for my physical well-being**, for my family, and for my property value should an antenna be placed in front of my home. The FCC exposure limits protect us from adverse thermal effects such as shock, burns and being heated, but not from the harmful biological effects known by our scientists for more than 50 years. I implore you to protect me, us.

I perceive that small cell antenna in the right-of-way in front of a home means 20 percent devaluation in property value and sickness and untold suffering to one or more members of that household.

The city of Encinitas needs a small cell ordinance immediately so that there is oversight about placement of small cell antennas in our community and especially our sensitive and residential areas.

As written this urgency ordinance provides a convenient administrative process for the Telecom to put small cell antennas anywhere they want. I say this because there is an absence of administrative teeth that would empower the city of Encinitas to enforce the location preference (e.g. prevent small cell antenna installation in front of homes), control the application and shot clock process and installation quality.

My request for the City of Encinitas is that this ordinance be sent back to staff for major upgrade that would reflect the protective aspects of the Calabasas and Hercules ordinances that are part of this record. Please note that these ordinances have been certified by their city councils to meet all requirements of the FCC directives, and therefore

serve as appropriate baselines for our community. Let's not open the door to indiscriminate placement of small cell antennas in our residential areas and the cluttering of our visual space.

If the city deems it necessary to have an ordinance in place immediately, then please make approval conditional on adding the following protective features garnered from the Calabasas municipal code section 17.12.050(C) and Hercules Title 10 Chapter 16 ordinances as a condition of approval. These are a few of many important examples from these ordinances.

Location Preference: remove the residential areas from Encinitas Section 10.a. This would be consistent with Calabasas 17.12.050(C) 3. "Preferred Zones and Locations" which does not include residential areas. (Note: Calabasas ordinance re-enforces this zoning preference in sections that specifically address small cell location in right of way… and asserts in the preamble that the ordinance is compliant to FCC directives.)

Application Process:

- Require a pre-application site inspection and pre-application meeting for verification that all application requirements have been met before accepting an application (Hercules Section 10-16.108 General Policies, General Application Process, para 8)
- Require that all support structures are certified to meet ANSI 222 as part of the application process (Hercules Section 10-16.113.E.14 Small Cell and Small Wireless Facilities).

Controlling the Shot Clock: Add these notes from Hercules, with edits applicable to Encinitas

Section 10-16.108 General Policies: (policy 19) *To prevent confusion and any loss of the City's rights under the FCC's 'Shot Clock' rule pursuant to the FCC Report and Order 14-153 as reference to the date an Application was officially filed and the start of the Shot Clock regarding the limited time allowed to determine if an Application is complete, at the time of the initial filing of an Application, it must contain a cover letter stating i) whether the Application is filed as an 'Eligible Facility' Application including the justification for such, or a 'Substantial Modification', or involves a new support structure; and ii) a statement that the Application contains all of the information required under Section 10.16 of the City's Code for that type of Application, and be signed by a person with first-hand personal knowledge of such.*

Section 10-16.113 Batched Applications: *An Applicant, or its agent of record, may submit Applications for multiple facilities or locations with the following conditions that are intended in order to assure compliance with the FCC's 'Shot Clock' requirements:*

a. *No single batched submittal shall contain more than five (5) Applications;*
b. *There must be a minimum of seven days between submittals of batched Applications;*
c. *No more than 4 batched Applications shall be accepted in any thirty (30) consecutive day period.*

Controlling the Shot Clock: add these notes from the Calabasas 17.12.050(C) Section 6.G.4 "Application Review" … *Each application in a batch must meet all the requirements for a complete application. If any application in a batch is incomplete, the entire batch shall be deemed incomplete*

Stealth Installations: the Encinitas ordinance displays pictures of approved small cell antenna installations that include telephone poles with small cell antennas, radio boxes and all the supporting cabling attached to the poles when Encinitas favors stealth installation and could require metal poles with attractive features. Require that all small cell antennas on light poles and power poles be stealth installations. This is consistent with both the Calabasas and Hercules ordinances, and the existing Encinitas ordinance for macro antenna installations. Remove all of the preapproved telephone pole installation examples from the Encinitas ordinance since these increase visual clutter and are not stealth.

Add definitions: "least intrusive means", "significant gap", "stealth facility" and "reasonable and compelling evidence".

I believe that our ordinance can be more protective. I ask that as a condition of approval of the ordinance that the Council orders a community meeting ASAP for the purpose of bringing together the citizens of Encinitas with the staff to review every available option that would make the ordinance more protective. It would be appropriate to have other legal opinions as inputs to our ordinance; we don't want to be less conservative than we have to especially when the safety of our community is at stake. There are aspects of the Calabasas ordinance, the Hercules ordinance, and ordinances from other cities that are more protective and we should consider these in the Encinitas ordinance.

Thank you for being proactive for all of our safety.

Sincerely,

Karen Rich

Kathy Noel

From: Annemarie Clisby
Sent: Wednesday, August 21, 2019 4:59 PM
To: Roy Sapau
Subject: FW: Emergency 5G ordinance

From: kathleen albear <kalbear1@yahoo.com>
Sent: Wednesday, August 21, 2019 4:39 PM
To: Council Members <council@encinitasca.gov>
Subject: Emergency 5G ordinance

August 20, 2019

Kat Albear

2167 Montgomery Ave
Cardiff by the Sea 92007

City of Encinitas Council
Mayor Blakespear, Deputy Mayor Hubbard, and City Council Members Kellie Shay Hinze, Tony Kranz, and Joe Mosca

Re: Encinitas Small Cell Antenna Urgency Ordinance

I have a perception of harm from microwave antennas in close proximity to my home and to the businesses I frequent in Encinitas. I'm afraid for my physical well-being, for my family, and for my property value should an antenna be placed in front of my home. The FCC exposure limits protect us from adverse thermal effects such as shock, burns and being heated, but not from the harmful biological effects known by our scientists for more than 50 years. I implore you to protect me, us.

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Thank you for being proactive for all of our safety.

Sincerely,

Kat Albear

Kathy Noel

From: Annemarie Clisby
Sent: Monday, September 23, 2019 10:05 AM
To: Roy Sapau
Subject: FW: NO small cell antennas not be allowed in residential areas

---

From: kathleen albear <kalbear1@yahoo.com>
Sent: Friday, September 20, 2019 5:42 PM
To: Council Members <council@encinitasca.gov>; Roy Sapau <RSapau@encinitasca.gov>
Cc: Kathleen Albear <kalbear1@yahoo.com>
Subject: NO small cell antennas not be allowed in residential areas

September 23, 2019
2167 Montgomery Ave
Cardiff by the Sea CA 92007

City of Encinitas, Council Members and Planner Roy Sapa'u

Subject: 5G Workshop 9/23/19

Please make the Encinitas small cell antenna ordinance as protective as possible for our residential and sensitive areas.

Children, animals, unborn babies and adults are at a large risk due to these 5G antennas.

Please take time to study what scientists have said about 5G. Information is added below.

An engineer I know at Qualcomm told me they know the dangers of 5G but they don't care, they are trying to beat the Chinese. Absolutely no concern for human life.

Once this is done we CANNOT undo it. Please act wisely.

Thanks for thinking about this issue for consideration.

Let's keep Encinitas a Safe place to live for us all.

5G health issues are well documented by Martin Paul "5G Risk, The Scientific Perspective":
https://peaceinspace.blogs.com/files/5g-emf-hazards--dr-martin-l.-pall--eu-emf2018-6-11us3.pdf

The impacts of antennas on real estate values are documented at this link: http://realtormag.realtor.org/daily-news/2014/07/25/cell-towers-antennas-problematic-for-buyers

Please protect our health and our property values. Incorporate into the Encinitas small cell antenna ordinance these concepts from other cities that have protective ordinances.

- Do not allow small cell antennas to be installed in residential areas (Calabasas, Los Altos, and Mill Valley.)

• Do not allow small cell antennas to be installed within 600 feet of sensitive areas. Sensitive areas include schools, preschools nurseries childcare centers hospitals fire stations, senior facilities, and any area deemed sensitive by the administrator of the small cell antenna ordinance. (Calabasas, Los Altos, Mill Valley and Hercules).)

• Do not allow new support structures to be installed in residential areas (Hercules).

• Require a 1000 foot setback to residential areas for new support structures (Hercules)

• Require all antenna installations at utility pole locations to be stealth and supporting equipment to the underground.(Hercules)

• Require that all antenna support structures meet the requirements of ANSI 222 class III, and that this is verified by an independent third-party engineer. (Hercules)

• Require third party testing for each antenna installation that verifies that RF emissions are not greater than the devices permitted for this location.

• Americans with Disabilities Act: add this statement to the boilerplate of the Encinitas ordinance: "all small cell antenna installations shall be ADA compliant in every respect". (San Diego County ordinance)

• Require a master plan for all proposed antenna locations before applications can be submitted.(Calabasas)

• Make the small cell antenna application process as rigorous and protective to our city as possible. (The Calabasas and Hercules ordinances provide a very thorough administrative process that puts the city in control of the applications.)

• Require liability insurance for each antenna site (Hercules)

The FCC Third Report and Order (https://www.fcc.gov/document/cellular-reform-third-report-and-order) is a regulation that authorizes 5G infrastructure and installation of small cell antennas on lampposts and utility poles in the rights-of-way. This is a telecommunications initiative to further corporate goals and violates local land use control and the basic intent of the Federal communications Act. 5G is an assault on our right to health and our right to safety. Many cities have protective ordinances in place despite Telecom lawsuit threats. **We request that the City of Encinitas get legal consul that is supportive of our requests to have a protective ordinance**… just like Calabasas, Mill Valley, and Los Altos.

Cities have the civic responsibility to protect their citizens, and we expect the City of Encinitas to protect all of us from the placement of 5G small cell antennas in our residential neighborhoods.

Sincerely

Kathleen Albear

5G: Great risk for EU, U.S. and International Health! Compelling Evidence for Eight Distinct Types of Great Harm Caused by Electromagnetic Field (EMF) Exposures and the Mechanism that Causes Them

Written and Compiled by Martin L. Pall, PhD
Professor Emeritus of Biochemistry and Basic Medical Sciences
Washington State University
Address: 638 NE 41st Ave., Portland OR 97232 USA
martin_pall@wsu.edu 503-232-3883 May 17, 2018

Summary:

We know that there is a massive literature, providing a high level of scientific certainty, for each of eight pathophysiological effects caused by non-thermal microwave frequency EMF exposures. This is shown in from 12 to 35 reviews on each specific effect, with each review listed in Chapter 1, providing a substantial body of evidence on the existence of each effect. Such EMFs:

1. Attack our nervous systems including our brains leading to widespread neurological/neuropsychiatric effects and possibly many other effects. This nervous system attack is of great concern.
2. Attack our endocrine (that is hormonal) systems. In this context, the main things that make us functionally different from single celled creatures are our nervous system and our endocrine systems – even a simple planaria worm needs both of these. Thus the consequences of the disruption of these two regulatory systems is immense, such that it is a travesty to ignore these findings.
3. Produce oxidative stress and free radical damage, which have central roles in essentially all chronic diseases.
4. Attack the DNA of our cells, producing single strand and double strand breaks in cellular DNA and oxidized bases in our cellular DNA. These in turn produce cancer and also mutations in germ line cells which produce mutations in future generations.
5. Produce elevated levels of apoptosis (programmed cell death), events especially important in causing both neurodegenerative diseases and infertility.
6. Lower male and female fertility, lower sex hormones, lower libido and increased levels of spontaneous abortion and, as already stated, attack the DNA in sperm cells.
7. Produce excessive intracellular calcium [Ca2+]i and excessive calcium signaling.
8. Attack the cells of our bodies to cause cancer. Such attacks are thought to act via 15 different mechanisms during cancer causation.

There is also a substantial literature showing that EMFs also cause other effects including life threatening cardiac effects (Chapter 3). In addition substantial evidence suggests EMF causation of very early onset dementias, including Alzheimer's, digital and other types of dementias (Chapter 3); and there is evidence that EMF exposures in utero and shortly after birth can cause ADHD and autism (Chapter 5).

Each of these effects is produced via the main mechanism of action of microwave/lower frequency EMFs, activation of voltage-gated calcium channels (VGCCs) (Chapter 2). Each of them is produced via what are called downstream effects of VGCC activation. It follows from this that we have a good understanding not only that these effects occur, but also how they can occur. The extraordinary sensitivity of the VGCC voltage sensor to the forces of the EMFs tells us that the current safety guidelines allow us to be exposed to EMF levels that are something like

7.2 million times too high. That sensitivity is predicted by the physics. Therefore, the physics and the biology are each pointing to the same mechanism of action of non-thermal EMFs.

The different effects produced are obviously very deep concerns. They become much deeper and become existential threats when one considers that several of these effects are both cumulative and eventually irreversible. There is substantial evidence for the cumulative nature and eventual irreversibility of the neurological/neuropsychiatric effects, of the reproductive effects, the mutational DNA effects, the cardiac effects, of some but not other of the hormonal effects (Chapter 3); any causation of ADHD and autism may add additional concerns (here the cumulative nature is probably limited to the perinatal period). When we know that sperm counts have dropped by more than 50% throughout the technologically advanced countries on earth, it is difficult to avoid the conclusion that the vast majority of the population in those countries is already substantially impacted. The same conclusion can be made based on the widespread nature of the neuropsychiatric effects in those countries. Both of those effects will get much much worse even with no increase in current exposures, due to the cumulative nature and irreversibility of these effects. I expect we will see crash in human reproduction almost to zero as happened in the Magras and Xenos mouse study which I estimate to occur within about 5 years, without any increases in our exposures. Obviously 4G and 5G will make the situation much worse. Similarly I expect that the deterioration in brain function that we are already seeing will seal our fate if we fail to act rapidly and vigorously. Our collective brain function may become completely incapable of dealing with such a mega-crisis situation.

Now it can be argued that some of these may not develop as I expect, although those expectations are based on the best available evidence. One may even be able to argue this for all of those expectations. However, when we have substantial risk of multiple existential threats to every single technologically advanced country on earth, failure to act vigorously means there is a very high probability of complete destruction of these societies. And the chaos which would inevitably ensue, in a world that still has nuclear weapons, may well lead to extinction. In the face of these types or risk, the only reasonable course is to move with great vigor to stop new exposures and lower current exposures. One can still access the internet, using wired connections. And we can lower cell phone tower and cell phone radiation substantially. Smart meters, if needed, can work via wired connections.

Over 60% of this document (Chapters 5 & 6), is focused on the failures of statements from SCENIHR, the telecommunications industry, the U.S. FCC and the U.S. FDA to reflect the science. Their statements repeatedly omit much, often all of the most important science. Their statements are rife not only with omissions, but also with easily demonstrable falsehoods and with false logic. These have often occurred at times where we know that they knew better. These have occurred along with vigorous efforts by the telecommunications industry to corrupt the science by attacking individual scientists whose only fault is that they have obtained important findings that the industry does not like. These attacks have occurred along with vigorous efforts to corrupt two agencies that have important regulatory roles.

There are also possible concerns about individual industry-linked research studies. All wireless communication devices put out polarized EMFs that carry information via pulsations. Both the pulsations and the polarization make these EMFs much more biologically active. There are three other factors that also influence the production of effects. Several industry-linked studies may have used these factors, along with using very tiny numbers of individual animals in their studies, to produce studies which may have been designed to fail (Chapter 5). It is not clear at this point whether this type of concern is quite limited or whether it is very broad.

The European Commission has done nothing to protect European citizens from any of these very serious health hazards and the U.S. FDA, EPA and National Cancer Institute have done nothing to protect American citizens. The U.S. FCC has been much worse than that, acting vigorously with wanton disregard for our health.

Preface

The document that follows was, in its original form, sent to many of the authorities of the European Union, in conjunction with other documents sent to the same people by a group of European scientists. It was in response two documents that were, in turn, written by Mr. Ryan and Dr. Vinciūnas responding to a large group of European and other international scientists expressing great concern about the safety of 5G. I was asked by the leaders of the group of scientists to write my own response to those two documents. Mr. Ryan made the statement that "There is consistent evidence presented by national and international bodies (International Commission on Non Ionising Radiation Protection - ICNIRP, Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR) that exposure to electromagnetic fields does not represent a health risk, if it remains below the limits set by Council Recommendation 1999/519/EC1." In fact, that is not either the ICNIRP or SCENIHR position – their position, and similar positions have been taken by the U.S. FCC, FDA and the National Cancer Institute, is that the evidence is inconsistent or conflicting and therefore, in their view, no conclusions can be drawn. Some of these organization have also stated that there is no known mechanism by which effects can be produced. What is shown below is that there is a vast amount of evidence in the independent scientific literature that conflicts with both the conclusion about lack of demonstrated effects and the conclusion about lack of mechanism.

The European Commission, according to the Ryan and Vinciūnas documents and the U.S. National Cancer Institute, according to their web site, are each depending on the SCENIHR 2015 document to make judgments about EMF effects. Consequently, the reliability of SCENIHR 2015 is an essential element in determining the reliability of both of their assessments.

The document that is presented below, differs from the document that was emailed to EU authorities in three different ways: 1. The original document was sent as an email with multiple attachments. In this document attachments are simply provided as citations. The current document is a stand-alone document. 2. Some material is inserted to discuss positions taken by the U.S. FCC, FDA and National Cancer Institute, so as to be particularly relevant to the U.S. situation. 3. Substantial additional evidence is also provided.

The revised document contains seven chapters followed by a citation list for the entire document:

Chapter 1: Eight Extremely Well-Documented Effects of Non-Thermal EMF Exposures: Role of Pulsations, Other Factors that Influence EMF Effects, pp. 4-17

Chapter 2: How Each Such EMF Effect Is Directly Produced via Voltage-Gated Calcium Channel Activation: Role of the Voltage Sensor in Producing the Extraordinary Sensitivity to EMF Effects, pp. 17-23

Chapter 3. Strong Evidence for Cumulative and Irreversible EMF Effects pp. 23-27

Chapter 4. EMFs Including Wi-Fi May Be Particularly Damaging to Young People pp. 27,28

Chapter 5: The Importance of the SCENIHR 2015 Document and the Many Omissions, Flaws and Falsehoods in That Document pp. 28-58

Chapter 6: The U.S. Early Role in Recognizing Non-Thermal EMF Effects and How This Was Abandoned Starting in 1986: U.S. Failure to Research Health Impacts of Cell Phone Towers, Cell Phones, Wi-Fi, Smart Meters and Now 5G. What Is the Current Position of U.S. Government Agencies? pp. 58-78

Chapter 7: The Great Risks of 5G: What We Know and What We Don't Know pp. 78-82

Chapter 1. Eight Extremely Well-Documented Effects of Non-Thermal EMF Exposures: Role of Pulsations, Other Factors that Influence EMF Effects

Both the earlier Ryan document and the more recent Arūnas document each fail to pay any attention to the extensive scientific literature that has been accumulated on non-thermal electromagnetic field (EMF) effects. The scientific consensus of independent scientists based on information accumulated over the last 7 decades is just the opposite of what each of them states. I am copying into this document, at the end of Chapter 1, a series of 8 extremely well-documented effects of such EMF exposure, together with a list of review articles, most of them being peer reviewed articles published in well respected journals in the PubMed database, *that have each reviewed a body of evidence demonstrating the existence of each such effect*.

What are the effects produced by non-thermal exposures to microwave frequency EMFs, where we have an extensive scientific literature? Each of the following effects has been documented in from 12 to 34 reviews, listed at the end of Chapter 1.

1. Three types of cellular DNA attacks, producing single strand breaks in the cellular DNA, double strand breaks in cellular DNA and oxidized bases in cellular DNA. Each of these DNA changes have roles in cancer causation and in producing the most important mutational changes in humans and diverse animals. Double stranded DNA breaks produce chromosomal breaks, rearrangements, deletions and duplications and copy number mutations; they also produce gene amplification, an important mechanism in cancer causation. Single strand breaks in cellular DNA cause aberrant recombination events leading to copy number mutations. Oxidized bases cause point mutations. When these occur in somatic cells, they can each have roles in causing cancer. When these occur in germ line cells (and they have be shown to occur in sperm following EMF exposures), they cause the three most important types of mutations in future generations, chromosomal mutations, copy number mutations and point mutations. (21 different reviews documenting these types of cellular DNA damage)
2. A wide variety of changes leading to lowered male fertility, lowered female fertility, increased spontaneous abortion, lowered levels of estrogen, progesterone and testosterone, lowered libido (18 reviews). Human sperm count has dropped to below 50% of what used to be considered normal throughout the technologically advanced countries of the world [1]. Reproductive rates have fallen below replacement levels in every technologically advanced country of the world, with a single exception. These include every EU country, the U.S., Canada, Japan, South Korea, Taiwan, Singapore, Australia and New Zealand. Reproduction averages, in these countries, about 73% of replacement levels according to 2015 or 2016 data. A study on mouse reproduction [2] showed that radio/microwave frequency EMF exposure at doses well within our current safety guidelines produced substantial dose-dependent decreases in reproduction within

the first set of litters; further exposure produced dose-dependent complete or almost complete sterility that was found to be largely irreversible. When we have a technology that is universally present in these technologically advanced countries, that we know impacts reproduction, and reproduction has already dropped well below replacement levels, and we may be facing a catastrophic and irreversible decline in reproduction and there are more and more plans to expose us still further, don't you think that we should take note of the science? Mr. Ryan and Dr. Vinciūnas seem to be saying not at all. (Please note that the U.S. FCC and FDA also completely ignore this existential threat)

3. Neurological/neuropsychiatric effects (25 reviews). My own paper on this [3] and two earlier reviews cited in it found that there are whole series of repeatedly found EMF effects which have also become extremely widespread complaints in our technologically advanced societies, namely: sleep disturbance/insomnia; fatigue/tiredness; headache; depression/depressive symptoms; lack of concentration/attention/cognitive dysfunction; dizziness/vertigo; memory changes; restlessness/tension/anxiety/stress/agitation; irritability. These findings are not just based on epidemiological findings but are also based on profound impacts of EMFs, at levels well within our safety guidelines, on brain structure and function and also on the mechanism of non-thermal EMF action discussed below. When we have these neuropsychiatric effects becoming more and more common in technologically advanced societies all over the world, and *we know each of these is caused EMF exposures*, shouldn't we take note of this relationship?
4. Apoptosis/cell death (13 reviews). The two most important consequences of large increases in apoptosis (programmed cell death) are in causation of the neurodegenerative diseases and lowered reproduction although there are others.
5. Oxidative stress/free radical damage (19 reviews). Oxidative stress has roles in all or almost all chronic diseases. It is reported to have essential roles in producing the reproductive effects and the attacks on cellular DNA and may also have roles in producing the neurological effects and some of the cancer-causing effects shown to be produced here by EMF exposures.
6. Widespread endocrine (that is hormonal) effects (12 reviews). The steroid hormone levels drop with EMF exposure, whereas other hormone levels increase with initial exposure. The neuroendocrine hormones and insulin levels often drop with prolonged EMF exposure, possibly due to endocrine exhaustion.
7. Increases in intracellular calcium ([Ca2+]i) levels following EMF exposure (15 reviews). Calcium signaling also increases following EMF exposure.
8. Cancer causation (35 reviews). Brain cancer, salivary cancer, acoustic neuromas and two other types of cancer go up with cell phone use. People living near cell phone towers have increased cancer rates. Other types of EMFs are each implicated. Short wave radio, radio ham operators and people exposed to radar all are reported to have increased cancer incidence. Perhaps most telling, heavy-long term cell phone users have the highest incidence of brain cancer and have predominantly cancer increases on the ipsilateral side of the head (the side they use their cell phones), as opposed to the contralateral side. I have a paper [7], focused not on whether EMFs cause cancer but rather on ***how*** they can cause cancer. The paper shows that "downstream effects" of the main target of the EMFs in the cells of our bodies, can cause cancer in 15 different ways, including increases in cancer initiation, promotion and progression. Progression effects include both tissue invasion and metastasis. Each of these cancer causation effects are caused via mechanisms produced by downstream effects of the main non-thermal EMF mechanism, as discussed in Chapter 2.
9. Therapeutic effects of such EMFs. Such EMFs when focused on a specific region of the body where there is some dysfunction and when used at specific intensities, can have therapeutic effects. In my 2013 paper [4], I cited 12 different reviews where EMF

stimulation of bone growth was used therapeutically. There are something like 4000 papers on various therapeutic effects. Strangely, the telecommunications industry does not acknowledge these therapeutic effects, preferring rather to maintain the fiction that there are no non-thermal effects.

There is another set of reviews, 13 in this case, with each showing that pulsed EMFs are, in most cases, much more biologically active than are non-pulsed EMFs. This is particularly important because all wireless communication devices communicate via pulsations, making them potentially much more dangerous. It follows from this that if you wish to study the effects of Wi-Fi, cell phones, cordless phones, cell phone towers, smart meters or 5G, you had better study the real thing or at least something that pulses very much like the real thing. There are many studies that don't do this, but falsely claim to be genuine Wi-Fi, cell phone or cordless phone studies. Other factors that influence the occurrence of non-thermal EMF effects include the frequency being used, the polarization of the EMFs and the cell type being studied [4,5,8-11]. Furthermore there are intensity "windows" that produce maximum biological effects, such that both lower and higher intensities produce much less effect [5,8,9]. These window effect studies clearly show that dose-response curves are both non-linear and non-monotone, such that it is difficult or impossible to predict effects based on relative intensity even when all other factors are the same. The role of each of these factors is completely ignored by ICNIRP, SCENIHR, the U.S. FCC, FDA and National Cancer Institute as well as by many other industry-friendly groups. When each of these organizations concludes that "results are inconsistent" they are comparing studies based on superficial similarities but not on these demonstrated causal factors. What is being observed, therefore, is genuine biological heterogeneity, not inconsistency. It has been known since the beginning of modern science in the 16th century that how you do your studies is important in determining what results are obtained. How is it possible that ICNIRP, SCENIHR, the U.S. FCC, FDA and National Cancer Institute have forgotten this important fact?

The primary literature studies demonstrating roles of pulsation, frequency, polarization, cell type and intensity windows in determining biological effects are entirely dependent on having genuine effects to study. None of these studies could have been done without an effect to study. Consequently, the claims that there are no well-documented EMF effects are nonsense, based not only on the eight extremely well-documented effects summarized above, but also on the entire literature demonstrating the role of pulsation, frequency, polarization, cell type and intensity windows.

Now I haven't said anything about how these non-thermal EMF effects are produced. I am taking much of Chapter 2 from a recent paper [11].

Reviews each showing important health-related non-thermal effects of microwave frequency electromagnetic fields (EMFs).

These review lists were prepared by Dr. Martin L. Pall, Professor Emeritus of Biochemistry and Basic Medical Sciences, Washington State University. martin_pall@wsu.edu
BA degree in Physics, Phi Beta Kappa, with honors, Johns Hopkins University; PhD in Biochemistry & Genetics, Caltech.

Specific effects and reviews each reporting the effect in multiple primary literature studies:

Cellular DNA damage: Single strand and double strand breaks in cellular DNA and oxidized bases in cellular DNA, leading to chromosomal and other mutational changes:

1. Glaser ZR, PhD. 1971 Naval Medical Research Institute Research Report, June 1971. Bibliography of Reported Biological Phenomena ("Effects") and Clinical Manifestations Attributed to Microwave and Radio-Frequency Radiation. Report No. 2 Revised. https://scholar.google.com/scholar?q=Glaser+naval+medical+microwave+radio-frequency+1972&btnG=&hl=en&as_sdt=0%2C38 (Accessed Sept. 9, 2017)
2. Goldsmith JR. 1997 Epidemiologic evidence relevant to radar (microwave) effects. Environ Health Perspect 105(Suppl 6):1579-1587.
3. Yakymenko IL, Sidorik EP, Tsybulin AS. 1999 [Metabolic changes in cells under electromagnetic radiation of mobile communication systems]. Ukr Biokhim Zh (1999), 2011 Mar-Apr:20-28.
4. Aitken RJ, De Iuliis GN. 2007 Origins and consequences of DNA damage in male germ cells. Reprod Biomed Online 14:727-733.
5. Hardell, L., Sage, C. 2008. Biological effects from electromagnetic field exposure and public exposure standards. Biomed. Pharmacother. 62, 104-109.
6. Hazout A, Menezo Y, Madelenat P, Yazbeck C, Selva J, Cohen-Bacrie P. 2008 [Causes and clinical implications of sperm DNA damages]. Gynecol Obstet Fertil ;36:1109-1117.
7. Phillips JL, Singh NP, Lai H. 2009 Electromagnetic fields and DNA damage. Pathophysiology 16:79-88.
8. Ruediger HW. 2009 Genotoxic effects of radiofrequency electromagnetic fields. Pathophysiology. 16:89-102.
9. Makker K, Varghese A, Desai NR, Mouradi R, Agarwal A. 2009 Cell phones: modern man's nemesis? Reprod Biomed Online 18:148-157.
10. Yakymenko I, Sidorik E. 2010 Risks of carcinogenesis from electromagnetic radiation and mobile telephony devices. Exp Oncol 32:729-736.
11. Yakimenko IL, Sidorik EP, Tsybulin AS. 2011 [Metabolic changes in cells under electromagnetic radiation of mobile communication systems]. Ukr Biokhim Zh (1999). 2011 Mar-Apr;83(2):20-28.
12. Gye MC, Park CJ. 2012 Effect of electromagnetic field exposure on the reproductive system. Clin Exp Reprod Med 39:1-9. doi.org/10.5653/cerm.2012.39.1.1
13. Pall, ML. 2013. Electromagnetic fields act via activation of voltage-gated calcium channels to produce beneficial or adverse effects. J Cell Mol Med 17:958-965. doi: 10.1111/jcmm.12088.
14. Pall, M. L. 2015 Scientific evidence contradicts findings and assumptions of Canadian Safety Panel 6: microwaves act through voltage-gated calcium channel activation to induce biological impacts at non-thermal levels, supporting a paradigm shift for microwave/lower frequency electromagnetic field action. Rev. Environ. Health 3, 99-116. doi: 10.1515/reveh-2015-0001.
15. Hensinger P, Wilke E. 2016. Mobilfunk-Studienergebnisse bestätigen Risiken Studienrecherche 2016-4 veröffentlicht. Umwelt Medizin Gesellshaft 29:3/2016.
16. Houston BJ, Nixon B, King BV, De Iuliis GN, Aitken RJ. 2016 The effects of radiofrequency electromagnetic radiation on sperm function. Reproduction 152:R263-R276.
17. Batista Napotnik T, Reberšek M, Vernier PT, Mali B, Miklavčič D. 2016 Effects of high voltage nanosecond electric pulses on eukaryotic cells (in vitro): A systematic review. Bioelectrochemistry. 2016 Aug;110:1-12. doi: 10.1016/j.bioelechem.2016.02.011.
18. Asghari A, Khaki AA, Rajabzadeh A, Khaki A. 2016 A review on Electromagnetic fields (EMFs) and the reproductive system. Electron Physician. 2016 Jul 25;8(7):2655-2662. doi: 10.19082/2655.

19. Pall ML. 2018 How cancer can be caused by microwave frequency electromagnetic field (EMF) exposures: EMF activation of voltage-gated calcium channels (VGCCs) can cause cancer including tumor promotion, tissue invasion and metastasis via 15 mechanisms. Chapter 7 in Mobile Communications and Public Health, Marko Markov, Ed., CRC press, pp 163-184.
20. Pall ML. 2018 Wi-Fi is an important threat to human health. Environ Res 164:404-416.
21. Wilke I. 2018 Biological and pathological effects of 2.45 GHz on cells, fertility, brain and behavior. Umwelt Medizin Gesselshaft 2018 Feb 31 (1).

Lowered fertility, including tissue remodeling changes in the testis, lowered sperm count and sperm quality, lowered female fertility including ovarian remodeling, oocyte (follicle) loss, lowered estrogen, progesterone and testosterone levels (that is sex hormone levels), increased spontaneous abortion incidence, lowered libido:

1. Glaser ZR, PhD. 1971 Naval Medical Research Institute Research Report, June 1971. Bibliography of Reported Biological Phenomena ("Effects") and Clinical Manifestations Attributed to Microwave and Radio-Frequency Radiation. Report No. 2 Revised. https://scholar.google.com/scholar?q=Glaser+naval+medical+microwave+radio-frequency+1972&btnG=&hl=en&as_sdt=0%2C38 (Accessed Sept. 9, 2017)
2. Tolgskaya MS, Gordon ZV. 1973. Pathological Effects of Radio Waves, Translated from Russian by B Haigh. Consultants Bureau, New York/London, 146 pages.
3. Goldsmith JR. 1997 Epidemiological evidence relevant to radar (microwave) effects. Environ Health Perspect 105(Suppl 6):1579-1587.
4. Aitken RJ, De Iuliis GN. 2007 Origins and consequences of DNA damage in male germ cells. Reprod Biomed Online 14:727-733.
5. Hazout A, Menezo Y, Madelenat P, Yazbeck C, Selva J, Cohen-Bacrie P. 2008 [Causes and clinical implications of sperm DNA damages]. Gynecol Obstet Fertil ;36:1109-1117.
6. Makker K, Varghese A, Desai NR, Mouradi R, Agarwal A. 2009 Cell phones: modern man's nemesis? Reprod Biomed Online 18:148-157.
7. Kang N, Shang XJ, Huang YF. 2010 [Impact of cell phone radiation on male reproduction]. Zhonghua Nan Ke Xue 16:1027-1030.
8. Gye MC, Park CJ. 2012 Effect of electromagnetic field exposure on the reproductive system. Clin Exp Reprod Med 39:1-9. doi.org/10.5653/cerm.2012.39.1.1
9. La Vignera S, Condorelli RA, Vicari E, D'Agata R, Calogero AE. 2012 Effects of the exposure to mobile phones on male reproduction: a review of the literature. J Androl 33:350-356.
10. Carpenter DO. 2013 Human disease resulting from exposure to electromagnetic fields. Rev Environ Health 2013;28:159-172.
11. Nazıroğlu M, Yüksel M, Köse SA, Özkaya MO. 2013 Recent reports of Wi-Fi and mobile phone-induced radiation on oxidative stress and reproductive signaling pathways in females and males. J Membr Biol 246:869-875.
12. Adams JA, Galloway TS, Mondal D, Esteves SC, Mathews F. 2014 Effect of mobile telephones on sperm quality: a systematic review and meta-analysis. Environ Int 70:106-112.
13. Liu K, Li Y, Zhang G, Liu J, Cao J, Ao L, Zhang S. 2014 Association between mobile phone use and semen quality: a systematic review and meta-analysis. Andrology 2:491-501.

14. K Sri N. 2015 Mobile phone radiation: physiological & pathophysiological considerations. Indian J Physiol Pharmacol 59:125-135.
15. Hensinger P, Wilke E. 2016. Mobilfunk-Studienergebnisse bestätigen Risiken Studienrecherche 2016-4 veröffentlicht. Umwelt Medizin Gesellshaft 29:3/2016.
16. Houston BJ, Nixon B, King BV, De Iuliis GN, Aitken RJ. 2016 The effects of radiofrequency electromagnetic radiation on sperm function. Reproduction 152:R263-R276
17. Pall ML. 2018 Wi-Fi is an important threat to human health. Environ Res 164:404-416.
18. Wilke I. 2018 Biological and pathological effects of 2.45 GHz on cells, fertility, brain and behavior. Umwelt Medizin Gesselshaft 2018 Feb 31 (1).

Neurological/neuropsychiatric effects:

1. Marha K. 1966 Biological Effects of High-Frequency Electromagnetic Fields (Translation). ATD Report 66-92. July 13, 1966 (ATD Work Assignment No. 78, Task 11). http://www.dtic.mil/docs/citations/AD0642029 (accessed March 12, 2018)
2. Glaser ZR, PhD. 1971 Naval Medical Research Institute Research Report, June 1971. Bibliography of Reported Biological Phenomena ("Effects") and Clinical Manifestations Attributed to Microwave and Radio-Frequency Radiation. Report No. 2 Revised. https://scholar.google.com/scholar?q=Glaser+naval+medical+microwave+radio-frequency+1972&btnG=&hl=en&as_sdt=0%2C38 (Accessed Sept. 9, 2017)
3. Tolgskaya MS, Gordon ZV. 1973. Pathological Effects of Radio Waves, Translated from Russian by by Haigh. Consultants Bureau, New York/London, 146 pages.
4. Bise W. 1978 Low power radio-frequency and microwave effects on human electroencephalogram and behavior. Physiol Chem Phys 10:387-398.
5. Raines, J. K. 1981. Electromagnetic Field Interactions with the Human Body: Observed Effects and Theories. Greenbelt, Maryland: National Aeronautics and Space Administration 1981; 116 p.
6. Frey AH. 1993 Electromagnetic field interactions with biological systems. FASEB J 7:272-281.
7. Lai H. 1994 Neurological effects of radiofrequency electromagnetic radiation. In: Advances in Electromagnetic Fields in Living Systems, Vol. 1, J.C. Lin, Ed., Plenum Press, New York, pp. 27-88.
8. Grigor'ev IuG. 1996 [Role of modulation in biological effects of electromagnetic radiation]. Radiats Biol Radioecol 36:659-670.
9. Lai, H 1998 Neurological effects of radiofrequency electromagnetic radiation. http://www.mapcruzin.com/radiofrequency/henry_lai2.htm.
10. Aitken RJ, De Iuliis GN. 2007 Origins and consequences of DNA damage in male germ cells. Reprod Biomed Online 14:727-733.
11. Hardell, L., Sage, C. 2008. Biological effects from electromagnetic field exposure and public exposure standards. Biomed. Pharmacother. 62, 104-109.
12. Makker K, Varghese A, Desai NR, Mouradi R, Agarwal A. 2009 Cell phones: modern man's nemesis? Reprod Biomed Online 18:148-157.
13. Khurana VG, Hardell L, Everaert J, Bortkiewicz A, Carlberg M, Ahonen M. 2010 Epidemiological evidence for a health risk from mobile phone base stations. Int J Occup Environ Health 16:263-267.

14. Levitt, B. B., Lai, H. 2010. Biological effects from exposure to electromagnetic radiation emitted by cell tower base stations and other antenna arrays. Environ. Rev. 18, 369-395. doi.org/10.1139/A10-018
15. Carpenter DO. 2013 Human disease resulting from exposure to electromagnetic fields. Rev Environ Health 2013;28:159-172.
16. Politański P, Bortkiewicz A, Zmyślony M. 2016 [Effects of radio- and microwaves emitted by wireless communication devices on the functions of the nervous system selected elements]. Med Pr 67:411-421.
17. Hensinger P, Wilke E. 2016. Mobilfunk-Studienergebnisse bestätigen Risiken Studienrecherche 2016-4 veröffentlicht. Umwelt Medizin Gesellshaft 29:3/2016.
18. Pall ML. 2016 Microwave frequency electromagnetic fields (EMFs) produce widespread neuropsychiatric effects including depression. J Chem Neuroanat 75(Pt B):43-51. doi: 10.1016/j.jchemneu.2015.08.001.
19. Hecht, Karl. 2016 Health Implications of Long-Term Exposures to Electrosmog. Brochure 6 of A Brochure Series of the Competence Initiative for the Protection of Humanity, the Environment and Democracy. http://kompetenzinitiative.net/KIT/wp-content/uploads/2016/07/KI_Brochure-6_K_Hecht_web.pdf (accessed Feb. 11, 2018)
20. Sangün Ö, Dündar B, Çömlekçi S, Büyükgebiz A. 2016 The Effects of Electromagnetic Field on the Endocrine System in Children and Adolescents. Pediatr Endocrinol Rev 13:531-545.
21. Belyaev I, Dean A, Eger H, Hubmann G, Jandrisovits R, Kern M, Kundi M, Moshammer H, Lercher P, Müller K, Oberfeld G, Ohnsorge P, Pelzmann P, Scheingraber C, Thill R. 2016 EUROPAEM EMF Guideline 2016 for the prevention, diagnosis and treatment of EMF-related health problems and illnesses. Rev Environ Health DOI 10.1515/reveh-2016-0011.
22. Zhang J, Sumich A, Wang GY. 2017 Acute effects of radiofrequency electromagnetic field emitted by mobile phone on brain function. Bioelectromagnetics 38:329-338. doi: 10.1002/bem.22052.
23. Lai H. 2018. A Summary of Recent Literature (2007–2017) on Neurological Effects of Radio Frequency Radiation. Chapter 8 in Mobile Communications and Public Health, Marko Markov, Ed., CRC press, pp 185-220.
24. Pall ML. 2018 Wi-Fi is an important threat to human health. Environ Res 164:404-416.
25. Wilke I. 2018 Biological and pathological effects of 2.45 GHz on cells, fertility, brain and behavior. Umwelt Medizin Gesselshaft 2018 Feb 31 (1).

Apoptosis/cell death (an important process in production of neurodegenerative diseases that is also important in producing infertility responses):

1. Glaser ZR, PhD. 1971 Naval Medical Research Institute Research Report, June 1971. Bibliography of Reported Biological Phenomena ("Effects") and Clinical Manifestations Attributed to Microwave and Radio-Frequency Radiation. Report No. 2 Revised. https://scholar.google.com/scholar?q=Glaser+naval+medical+microwave+radio-frequency+1972&btnG=&hl=en&as_sdt=0%2C38 (Accessed Sept. 9, 2017)
2. Tolgskaya MS, Gordon ZV. 1973. Pathological Effects of Radio Waves, Translated from Russian by B Haigh. Consultants Bureau, New York/London, 146 pages.
3. Raines, J. K. 1981. Electromagnetic Field Interactions with the Human Body: Observed Effects and Theories. Greenbelt, Maryland: National Aeronautics and Space Administration 1981; 116 p.

4. Hardell L, Sage C. 2008. Biological effects from electromagnetic field exposure and public exposure standards. Biomed. Pharmacother. 62:104-109. doi: 10.1016/j.biopha.2007.12.004.
5. Makker K, Varghese A, Desai NR, Mouradi R, Agarwal A. 2009 Cell phones: modern man's nemesis? Reprod Biomed Online 18:148-157.
6. Levitt, B. B., Lai, H. 2010. Biological effects from exposure to electromagnetic radiation emitted by cell tower base stations and other antenna arrays. Environ. Rev. 18, 369-395. doi.org/10.1139/A10-018
7. Yakymenko I, Sidorik E. 2010 Risks of carcinogenesis from electromagnetic radiation and mobile telephony devices. Exp Oncol 32:729-736.
8. Yakimenko IL, Sidorik EP, Tsybulin AS. 2011 [Metabolic changes in cells under electromagnetic radiation of mobile communication systems]. Ukr Biokhim Zh (1999). 2011 Mar-Apr;83(2):20-28.
9. Pall, ML. 2013. Electromagnetic fields act via activation of voltage-gated calcium channels to produce beneficial or adverse effects. J Cell Mol Med 17:958-965. doi: 10.1111/jcmm.12088.
10. Pall ML. 2016 Microwave frequency electromagnetic fields (EMFs) produce widespread neuropsychiatric effects including depression. J Chem Neuroanat 75(Pt B):43-51. doi: 10.1016/j.jchemneu.2015.08.001.
11. Batista Napotnik T, Reberšek M, Vernier PT, Mali B, Miklavčič D. 2016 Effects of high voltage nanosecond electric pulses on eukaryotic cells (in vitro): A systematic review. Bioelectrochemistry. 2016 Aug;110:1-12. doi: 10.1016/j.bioelechem.2016.02.011.
12. Asghari A, Khaki AA, Rajabzadeh A, Khaki A. 2016 A review on Electromagnetic fields (EMFs) and the reproductive system. Electron Physician. 2016 Jul 25;8(7):2655-2662. doi: 10.19082/2655.
13. Pall ML. 2018 Wi-Fi is an important threat to human health. Environ Res 164:404-416.

Oxidative stress/free radical damage (important mechanisms involved in almost all chronic diseases; direct cause of cellular DNA damage):

1. Raines, J. K. 1981. Electromagnetic Field Interactions with the Human Body: Observed Effects and Theories. Greenbelt, Maryland: National Aeronautics and Space Administration 1981; 116 p.
2. Hardell, L., Sage, C. 2008. Biological effects from electromagnetic field exposure and public exposure standards. Biomed. Pharmacother. 62, 104-109.
3. Hazout A, Menezo Y, Madelenat P, Yazbeck C, Selva J, Cohen-Bacrie P. 2008 [Causes and clinical implications of sperm DNA damages]. Gynecol Obstet Fertil ;36:1109-1117
4. Makker K, Varghese A, Desai NR, Mouradi R, Agarwal A. 2009 Cell phones: modern man's nemesis? Reprod Biomed Online 18:148-157.
5. Desai NR, Kesari KK, Agarwal A. 2009 Pathophysiology of cell phone radiation: oxidative stress and carcinogenesis with focus on the male reproductive system. Reproduct Biol Endocrinol 7:114.
6. Yakymenko I, Sidorik E. 2010 Risks of carcinogenesis from electromagnetic radiation and mobile telephony devices. Exp Oncol 32:729-736.
7. Yakimenko IL, Sidorik EP, Tsybulin AS. 2011 [Metabolic changes in cells under electromagnetic radiation of mobile communication systems]. Ukr Biokhim Zh (1999). 2011 Mar-Apr;83(2):20-28.
8. Consales, C., Merla, C., Marino, C., et al. 2012. Electromagnetic fields, oxidative stress, and neurodegeneration. Int. J. Cell Biol. 2012: 683897.

9. LaVignera et al 2012 La Vignera S, Condorelli RA, Vicari E, D'Agata R, Calogero AE. 2012 Effects of the exposure to mobile phones on male reproduction: a review of the literature. J Androl 33:350-356.
10. Pall, ML. 2013. Electromagnetic fields act via activation of voltage-gated calcium channels to produce beneficial or adverse effects. J Cell Mol Med 17:958-965. doi: 10.1111/jcmm.12088.
11. Nazıroğlu M, Yüksel M, Köse SA, Özkaya MO. 2013 Recent reports of Wi-Fi and mobile phone-induced radiation on oxidative stress and reproductive signaling pathways in females and males. J Membr Biol 246:869-875.
12. Pall, M. L. 2015. Scientific evidence contradicts findings and assumptions of Canadian Safety Panel 6: microwaves act through voltage-gated calcium channel activation to induce biological impacts at non-thermal levels, supporting a paradigm shift for microwave/lower frequency electromagnetic field action. Rev. Environ. Health 3, 99-116.
13. Yakymenko I, Tsybulin O, Sidorik E, Henshel D, Kyrylenko O, Kysylenko S. 2015 Oxidative mechanisms of biological activity of low-intensity radiofrequency radiation. Electromagnetic Biol Med: Early Online 1-16. ISSN: 1536-8378.
14. Hensinger P, Wilke E. 2016. Mobilfunk-Studienergebnisse bestätigen Risiken Studienrecherche 2016-4 veröffentlicht. Umwelt Medizin Gesellshaft 29:3/2016.
15. Houston BJ, Nixon B, King BV, De Iuliis GN, Aitken RJ. 2016 The effects of radiofrequency electromagnetic radiation on sperm function. Reproduction 152:R263-R276.
16. Dasdag S, Akdag MZ. 2016 The link between radiofrequencies emitted from wireless technologies and oxidative stress. J Chem Neuroanat 75(Pt B):85-93.
17. Wang H, Zhang X. 2017 Magnetic fields and reactive oxygen species. Int J Mol Sci. 2017 Oct 18;18(10). pii: E2175. doi: 10.3390/ijms18102175.
18. Pall ML. 2018 Wi-Fi is an important threat to human health. Environ Res 164:404-416.
19. Wilke I. 2018 Biological and pathological effects of 2.45 GHz on cells, fertility, brain and behavior. Umwelt Medizin Gesselshaft 2018 Feb 31 (1).

Endocrine, that is hormonal effects:

1. Glaser ZR, PhD. 1971 Naval Medical Research Institute Research Report, June 1971. Bibliography of Reported Biological Phenomena ("Effects") and Clinical Manifestations Attributed to Microwave and Radio-Frequency Radiation. Report No. 2 Revised. https://scholar.google.com/scholar?q=Glaser+naval+medical+microwave+radio-frequency+1972&btnG=&hl=en&as_sdt=0%2C38 (Accessed Sept. 9, 2017)
2. Tolgskaya MS, Gordon ZV. 1973. Pathological Effects of Radio Waves, Translated from Russian by B Haigh. Consultants Bureau, New York/London, 146 pages.
3. Raines, J. K. 1981. Electromagnetic Field Interactions with the Human Body: Observed Effects and Theories. Greenbelt, Maryland: National Aeronautics and Space Administration 1981; 116 p.
4. Hardell, L., Sage, C. 2008. Biological effects from electromagnetic field exposure and public exposure standards. Biomed. Pharmacother. 62, 104-109.
5. Makker K, Varghese A, Desai NR, Mouradi R, Agarwal A. 2009 Cell phones: modern man's nemesis? Reprod Biomed Online 18:148-157.
6. Gye MC, Park CJ. 2012 Effect of electromagnetic field exposure on the reproductive system. Clin Exp Reprod Med 39:1-9. doi.org/10.5653/cerm.2012.39.1.1

7. Pall, M. L. 2015. Scientific evidence contradicts findings and assumptions of Canadian Safety Panel 6: microwaves act through voltage-gated calcium channel activation to induce biological impacts at non-thermal levels, supporting a paradigm shift for microwave/lower frequency electromagnetic field action. Rev. Environ. Health 3, 99-116.
8. Sangün Ö, Dündar B, Çömlekçi S, Büyükgebiz A. 2016 The Effects of Electromagnetic Field on the Endocrine System in Children and Adolescents. Pediatr Endocrinol Rev 13:531-545.
9. Hecht, Karl. 2016 Health Implications of Long-Term Exposures to Electrosmog. Brochure 6 of A Brochure Series of the Competence Initiative for the Protection of Humanity, the Environment and Democracy. http://kompetenzinitiative.net/KIT/wp-content/uploads/2016/07/KI_Brochure-6_K_Hecht_web.pdf (accessed Feb. 11, 2018)
10. Asghari A, Khaki AA, Rajabzadeh A, Khaki A. 2016 A review on Electromagnetic fields (EMFs) and the reproductive system. Electron Physician. 2016 Jul 25;8(7):2655-2662. doi: 10.19082/2655.
11. Pall ML. 2018 Wi-Fi is an important threat to human health. Environ Res 164:404-416.
12. Wilke I. 2018 Biological and pathological effects of 2.45 GHz on cells, fertility, brain and behavior. Umwelt Medizin Gesselshaft 2018 Feb 31 (1).

Increased intracellular calcium: intracellular calcium is maintained at very low levels (typically about 2 X 10-9 M) except for brief increases used to produce regulatory responses, such that sustained elevation of intracellular calcium levels produces many pathophysiological (that is disease-causing) responses).

1. Adey WR. 1988 Cell membranes: the electromagnetic environment and cancer promotion. Neurochem Res.13:671-677.
2. Walleczek, J. 1992. Electromagnetic field effects on cells of the immune system: the role of calcium signaling. FASEB J. 6, 3177-3185.
3. Adey, WR. 1993 Biological effects of electromagnetic fields. J Cell Biochem 51:410-416.
4. Frey AH. 1993 Electromagnetic field interactions with biological systems. FASEB J 7:272-281.
5. Funk RHW, Monsees T, Özkucur N. 2009 Electromagnetic effects—Form cell biology to medicine. Prog Histochem Cytochem 43:177-264.
6. Yakymenko IL, Sidorik EP, Tsybulin AS. 1999 [Metabolic changes in cells under electromagnetic radiation of mobile communication systems]. Ukr Biokhim Zh (1999), 2011 Mar-Apr:20-28.
7. Gye MC, Park CJ. 2012 Effect of electromagnetic field exposure on the reproductive system. Clin Exp Reprod Med 39:1-9. doi.org/10.5653/cerm.2012.39.1.1
8. Pall, ML. 2013. Electromagnetic fields act via activation of voltage-gated calcium channels to produce beneficial or adverse effects. J Cell Mol Med 17:958-965. doi: 10.1111/jcmm.12088.
9. Pall ML. 2014 Electromagnetic field activation of voltage-gated calcium channels: role in therapeutic effects. Electromagn Biol Med. 2014 Apr 8 doi: 10.3109/15368378.2014.906447.
10. Pall ML. 2015 How to approach the challenge of minimizing non-thermal health effects of microwave radiation from electrical devices. International Journal of Innovative Research in Engineering & Management (IJIREM) ISSN: 2350-0557, Volume-2, Issue -5, September 2015; 71-76.

11. Pall, M. L. 2015 Scientific evidence contradicts findings and assumptions of Canadian Safety Panel 6: microwaves act through voltage-gated calcium channel activation to induce biological impacts at non-thermal levels, supporting a paradigm shift for microwave/lower frequency electromagnetic field action. Rev. Environ. Health 3, 99-116. doi: 10.1515/reveh-2015-0001.
12. Pall ML. 2016 Electromagnetic fields act similarly in plants as in animals: Probable activation of calcium channels via their voltage sensor. Curr Chem Biol 10: 74-82.
13. Pall ML. 2016 Microwave frequency electromagnetic fields (EMFs) produce widespread neuropsychiatric effects including depression. J Chem Neuroanat 75(Pt B):43-51. doi: 10.1016/j.jchemneu.2015.08.001.
14. Batista Napotnik T, Reberšek M, Vernier PT, Mali B, Miklavčič D. 2016 Effects of high voltage nanosecond electric pulses on eukaryotic cells (in vitro): A systematic review. Bioelectrochemistry. 2016 Aug;110:1-12. doi: 10.1016/j.bioelechem.2016.02.011.
15. Asghari A, Khaki AA, Rajabzadeh A, Khaki A. 2016 A review on electromagnetic fields (EMFs) and the reproductive system. Electron Physician. 2016 Jul 25;8(7):2655-2662. doi: 10.19082/2655.

Pulsed EMFs are, in most cases much more biologically active than are non-pulsed EMFs. This is important because all wireless communication devices communicate via pulsations and because the "smarter" the devices are, the more they pulse because the pulsations convey the information. What should be obvious is that you cannot study such pulsation roles if there were no biological effects produced by such EMFs. *The pulsation studies alone tell us that there are many such EMF effects.*

1. Osipov YuA, 1965 [Labor hygiene and the effect of radiofrequency electromagnetic fields on workers]. Leningrad Meditsina Publishing House, 220 pp.
2. Pollack H, Healer J. 1967 Review of Information on Hazards to Personnel from High-Frequency Electromagnetic Radiation. Institute for Defense Analyses; Research and Engineering Support Division. IDA/HQ 67-6211, Series B, May 1967.
3. Frey AH. 1974 Differential biologic effects of pulsed and continuous electromagnetic fields and mechanisms of effect. Ann N Y Acad Sci 238: 273-279.
4. Creighton MO, Larsen LE, Stewart-DeHaan PJ, Jacobi JH, Sanwal M, Baskerville JC, Bassen HE, Brown DO, Trevithick JR. 1987 In vitro studies of microwave-induced cataract. II. Comparison of damage observed for continuous wave and pulsed microwaves. Exp Eye Res 45:357-373.
5. Grigor'ev IuG. 1996 [Role of modulation in biological effects of electromagnetic radiation]. Radiats Biol Radioecol 36:659-670.
6. Belyaev I. 2005 Non-thermal biological effects of microwaves. Microwave Rev 11:13-29.
7. Belyaev I. 2005 Non-thermal biological effects of microwaves: current knowledge, further perspective and urgent needs. Electromagn Biol Med 24(3):375-403.
8. Markov MS. 2007 Pulsed electromagnetic field therapy: History, state of the art and future. The Environmentalist 27:465-475.
9. Van Boxem K, Huntoon M, Van Zundert J, Patijn J, van Kleef M, Joosten EA. 2014 Pulsed radiofrequency: a review of the basic science as applied to the pathophysiology of radicular pain: a call for clinical translation. Reg Anesth Pain Med. 2014 Mar-Apr;39(2):149-59.
10. Belyaev, I. 2015. Biophysical mechanisms for nonthermal microwave effects. In: Electromagnetic Fields in Biology and Medicine, Marko S. Markov, ed, CRC Press, New York, pp 49-67.

11. Pall, M. L. 2015 Scientific evidence contradicts findings and assumptions of Canadian Safety Panel 6: microwaves act through voltage-gated calcium channel activation to induce biological impacts at non-thermal levels, supporting a paradigm shift for microwave/lower frequency electromagnetic field action. Rev. Environ. Health 3, 99-116. doi: 10.1515/reveh-2015-0001.
12. Panagopoulos DJ, Johansson O, Carlo GL. 2015 Real versus simulated mobile phone exposures in experimental studies. BioMed. Res. Int. 2015, article ID 607053, 8 pages. doi: 10.1155/2015/607053.
13. Batista Napotnik T, Reberšek M, Vernier PT, Mali B, Miklavčič D. 2016 Effects of high voltage nanosecond electric pulses on eukaryotic cells (in vitro): A systematic review. Bioelectrochemistry. 2016 Aug;110:1-12. doi: 10.1016/j.bioelechem.2016.02.011.

Cancer causation by EMF exposures:

1. Dwyer, M. J., Leeper, D. B. 1978 A Current Literature Report on the Carcinogenic Properties of Ionizing and Nonionizing Radiation. DHEW Publication (NIOSH) 78-134, March 1978.
2. Marino AA, Morris DH. 1985 Chronic electromagnetic stressors in the environment. A risk factor in human cancer. J environ sci health C3:189-219.
3. Adey WR. 1988 Cell membranes: the electromagnetic environment and cancer promotion. Neurochem Res.13:671-677.
4. Adey WR. 1990 Joint actions of environmental nonionizing electromagnetic fields and chemical pollution in cancer promotion. Environ Health Perspect 86:297-305.
5. Frey AH. 1993 Electromagnetic field interactions with biological systems. FASEB J 7:272-281.
6. Goldsmith JR. 1995 Epidemiological evidence of radiofrequency radiation (microwave) effects on health in military, broadcasting and occupational settings. Int J Occup Environ Health 1:47-57.
7. Goldsmith JR. 1997 Epidemiologic evidence relevant to radar (microwave) effects. Env Health Perspect 105(Suppl 6):1579-1587.
8. Kundi M, Mild K, Hardell L, Mattsson M. 2004 Mobile telephones and cancer – a review of the epidemiological evidence. J Toxicol Env Health, Part B 7:351-384.
9. Kundi M. 2004 Mobile phone use and cancer. Occup Env Med 61:560-570.
10. Behari J, Paulraj R. 2007 Biomarkers of induced electromagnetic field and cancer. Indian J Exp Biol 45:77-85.
11. Hardell L, Carlberg M, Soderqvist F, Hansson Mild K. 2008 Meta-analysis of long-term mobile phone use and the association with brain tumors. Int J Oncol 32:1097-1103.
12. Khurana VG, Teo C, Kundi M, Hardell L, Carlberg M. 2009 Cell phones and brain tumors: a review including the long-term epidemiologic data. Surg Neurol 72:205-214.
13. Desai NR, Kesari KK, Agarwal A. 2009 Pathophysiology of cell phone radiation: oxidative stress and carcinogenesis with focus on the male reproductive system. Reproduct Biol Endocrinol 7:114.
14. Davanipour Z, Sobel E. 2009 Long-term exposure to magnetic fields and the risks of Alzheimer's disease and breast cancer: Further biological research. Pathophysiology 16:149-156.
15. Yakymenko I, Sidorik E. 2010 Risks of carcinogenesis from electromagnetic radiation and mobile telephony devices. Exp Oncol 32:729-736.
16. Carpenter DO. 2010 Electromagnetic fields and cancer: the cost of doing nothing. Rev Environ Health 25:75-80.

17. Giuliani L, Soffriti M (Eds). 2010 NON-THERMAL EFFECTS AND MECHANISMS OF INTERACTION BETWEEN ELECTROMAGNETIC FIELDS AND LIVING MATTER, RAMAZZINI INSTITUTE EUR. J. ONCOL. LIBRARY Volume 5, National Institute for the Study and Control of Cancer and Environmental Diseases "Bernardino Ramazzini" Bologna, Italy 2010, 400 page monograph.
18. Khurana, V. G., Hardell, L., Everaert, J., Bortkiewicz, A., Carlberg, M., Ahonen, M. 2010 Epidemiological evidence for a health risk from mobile phone base stations. Int. J. Occup. Environ. Health 16, 263-267.
19. Yakymenko, I., Sidorik, E., Kyrylenko, S., Chekhun, V. 2011. Long-term exposure to microwave radiation provokes cancer growth: evidences from radars and mobile communication systems. Exp. Oncol. 33(2), 62-70.
20. Biointiative Working Group, David Carpenter and Cindy Sage (eds). 2012 Bioinitiative 2012: A rationale for biologically-based exposure standards for electromagnetic radiation. http://www.bioinitiative.org/participants/why-we-care/
21. Ledoigt G, Belpomme D. 2013 Cancer induction molecular pathways and HF-EMF irradiation. Adv Biol Chem 3:177-186.
22. Hardell L, Carlberg M. 2013 Using the Hill viewpoints from 1965 for evaluating strengths of evidence of the risk for brain tumors associated with use of mobile and cordless phones. Rev Environ Health 28:97-106. doi: 10.1515/reveh-2013-0006.
23. Hardell L, Carlberg M, Hansson Mild K. 2013 Use of mobile phones and cordless phones is associated with increased risk for glioma and acoustic neuroma. Pathophysiology 2013;20(2):85-110.
24. Carpenter DO. 2013 Human disease resulting from exposure to electromagnetic fields. Rev Environ Health 2013;28:159-172.gj
25. Davis DL, Kesari S, Soskolne CL, Miller AB, Stein Y. 2013 Swedish review strengthens grounds for concluding that radiation from cellular and cordless phones is a probable human carcinogen. Pathophysiology 20:123-129.
26. Morgan LL, Miller AB, Sasco A, Davis DL. 2015 Mobile phone radiation causes brain tumors and should be classified as a probable human carcinogen (2A). Int J Oncol 46(5): 1865-1871.
27. Mahdavi M, Yekta R, Tackallou SH. 2015 Positive correlation between ELF and RF electromagnetic fields on cancer risk. J Paramed Sci 6(3), ISSN 2008-4978.
28. Carlberg M, Hardell L. 2017 Evaluation of Mobile Phone and Cordless Phone Use and Glioma Risk Using the Bradford Hill Viewpoints from 1965 on Association or Causation. BioMed Res Int 2017, Article ID 9218486, https://doi.org/10.1155/2017/9218486
29. Bortkiewicz A, Gadzicka E, Szymczak W. 2017 Mobile phone use and risk for intracranial tumors and salivary gland tumors - A meta-analysis. Int J Occup Med Environ Health 30:27-43.
30. Bielsa-Fernández P, Rodríguez-Martín B. 2017 [Association between radiation from mobile phones and tumour risk in adults]. Gac Sanit. 2017 Apr 12. pii: S0213-9111(17)30083-3. doi: 10.1016/j.gaceta.2016.10.014. [Epub ahead of print]
31. Alegría-Loyola MA, Galnares-Olalde JA, Mercado M. 2017 [Tumors of the central nervous system]. Rev Med Inst Mex Seguro Soc 55:330-334.
32. Prasad M, Kathuria P, Nair P, Kumar A, Prasad K. 2017 Mobile phone use and risk of brain tumours: a systematic review of association between study quality, source of funding, and research outcomes. Neurol Sci. 2017 Feb 17. doi: 10.1007/s10072-017-2850-8. [Epub ahead of print].
33. Miller A. 2017 References on cell phone radiation and cancer. https://ehtrust.org/references-cell-phone-radio-frequency-radiation-cancer/ (Accessed Sept. 9, 2017)

34. Hardell L. 2017 World Health Organization, radiofrequency radiation and health – a hard nut to crack (Review). Int J Oncol 51:405-413.
35. Pall ML. 2018 How cancer can be caused by microwave frequency electromagnetic field (EMF) exposures: EMF activation of voltage-gated calcium channels (VGCCs) can cause cancer including tumor promotion, tissue invasion and metastasis via 15 mechanisms. Chapter 7 in: Mobile Communications and Public Health, Marko Markov, Ed., CRC Press, pp 163-184.

Each of these reviews, typically cite from 5 to over 100 primary literature citations, each showing that non-thermal EMF exposures produce the effect under which they are listed. It follows from this, that there are not only 11 or more reviews documenting each of these effects, but there is also a massive primary literature documenting these effects as well. It follows from this that the ICNIRP, FCC and International Safety Guidelines, which are entirely based only on thermal effects are inadequate and there have been petitions and other statements of international groups of scientists expressing great concern about this. *It follows that the ICNIRP, FCC and International safety guidelines are completely unscientific and cannot be relied upon to protect our safety.*

Chapter 2: How Each Such EMF Effect Is Produced via Voltage-Gated Calcium Channel Activation: Role of the Voltage Sensor in Producing the Extraordinary Sensitivity to EMF Effects

The Pall, 2013 [4] study showed that in 24 different studies (there are now a total of 26 [5]), effects of low-intensity EMFs, both microwave frequency and also lower frequency EMFs, could be blocked by calcium channel blockers, drugs that are specific for blocking voltage-gated calcium channels (VGCCs). There were 5 different types of calcium channel blockers used in these studies each thought to be highly specific, each structurally distinct and each binding to a different site on the VGCCs. *In studies where multiple effects were studied, all studied effects were blocked or greatly lowered by calcium channel blockers*. These studies show that EMFs produce diverse non-thermal effects via VGCC activation in many human and animal cells and even in plant cells where some similar calcium channels are involved [6]. Furthermore, many different effects shown to be produced in repeated studies by EMF exposures, including the effects discussed above, can each be produced by downstream effects of VGCC activation, via increased intracellular calcium [Ca2+]i, as discussed below.

Various EMFs act via VGCC activation, as shown by calcium channel blocker studies. These include microwave frequency EMFs, nanosecond pulse EMFs, intermediate frequency EMFs, extremely low frequency EMFs and even static electrical fields and static magnetic fields.

It is important to discuss why the VGCCs are so sensitive to activation by these low-intensity EMFs. Each of the VGCCs have a voltage sensor which is made up of 4 alpha helixes, each designated as an S4 helix, in the plasma membrane. Each of these S4 helixes has 5 positive charges on it, for a total of 20 positive charges making up the VGCC voltage sensor [5,8]. Each of these charges is within the lipid bilayer part of the plasma membrane. The electrical forces on the voltage sensor are extraordinarily high for three distinct reasons [5,8]. 1. The 20 charges on the voltage sensor make the forces on voltage sensor 20 times higher than the forces on a single charge. 2. Because these charges are within the lipid bilayer section of the membrane where the dielectric constant is about $1/120^{th}$ of the dielectric constant of the aqueous parts of the cell, the law of physics called Coulomb's law, predicts that the forces will be approximately 120 times higher than the forces on charges in the aqueous parts of the cell. 3. Because the plasma membrane has a high electrical resistance whereas the aqueous parts of the cell are highly

conductive, the electrical gradient across the plasma membrane is estimated to be concentrated about 3000-fold. The combination of these factors means that comparing the forces on the voltage sensor with the forces on singly charged groups in the aqueous parts of the cell, the forces on the voltage sensor are approximately 20 X 120 X 3000 = 7.2 million times higher [5,8]. The physics predicts, therefore, extraordinarily strong forces activating the VGCCs via the voltage sensor. It follows that the biology tells us that the VGCCs are the main target of the EMFs and the physics tells us why they are the main target. *Thus the physics and biology are pointing in exactly the same direction*.

We have, then, very strong arguments that the EMFs act directly on the voltage-sensor to activate the VGCCs. There are several other types of evidence, each providing important evidence supporting this view:

1. In a study published by Pilla [12], it was found that pulsed EMFs produced an "instantaneous" increase in calcium/calmodulin-dependent nitric oxide synthesis in cells in culture. What this study [12] showed was that following EMF exposure, the cells in culture, must have produced a large increase in [Ca2+]i, this in turn produced a large increase in nitric oxide synthesis, the nitric oxide diffused out of the cells and out of the aqueous medium above the cells into the gas phase, where the nitric oxide was detected by a nitric oxide electrode. This entire sequence occurred in less than 5 seconds. This eliminates almost any conceivable indirect effect, except possibly via plasma membrane depolarization. Therefore, it is likely that the pulsed EMFs are acting directly on the voltage sensors of the VGCCs and possibly the voltage-gated sodium channels, to produce the [Ca2+]i increase.

2. There are also additional findings pointing to the voltage sensor as the direct target of the EMFs. In addition to the VGCCs, there are also voltage-gated sodium, potassium and chloride channels, with each of these having a voltage sensor similar to those found in the VGCCs. Lu et al [13] reported that voltage gated sodium channels, in addition to the VGCCs were activated by EMFs. Tabor et al [14] found that Mauthner cells, specialized neurons with special roles in triggering rapid escape mechanisms in fish, were almost instantaneously activated by electrical pulses, which acted via voltage-gated sodium channel activation to subsequently produce large [Ca2+]i increases. Zhang et al [15] reported that in addition to the VGCCs, potassium and chloride channels were each activated by EMFs, although these other voltage-gated ion channels had relatively modest roles, compared with the VGCCs, in producing biological effects. Each of these three studies [13-15] used specific blockers for these other voltage-gated ion channels to determine their roles. The Tabor et al [14] study also used genetic probing to determine the role of the voltage-gated sodium channels. Lu et al [13] also used whole cell patch clamp measurements to measure the rapid influx of both sodium and calcium into the cell via the voltage-gated channels following EMF exposure. Sodium influx, particularly in electrically active cells, acts in the normal physiology to depolarize the plasma membrane, leading to VGCC activation such that the voltage-gated sodium channels may act primarily via indirect activation of the VGCCs. In summary then, we have evidence that in animal including human cells, seven distinct classes of voltage-gated ion channels are each activated by EMF exposures: From Ref. [4], four classes of voltage-gated ion channels were shown from calcium channel blocker studies, to be activated by EMFs, L-type, T-type, N-type and P/Q –type VGCCs. In this paragraph we have evidence that three other channels are also activated, voltage-gated sodium channels, voltage-gated potassium channels and voltage-gated chloride channels. Furthermore the plant studies strongly suggest that the so called TPC channels, which contain a similar voltage sensor, are activated in plants allowing calcium influx into plants to produce similar EMF-induced responses [6]. In summary, then we have evidence for eight different ion channels being activated by EMF exposure, four classes of VGCCs, one class each of voltage-gated sodium,

potassium and chloride channels and also one class of plant channel, with each of these channels having a similar voltage-sensor regulating its opening. One can put those observations together with the powerful findings from the physics, that the electrical forces on the voltage-sensor are stunningly strong, something like 7.2 million times stronger than the forces on the singly charged groups in the aqueous phases of the cell. Now you have a stunningly powerful argument that the voltage sensor is the predominant direct target of the EMFs.

3. The most important study on this subject, was published by Tekieh et al [16]. It showed that microwave frequency EMFs directly activate the VGCCs in isolated membranes. A variety of microwave frequencies were used in these studies and each such frequency produced VGCC activation in a completely cell-free system. This study clearly shows that the EMF activation of the VGCCs is direct and not due to some indirect regulatory effect.

How then does the estimated sensitivity of the voltage-sensor, about 7.2 million times greater forces than the forces on singly charged groups, compare with previous estimates of levels of EMF exposure needed to produce biological effects? The ICNIRP 2009 [17] safety guidelines allowed for 2 to 10 W/m^2 exposure, depending upon frequency. In contrast, the Bioinitiative Working Group 2007 [18] proposed a precautionary target level of 3 to 6 $\mu W/m^2$ or about a million-fold lower, using a safety factor of 10. If one uses a more commonly used safety factor of 50 to 100, then the 7.2 million-fold sensitivity of the voltage-sensor, predicted by the physics, falls right in the middle of the Bioinitiative Working Group 2007 calculations. So again, it can be argued that the physics and the biology are pointing in the same direction, in this case pointing to the same approximate range of sensitivity.

You may be wondering why I am spending so much time and space going through each of these studies. The answer is that a well over a trillion dollar (or trillion euro) set of industries, the telecommunications industry, has been putting out propaganda for over two decades, arguing that there cannot be a mechanism of action of these non-thermal EMFs to produce biological effects; and that these EMFs are too weak to do anything and that only thermal effects are documented. It is essential to dot every **i** and cross every **t** with regard to the main mechanism of action of non-thermal effects. That is exactly what has been done here.

<u>How Can the Diverse Effects of Such EMF Exposures Be Produced by VGCC Activation?</u>

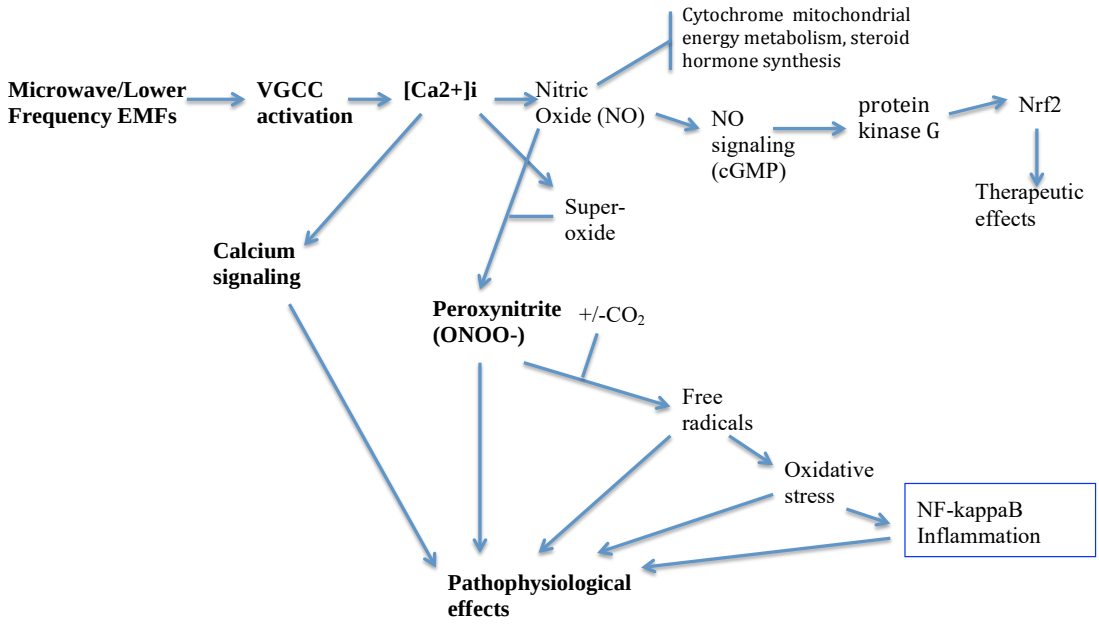

Fig. 1 How EMFs Act via VGCC Activation to Produce Various Effects

The mechanisms by which various effects can be generated by VGCC activation are outlined in Fig. 1. Going across the top of Fig. 1, it can be seen that increased intracellular calcium [Ca2+]i can increase nitric oxide (NO) synthesis, stimulating the NO signaling pathway (going to the right from top, center), to produce therapeutic effects. NO (very top) can also bind to cytochromes and inhibit their activity. NO binding to the terminal oxidase in the mitochondria inhibits energy metabolism and lowers, therefore, ATP. NO binding to cytochrome P450s, lowers synthesis of steroid hormones, including estrogen, progesterone and testosterone. The P450 lowering also lowers detoxification and vitamin D activity. Most of the pathophysiological effects are produced by the peroxynitrite/free radical/oxidative stress pathway center to lower right (Fig. 1) and also by excessive calcium signaling pathway (slightly left of center, Fig. 1). Some of the ways these are thought to produce various well-established EMF effects are outlined in Table 1.

Table 1. How Eight Established Effects of EMFs Can Be Produced by VGCC Activation

EMF effect	Probable mechanism(s)
Oxidative stress	Produced by elevated levels of peroxynitrite and the free radical breakdown products of peroxynitrite and its CO_2 adduct. Four studies of EMF exposure, cited in [4] showed that oxidative stress following exposure was associated with major elevation of 3-nitrotyrosine, a marker of peroxynitrite, thus confirming this interpretation. Two other studies each found 3-nitrotyrosine elevation, both following 35 GHz exposures [19,20].
Lowered male/female fertility, elevated spontaneous abortion, lowered libido	Both the lowered male fertility and lowered female fertility are associated with and presumably caused by the oxidative stress in the male and female reproductive organs. Spontaneous abortion is often caused by chromosomal mutations, so the germ line mutations may have a causal role. Lowered libido may be caused by lowered estrogen, progesterone and testosterone levels. It seems likely that

	these explanations may be oversimplified. One additional mechanism that may be important in producing lowered fertility is that VGCC activation and consequent high [Ca2+]i levels is known to have a key role in avoiding polyspermy. Consequently, if this response is triggered before any fertilization of an egg has occurred, it may prevent any sperm from fertilizing and egg.
Neurological/ neuropsychiatric effects	Of all cells in the body, the neurons have the highest densities of VGCCs, due in part to the VGCC role and [Ca2+]i role in the release of every neurotransmitter in the nervous system. Calcium signaling regulates synaptic structure and function in 5 different ways, each likely to be involved here. Oxidative stress and apoptosis are both thought to have important roles. Lowered sleep and increased fatigue are likely to involve lowered nocturnal melatonin and increased nocturnal norepinephrine.
Apoptosis	Apoptosis can be produced by excessive Ca2+ levels in the mitochondria and by double strand breaks in cellular DNA; it seems likely that both of these mechanisms are involved following EMF exposure. A third mechanism for triggering apopotosis, endoplasmic reticulum stress (see bottom row in this Table), may also be involved.
Cellular DNA damage	Cellular DNA damage is produced by the free radical breakdown products of peroxynitrite directly attacking the DNA [7].
Changes in non-steroid hormone levels	The release of non-steroid hormones is produced by VGCC activation and [Ca2+]i elevation. The immediate effects of EMF exposures is to increase hormone release and to raise, therefore, hormone levels. However many hormone systems become "exhausted" as a consequence of chronic EMF exposures. The mechanism of exhaustion is still uncertain, but it may involve oxidative stress and inflammation.
Lowered steroid hormone	Steroid hormones are synthesized through the action of cytochrome P450 enzymes; activity of these hormones is inhibited by binding of high levels of nitric oxide (NO) leading to lowered hormone synthesis.
Calcium overload	Produced by excessive activity of the VGCCs; secondary calcium overload is produced by oxidative stress activation of TRPV1, TRPM2 and possibly some other TRP receptors, opening the calcium channel of these receptors.
Heat shock protein induction	There is a large literature showing that excessive [Ca2+]i induces very large increases in heat shock proteins. This is thought to be produced by complex calcium signaling changes involving the endoplasmic reticulum, mitochondria and the cytosol and also involving excessive [Ca2+]i producing increasing protein misfolding [21-23]. It should be noted that some calcium is essential for proper protein folding in the endoplasmic reticulum such that only excessive calcium leads to misfolding and consequent endoplasmic reticulum stress.

Each of the seven established EMF effects, discussed above, can be generated through the mechanisms outlined in Fig. 1, as shown by Table 1. An eighth, heat shock protein induction can also be so explained (Table 1). Several other such effects, including EMF causation of

cataracts, breakdown of the blood-brain barrier, lowered nocturnal melatonin are also so explained, as discussed earlier [5]. The primary mechanism for therapeutic effects was discussed in [4,24,25] and was also shown to be generated via such VGCC downstream effects. Fifteen mechanisms for EMF cancer causation are described in ref [7]; these are far too complex to describe in this document so the reader is referred to ref [7].

It can be seen, in summary, that we are far beyond the issue whether there are non-thermal EMF effects. Rather many researchers have identified many established effects of EMF exposure. The main direct targets of non-thermal EMF exposure, the VGCCs have also been identified and how these get activated by EMF exposure acting on the VGCC voltage-sensor has also been determined. And finally we have identified how a wide variety of these effects can be generated via downstream effects produced by such VGCC activation.

Our current safety guidelines are based only on heating (thermal) effects. Heating is produced predominantly by forces on singly charged groups in the aqueous phases of the cell but the forces on the voltage sensor are approximately 7.2 million times higher. Therefore, our current safety guidelines are allowing us to be exposed to EMFs that are approximately 7.2 million times too strong. That 7.2 million figure is somewhat similar to the estimate given by the Bioinitiative Report and by the Building Biologists, based on completely different considerations.

It should be obvious, that non-thermal EMFs:

1. Attack our nervous systems including our brains leading to widespread neuropsychiatric effects and possibly many other effects. This nervous system attack is of great concern.
2. Attack our endocrine (that is hormonal) systems. In this context, the main things that make us functionally different from single celled creatures are our nervous system and our endocrine systems – even a simple planaria worm needs both of these. Thus the consequences of the disruption of these two regulatory systems is immense, such that it is a travesty to ignore these findings.
3. Produce oxidative stress and free radical damage, which have central roles in all common chronic diseases.
4. Attack the DNA of our cells, producing single strand and double strand breaks in cellular DNA and oxidized bases in our cellular DNA. These in turn produce both cancer and mutations in germ line cells with germ line mutations producing mutations impacting future generations.
5. Produce elevated levels of apoptosis (programmed cell death), events especially important in causing both neurodegenerative diseases and infertility.
6. Lower male and female fertility, lowered sex hormones, lowered libido, increased levels of spontaneous abortion and, as already stated, attacks on the DNA in sperm cells.
7. Produce excessive intracellular calcium [Ca2+]i and increased calcium signaling.
8. Act in the cells of our bodies via 15 different mechanisms to cause cancer.

By attacking all of these important systems in the body, EMFs attack everything we care about including our health (in many ways), our reproductive systems, the integrity of our genomes and our ability to produce healthy offspring.

There are 79 different reviews listed at the end of Chapter 1, with each documenting the existence of one or more of these various non-thermal EMF effects. What, then, do the two organization reports that the EU authorities and U.S. authorities rely upon, ICNIRP and SCENIHR 2015, have to say about these independent reviews. The answer is absolutely nothing! Neither one of them

uses any of these independent reviews to assess EMF effects. This whole area is discussed in much more detail in Chapter 5, below.

Chapter 3. Strong Evidence for Cumulative and Irreversible EMF Effects

Two questions that must be raised about the effects of these low-intensity EMFs producing biological effects is are they cumulative and are they reversible? I am aware of several different types of evidence for cumulative effects and also for irreversible effects.

Three of the human occupational exposure studies from the 1970's reviewed in the Raines, National Aeronautics and Space Administration (NASA) study [26], showed that effects increased substantially with increasing time of exposure to a particular type and intensity of EMF. While these three studies each show cumulative effects but they provide no data on possible irreversibility of these neurological/neuropsychiatric effects. However the largest review of such occupational exposures (Hecht [28]) does provide substantial evidence on the cumulative nature and irreversibility of these neurological/neuropsychiatric effects.

Hecht [28] reviewed 60 different studies of occupational exposures that were done between 1960 and 1990 in the Soviet Union and East Germany. These were occupational exposure studies of over 3500 people, who were exposed to microwave frequency EMFs at intensities of less than 1/1000th of our safety guidelines. These studies [28] found that these EMFs produced neuropsychiatric effects similar to those found in my much more recent study [3], listed in Chapter 1 as well as on cardiac effects. Neither the neuropsychiatric findings nor the cardiac findings were unique however. Similar neuropsychiatric effects have been found to be caused by low intensity EMF exposures [27,29-34]. Cardiac effects have also been found in humans [26,29,30,32,34,35] similar to those found by Hecht [28].

Hecht [28] reports that exposures at those very low intensities for up to 3 years produced increased sympathetic nervous system activity, apparently in response to the EMF stress, following the classic stress sequence described by Hans Selye in 1953. No other effects were apparent during this circa 3 year period. However longer exposure produced observable neurological/neuropsychiatric and cardiac effects as well as other effects which were initially modest. Exposures of 3 to 5 years typically produced effects that could be largely reversed after 2 to 3 years in a no-EMF exposure environment. Hecht states that "if detected early, effective therapy is possible." However longer than 4 to 5 years exposures produced more severe effects which did not reverse when the persons were subsequently put into a no-EMF exposure environment. These and other effects continued to worsen with 10 years of exposure or longer. This cumulative nature of such EMF exposures was noted in two earlier reviews cited by Hecht et al [36,37]. These studies, then, provide very large amounts of evidence both for the cumulative nature of these neuropsychiatric effects, as well as the apparent irreversibility of these effects as they become more severe. Hecht also notes that "decline in health status increasingly amplifies EMF effects." This a pattern of increasing apparent sensitivity produced by previous exposure is similar to that described in the Western literature on electromagnetic hypersensitivity (EHS), something that Hecht recognizes [28]. EHS something that is discussed very briefly below in this section.

There are strong similarities between the Hecht [28] findings on microwave frequency EMFs in humans and the impacts of such EMFs on cellular and organ histology in rodents, as were reviewed in Tolgskaya and Gordon [38] and discussed in Pall [3]. In rodents, initially non-thermal exposures over periods of 1 to 2 months produced modest changes in structure of the brain and of the neurons. When such exposures ceased, most of the structural changes

disappeared – that is the changes were largely reversed when the animals were placed back into a no-EMF environment. However more months of exposure produced much more severe impacts on brain and neuronal structure and these were irreversible [38, 3]. More recent, Western country and other country studies cited in [3], provide much further support for brain impacts similar to those found in Soviet and also other country brain studies reviewed by Tolgskaya and Gordon[38]. Tolgskaya and Gordon [38,3] also reported findings that in histological studies, the nervous system was the most sensitive organ in the body, followed closely by effects on the heart and the testis, although many other organs were also impacted. Thus, the Tolgskaya and Gordon review [38,3] provides very important support for the findings of neurological/neuropsychiatric effects, the cardiac effects, discussed immediately above and below, and the reproductive effects discussed in Chapter 1. By comparing the animal studies with the human studies, one can see the striking similarities, with the major difference being that the effects in rodents are much more rapid than the effects on humans. Given the much higher metabolic rates in rodents and much lower life spans in rodents, the timing difference is not surprising. With regard to the issues of cumulative nature and irreversibility, both rodent and human studies provide strong support for both neurological and neuropsychiatric effects showing both cumulative nature and irreversibility and show a similar pattern of cumulative effects with the cardiac effects.

What are the cardiac effects discussed briefly above, that are produced by non-thermal microwave frequency EMF exposures? The effects include tachycardia (rapid heartbeat) where some people with apparent EHS, on blinded exposure to cordless phone radiation have instantaneous tachycardia, an effect that is also essentially instantaneously reversible on cessation of exposure [28,35,36]. So tachycardia can be an almost instantaneous response to EMFs and it is sometimes also found with arrhythmia. Prolonged exposures produce both arrhythmias and bradycardia (slow heart beat) [26-30,32]. Similar EMF cardiac effects were seen in animal studies, with the earliest of these going back to the late 1960s.

Some of the early studies on long-term EMF cardiac effects are listed in Table 2, below. They show that such chronic exposures produce bradycardia and sometimes arrhythmia. The early Soviet studies (labeled USSR) reported similar findings to those found in the western studies (Table 2).

Table 2. Chronic Exposure, Non-Thermal EMF Cardiac Effects from NASA Review [26]

Study	**Effects Reported**
Schwan 1977	Cardiology changes
Dwyer 1978	Bradycardia, hypotension
Sadicikova (USSR)	Bradycardia, hypo & hypertension, cardiac pain, systolic murmur
Kalyada (USSR)	“cardiovascular changes”
Sadichikova (USSR)	Changes in cardiovascular system
Pressman 1970	QRS interval in ECG increased (bradycardia), also arrhythmia
Domanski (USSR)	Bradycardia, hypotension, ECG changes (shows both bradycardia and arrhythmia)
Lerner (1980)	Bradycardia
Stuchley (1978)	Bradycardia (measured in 2 ways), hyper & hypotension, cardiac pain, systolic murmur.

Arrhythmias, especially when they are accompanied by bradycardia, are often associated with sudden cardiac death. We are having an epidemic of young, apparently healthy athletes dying in

the middle of an athletic competition of apparent sudden cardiac death, which may, therefore be possibly caused by EMF exposures [39]. Some of these individuals have been saved from death [39] and subsequently found to be suffering from bradycardia and arrhythmias. Another type of cardiac effect is that when apparent EHS people are exposed to Wi-Fi, cell phone, cell phone tower or smart meter radiation, they are reported to suffer from heart palpitations. Each of these four types of cardiac effects, tachycardia, arrhythmias, bradycardia and heart palpitations involve aberrations in the electrical control of the heartbeat. How can these be produced?

The heartbeat is controlled by pacemaker cells in what is called the sino-atrial node of the heart. Those pacemaker cells have been shown to have very high densities of the T-type VGCCs which may make these cells particularly susceptible to direct effects of the EMFs (recall that EMFs act via VGCC activation). The T-type and the L-type VGCCs have essential roles in controlling the heartbeat. It follows that EMF exposures, acting directly on the pacemaker cells of the heart, can produce tachycardia responses. Furthermore, gene mutations in a VGCC gene that produce increased VGCC activity can produce both tachycardia and arrhythmia in young babies carrying those mutations; these young children die of sudden cardiac death at a very young age. How then do we get bradycardia? Bradycardia is produced when EMFs chronically impact the sino-atrial node, such that the dysfunction involved in heart failure, which is very complex, produces dysfunction of the pacemaker cells of the heart, producing bradycardia [40].

It follows from this that EMF-produced bradycardia and chronic arrhythmias are likely to be caused by heart-failure-like changes that particularly impact the sino-atrial node of the heart, including the tissue remodeling found in heart failure. This model has been confirmed by the findings of Liu et al [41], who found that pulsed microwave frequency EMF produced tissue remodeling that specifically impacted the sino-atrial node of the heart with remodeling changes similar to those found in heart failure [40]. Heart failure develops in a cumulative fashion and, based on current medicine at least, is an irreversible process involving tissue remodeling and a large number of other biochemical and physiological changes [41]. It seems likely, therefore, that the EMF effects on the heart are both cumulative and irreversible.

You will recall, from the discussion at the beginning of Chapter 1, that there are 18 reviews documenting that EMF produces lowered fertility. These act via diverse mechanisms. These include tissue remodeling changes in the testis, lowered sperm count and sperm quality, lowered female fertility including ovary remodeling and oocyte apoptosis, lowered estrogen, progesterone and testosterone levels (that is sex hormone levels), increased spontaneous abortion incidence, and lowered libido. We already have sperm count drops to below 50% of normal in every technologically advanced country on earth [1]. We also have fertility drops to well below replacement levels in every technologically advanced country on earth, with one exception. Clinical observations argue that while there are sometimes technical fixes that allow some reproduction, infertility appears to be inherently irreversible. The Magras and Xenos [2] in mice, also discussed in Chapter 1 shows that radiofrequency radiation exposures well below our safety guidelines, produce immediate drops in mouse reproduction in the first litter. Further exposures to the same EMF levels produced a crash in reproduction essentially to zero, a crash that appeared to be essentially irreversible.

We don’t know that humans will behave very similarly to mice. We do know that the EMFs produce the diverse effects on human reproduction listed in the previous paragraph. My prediction is that even if exposures level off where they are now, we will start seeing crashes in reproduction within about 5 years. If we go ahead with 5G, that crash may be almost instantaneous.

Mutation accumulation produced by cellular DNA damage is likely to be both cumulative and irreversible, as well, because later mutations are highly unlikely to reverse previously occurring mutations. It has been estimated that all we need to have is an increase in germ line mutation of 2 ½ to 3-fold, to become over time, extinct from the very high levels of mutations in each newborn. From the high levels of DNA damage produced in human sperm from common EMF exposures, we may be already well above that level.

It follows from this that we already face four existential threats produced by microwave frequency EMF exposures to the survival of every technologically advanced society on earth:

1. Cumulative and irreversible neurological/neuropsychiatric effects.
2. Cumulative and irreversible reproductive effects.
3. Cumulative and irreversible cardiac effects, leading to sudden cardiac death.
4. DNA effects in germ line, including sperm cells, leading to major impacts on our gene pool and high mutation frequencies.

Any one of these can destroy us on its own and with the ever increasing exposures and especially the vast increases in exposure that the 5G rollout will inevitably produce, that destruction is likely to be imminent. These don't even take into consideration the cancer effects, the hormonal effects or other effects produced by increased oxidative stress or increased apoptotic cell death. There is extraordinary evidence for each of these effects of EMF exposure, which have been repeatedly documented in the reviews listed in Chapter 1.

The following information is derived from an abstract that I used for a talk at the Neuroscience 2016 meeting in Los Angeles, a meeting that was focused on Alzheimer's disease and similar dementias. The discussion here raises the question of whether Alzheimer's and other dementias may be still another set of irreversible diseases where cumulative effects of microwave frequency EMFs may have important causal roles. Dementias and other types of neurological deaths have had unexplained rapid recent increases [42-44]. The parallel between these increases and the increases in cell phone and other EMF exposures suggested that such exposures may cause dementia increases [45]. Reports show people circa age 30 developing Alzheimer's or other very early onset dementias and even younger people are reported to develop digital dementias, dementias caused by heavy use of digital devices [46-48]. One of the questions being raised here, is whether digital dementias are caused, at least in part, by the EMF exposures produced by these digital devices and the Wi-Fi fields involved in their usage, rather than solely by such things as screen time, as is often assumed. As you have seen in chapter 2, microwave and lower frequency EMFs act via activation of the VGCCs, leading to increases in intracellular calcium ([Ca2+]i) and downstream effects including increased Ca2+ signaling, NO, superoxide, peroxynitrite, free radicals, oxidative stress, NF-kappaB and mitochondrial dysfunction.

Each of these downstream effects have been shown to have important roles in causing Alzheimer's disease and other neurodegenerative diseases [49-51]. These all suggest plausible mechanisms for action for EMFs causing Alzheimer's disease. Furthermore the amyloid-beta protein (Aβ) which has an specific role in causing Alzheimer's disease, is produced in increasing amounts by elevated [Ca2+]i, and small Aβ aggregates form Ca2+ channels in the plasma membrane and aggregates also raise [Ca2+]i via increased VGCC and RYRr activity, suggesting a vicious cycle between Aβ and [Ca2+]i in Alzheimer's disease. This argues that increased intracellular calcium levels, produced by the EMFs increases Aβ and increased Aβ increases intracellular calcium, in what may be the central mechanism in causing Alzheimer's disease.

Four rodent studies support an EMF role in Alzheimer's disease. A series of short pulses of EMFs in young rats, produced the following in the equivalent of middle aged rats: elevated brain Aβ and oxidative stress; lowered cognition and memory [52,53]. 900 MHz exposures produces oxidative stress, increased Aβ and lowered miR-107, all found in Alzheimer's disease brains [52-55]. There are many animal studies showing roles for [Ca2+]i through both VGCCs and RYRs in causing Alzheimer's disease in rodent models; these include studies with calcium channel blockers and studies of transgenic mice with varying VGCC and RYR expression. Very low EMF exposures can produce, however, protective responses [56,57]; this is not surprising because EMF therapy is thought to act via NO signaling and protein kinase G (see Fig.1, Chapter 2) and this pathway is reported to protect from Alzheimer's disease. Epidemiological studies have shown that exposure of humans of 50/60 Hz EMFs, which also act via VGCC activation, can cause elevated Alzheimer's disease incidence [58,59]. Interestingly, a 1997 article in Microwave News, discussing two such epidemiological findings on EMFs and Alzheimer's disease in humans, found that occupational exposures to EMFs produced as much as a four-fold increase in Alzheimer's disease [59A]. That same article [59A] suggested a similar mechanism to the mechanism suggested here, namely that increased [Ca2+]i following EMF exposure produces increases in Aβ. In conclusion, a wide range of studies support the view that low intensity microwave frequency exposures acting via VGCC activation and [Ca2+]i, can produce increases in Aβ and other causal factors of Alzheimer's disease in humans and in animals and EMFs have been shown to produce Alzheimer's effects in rats.

These various findings on EMFs and Alzheimer's disease, the increasingly early onset of dementias and the occurrence of digital dementias, all suggest we may have another very high level threat caused by EMF exposures, possibly involving cumulative EMF effects and leading to severe, irreversible brain damage.

Chapter 4 EMFs Including Wi-Fi May Be Particularly Damaging to Young People

Most arguments that have been made that microwave frequency EMFs may be much more damaging to young children have centered on the much smaller skulls and skull thickness in young children, increasing the exposure of their brains to EMFs [60, 61]. However there are other arguments to be made. EMFs have been shown to be particularly active in producing effects on embryonic stem cells [62-71]. Because such stem cells occur at much higher cell densities in children, with stem cell densities the highest in the fetus and decreasing with increasing age [62, 63], impacts on young children are likely to be much higher than in adults. The decreased DNA repair and increased DNA damage following EMF exposure, in conjunction with the increased cell division in young children, strongly suggest that young children may be increasingly susceptible to cancer following such exposures [62-64, 71]. Two reviews discussed in the next chapter provide further evidence on higher cancer susceptibility of children. EMF action on stem cells may also cause young children to be particularly susceptible to disruption of brain development [66,71], something that may be relevant to autism causation.

It is my belief that the role of [Ca2+]i in synapse development is also relevant to the possible EMF causation of autism. The Hecht review of Soviet occupational exposure studies [28] reports that "younger persons show a greater sensitivity to electromagnetic fields than adults." These are all very problematic issues and we cannot rule out the possibility that there are other problematic issues as well. Redmayne and Johansson [72] reviewed the literature showing that there are age-related effects, such that young people are more sensitive to EMF effects. It follows from these various findings that the placement of Wi-Fi into schools around the country and the not uncommon placing of cell phone towers on schools may well both be a high level threats to the health of our children as well being a threat to teachers and any very sensitive fetuses teachers

may be carrying, as well. Mr. Barrie Trower, a retired military intelligence expert from the U.K. has been going around the world, at his expense, speaking against Wi-Fi in schools. His knowledge on this is based in part on classified information which he is unable to discuss, but has given him great concern.

Chapter 5: The Importance of the SCENIHR 2015 Document and the Many Omissions, Flaws and Falsehoods in That Document

One thing that I think we can all agree upon, is that the SCENIHR 2015 [73] document is an important document. The reason for its importance is that previous industry-friendly documents, and there have been many of them, have only reviewed very limited amounts of the literature on EMF effects. Consequently all of these other documents are open to the criticism that they have cherry picked what little data they have chosen to discuss. SCENIHR 2015 [73] has a reference list of almost 48 pages in length, going from page 233 to 280. So it appears that SCENIHR 2015 may have done a much more thorough and defensible review of the literature. Our assessement of SCENIHR 2015 [73] is important because of the confidence expressed in this document both by Mr. Ryan and Dr. Vinciūnas and also by the U.S. National Cancer Institute. The question that is being raised here is whether SCENIHR 2015 is thorough and defensible or not.

The Speit/Schwarz Controversy: How SCENIHR Has Put Out Seven Falsehoods in Support of the Industry Progaganda Position

I am going to start by discussing a single particularly important issue from [73]. At the end of Table 5 in [73]. there is a claim that a 2013 study by Speit et al [74] was unable to replicate the findings of a 2008 study published by Schwarz et al [75]. In Table 5 they state further that Speit el al found "No effect on DNA integrity (MN) and DNA migration (comet); Repetition study of Schwarz et al, 2008." What is called loss of DNA integrity here, measured by formation of micronuclei (MN), is caused by the formation of double strand breaks in cellular DNA. The comet assay measures single strand breaks in cellular DNA. Schwarz et al [75] found strong evidence that there were large increases in both single strand and double strand breaks in cellular DNA following very low intensity exposures to a cell phone-like pulsed radiation, but SCENIHR claims that Speit et al [74] were unable to repeat the earlier study. Elsewhere (p.89, bottom) SCENIHR states that "By using the same exposure system and the same experimental protocols as the authors of the original study, they failed to confirm the results. They did not find any explanation for these conflicting results (Speit et al, 2013)."

A careful examination of both [74] and [75] finds the following: 1. Speit et al [74] used a lymphocytic cell line, HL-60; Schwarz et al [75] studied human fibroblasts. This is a big difference because, as we have already said, different cell types behave differently. 2. Speit et al [74] used 1800 MHz radiation; Schwarz et al [75] used 1950 MHz radiation (the frequency of UMTS, also called 3G). Again we have a potentially important difference because effects are influenced by the frequency used. 3. Speit et al [74] used a continuous wave EMF; Schwarz et al [75] used a highly pulsed EMF, with high levels of both KHz and MHz pulsations to mimic the pulsation pattern of 3G cell phones. This is expected to produce very large differences between the two studies. 4. Speit et al [74] used a reverberation exposure chamber; Schwarz et al [75] did not use any exposure chamber. This could be another very large difference between the two studies, a difference that will be discussed toward the end of this chapter. 5. So where did the claim come from that Speit was trying to repeat the Schwarz study? Speit et al [74] says in their paper that they were trying to repeat another study (not Schwarz) that was described in a report but was never published. 6. Speit et al [74] do not even cite the Schwarz et al [75] paper, so obviously they did not intend to repeat Schwarz. We have then SCENIHR 2015 stating three

multifaceted falsehoods that Speit et al [74] tried to repeat the earlier studies of Schwarz et al [75], that they were unable to repeat those Schwarz et al [75] studies and that they used identical methodology to that used by Schwarz et al [75]. In addition to those three are four underlying falsehoods – namely that the two studies used very different methodologies, notably differing in the cell type studied, differing in the frequency used, differing widely in the in pulsations used and differing in the use of an exposure chamber. *Each of these falsehoods are SCENIHR's not Speit et al [74]'s, each of them can be easily seen to be false by even a superficial reading of these two papers*.

As you might guess, there is a major story behind all of this. The very low intensity exposure used in the Schwarz et al [75] study produced large numbers of DNA breaks, larger than that produced by 1600 chest X-rays. This conclusion can be made by comparing the results of Schwarz et al [75] with the earlier study of Lutz and Adlkofer [76]. From this comparison, it seems clear that non-ionizing radiation similar to 3G radiation can be much more dangerous to the DNA of our cells than is a similar energy of ionizing radiation. When this was found, the industry went into attack mode, attacking the two Professors who collaborated in [75], Prof. Franz Adlkofer in Germany and Prof. Hugo Rüdinger in Austria. The first couple of years of these attacks have been described in some detail on pp 117-131 in Dr. Devra Davis' book Disconnect [77]. Before the SCENIHR 2015 document was drafted, it was clear that the publishers who had published Adlkofer's and Rüdinger's work, not just the Schwarz et al [75] study but other papers by the same research group, had long since rejected the industry propaganda claims. In addition. Adlkofer had won a lawsuit in the German courts against his main accuser. He has subsequently since won a second such lawsuit. The last paragraph on p.89 in SCENIHR 2015 is word for word industry propaganda. What is clear is that SCENIHR is wittingly or unwittingly serving as a propagandist for the industry in and that process, SCENIHR has no difficulty in putting forth seven obvious, individually important falsehoods.

One question that needs to be raised is how is it possible for microwave frequency EMFs to produce much more cellular DNA damage than a comparable energy level of ionizing radiation? Both ionizing radiation and microwave/lower frequency EMFs act via free radicals to attack the DNA. If you examine Fig. 1, Chapter 2, you will see how low intensity microwave frequency EMFs can act (p. 20). The free radicals that attack the DNA are breakdown products peroxynitrite.. The sequence of events leading to those free radicals starts, of course with the extraordinarily high sensitivity of the VGCC voltage sensor to the electrical forces of the EMFs that open the VGCC calcium channels. Following that there are three steps in the process leading to peroxynitrite elevation *each of which have high levels of amplification*. The first of these is that when the VGCC channels are open, they allow the influx of about a million calcium ion per second into the cell. The second amplification is that elevated intracellular calcium [Ca2+]i activates the synthesis of both nitric oxide (NO) and superoxide. The third amplification is that the formation of peroxynitrite is proportional to the product of nitric oxide concentration *times* the superoxide concentration. When you have three sequential amplification mechanisms, you can get a very large response, in this case free radical attack on cellular DNA, from a very small initial signal. That is where much of the existential crises are coming are from, with EMFs threatening the survival of every technologically advanced country on earth.

Going back to falsehoods perpetrated by SCENIHR regarding Speit/Schwarz, here are two possible interpretations for those seven falsehoods. One is that SCENIHR is simply an industry propaganda organ. The second is that we have a group of scientists (SCENIHR) who are largely incompetent and that it is just coincidence that these seven falsehoods serve the industry propaganda case. Either of these interpretations completely destroy the claims of confidence in

SCENIHR that Mr. Ryan and Dr. Vinciūnas made in the documents they wrote that were referred to in the Preface of this document.

I have written here another 27 pages critiquing the SCENIHR 2015 [73] document. If you are already convinced that the SCENIHR claims that there are no established non-thermal EMF effects are false and that we have eight extremely well documented effects (Chapter 1) and that we have detailed mechanisms of how these effects are produced (Chapter 2), then I suggest you skip to the summary of Chapter 5 starting on p. 57 and then go on to the consider the U.S. situation in Chapter 6 and 5G in Chapter 7. If, however, you are not so convinced, you need to read the intervening 27 pages.

22 Reviews on EMF Effects, 20 of Which Are Ignored by SCENIHR, Two of Which Are Discussed in [73] but Essentially Dismissed

Now let's go on to consider how SCENIHR 2015 [73] considers the many independent reviews, listed in Chapter 1, which disagree with them and also fall into the 2009 through 2013 period that SCENIHR claims to have thoroughly considered. See Table 3.

Table 3: 2009 to 2013 Reviews that Should Have Been Cited and Discussed in SCENIHR 2015

Citation	**Brief Summary**	**What does SCENIHR 2015 say about it?**
[78] Khurana VG, Teo C, Kundi M, Hardell L, Carlberg M. 2009 Cell phones and brain tumors: a review including the long-term epidemiologic data. Surg Neurol 72:205-214.	Meta-analysis study of cell phone usage and brain cancer. The results indicate that using a cell phone for > or = 10 years approximately doubles the risk of being diagnosed with a brain tumor on the same ("ipsilateral") side of the head preferred for cell phone use. The data achieve statistical significance for glioma and acoustic neuroma but not for meningioma. CONCLUSION: The authors conclude that there is adequate epidemiologic evidence to suggest a link between prolonged cell phone usage and the development of an ipsilateral brain tumor.	Nothing. Review is not cited and not discussed.
[79] Desai NR, Kesari KK, Agarwal A. 2009 Pathophysiology of cell phone radiation: oxidative stress and carcinogenesis with focus on the male reproductive system. Reproduct Biol Endocrinol 7:114.	This review identifies the plasma membrane as a target of RF-EMW. In addition, the effects of RF-EMW on plasma membrane structures (i.e. NADH oxidase, phosphatidylserine, ornithine decarboxylase) and voltage-gated calcium channels are discussed. We explore the disturbance in reactive oxygen species (ROS) metabolism caused by RF-EMW and delineate NADH oxidase mediated ROS formation as playing a central role in oxidative stress (OS) due to cell phone radiation (with a focus on the male reproductive system). This review also addresses: 1) the controversial effects of RF-EMW on mammalian cells and sperm DNA as well as its effect on apoptosis, 2) epidemiological, in vivo animal and in vitro studies on	Nothing. Review is not cited and not discussed.

	the effect of RF-EMW on male reproductive system.	
[80] Makker K, Varghese A, Desai NR, Mouradi R, Agarwal A. 2009 Cell phones: modern man's nemesis? Reprod Biomed Online 18:148-157.	Effects of cell phone exposure on the cardiovascular system, sleep and cognitive function, as well as localized and general adverse effects, genotoxicity potential, neurohormonal secretion and tumour induction. The proposed mechanisms by which cell phones adversely affect various aspects of human health, and male fertility in particular, are explained, and the emerging molecular techniques and approaches for elucidating the effects of mobile phone radiation on cellular physiology using high-throughput screening techniques, such as metabolomics and microarrays, are discussed. A novel study is described, which is looking at changes in semen parameters, oxidative stress markers and sperm DNA damage in semen samples exposed in vitro to cell phone radiation.	Nothing. Review is not cited and not discussed.
[81] Ruediger HW. 2009 Genotoxic effects of radiofrequency electromagnetic fields. Pathophysiology. 16:89-102.	101 publications are exploited which have studied genotoxicity of radiofrequency electromagnetic fields (RF-EMF) in vivo and in vitro. Of these 49 report a genotoxic effect and 42 do not. In addition, 8 studies failed to detect an influence on the genetic material, but showed that RF-EMF enhanced the genotoxic action of other chemical or physical agents. Variation in results may in part be explained by the different cellular systems and from the variety of analytical methods being used. Taking altogether there is ample evidence that RF-EMF can alter the genetic material of exposed cells in vivo and in vitro and in more than one way. This genotoxic action may be mediated by microthermal effects in cellular structures, formation of free radicals, or an interaction with DNA-repair mechanisms.	Nothing. Review is not cited and not discussed.
[82] Phillips JL, Singh NP, Lai H. 2009 Electromagnetic fields and DNA damage. Pathophysiology 16:79-88.	A major concern of the adverse effects of exposure to non-ionizing electromagnetic field (EMF) is cancer induction. Since the majority of cancers are initiated by damage to a cell's genome, studies have been carried out to investigate the effects of electromagnetic fields on DNA and chromosomal structure. Additionally, DNA damage can lead to changes in cellular functions and cell death. Single cell gel electrophoresis, also known as the 'comet assay', has been widely used in EMF research to determine DNA damage, reflected as single-strand breaks, double-strand breaks, and crosslinks. Studies have also been carried out to investigate chromosomal conformational changes and micronucleus formation in cells after exposure to EMF. This review describes the comet assay and its utility to qualitatively and quantitatively assess DNA damage, reviews studies that have	Nothing. Review is not cited and not discussed.

	investigated DNA strand breaks and other changes in DNA structure, and then discusses important lessons learned from our work in this area.	
[83] Davanipour Z, Sobel E. 2009 Long-term exposure to magnetic fields and the risks of Alzheimer's disease and breast cancer: Further biological research. Pathophysiology 16:149-156.	Extremely low frequency (ELF) and radio frequency (RF) magnetic fields (MFs) pervade our environment. Whether or not these magnetic fields are associated with increased risk of serious diseases, e.g., cancers and Alzheimer's disease, is thus important when developing a rational public policy. Our objective was to provide an unbiased review of the current knowledge and to provide our general and specific conclusions. RESULTS: The evidence indicates that long-term significant occupational exposure to ELF MF may certainly increase the risk of both Alzheimer's disease and breast cancer. There is now evidence that two relevant biological processes (increased production of amyloid beta and decreased production of melatonin) are influenced by high long-term ELF MF exposure that may lead to Alzheimer's disease. There is further evidence that one of these biological processes (decreased melatonin production) may also lead to breast cancer. Finally, there is evidence that exposures to RF MF and ELF MF have similar biological consequences. CONCLUSION: It is important to mitigate ELF and RF MF exposures through equipment design changes and environmental placement of electrical equipment.	Nothing. Review is not cited and not discussed.
[84] Yakymenko I, Sidorik E. 2010 Risks of carcinogenesis from electromagnetic radiation and mobile telephony devices. Exp Oncol 32:729-736.	Latest epidemiological data reveal a significant increase in risk of development of some types of tumors in chronic (over 10 years) users of mobile phone. It was detected a significant increase in incidence of brain tumors (glioma, acoustic neuroma, meningioma), parotid gland tumor, seminoma in long-term users of mobile phone, especially in cases of ipsilateral use (case-control odds ratios from 1.3 up to 6.1). Two epidemiological studies have indicated a significant increase of cancer incidence in people living close to the mobile telephony base station as compared with the population from distant area. These data raise a question of adequacy of modern safety limits of electromagnetic radiation (EMR) exposure for humans. For today the limits were based solely on the conception of thermal mechanism of biological effects of RF/MW radiation. Meantime the latest experimental data indicate the significant metabolic changes in living cell under the low-intensive (non-thermal) EMR exposure. Among reproducible biological effects of low-intensive MWs are reactive oxygen species overproduction, heat shock proteins	Nothing. Review is not cited and not discussed.

	expression, DNA damages, apoptosis. Practical steps must be done for reasonable limitation of excessive EMR exposure, along with the implementation of new safety limits of mobile telephony devices radiation, and new technological decisions, which would take out the source of radiation from human brain.	
[85] Carpenter DO. 2010 Electromagnetic fields and cancer: the cost of doing nothing. Rev Environ Health 25:75-80.	Concern of health hazards from EMFs has increased as the use of cell phones and other wireless devices has grown in all segments of society, especially among children. While there has been strong evidence for an association between leukemia and residential or occupational exposure to ELF EMFs for many years, the standards in existence are not sufficiently stringent to protect from an increased risk of cancer. For RF EMFs, standards are set at levels designed to avoid tissue heating, in spite of convincing evidence of adverse biological effects at intensities too low to cause significant heating. Recent studies demonstrate elevations in rates of brain cancer and acoustic neuroma only on the side of the head where individuals used their cell phone. Individuals who begin exposure at younger ages are more vulnerable. These data indicate that the existing standards for radiofrequency exposure are not adequate. While there are many unanswered questions, the cost of doing nothing will result in an increasing number of people, many of them young, developing cancer.	Nothing. Review is not cited and not discussed.
[86] Giuliani L, Soffritti M (Eds). 2010 NON-THERMAL EFFECTS AND MECHANISMS OF INTERACTION BETWEEN ELECTROMAGNETIC FIELDS AND LIVING MATTER, RAMAZZINI INSTITUTE EUR. J. ONCOL. LIBRARY Volume 5, National Institute for the Study and Control of Cancer and Environmental Diseases "Bernardino Ramazzini" Bologna, Italy 2010, 400 page monograph.	Contains entire articles on: 1. Influence of mobile phone radiation on cognitive function. 2. Impact of DECT cordless phone radiation on heart rate variability and on the autonomic nervous system. 3 & 4. Two articles on the impact of radiofrequency radiation on the blood-brain barrier. 5 & 6. Two articles on microwave/radiofrequency radiation and cancer causation. 7. Epidemiological studies of EMF impact on human reproduction.	Nothing. Review is not cited and not discussed.
[87] Khurana, V. G., Hardell, L., Everaert,	We identified a total of 10 epidemiological studies that assessed for putative health effects of mobile phone	Nothing. Review is not

J., Bortkiewicz, A., Carlberg, M., Ahonen, M. 2010 Epidemiological evidence for a health risk from mobile phone base stations. Int. J. Occup. Environ. Health 16, 263-267.	base stations (cell phone antennae). Seven of these studies explored the association between base station proximity and neurobehavioral effects and three investigated cancer. We found that eight of the 10 studies reported increased prevalence of adverse neurobehavioral symptoms or cancer in populations living at distances < 500 meters from base stations. None of the studies reported exposure above accepted international guidelines, suggesting that current guidelines may be inadequate in protecting the health of human populations. We believe that comprehensive epidemiological studies of long-term mobile phone base station exposure are urgently required to more definitively understand its health impact.	cited and not discussed.
[88] Levitt, B. B., Lai, H. 2010. Biological effects from exposure to electromagnetic radiation emitted by cell tower base stations and other antenna arrays. Environ. Rev. 18, 369-395. doi.org/10.1139/A10-018	Both anecdotal reports and some epidemiology studies, reviewed in this study, have found headaches, skin rashes, sleep disturbances, depression, decreased libido, increased rates of suicide, concentration problems, dizziness, memory changes, increased risk of cancer, tremors, and other neurophysiological effects in populations near base stations. Cardiac effects were also reported. Symptoms reported may be classic microwave sickness, first described in 1978. Nonionizing electromagnetic fields are among the fastest growing forms of environmental pollution. Some extrapolations can be made from research other than epidemiology regarding biological effects from exposures at levels far below current exposure guidelines.	Nothing. Review is not cited and not discussed.
[89] Kang N, Shang XJ, Huang YF. 2010 [Impact of cell phone radiation on male reproduction]. Zhonghua Nan Ke Xue 16:1027-1030.	With the popularized use cell phones, more and more concern has been aroused over the effects of their radiation on human health, particularly on male reproduction. Cell phone radiation may cause structural and functional injuries of the testis, alteration of semen parameters, reduction of epididymal sperm concentration and decline of male fertility. This article presents an overview on the impact of cell phone radiation on male reproduction.	Nothing. Review is not cited and not discussed.
[90] Yakymenko, I., Sidorik, E., Kyrylenko, S., Chekhun, V. 2011. Long-term exposure to microwave radiation provokes cancer growth: evidences from radars and mobile communication systems. Exp. Oncol. 33(2), 62-70.	The carcinogenic effect of MW irradiation is typically manifested after long term (up to 10 years and more) exposure. Nevertheless, even a year of operation of a powerful base transmitting station for mobile communication reportedly resulted in a dramatic increase of cancer incidence among population living nearby. In addition, model studies in rodents unveiled a significant increase in carcinogenesis after 17-24 months of MW exposure both in tumor-prone and intact animals. To that, such metabolic changes, as overproduction of reactive oxygen species, 8-hydroxi-2-deoxyguanosine formation, or ornithine	Nothing. Review is not cited and not discussed.

	decarboxylase activation under exposure to low intensity MW confirm a stress impact of this factor on living cells. We also address the issue of standards for assessment of biological effects of irradiation. It is now becoming increasingly evident that assessment of biological effects of non-ionizing radiation based on physical (thermal) approach used in recommendations of current regulatory bodies, including the International Commission on Non-Ionizing Radiation Protection (ICNIRP) Guidelines, requires urgent reevaluation. We conclude that recent data strongly point to the need for re-elaboration of the current safety limits for non-ionizing radiation using recently obtained knowledge. We also emphasize that the everyday exposure of both occupational and general public to MW radiation should be regulated based on a precautionary principles which imply maximum restriction of excessive exposure.	
[91] Yakimenko IL, Sidorik EP, Tsybulin AS. 2011 [Metabolic changes in cells under electromagnetic radiation of mobile communication systems]. Ukr Biokhim Zh (1999). 2011 Mar-Apr;83(2):20-28.	Review is devoted to the analysis of biological effects of microwaves. The results of last years' researches indicated the potential risks of long-term low-level microwaves exposure for human health. The analysis of metabolic changes in living cells under the exposure of microwaves from mobile communication systems indicates that this factor is stressful for cells. Among the reproducible effects of low-level microwave radiation are overexpression of heat shock proteins, an increase of reactive oxygen species level, an increase of intracellular Ca2+, damage of DNA, inhibition of DNA reparation, and induction of apoptosis. Extracellular-signal-regulated kinases ERK and stress-related kinases p38MAPK are involved in metabolic changes. Analysis of current data suggests that the concept of exceptionally thermal mechanism of biological effects of microwaves is not correct. In turn, this raises the question of the need to revaluation of modern electromagnetic standards based on thermal effects of non-ionizing radiation on biological systems.	Nothing. Review is not cited and not discussed.
[92] Gye MC, Park CJ. 2012 Effect of electromagnetic field exposure on the reproductive system. Clin Exp Reprod Med 39:1-9. doi.org/10.5653/cerm. 2012.39.1.1 . Clin Exp Reprod Med 39:1-9. doi.org/10.5653/cerm.	The safety of human exposure to an ever-increasing number and diversity of electromagnetic field (EMF) sources both at work and at home has become a public health issue. To date, many *in vivo* and *in vitro* studies have revealed that EMF exposure can alter cellular homeostasis, endocrine function, reproductive function, and fetal development in animal systems. Reproductive parameters reported to be altered by EMF exposure include male germ cell death, the estrous cycle, reproductive endocrine hormones, reproductive organ weights, sperm motility, early embryonic development, and pregnancy success. At	Nothing. Review is not cited and not discussed.

2012.39.1.1	the cellular level, an increase in free radicals and [Ca(2+)]i may mediate the effect of EMFs and lead to cell growth inhibition, protein misfolding, and DNA breaks. The effect of EMF exposure on reproductive function differs according to frequency and wave, strength (energy), and duration of exposure. In the present review, the effects of EMFs on reproductive function are summarized according to the types of EMF, wave type, strength, and duration of exposure at cellular and organism levels.	
[93] La Vignera S, Condorelli RA, Vicari E, D'Agata R, Calogero AE. 2012 Effects of the exposure to mobile phones on male reproduction: a review of the literature. J Androl 33:350-356.	The use of mobile phones is now widespread. A great debate exists about the possible damage that the radiofrequency electromagnetic radiation (RF-EMR) emitted by mobile phones exerts on different organs and apparatuses. The aim of this article was to review the existing literature exploring the effects of RF-EMR on the male reproductive function in experimental animals and humans. Studies have been conducted in rats, mice, and rabbits using a similar design based upon mobile phone RF exposure for variable lengths of time. Together, the results of these studies have shown that RF-EMR decreases sperm count and motility and increases oxidative stress. In humans, 2 different experimental approaches have been followed: one has explored the effects of RF-EMR directly on spermatozoa and the other has evaluated the sperm parameters in men using or not using mobile phones. The results showed that human spermatozoa exposed to RF-EMR have decreased motility, morphometric abnormalities, and increased oxidative stress, whereas men using mobile phones have decreased sperm concentration, decreased motility (particularly rapid progressive motility), normal morphology, and decreased viability. These abnormalities seem to be directly related to the duration of mobile phone use.	Nothing. Review is not cited and not discussed.
[94] Biointiative Working Group, David Carpenter and Cindy Sage (eds). 2012 Bioinitiative 2012: A rationale for biologically-based exposure standards for electromagnetic radiation. http://www.bioinitiative.org/participants/why-we-care/	Sections on EMF effects: SECTION 4: EVIDENCE FOR INADEQUACY OF THE STANDARDS SECTION 5: EVIDENCE FOR EFFECTS ON GENE AND PROTEIN EXPRESSION SECTION 6: EVIDENCE FOR GENOTOXIC EFFECTS – RFR AND ELF DNA DAMAGE SECTION 7: EVIDENCE FOR STRESS RESPONSE (STRESS PROTEINS) SECTION 8: EVIDENCE FOR EFFECTS ON IMMUNE FUNCTION SECTION 9: EVIDENCE FOR EFFECTS ON NEUROLOGY AND BEHAVIOR SECTION 10: EFFECTS OF EMF FROM WIRELESS COMMUNICATION UPON THE	Nothing. Review is not cited and not discussed.

	BLOOD-BRAIN BARRIER SECTION 11: EVIDENCE FOR BRAIN TUMORS AND ACOUSTIC NEUROMAS SECTION 12: EVIDENCE FOR CHILDHOOD CANCERS (LEUKEMIA) SECTION 13: EVIDENCE FOR EFFECTS ON MELATONIN: ALZHEIMER'S DISEASE AND BREAST CANCER SECTION 14: EVIDENCE FOR BREAST CANCER PROMOTION SECTION 15: EVIDENCE FOR DISRUPTION BY THE MODULATING SIGNAL SECTION 16: PLAUSIBLE GENETIC AND METABOLIC MECHANISMS FOR BIOEFFECTS OF VERY WEAK ELF MAGNETIC FIELDS ON LIVING TISSUE SECTION 17 EVIDENCE BASED ON EMF MEDICAL THERAPEUTICS SECTION 18: FERTILITY AND REPRODUCTION EFFECTS OF EMF SECTION 19: FETAL AND NEONATAL EFFECTS OF EMF SECTION 20: FINDINGS IN AUTISM CONSISTENT WITH EMF AND RFR	
[4] Pall, ML. 2013. Electromagnetic fields act via activation of voltage-gated calcium channels to produce beneficial or adverse effects. J Cell Mol Med 17:958-965. doi: 10.1111/jcmm.12088.	The direct targets of extremely low and microwave frequency range electromagnetic fields (EMFs) in producing non-thermal effects have not been clearly established. However, studies in the literature, reviewed here, provide substantial support for such direct targets. Twenty-three studies have shown that voltage-gated calcium channels (VGCCs) produce these and other EMF effects, such that the L-type or other VGCC blockers block or greatly lower diverse EMF effects. Furthermore, the voltage-gated properties of these channels may provide biophysically plausible mechanisms for EMF biological effects. Downstream responses of such EMF exposures may be mediated through Ca(2+) /calmodulin stimulation of nitric oxide synthesis. Potentially, physiological/therapeutic responses may be largely as a result of nitric oxide-cGMP-protein kinase G pathway stimulation. A well-studied example of such an apparent therapeutic response, EMF stimulation of bone growth, appears to work along this pathway. However, pathophysiological responses to EMFs may be as a result of nitric oxide-peroxynitrite-oxidative stress pathway of action. A single such well-documented example, EMF induction of DNA single-strand breaks in cells, as measured by alkaline comet assays, is reviewed here. Such single-strand breaks are	This was cited. Sole statement is: "(see Pall, 2013 for a review of studies suggesting effects through voltage-gated calcium channels)." None of the important implications listed on the left are used in any way in the rest of the SCENIHR 2015 document See text for further discussion..

	known to be produced through the action of this pathway. Data on the mechanism of EMF induction of such breaks are limited; what data are available support this proposed mechanism. Other Ca(2+) -mediated regulatory changes, independent of nitric oxide, may also have roles. This article reviews, then, a substantially supported set of targets, VGCCs, whose stimulation produces non-thermal EMF responses by humans/higher animals with downstream effects involving Ca(2+) /calmodulin-dependent nitric oxide increases, which may explain therapeutic and pathophysiological effects.	
[95] Nazıroğlu M, Yüksel M, Köse SA, Özkaya MO. 2013 Recent reports of Wi-Fi and mobile phone-induced radiation on oxidative stress and reproductive signaling pathways in females and males. J Membr Biol 246:869-875.	The aim of the study was to discuss the mechanisms and risk factors of EMR changes on reproductive functions and membrane oxidative biology in females and males. It was reported that even chronic exposure to EMR did not increase the risk of reproductive functions such as increased levels of neoantigens abort. However, the results of some studies indicate that EMR induced endometriosis and inflammation and decreased the number of follicles in the ovarium or uterus of rats. In studies with male rats, exposure caused degeneration in the seminiferous tubules, reduction in the number of Leydig cells and testosterone production as well as increases in luteinizing hormone levels and apoptotic cells. In some cases of male and female infertility, increased levels of oxidative stress and lipid peroxidation and decreased values of antioxidants such as melatonin, vitamin E and glutathione peroxidase were reported in animals exposed to EMR. In conclusion, the results of current studies indicate that oxidative stress from exposure to Wi-Fi and mobile phone-induced EMR is a significant mechanism affecting female and male reproductive systems.	This was listed on p.285 under ***Literature identified but not cited.*** SCENIHR chose not to cite or discuss this paper, although they had identified it.
[96] Ledoigt G, Belpomme D. 2013 Cancer induction molecular pathways and HF-EMF irradiation. Adv Biol Chem 3:177-186.	The response of cells to different types of electromagnetic fields can be induced by low-level (athermal) high frequency (HF) electromagnetic fields (EMFs) exposure associated with mobile phone technologies. There are many examples of biological effects involving the epigenome. EMFs could trigger protein activation mediated by ligands, such as Ca2+, that alter the conformation of binding proteins, especially the NADPH plasmic membrane oxidase, so inducing increased formation of reactive oxygen species (ROS) that may alter proteomic functions. Classical anti-apoptotic and procarcinogenic signaling pathways that are commonly found activated in human malignancies and in inflammation mainly involve the tran-	Nothing. Review is not cited and not discussed.

	scription factor NF-κB. The microenvironment that exists during chronic inflammation can contribute to cancer progression. The data support the proposition that long term HF-EMF exposure associated with improper use of cell phones can potentially cause cancer.	
[97] Hardell L, Carlberg M. 2013 Using the Hill viewpoints from 1965 for evaluating strengths of evidence of the risk for brain tumors associated with use of mobile and cordless phones. Rev Environ Health 28:97-106. doi: 10.1515/reveh-2013-0006.	BACKGROUND: Wireless phones, i.e., mobile phones and cordless phones, emit radiofrequency electromagnetic fields (RF-EMF) when used. An increased risk of brain tumors is a major concern. The International Agency for Research on Cancer (IARC) at the World Health Organization (WHO) evaluated the carcinogenic effect to humans from RF-EMF in May 2011. It was concluded that RF-EMF is a group 2B, i.e., a "possible", human carcinogen. Bradford Hill gave a presidential address at the British Royal Society of Medicine in 1965 on the association or causation that provides a helpful framework for evaluation of the brain tumor risk from RF-EMF. METHODS:All nine issues on causation according to Hill were evaluated. Regarding wireless phones, only studies with long-term use were included. In addition, laboratory studies and data on the incidence of brain tumors were considered. RESULTS: The criteria on strength, consistency, specificity, temporality, and biologic gradient for evidence of increased risk for glioma and acoustic neuroma were fulfilled. Additional evidence came from plausibility and analogy based on laboratory studies. Regarding coherence, several studies show increasing incidence of brain tumors, especially in the most exposed area. Support for the experiment came from antioxidants that can alleviate the generation of reactive oxygen species involved in biologic effects, although a direct mechanism for brain tumor carcinogenesis has not been shown. In addition, the finding of no increased risk for brain tumors in subjects using the mobile phone only in a car with an external antenna is supportive evidence. Hill did not consider all the needed nine viewpoints to be essential requirements. CONCLUSION:Based on the Hill criteria, glioma and acoustic neuroma should be considered to be caused by RF-EMF emissions from wireless phones and regarded as carcinogenic to humans, classifying it as group 1 according to the IARC classification. Current guidelines for exposure need to be urgently revised.	Nothing. Review is not cited and not discussed. The Hill criteria are THE well-accepted way of analyzing biological plausiblility of epidemiologic al evidence. It is unacceptable for SCENIHR not to consider this review when attempting to analyze epidemiologic al evidence of EMF cancer causation.
[98] Hardell L, Carlberg M, Hansson Mild K. 2013 Use of	The International Agency for Research on Cancer (IARC) at WHO evaluation of the carcinogenic effect of RF-EMF on humans took place during a 24-31 May	This paper is cited and discussed

mobile phones and cordless phones is associated with increased risk for glioma and acoustic neuroma. Pathophysiology 2013;20(2):85-110.	2011 meeting at Lyon in France. The Working Group consisted of 30 scientists and categorised the radiofrequency electromagnetic fields from mobile phones, and from other devices that emit similar non-ionising electromagnetic fields (RF-EMF), as Group 2B, i.e., a 'possible', human carcinogen. The decision on mobile phones was based mainly on the Hardell group of studies from Sweden and the IARC Interphone study. We give an overview of current epidemiological evidence for an increased risk for brain tumours including a meta-analysis of the Hardell group and Interphone results for mobile phone use. Results for cordless phones are lacking in Interphone. The meta-analysis gave for glioma in the most exposed part of the brain, the temporal lobe, odds ratio (OR)=1.71, 95% confidence interval (CI)=1.04-2.81 in the ≥10 years (>10 years in the Hardell group) latency group. Ipsilateral mobile phone use ≥1640h in total gave OR=2.29, 95% CI=1.56-3.37. The results for meningioma were OR=1.25, 95% CI=0.31-4.98 and OR=1.35, 95% CI=0.81-2.23, respectively. Regarding acoustic neuroma ipsilateral mobile phone use in the latency group ≥10 years gave OR=1.81, 95% CI=0.73-4.45. For ipsilateral cumulative use ≥1640h OR=2.55, 95% CI=1.50-4.40 was obtained. Also use of cordless phones increased the risk for glioma and acoustic neuroma in the Hardell group studies. Survival of patients with glioma was analysed in the Hardell group studies yielding in the >10 years latency period hazard ratio (HR)=1.2, 95% CI=1.002-1.5 for use of wireless phones. This increased HR was based on results for astrocytoma WHO grade IV (glioblastoma multiforme). Decreased HR was found for low-grade astrocytoma, WHO grades I-II, which might be caused by RF-EMF exposure leading to tumour-associated symptoms and earlier detection and surgery with better prognosis. Some studies show increasing incidence of brain tumours whereas other studies do not. It is concluded that one should be careful using incidence data to dismiss results in analytical epidemiology. The IARC carcinogenic classification does not seem to have had any significant impact on governments' perceptions of their responsibilities to protect public health from this widespread source of radiation.	very briefly. See text for discussion.
[99] Davis DL, Kesari S, Soskolne CL, Miller AB, Stein Y. 2013 Swedish review strengthens grounds for concluding that	Mobile phones are two-way microwave radios that also emit low levels of electromagnetic radiation. Inconsistent results have been published on potential risks of brain tumors tied with mobile phone use as a result of important methodological differences in study design and statistical power. Some studies have	Nothing. Review is not cited and not discussed.

radiation from cellular and cordless phones is a probable human carcinogen. Pathophysiology 20:123-129.	examined mobile phone users for periods of time that are too short to detect an increased risk of brain cancer, while others have misclassified exposures by placing those with exposures to microwave radiation from cordless phones in the control group, or failing to attribute such exposures in the cases. In 2011, the World Health Organization, International Agency for Research on Cancer (IARC) advised that electromagnetic radiation from mobile phone and other wireless devices constitutes a "possible human carcinogen," 2B. Recent analyses not considered in the IARC review that take into account these methodological shortcomings from a number of authors find that brain tumor risk is significantly elevated for those who have used mobile phones for at least a decade. Studies carried out in Sweden indicate that those who begin using either cordless or mobile phones regularly before age 20 have greater than a fourfold increased risk of ipsilateral glioma. Given that treatment for a single case of brain cancer can cost between $100,000 for radiation therapy alone and up to $1 million depending on drug costs, resources to address this illness are already in short supply and not universally available in either developing or developed countries. Significant additional shortages in oncology services are expected at the current growth of cancer. No other environmental carcinogen has produced evidence of an increased risk in just one decade. Empirical data have shown a difference in the dielectric properties of tissues as a function of age, mostly due to the higher water content in children's tissues. High resolution computerized models based on human imaging data suggest that children are indeed more susceptible to the effects of EMF exposure at microwave frequencies. If the increased brain cancer risk found in young users in these recent studies does apply at the global level, the gap between supply and demand for oncology services will continue to widen. Many nations, phone manufacturers, and expert groups, advise prevention in light of these concerns by taking the simple precaution of "distance" to minimize exposures to the brain and body. We note that brain cancer is the proverbial "tip of the iceberg"; the rest of the body is also showing effects other than cancers.	

Of these 22 reviews, 19 are found in the PubMed database, the most widely used medical database in the world, so there is no excuse for not discussing these 19, but only two of them were discussed (see below). With regard to the eight different types of effects that I consider established non-thermal EMF effects, each of them were reviewed in multiple studies described in Table 3 as follows: Cancer 12 reviews [78,82,83-87,90,94,96-98]; Oxidative stress/free

radicals 8 reviews [79,80,84,90,92,-96]; Cellular DNA damage 10 review [4,79,80-82,84,90-92,94]; Apoptosis/cell death 3 reviews [79,82,91]; Lowered fertility 7 reviews [80,86,89,92-95]; Neurological/neuropsychiatric effects 4 reviews [80,87,88,94]; Calcium overload 4 reviews [4,91,92,96]; Endocrine effects 2 reviews [92,95]. It is not clear why so many important reviews on effects are not found in SCENIHR 2015 [73]. What is perhaps surprising, is that these reviews also document many other effects, none of which are clearly acknowledged by SCENIHR. These include stress responses; breakdown of the blood-brain barrier; fetal and neonatal effects; therapeutic effects; Alzheimer's disease; increased nitric oxide; endometriosis; changes in protein levels (proteomics) and changes in gene expression; NF-kappaB elevation; increased suicide; changes in protein kinase activity including ERK and p32MAPK; mechanisms associated with oxidative stress including elevated NADPH/NADH oxidase increased lipid peroxidation and decreased enzymatic antioxidant activity, increased ornithine decarboxylase; and autism. It can be seen from this that the SCENIHR 2015 document seems to be systematically avoiding considering substantial bodies of evidence regarding a very large range of repeatedly reported EMF effects, each of which challenges the SCENIHR position that no effects are established.

Three specific issues regarding apparent cancer causation by EMFs need to be discussed here. Five of these reviews each review a body of evidence showing that cancer rates are higher on the side of the head where people use their cell phones and cordless phones, the ipsilateral side, as opposed to the opposite side of the head, called the contralateral side [78,84,85,98,99]. These are very important studies because they are not likely to be affccted by how complete the reporting data are, or whether there are affects produced by chemicals, ionizing radiation or other EMFs; each of these factors should not be specific for the side of the head impacted. The contralateral side of the head serves as a control that can be compared with the ipsilateral side of the head. What is strange about the SCENIHR 2015 document, is that it avoids discussing all of these data presented in these five reviews. That is even true for [98] which is discussed very briefly in SCENIHR 2015. Only one body of evidence from [98] is discussed in SCENIHR 2015 but several others are not discussed, including the two bodies of evidence which each find statistically significant rises in ipsilateral cancer as compared with contralateral cancer. The ipsilateral findings produce very strong arguments that cell phones and/or cordless phones do cause brain cancer in humans. The best evidence suggests that both cell phones and cordless phones do cause cancer. What does SCENIHR 2015 [73] say about ipsilateral cancer? [73] states, on p. 74 that "ORs for glioma were higher in subjects who reported phone use mostly on the same side of the head (ipsilateral) as their tumour than for use on the opposite side (contralateral). For meningioma, ORs for temporal lobe tumours were slightly lower than for other locations, while a similar pattern as for glioma of higher ipsilateral ORs compared to contralateral ORs was seen." On p. 76, SCENIHR states that "Afterwards, in an attempt to quantify the relationship, Interphone and the Hardell studies were analysed in a meta-analytical approach (Hardell et al., 2013a), an OR of 1.71 (CI: 1.04-2.81) was found for temporal glioma among ipsilateral mobile phone users of 10+ years of use…." On p. 77, regarding a study designed to assess the reliability of self-reported cell phone usage in young brain cancer patients, a study **not** designed to assess ipsilateral effects in patients whose cancer cases may likely have been caused by cell phone usage, the SCENIHR 2015 document states "No clear patterns were seen when comparing ipsilateral and contralateral use." That is not surprising. It can be seen from this that 2 out of 3 studies that SCENIHR discussed argue that there is increased ipsilateral cancer and argue therefore that cell phones or cordless phones do cause cancer. Furthermore, they ignore large amounts of data, cited in [78,84,85,98,99] that provide further support for this view. When SCENIHR wishes to take the opposite position from that taken in these reviews, it is incumbent on SCENIHR to cite them, to discuss the data and opinion presented in those reviews and then and only then can they argue for their position. Having failed to do those things, SCENIHR loses credibility in any argument that they are doing what they can to protect our

health. The same is true for all of the other effects where they similarly fail to cite large numbers of obviously relevant reviews, each arguing for various health effects produced by EMF exposures.

Two other findings from these reviews are important in assessing EMF cancer causation. Refs. [85 and 99] each provide evidence that younger people are more susceptible to cancer causation by EMFs than are adults. SCENIHR takes the opposite view but cannot argue credibly without considering those who differ. The other finding found in [97] is that the epidemiological evidence on cancer causation by microwave frequency EMFs satisfies most of the Hill criteria. The Hill criteria are THE well-accepted criteria that allow one to distinguish chance associations from causal roles in epidemiology. Because epidemiology is the main basis for the arguments that SCENIHR makes against the conclusion that EMFs cause cancer, it is essential that SCENIHR carefully examine the Hill criteria. They fail to do so. They also ignored this study where these criteria were examined and where it was concluded that the majority of the Hill criteria argue that EMFs do cause cancer. This again, undercuts any claim that SCENIHR has carefully considered critically important findings with regard to EMF health effects.

There are several places in the SCENIHR 2015 document, where they state that no mechanisms have been identified by which claimed effects of EMFs can be produced. These can be found by searching the SCENIHR 2015 document using "mechanism" as the search term. However [4] clearly states that the VGCC activation mechanism triggered by EMF exposure can produce, via this mechanism, cellular DNA damaging effects, can produce therapeutic effects and can produce oxidative stress effects. It can be seen, therefore that SCENIHR has no problem making repeated claims that have been falsified by information that they presumably have examined. It also can be seen from this, that even in the cases where SCENIHR cites and very briefly discusses a review that disagrees with them, one can have no assurance that the information is used by SCENIHR in its assessment of health impacts. The causation of cellular DNA damage by EMFs acting via VGCC activation also has important implications with regard to cancer causation. Because almost all cases of cancer start with mutagenic DNA damage in the cell destined to become a cancer cell, this shows how EMFs can initiate the process of carcinogenesis.

It is clear that the SCENIHR 2015 document neither cited nor discussed 20 out of 22 reviews that have documented non-thermal effects of EMFs. In addition, the most important findings of the two that were cited in the document were ignored in the document as well. Therefore SCENIHR has systematically avoided discussing the most important implications of reviews that fell into the time frame they purport to have studied and disagreed with SCENIHR on the existence of important effects. The question can be raised, however, as to whether the SCENIHR has done a better job in its consideration of primary literature citations. To answer that question, I am using a database of important primary literature, regarding effects of cell phone EMFs that we are commonly exposed to.

<u>23 Genuine Cell Phone Studies, Each of Which Should Be Discussed in SCENIHR 2015, 20 of Which Are Not.</u>

Panagopoulos et al [100] showed that whereas 46 out of 48 studies on genuine cell phone radiation showed health-related effects, the majority of studies on simulated cell phones reported no statistically significant effects. They [100] interpreted the difference of results as having been caused by the lowered pulsation rate of the "simulated" cell phone exposures. While I am sure that is part of the explanation, there may be other possible differences that are discussed later in this chapter.

Of those 48 genuine cell phone studies, 23 fell into the time frame (Jan. 2009 through Dec. 2013) reviewed in SCENIHR, 2015. Because of the importance of cell phones and therefore cell phone radiation in our lives, I am using these 23 as a database of primary literature studies that should all be covered in the SCENIHR 2015 [73] document. How many of these 23 were reviewed and cited in SCENIHR 2015? The answer is four (17%) and I will discuss how each of them were discussed below. I have inserted 17 of these into Table 4 below, but six were left out, because they are easy to summarize. These six are all Drosophila studies, none of which were discussed in SCENIHR 2015 [73] but are easy to summarize. All six Drosophila studies were focused on lowered fertility following EMF exposure, with the majority of these focused on lowered female fertility. Four of the six found increased apoptosis following cell phone EMF exposaure and four of the six also found cellular DNA damage following exposure. These are important because of the similarities of each of these effects to effects found in mammals. They are also important because they found DNA damage in Drosophila eggs, whereas mammalian eggs no similar studies have been done because of the difficulty in doing so. Two of these six Drosophila studies, also identified a low intensity exposure window which produced much larger effects than did lower or higher intensities. These exposure windows make it difficult or impossible to predict EMF effects based on EMF intensities. However, the industry and industry friendly groups such as SCENIHR repeatedly make such false predictions.

In mammals there are many studies showing DNA damage in sperm following EMF exposure. This DNA damage in germ line cells is particularly importance because of the importance of mutations passed onto progeny. Table 4 summarizes the other 17 genuine cell phone radiation findings that that SCENIHR 2015 [73] should be discussing, 15 of which were not discussed or cited in SCENIHR 2015.

Table 4: Genuine Cell Phone Studies that Fell into the 2009 through 2013 SCENIHR 2015 period

Citation studied	Cell Phone Effects Reported	SCENIHR comments
1. Mailankot M, Kunnath AP, Jayalekshmi H, Koduru B, Valsalan R. 2009 Radio frequency electromagnetic radiation (RF-EMR) from GSM (0.9/1.8GHz) mobile phones induces oxidative stress and reduces sperm motility in rats. Clinics (Sao Paulo) 64:561-565.	The present study was designed to evaluate the effects of RF-EMR from mobile phones on free radical metabolism and sperm quality. MATERIALS AND METHODS: Male albino Wistar rats (10-12 weeks old) were exposed to RF-EMR from an active GSM (0.9/1.8 GHz) mobile phone for 1 hour continuously per day for 28 days. Controls were exposed to a mobile phone without a battery for the same period. The phone was kept in a cage with a wooden bottom in order to address concerns that the effects of exposure to the phone could be due to heat emitted by the phone rather than to RF-EMR alone. Animals were sacrificed 24 hours after the last exposure and tissues of interest were harvested. RESULTS: One hour of exposure to the phone did not significantly change facial temperature in either group of rats. No significant difference was observed in total sperm count between controls and RF-EMR exposed groups. However, rats exposed to RF-EMR exhibited a significantly reduced percentage of motile sperm. Moreover, RF-EMR exposure resulted in a significant increase in lipid peroxidation and low GSH content in the testis and epididymis.	Listed under literature identified but not cited. SCENIHR knew about this paper but decided not to discuss it.

	CONCLUSION: Given the results of the present study, we speculate that RF-EMR from mobile phones negatively affects semen quality and may impair male fertility.	
2. Gul A, Celebi H, Uğraş S. 2009 The effects of microwave emitted by cellular phones on ovarian follicles in rats. Arch Gynecol Obstet 280:729-733. doi: 10.1007/s00404-009-0972-9.	The aim of this study was to investigate whether there were any toxic effects of microwaves of cellular phones on ovaries in rats. METHODS: In this study, 82 female pups of rats, aged 21 days (43 in the study group and 39 in the control group) were used. Pregnant rats in the study group were exposed to mobile phones that were placed beneath the polypropylene cages during the whole period of pregnancy. The cage was free from all kinds of materials, which could affect electromagnetic fields. A mobile phone in a standby position for 11 h and 45 min was turned on to speech position for 15 min every 12 h and the battery was charged continuously. On the 21st day after the delivery, the female rat pups were killed and the right ovaries were removed. The volumes of the ovaries were measured and the number of follicles in every tenth section was counted. RESULTS: The analysis revealed that in the study group, the number of follicles was lower than that in the control group. The decreased number of follicles in pups exposed to mobile phone microwaves suggest that intrauterine exposure has toxic effects on ovaries. CONCLUSION: We suggest that the microwaves of mobile phones might decrease the number of follicles in rats by several known and, no doubt, countless unknown mechanisms.	Not cited and not discussed by SCENIHR.
3. Imge EB, Kiliçoğlu B, Devrim E, Cetin R, Durak I. 2010 Effects of mobile phone use on brain tissue from the rat and a possible protective role of vitamin C - a preliminary study. Int J Radiat Biol 86:1044-1049. doi: 10.3109/09553002.2010.501838.	To evaluate effects of mobile phone use on brain tissue and a possible protective role of vitamin C. MATERIALS AND METHODS: Forty female rats were divided into four groups randomly (Control, mobile phone, mobile phone plus vitamin C and, vitamin C alone). The mobile phone group was exposed to a mobile phone signal (900 MHz), the mobile phone plus vitamin C group was exposed to a mobile phone signal (900 MHz) and treated with vitamin C administered orally (per os). The vitamin C group was also treated with vitamin C per os for four weeks. Then, the animals were sacrificed and brain tissues were dissected to be used in the analyses of malondialdehyde (MDA), antioxidant potential (AOP), superoxide dismutase, catalase (CAT), glutathione peroxidase (GSH-Px), xanthine oxidase, adenosine deaminase (ADA) and 5'nucleotidase (5'-NT). RESULTS: Mobile phone use caused an inhibition in 5'-NT and CAT activities as compared to the control group. GSH-Px activity and the MDA level were also found to be reduced in the mobile phone group but not significantly. Vitamin C caused a significant increase in the activity of GSH-Px and non-significant increase in the activities of 5'-NT,	Not cited and not discussed by SCENIHR.

	ADA and CAT enzymes. CONCLUSION: Our results suggest that vitamin C may play a protective role against detrimental effects of mobile phone radiation in brain tissue.	
4. Sharma VP, Kumar NR. 2010 Changes in honeybee behavior under the influence of cell phone radiation. Curr Science 98: 1376-1378.	Honeybee behaviour and biology has been affected by electrosmog since these insects have magnetite in their bodies which helps them in navigation. There are reports of sudden disappearance of bee populations from honeybee colonies. The reason is still not clear. We have compared the performance of honeybees in cellphone radiation exposed and unexposed colonies. A significant ($p < 0.05$) decline in colony strength and in the egg laying rate of the queen was observed. The behaviour of exposed foragers was negatively influenced by the exposure, there was neither honey nor pollen in the colony at the end of the experiment.	Not cited and not discussed by SCENIHR.
5. Vecchio F, Babiloni C, Ferreri F, Buffo P, Cibelli G, Curcio G, van Dijkman S, Melgari JM, Giambattistelli F, Rossini PM. 2010 Mobile phone emission modulates inter-hemispheric functional coupling of EEG alpha rhythms in elderly compared to young subjects. Clin Neurophysiol 121:163-171. doi: 10.1016/j.clinph.2009.11.002.	It has been reported that GSM electromagnetic fields (GSM-EMFs) of mobile phones modulate--after a prolonged exposure--inter-hemispheric synchronization of temporal and frontal resting electroencephalographic (EEG) rhythms in normal young subjects [Vecchio et al., 2007]. Here we tested the hypothesis that this effect can vary on physiological aging as a sign of changes in the functional organization of cortical neural synchronization. METHODS: Eyes-closed resting EEG data were recorded in 16 healthy elderly subjects and 5 young subjects in the two conditions of the previous reference study. The GSM device was turned on (45 min) in one condition and was turned off (45 min) in the other condition. Spectral coherence evaluated the inter-hemispheric synchronization of EEG rhythms at the following bands: delta (about 2-4 Hz), theta (about 4-6 Hz), alpha 1 (about 6-8 Hz), alpha 2 (about 8-10 Hz), and alpha 3 (about 10-12 Hz). The aging effects were investigated comparing the inter-hemispheric EEG coherence in the elderly subjects vs. a young group formed by 15 young subjects (10 young subjects of the reference study; Vecchio et al., 2007). RESULTS: Compared with the young subjects, the elderly subjects showed a statistically significant ($p<0.001$) increment of the inter-hemispheric coherence of frontal and temporal alpha rhythms (about 8-12 Hz) during the GSM condition. CONCLUSIONS: These results suggest that GSM-EMFs of a mobile phone affect inter-hemispheric synchronization of the dominant (alpha) EEG rhythms as a function of the physiological aging. SIGNIFICANCE: This study provides further evidence that physiological aging is related to changes in the functional organization of cortical neural synchronization.	Was cited and discussed – see text.
6. Kumar NR,	The present study was carried out to find the effect of cell	Not cited

Sangwan S, Badotra P. 2011 Exposure to cell phone radiations produces biochemical changes in worker honey bees. Toxicol Int. 2011 Jan;18(1):70-2. doi: 10.4103/0971-6580.75869.	phone radiations on various biomolecules in the adult workers of Apis mellifera L. The results of the treated adults were analyzed and compared with the control. Radiation from the cell phone influences honey bees' behavior and physiology. There was reduced motor activity of the worker bees on the comb initially, followed by en masse migration and movement toward "talk mode" cell phone. The initial quiet period was characterized by rise in concentration of biomolecules including proteins, carbohydrates and lipids, perhaps due to stimulation of body mechanism to fight the stressful condition created by the radiations. At later stages of exposure, there was a slight decline in the concentration of biomolecules probably because the body had adapted to the stimulus.	and not discussed by SCENIHR.
7. Favre D. 2011 Mobile phone-induced honeybee worker piping. Apidologie 42:270-279.	Electromagnetic waves originating from mobile phones were tested for potential effects on honeybee behavior. Mobile phone handsets were placed in the close vicinity of honeybees. The sound made by the bees was recorded and analyzed. The audiograms and spectrograms revealed that active mobile phone handsets have a dramatic impact on the behavior of the bees, namely by inducing the worker piping signal. In natural conditions, worker piping either announces the swarming process of the bee colony or is a signal of a disturbed bee colony.	Not cited and not discussed by SCENIHR.
8. Cammaerts MC, Debeir O, Cammaerts R. 2011. Changes in Paramecium caudatum (protozoa) near a switched-on GSM telephone. Electromagn Biol Med. 2011 Mar;30(1):57-66. doi: 10.3109/15368378.2011.566778.	The protozoan Paramecium caudatum was examined under normal conditions versus aside a switched-on GSM telephone (900 MHz; 2 Watts). Exposed individuals moved more slowly and more sinuously than usual. Their physiology was affected: they became broader, their cytopharynx appeared broader, their pulse vesicles had difficult in expelling their content outside the cell, their cilia less efficiently moved, and trichocysts became more visible. All these effects might result from some bad functioning or damage of the cellular membrane. The first target of communication electromagnetic waves might thus be the cellular membrane.	Listed under literature identified but not cited. SCENIHR knew about this paper but decided not to discuss it.
9. Çam ST, Seyhan N. 2012 Single-strand DNA breaks in human hair root cells exposed to mobile phone radiation. Int J Radiat Biol 88:420-424. doi: 10.3109/09553002.2012.666005.	To analyze the short-term effects of radiofrequency radiation (RFR) exposure on genomic deoxyribonucleic acid (DNA) of human hair root cells. SUBJECTS AND METHODS: Hair samples were collected from eight healthy human subjects immediately before and after using a 900-MHz GSM (Global System for Mobile Communications) mobile phone for 15 and 30 min. Single-strand DNA breaks of hair root cells from the samples were determined using the 'comet assay'. RESULTS: The data showed that talking on a mobile phone for 15 or 30 min significantly increased ($p < 0.05$) single-strand DNA breaks in cells of hair roots close to the phone. Comparing the 15-min and 30-min data using the paired t-	Not cited and not discussed by SCENIHR.

	test also showed that significantly more damages resulted after 30 min than after 15 min of phone use. CONCLUSIONS: A short-term exposure (15 and 30 min) to RFR (900-MHz) from a mobile phone caused a significant increase in DNA single-strand breaks in human hair root cells located around the ear which is used for the phone calls.	
10. Vecchio F, Tombini M, Buffo P, Assenza G, Pellegrino G, Benvenga A, Babiloni C, Rossini PM. 2012 Mobile phone emission increases inter-hemispheric functional coupling of electroencephalographic α rhythms in epileptic patients. Int J Psychophysiol 84:164-171. doi: 10.1016/j.ijpsycho.2012.02.002.	It has been reported that GSM electromagnetic fields (GSM-EMFs) of mobile phones modulate - after a prolonged exposure - inter-hemispheric synchronization of temporal and frontal resting electroencephalographic (EEG) rhythms in normal young and elderly subjects (Vecchio et al., 2007, 2010). Here we tested the hypothesis that this can be even more evident in epileptic patients, who typically suffer from abnormal mechanisms governing synchronization of rhythmic firing of cortical neurons. Eyes-closed resting EEG data were recorded in ten patients affected by focal epilepsy in real and sham exposure conditions. These data were compared with those obtained from 15 age-matched normal subjects of the previous reference studies. The GSM device was turned on (45 min) in the "GSM" condition and was turned off (45 min) in the other condition ("sham"). The mobile phone was always positioned on the left side in both patients and control subjects. Spectral coherence evaluated the inter-hemispheric synchronization of EEG rhythms at the following frequency bands: delta (about 2-4 Hz), theta (about 4-6 Hz), alpha1 (about 6-8 Hz), alpha2 (about 8-10 Hz), and alpha3 (about 10-12 Hz). The effects on the patients were investigated comparing the inter-hemispheric EEG coherence in the epileptic patients with the control group of subjects evaluated in the previous reference studies. Compared with the control subjects, epileptic patients showed a statistically significant higher inter-hemispheric coherence of temporal and frontal alpha rhythms (about 8-12 Hz) in the GSM than "Sham" condition. These results suggest that GSM-EMFs of mobile phone may affect inter-hemispheric synchronization of the dominant (alpha) EEG rhythms in epileptic patients. If confirmed by future studies on a larger group of epilepsy patients, the modulation of the inter-hemispheric alpha coherence due to the GSM-EMFs could have clinical implications and be related to changes in cognitive-motor function.	Was cited and discussed – see text.
11. Al-Damegh MA. 2012 Rat testicular impairment induced by electromagnetic radiation from a conventional cellular	OBJECTIVE: The aim of this study was to investigate the possible effects of electromagnetic radiation from conventional cellular phone use on the oxidant and antioxidant status in rat blood and testicular tissue and determine the possible protective role of vitamins C and E in preventing the detrimental effects of electromagnetic	Listed under literature identified but not cited.

telephone and the protective effects of the antioxidants vitamins C and E. Clinics 67:785-792	radiation on the testes. MATERIALS AND METHODS: The treatment groups were exposed to an electromagnetic field, electromagnetic field plus vitamin C (40 mg/kg/day) or electromagnetic field plus vitamin E (2.7 mg/kg/day). All groups were exposed to the same electromagnetic frequency for 15, 30, and 60 min daily for two weeks. RESULTS: There was a significant increase in the diameter of the seminiferous tubules with a disorganized seminiferous tubule sperm cycle interruption in the electromagnetism-exposed group. The serum and testicular tissue conjugated diene, lipid hydroperoxide, and catalase activities increased 3-fold, whereas the total serum and testicular tissue glutathione and glutathione peroxidase levels decreased 3-5 fold in the electromagnetism-exposed animals. CONCLUSION: Our results indicate that the adverse effect of the generated electromagnetic frequency had a negative impact on testicular architecture and enzymatic activity. This finding also indicated the possible role of vitamins C and E in mitigating the oxidative stress imposed on the testes and restoring normality to the testes.	SCENIHR knew about this paper but decided not to discuss it.
12. Aldad TS, Gan G, Gao X-B, Taylor HS. 2012 Fetal radiofrequency radiation from 800-1900 MH-rated cellular telephone affects neurodevelopment and behavior in mice. Scientific Rep 2, article 312.	Neurobehavioral disorders are increasingly prevalent in children, however their etiology is not well understood. An association between prenatal cellular telephone use and hyperactivity in children has been postulated, yet the direct effects of radiofrequency radiation exposure on neurodevelopment remain unknown. Here we used a mouse model to demonstrate that in-utero radiofrequency exposure from cellular telephones does affect adult behavior. Mice exposed in-utero were hyperactive and had impaired memory as determined using the object recognition, light/dark box and step-down assays. Whole cell patch clamp recordings of miniature excitatory postsynaptic currents (mEPSCs) revealed that these behavioral changes were due to altered neuronal developmental programming. Exposed mice had dose-responsive impaired glutamatergic synaptic transmission onto layer V pyramidal neurons of the prefrontal cortex. We present the first experimental evidence of neuropathology due to in-utero cellular telephone radiation. Further experiments are needed in humans or non-human primates to determine the risk of exposure during pregnancy.	Was cited and discussed, see text.
13. Liu C, Gao P, Xu SC, Wang Y, Chen CH, He MD, Yu ZP, Zhang L, Zhou Z. 2013 Mobile phone radiation induces mode-dependent	A mouse spermatocyte-derived GC-2 cell line was exposed to a commercial mobile phone handset once every 20 min in standby, listen, dialed or dialing modes for 24 h. DNA damage was determined using an alkaline comet assay. RESULTS: The levels of DNA damage were significantly increased following exposure to MPR in the listen, dialed and dialing modes. Moreover, there	Not cited and not discussed by SCENIHR.

DNA damage in a mouse spermatocyte-derived cell line: a protective role of melatonin. Int J Radiat Biol. 2013. 89: 993-1001. doi: 10.3109/09553002.2013.811309.	were significantly higher increases in the dialed and dialing modes than in the listen mode. Interestingly, these results were consistent with the radiation intensities of these modes. However, the DNA damage effects of MPR in the dialing mode were efficiently attenuated by melatonin pretreatment. CONCLUSIONS: These results regarding mode-dependent DNA damage have important implications for the safety of inappropriate mobile phone use by males of reproductive age and also suggest a simple preventive measure: Keeping mobile phones as far away from our body as possible, not only during conversations but during 'dialed' and 'dialing' operation modes. Since the 'dialed' mode is actually part of the standby mode, mobile phones should be kept at a safe distance from our body even during standby operation. Furthermore, the protective role of melatonin suggests that it may be a promising pharmacological candidate for preventing mobile phone use-related reproductive impairments.	
14. Koca O, Gökçe AM, Öztürk MI, Ercan F, Yurdakul N, Karaman MI. 2013 Effects of intensive cell phone (Philips Genic 900) use on the rat kidney tissue. Urol J. 2013 Spring;10:886-891.	To investigate effects of electromagnetic radiation (EMR) emitted by cell phones on the rat kidney tissue. MATERIALS AND METHODS: Twenty-one male Albino rats were divided into 3 groups, each comprising 7 rats. Group 1 was exposed to a cell phone in speech mode for 8 hours/day for 20 days and their kidneys were removed. Group 2 was exposed to EMR for 20 days and then their kidneys were removed after an interval of 20 days. Cell phone used in the present study was Philips Genie 900, which has the highest specific absorption rate on the market. RESULTS: Light microscopic examination of the kidney tissues obtained from the first group of rats revealed glomerular damage, dilatation of Bowman's capsule, formation of large spaces between the tubules, tubular damage, perivascular edema, and inflammatory cell infiltration. The mean severity score was 4.64 ± 1.7 in group 1, 4.50 ± 0.8 in group 2, and 0 in group 3. While there was no significant difference between group 1 and group 2 ($P > .05$), the mean severity scores of groups 1 and 2 were significantly higher than that of the control group ($P = .001$ for each). CONCLUSION: Considering the damage in rat kidney tissue caused by EMR-emitting cell phones, high-risk individuals should take protective measures.	Not cited and not discussed by SCENIHR.
15. Meo SA, Al Rubeaan K. 2013 Effects of exposure to electromagnetic field radiation (EMFR) generated by activated mobile	Extensive use of mobile phones has been accompanied by a common public debate about possible adverse effects on human health. No study has been published so far to establish any association between the fastest growing innovation of mobile phone and fasting blood glucose. The aim was to determine the effects of exposure to electromagnetic field radiation generated by mobile	Not cited and not discussed by SCENIHR.

phones on fasting blood glucose. Int J Occup Med Environ Health 26:235-241. doi: 10.2478/s13382-013-0107-1.	phones on fasting blood glucose in Wistar Albino rats. MATERIALS AND METHODS: 40 Male Albino rats (Wistar Strain) were divided into 5 equally numerous groups. Group A served as the control one, group B received mobile phone radiation for less than 15 min/day, group C: 15-30 min/day, group D: 31-45 min/day, and group E: 46-60 min/day for a total period of 3 months. Fasting blood glucose was determined by using Spectrophotometer and serum insulin by Enzyme-linked Immunosorbent Assay (ELISA). The Homeostatic Model (HOMA-B) was applied for the assessment of β-cell function and (HOMA-IR) for resistance to insulin. RESULTS: Wister Albino rats exposed to mobile phone radiation for longer than 15 min a day for a total period of 3 months had significantly higher fasting blood glucose ($p < 0.015$) and serum insulin ($p < 0.01$) compared to the control group. HOMA-IR for insulin resistance was significantly increased ($p < 0.003$) in the groups that were exposed for 15-30 and 46-60 min/day compared to the control rats. CONCLUSION:The results of the present study show an association between long-term exposure to activated mobile phones and increase in fasting blood glucose and serum insulin in Albino rats.	
16. Tsybulin O, Sidorik E, Brieieva O, Buchynska L, Kyrylenko S, Henshel D, Yakymenko I. 2013 GSM 900 MHz cellular phone radiation can either stimulate or depress early embryogenesis in Japanese quails depending on the duration of exposure. Int J Radiat Biol 89:756-763. doi: 10.3109/09553002.2013.791408.	Our study was designed to assess the effects of low intensity radiation of a GSM (Global System for Mobile communication) 900 MHz cellular phone on early embryogenesis in dependence on the duration of exposure. MATERIALS AND METHODS: Embryos of Japanese Quails were exposed in ovo to GSM 900 MHz cellular phone radiation during initial 38 h of brooding or alternatively during 158 h (120 h before brooding plus initial 38 h of brooding) discontinuously with 48 sec ON (average power density 0.25 μW/cm(2), specific absorption rate 3 μW/kg) followed by 12 sec OFF intervals. A number of differentiated somites were assessed microscopically. Possible DNA damage evoked by irradiation was assessed by an alkaline comet assay. RESULTS: Exposure to radiation from a GSM 900 MHz cellular phone led to a significantly altered number of differentiated somites. In embryos irradiated during 38 h the number of differentiated somites increased ($p < 0.001$), while in embryos irradiated during 158 h this number decreased ($p < 0.05$). The lower duration of exposure led to a significant ($p < 0.001$) decrease in a level of DNA strand breaks in cells of 38-h embryos, while the higher duration of exposure resulted in a significant ($p < 0.001$) increase in DNA damage as compared to the control. CONCLUSION: Effects of GSM 900 MHz cellular phone radiation on early embryogenesis can be either stimulating or deleterious depending on the duration of exposure.	Listed under literature identified but not cited. SCENIHR knew about this paper but decided not to discuss it.

17. Luo Q, Jiang Y, Jin M, Xu J, Huang HF. 2013 Proteomic analysis on the alteration of protein expression in the early-stage placental villous tissue of electromagnetic fields associated with cell phone exposure. Reprod Sci 20:1055-1061. doi: 10.1177/1933719112473660.	To explore the possible adverse effects and search for cell phone electromagnetic field (EMF)-responsive proteins in human early reproduction, a proteomics approach was employed to investigate the changes in protein expression profile induced by cell phone EMF in human chorionic tissues of early pregnancy in vivo. METHODS: Volunteer women about 50 days pregnant were exposed to EMF at the average absorption rate of 1.6 to 8.8 W/kg for 1 hour with the irradiation device placed 10 cm away from the umbilicus at the midline of the abdomen. The changes in protein profile were examined using 2-dimensional electrophoresis (2-DE). RESULTS: Up to 15 spots have yielded significant change at least 2- to 2.5-folds up or down compared to sham-exposed group. Twelve proteins were identified-procollagen-proline, eukaryotic translation elongation factor 1 delta, chain D crystal structure of human vitamin D-binding protein, thioredoxin-like 3, capping protein, isocitrate dehydrogenase 3 alpha, calumenin, Catechol-O-methyltransferase protein, proteinase inhibitor 6 (PI-6; SerpinB6) protein, 3,2-trans-enoyl-CoA isomerase protein, chain B human erythrocyte 2,3-bisphosphoglycerate mutase, and nucleoprotein. CONCLUSION: Cell phone EMF might alter the protein profile of chorionic tissue of early pregnancy, during the most sensitive stage of the embryos. The exposure to EMF may cause adverse effects on cell proliferation and development of nervous system in early embryos. Furthermore, 2-DE coupled with mass spectrometry is a promising approach to elucidate the effects and search for new biomarkers for environmental toxic effects.	Listed under literature identified but not cited. SCENIHR knew about this paper but decided not to discuss it.

If you look through the studies described in Table 4, you will see multiple studies in oxidative stress/free radical damage, on changes in tissue structure (sometimes called remodeling), on cellular DNA damage, on male fertility (and also one on female fertility), on behavioral changes and on neurological changes. There is also one study on insulin/type 2 diabetes (hormonal effect). It follows from this that five of the effects that were extensively documented in large numbers of reviews (Chapter 1) are further demonstrated, as being caused be cell phone radiation, in these studies. In addition the tissue remodeling and proteomic changes discussed in Chapter 3 are also further demonstrated here. One question that needs to be raised with regard to SCENIHR is why so many clearly important primary literature studies of cell phone radiation (perhaps the most important source of human microwave irradiation) are not discussed in SCENIHR 2015. I will discuss certain particular articles that I think are particularly important for *particular reasons*. Subsequently, I will discuss the three articles that SCENIHR does discuss.

One of the more interesting studies not discussed by SCENIHR, is #11 in Table 4. This was published by a woman scientist in Saudi Arabia. What it shows is that 15, 30 or 60 minutes per day of cell phone radiation disrupts the structure of the rat testis and also produces high levels of oxidative stress as shown by measuring 5 different markers of oxidative stress. Such studies have been done for several decades, with oxidative stress having been shown in many different organs

following EMF exposures. What is particularly important in this study is that high levels of two different antioxidants, vitamin C and vitamin E, were each shown to produce substantial protection of the testis structure from the EMF effects while partially normalizing the oxidative stress elevation. What this clearly shows is that the oxidative stress causes the testis tissue disruption. So we don't just have evidence for two effects, testis disruption and oxidative stress but we have strong evidence that one causes the other. It is exactly these connections that are essential for the progression of the science!

13 is another study not discussed by SCENIHR which is particularly important. It looks at cell phone radiation DNA damage produced in a mouse spermatocyte-derived cell line. What it finds is that DNA damage is particularly high when the cell phone is in the dialed or dialing mode, as opposed to a listen mode. They also state that the radiation levels in the three modes correspond, at least roughly, to the DNA damage effects seen. They also show that pretreatment with melatonin (which is known to have antioxidant effects) greatly lowers the DNA damage produced by the cell phone EMF exposures. This is similar to the study discussed immediately above because it again shows that one effect, DNA damage is produced by another effect, namely oxidative stress/free radical elevation. You will recall that as discussed in Chapter 2, cellular DNA damage following EMF exposure is produced by the attacks by on the DNA by peroxynitrite derived free radicals. This study provides confirmation for that mechanism.

#14 is another study not discussed by SCENIHR which is also particularly important. It looks at the impact of cell phone radiation on kidney structure of rats, using six different measures of kidney structure. There were two groups of rats that were exposed to cell phone radiation which were both compared with each other and with normal unexposed control rats. The two exposed groups differed from each other in one group the kidney structure was assessed immediately following the 20 day exposure period. The second exposure group was also exposed for 20 days but was given 20 days subsequently with no exposure to see if the kidney structure spontaneously recovered. There was no recovery seen in the second group, showing that the kidney damage was effectively irreversible. In Chapter 3, several tissue remodeling type effects produced by EMF exposure appeared to be irreversible. Study #14 may add an additional such effect to that list.

#15 is another study not discussed by SCENIHR which is also particularly important. In this study control (unexposed) rats were compared with rats exposed to cell phone radiation for: less than 15 minutes per day, 15 to 30 minutes per day, 31 to 45 minutes per day or 45 to 60 minutes per day. Rats exposed to over 15 minutes per day of cell phone radiation showed type 2 diabetes onset-like effects, with higher fasting glucose levels and higher serum insulin levels. This appears to be, therefore a study showing important hormone dysfunction. It should be noted that the same research group has found similar changes in people living near cell phone towers [101]. Consequently, this is still another situation where findings in experimental animal studies appear to be directly applicable to humans.

Of the papers that were discussed, it is my opinion that the Aldad et al paper (#12, Table 4) is perhaps the most important. The paper starts out discussing the very large increase in ADHD that we have had in recent years, an increase which suggests that one or more environmental changes must be involved. This paper is from a distinguished laboratory, Hugh Taylor's laboratory at Yale, and was published in one of the highly respected Nature journals and the paper, at this writing has been cited 89 times, showing a high level of scientific interest in it. The paper showed that prenatal exposure of pregnant mice to cell phone radiation produced three highly statistically significant changes in the adult mice. These were a decrease in measured memory function, increase in hyperactivity and increase in anxiety. They also showed that there was a dose dependent decrease in an important neurological parameter, the frequency of miniature

excitatory postsynaptic currents, allowing the authors to conclude "that these behavioral changes were due to altered neuronal developmental programming." SCENIHR states the following about this study: "Neurodevelopment from a functional point of view was studied by Aldad et al. (2012) who exposed mice in utero and investigated them as adults for certain behavioural traits and electrophysiological characteristics. Exposure is poorly described but is reported to be to a muted telephone (900-1800 MHz) during the entire gestation period. After blinded investigations, the authors concluded that exposed animals displayed hyperactivity, memory deficiencies, decreased anxiety, and impaired glutamatergic transmission. Although the study employs relevant biological end-points, it cannot be used for any conclusions regarding pre-natal mobile phone exposure and functional development of the brain." SCENIHR fails to tell us why they claim the exposures were poorly described nor do they provide any reasoning on why "it cannot be used for any conclusions regarding pre-natal mobile phone exposure and development of the brain." It is hard to see how such results could be found unless there are substantial effects of pre-natal exposure. Because the study used genuine cell phone radiation, the effects seen are disturbing. It would be reasonable for SCENIHR to call for more studies of this type to see if they can be replicated. Having said that there have been five subsequent studies that I found where pre-natal mouse exposure to non-thermal EMFs produced substantial and somewhat similar adult neurological effects and or behavioral effects [102-106]. These five included exposures to Wi-Fi and to DECT (cordless phone) EMFs. These studies provide, then, strong evidence that prenatal exposures to EMFs can in animals, produce ADHD-like effects even into adulthood. They also show that during the late prenatal period, the developing brain is particularly sensitive to the effects of microwave frequency EMFs and raise the issue of how long after birth such sensitivity is also seen. It is common for SCENIHR and other industry friendly organizations to treat experimental studies as if they had the weaknesses of epidemiological studies. They don't because they can and do in these cases, directly demonstrate causation. In epidemiology, causation can be inferred but not directly demonstrated. What about epidemiological evidence with regard to EMF causation of ADHD? There are two such studies that each provide evidence for an association between prenatal cell phone exposures and development of ADHD [107,108]. SCENIHR knew about both of these, since it discusses one of them which is, in turn, based on the earlier one. Why then did SCENIHR not make the connection of those two studies with at Aldad study (#12 in Table 4)? That is of course an important failure, given that the Aldad study greatly strengthens the argument for EMF causation of ADHD.

Given the current situation where there are a total of 6 studies showing that pre-natal EMF exposures, including cell phone, Wi-Fi and cordless phone EMFs can cause ADHD-like effects in mice and two human epidemiological studies suggesting a similar mechanism in humans and the parallel between the huge increase in ADHD in humans and the huge increase in microwave frequency EMF exposures, is there any other type of evidence that supports a causal role for EMFs? It turns out there is. EMFs act primarily via VGCC activation (Chapter 20. Genetic polymorphism studies show that elevated VGCC activity has a role in causing ADHD [109], acting to a substantial extent prenatally. This is the way real science works. It is not the way that SCENIHR works.

The Vecchio et al 2010 paper (#5, Table 4) was discussed in SCENIHR 2015 as follows: "A study by Vecchio et al. (2010) analysed age-dependent EMF effects on alpha activity in waking EEGs in 16 older (47-84 years) and 15 younger subjects (20-37 years). Participants were exposed to a GSM signal (902.40 MHz, modulation frequencies: 8.33 and 217 Hz) for 45 min with a maximum SAR of 0.5 W/kg emitted by a commercially available mobile phone which was set using a test card in a double-blind cross-over paradigm. EEG was recorded for 5 min prior to and following exposure at 19 electrodes. The authors found an increased inter-hemispheric coherence of frontal alpha EEG activity after GSM exposure which was statistically significant for the

elderly subjects but not for the young ones. This might point to a GSM-EMF related inter-hemispheric synchronization of alpha rhythms as a function of physiological aging." Another related study (#by the same research group was also cited and discussed SCENIHR 2015 [73] as follows: "Vecchio et al. (2012a) used the same study design to investigate an exposure effect in patients with epilepsy. Data from 10 patients were compared to results from 15 age- matched controls from previous studies. Patients showed a statistically significant higher inter-hemispheric coherence of temporal and frontal alpha-rhythms under exposure as compared to control subjects. According to the authors, these results might indicate a GSM exposure effect on inter-hemispheric synchronization of the dominant (alpha) EEG rhythms in epileptic patients."

What do I have to say about the two Vecchio studies? They are both based on an earlier 2007 study which showed that increased EEG coherence between the two hemispheres of the brain was produced by genuine cell phone EMF exposure. What the 2010 study (#5 in Table 4) shows is that the EMF-induced increased coherence is much higher in older adults than it is in younger adults. What the 2012 study (#10 in Table 4) shows is that the EMF-induced coherence seen in people with epilepsy is also much higher than in people without epilepsy. These three studies then provide large amounts of evidence for a neurological effect of cell phone radiation that is influenced by two variables, age and epilepsy. These findings should be looked at the context of the 23 reviews, listed in Chapter 1, each showing that EMFs produce both neurological and/or neuropsychiatric impacts on the brain. Here we have still another neurological effect, one that is influenced by age and epileptic condition. There are, then three important findings in these studies. One is that while we have had quite lot of evidence showing that children are more sensitive to EMF effects than adults, this is the first clear finding, to my knowledge, that suggests that older people may be more sensitive to a neurological effect. The linkage to epilepsy should not be surprising as some EHS people are reported to have seizures triggered by very low intensity EMF exposures. Finally, the communication between the two hemispheres of the brain has been known for over half a century to be through what is called the corpus callosum, a structure deeply buried in the middle of the brain, linking the two hemispheres. These effects increasing the coherence between the two hemispheres are probably produced, therefore, through the impact of the EMFs on the corpus callosum. That implies, in turn, that the EMFs act much more deeply in the brain than the industry claims is possible.

The problem with SCENIHR is that it lives in a totally fictional universe where none of those EMF effect reviews exist or at least none of them have any relevance to the SCENIHR world. Neither of the two Vecchio et al studies, discussed in the previous two paragraphs, are used by SCENIHR [73] to make any conclusions about EMF effects or lack thereof – they are only cited in the quote that I gave you. We know that because because the citations are by author's last name and are, therefore easily searchable. Similarly, the Aldad et al (#12) study discussed two paragraphs further up, was also never cited except in the quotation given. So none of these three papers are used to assess any effects of EMFs or lack of effects. The same thing is true of the two reviews from Table 3 that were cited and discussed in [73]. They also were only cited in the quoted section and are never used to assess EMF effects or the mechanism of EMF action. As previously noted, there are several statements in SCENIHR 2015 [73] regarding lack of any available mechanism to explain claimed EMF effects, something that is directly contradicted by one of those cited and discussed reviews [4]. The consequence of all of that is that we have two very large and very consequential bodies of literature, the reviews on EMF effects and the literature on genuine cell phone radiation effects, which are entirely missing from any SCENIHR 2015 [73] conclusion.

<u>Is There Another Systematic Effort by Industry to Corrupt the Literature that Has Been Followed to Some Extent by SCENIHR?</u>

The important roles of pulsation, window effects, frequency, cell type and polarization in determining biological activity of EMFs were discussed in Chapter 1, where it was noted that SCENIHR fails to pay attention to any of these roles. That failure shows up in many places in the document. In Tables 5, 6, 7, 8, 9, 10, 11, 12, 13 and 14 of SCENIHR 2015 [73], the discussion of each table centers on how many studies found apparent effects and how many did not. But these numbers are irrelevant to the issue of whether there are effects or not. In fact one can argue that the industry, knowing about the roles of each of these factors, could fund any number of studies designed to give apparent negative results just by manipulating these factors to minimize responses and by only studying tiny numbers of individuals to produce low statistical power. This approach closely describes the approach used in seven studies of what were claimed to be genuine Wi-Fi studies that were described by Foster and Moulder [110] in Table 4 of their paper. Those seven studies were shown [11] to all have used an EMF that was not genuine Wi-Fi, despite claims to the contrary. They each used one of two types of reverberation exposure chamber for their rodent exposures, with each type of chamber greatly lowering the polarization of the EMFs [11] and also generating some level of destructive interference from variable path lengths produced by the reverberations. Each of these changes from genuine Wi- Fi is predicted to lower effects. Foster and Moulder [110] concluded that there was no effect in any of these studies. However tiny numbers of rodents were studied, between 3 and 15 in each class, such that these studies have very low statistical power to conclude anything substantive.

It is not possible to conclude no effect even with large studies. At most one can claim that there is no statistically significant evidence of an effect. With tiny numbers, a claim of no effect is complete nonsense. This problem with "no effect" claims is documented in a section of Rothman et al., Modern Epidemiology, 3rd Edition, a highly respected source of information, cited over 19,000 times according to the Google Scholar database. It states (p. 151, bottom) that: "A common misinterpretation of significance tests is that there no difference between two observed groups because the null test is not statistically significant, in that P is greater that the cutoff for declaring statistical significance (again, usually 0.05). This interpretation confuses a descriptive issue (whether two observed groups differ) with an inference about the superpopulation. The significance test refers only to the superpopulation, not the observed groups. To say that the difference is not statistically significant means only that one cannot reject the null hypothesis that the superpopulation groups are the same; it does not imply that the two groups are the same." All such claims of "no effect" are, therefore flawed. When they are made regarding very small studies with very low statistical power, they are particularly deeply flawed.

Were these seven studies designed to fail? I don't think we can say for certain but they certainly *look* as if they may have been. They also raise the serious question about whether the industry may be corrupting the science, by using their knowledge of the roles of pulsation, window effects, frequency, cell type and polarization.

The SCENIHR 2015 document has 127 places in the 221 pages of text where the term "no effect" was found (these can be easily found by searching the document using "no effect" for the search terms (that also picks up "no effects" statements. The first two of these 127 places are used properly, to describe the null hypothesis. *Each of the other 125 should not be there*, with each of those 125 overstating the case and therefore, improperly supporting the industry propaganda case.

In any case, the only way to show that there are inconsistencies or conflicts in the EMF literature is to carefully repeat studies finding such effects, not to flood the literature with studies done under other conditions. The logic used throughout SCENIHR 2015 [73] of just counting numbers of studies is deeply flawed.

Summary of Flaws in SCENIHR 2015

The first set of flaws, is that SCENIHR is perfectly willing to make statements which they know or should have known are false. The most egregious example of this is the Speit/Schwarz controversy described at the beginning of this chapter where there are seven clear falsehoods *created by SCENIHR*, each of which greatly strengthens the telecommunications industry propaganda positions. There are many others, described in this chapter that are substantive, but less egregious than the Speit/Schwarz falsehoods.

There is a vast literature, both in the review literature and in the primary literature studies, that disagrees strongly with the SCENIHR positions and is completely ignored by SCENIHR. In a few cases, such studies are cited and very briefly discussed by SCENIHR but then they have no impact on the assessments that SCENIHR makes in the SCENIHR 2015 document [73]. In most cases, they are neither cited nor discussed. The situation here is similar to an organization that has two sets of books, the fake books that are used in public and then a genuine set of books that includes all of the data that are too inconvenient to be included in the fake set of books.

The finally, we have three additional considerations which interact with each other to produce the completely bogus logic used by SCENIHR and by other organizations that have taken positions similar those taken by SCENIHR. One of those considerations comes from our knowledge that pulsation pattern, cell type, polarization and frequency can all influence biological effects and that there are exposure windows that produce much larger effects than are seen with either lower or higher intensities. Our knowledge of these factors mean that it is possible for the telecommunications industry to foster any number of studies where it is unlikely that statistically significant evidence of effects will be seen. I have presented examples where this may have been done. One of the most bizarre things about the SCENIHR 2015 document [73] is that there is a sentence on p. 101 where they state "In some of these cases, the effect seemed to be dependent on the cell type investigated and by the electromagnetic parameters applied (frequency, modulation)." Modulation and pulsation are the same thing. They know about these three factors and therefore, they know that these factors may explain differences in results obtained by different studies. But they still falsely assume that such differences imply inconsistencies in results and falsely assume that it makes sense to simply count apparent positive and apparent negative studies as a way of assessing whether there are effects or not.

SCENIHR has often falsely stated that these studies show no effects as opposed to lack of statistical significance of any effects. SCENIHR 2015 document has 125 places where such bogus claims of "no effect" are found. They repeatedly claim the literature is inconsistent but studies done under different conditions are *not* inconsistent because they are more likely to be due to genuine biological heterogeneity of responses. The false logic described here is used, in turn, to support another highly pervasive false logic. I've documented where SCENIHR has simply counted numbers of studies showing so many findings of effects and some other number of findings of "no effect." But these numbers are meaningless, when the studies are done under different conditions and where the "no effect" numbers can easily be inflated by studies designed to produce such results. They are also, of course, meaningless, when large numbers of studies that show effects are eliminated by SCENIHR by the simple process of pretending they don't exist. You can see from this, that the entire logical framework behind the SCENIHR 2015 [73] document is completely bogus.

Lastly, before going on to the situation in the U.S. and with 5G, there is one other thing I want to state here. In 2005, Dr. Jared Diamond published a book [111] entitled "Collapse: How

Societies Choose to Fail or Succeed." In it he documents how each society that "chose to fail," chose paths that had some short term gains but also had much more severe longer-term consequences. This is exactly what we have been doing with the EMFs, except that the consequences are much more severe than the collapse of one society – here all of the advanced technology societies on earth are at great risk.

Chapter 6: The U.S. Early Role in Recognizing Non-Thermal EMF Effects and How This Was Abandoned Starting in 1986: U.S. Failure to Research Health Impacts of Cell Phone Towers, Cell Phones, Wi-Fi, Smart Meters and Now 5G. What Is the Current Position of U.S. Government Agencies?

We in the U.S. often take great pride in our scientific research. That is, of course, especially true of U.S. scientists, of which I am one. We have far more Nobel laureates than any other country so we think of ourselves as being the #1 science country in the world. But we have had, over the past 20 years, almost no scientific primary literature studies, either laboratory studies or epidemiological studies, on non-thermal microwave frequency EMF effects. We had much more such research in this area 35 years ago,

In terms of non-thermal effects of microwave frequency (sometimes called radiofrequency) EMFs, the U.S. government published documents acknowledging the existence of large numbers of such non-thermal effects. This included the 1971 U.S. Office of Naval Medical Research Institute Report [30] and the 1981 report from the National Aeronautics and Space Administration (NASA) [26]. The most recent such report acknowledging widespread non-thermal EMF effects was the NCRP report [112] published in 1986. It follows that for the past 32 years, the U.S.government has been in denial on what *had been* repeatedly recognized by our government and is of great importance to protecting our health. 1986 turns out to be a key year because in that year, the U.S. Environmental Protection Agency (EPA) shut down its in house research program studying non-thermal EMF effects. In 1986, the U.S. Office of Naval Research, which had been funding grants in this area, stopped funding any new grants – the already funded grants were funded to the end of the grant period but no new grants were funded past 1986. A few years later, I think it was in late 1994, a similar shutdown of grants went into effect at the NIEHS, the part of the National Institutes of Health (NIH) which supports environmental health research. In 1999, the last U.S. agency that had been funding some research in this area, The Department of Energy also shut down what little research it had been funding.

The consequences of those shutdowns is that of the 17 studies on people living near cell phone towers, not a single study has been done in the U.S. Of the 23 studies of effects of genuine Wi-Fi EMFs, each of them showing effects [11], not a single study was done in the U.S. Of the over 50 studies on genuine cell phone radiation effects, only single one was done in the U.S, the NTP cell phone cancer study required by the Congress. So we have a situation where the U.S. government is encouraging EMF exposures and, in many cases, making it impossible to avoid EMF exposures while doing nothing or almost nothing to ensure our safety. There are a tiny number of studies that somehow sneak through, such as the Aldad et al study (#12 in Table 4) discussed in the preceding chapter, which was funded through the Child and Human Development Institute of the NIH, but these are few and far between.

How did these shutdowns happen? I don't know about 1986 but have some useful information from 1994/1995.

Attacks by the Telecommunications Industry on Two U.S. Scientists

Dr. Henry Lai from the University of Washington and a collaborator, NP Singh were using the alkaline comet assay, discussed earlier in this document to measure single stranded breaks in cellular DNA. They found a substantial elevation of the levels following low level EMF exposure in late1994. Before that finding had even been published, they found that they were targets of a severe attack from the telecommunications industry. A key document providing evidence of this was what was called the "War-Gaming" memo [113], where an executive named Norm Sandler, head of the Corporate Communications Department of Motorola (at that time the largest cell phone company) sent the memo to Michael Kehs of a public relations campaign in Washington DC (dated Dec. 13, 1994), describing their planned response to these at that time, unpublished findings. The memo stated that "While this work raises some interesting questions about possible biological effects, it is our understanding that there are too many uncertainties—related to the methodology employed, the findings that have been reported and the science that underlies them—to draw any conclusions about its significance at this time. Without additional work in this field, there is absolutely no basis to determine whether the researchers found what they report finding—or that the results have anything at all to do with DNA damage or health risks, especially at the frequencies and power levels of power levels of wireless communication devices.

In discussing the frequency differentiation issue, we should be able to say that Lai-Singh and Sarkar were not conducted at cellular (that is cell phone) frequencies."

(My comments are as follows: It is true that Lai/Singh used a different frequency from that used by cell phones. So the industry was correct about that. But the findings also show that the industry claims that there cannot be any non-thermal effects are wrong, and that may be more important. Singh had a reputation of being a genuine international expert on comet assays, so I doubt that methodology was a problem. If this had nothing to do with DNA damage or health risks, Motorola would not be worrying about these findings. There were at that time (1994) previously published studies of EMF effects on cellular DNA including the concurrent Sarkar findings and including findings of chromosome breaks and rearrangements reported in [30]).

Further down, the memo: "I think we have sufficiently war-gamed the Lai-Singh issue, assuming that SAG (Scientific Advisory Group, a group linked to the telecom industry) and the CTIA (the umbrella telecom lobbying, publicity and legal organization) have done their homework. We want to run this by George Carlo and fill him in on contacts we have made."

Under Excerpts from Confidential Working Draft #3. Question and Response:

Q. How can Motorola downplay the significance of the Lai study when one of your own expert consultants is on record telling Microwave News that the results—if replicated—could throw previous notions of RF safety into question?
R. It is not a question of downplaying the significance of the Lai study. In his comments to Microwave News, Dr. Sheppard raised the key question: Can it be replicated and interpreted? We will wait and see."
(My comments: Replication needed to be done, so that was a valid point. The interpretation was and is clear – it is that EMF exposures produce large increases in the numbers of single strand breaks in the cellular DNA.)

"Action Planned: In addition to response materials prepared by SAG (see attached copies) we will work with SAG to identify appropriate experts to comment in general on the science of DNA research, in addition to any experts SAG may be able to recommend to publicly comment on one or both of these particular studies.

Then they talk about Media Strategy where Motorola stays in the background with SAG and CTIA in front."

Three important things happened to Dr. Henry Lai at about this time [114,115]. In November 1994, before the War-Gaming memo had been written, a representative of the industry called the NIH claiming that money had been misspent from the Henry Lai grant for the DNA studies. Dr. Lai faxed the NIH an explanation which was accepted. However, the cutoff of new NIEHS funding appears to have occurred at this time, such that the industry pressure is likely to have been important. Furthermore [114] "The industry made a full-court press to discredit the DNA break study. A consistent and coordinated message was put out to marginalize Lai and Singh. For instance, in November 1994 (note: this was also before the War-Gaming memo was written), Q. Balzano, then a senior Motorola executive, wrote to us (Microwave News) that "Even if it is validated, the effects it purports to show may be inconsequential." (My comment is that DNA breaks produced at intensity levels well below safety guidelines are *not* inconsequential. If they were, the industry would not be worrying so much about them). Ron Nessen, the CTIA's top spokesman told a Florida newspaper that "It's not very relevant." He also tried to cast doubt on the comet assay pioneered by Singh to measure DNA breaks. It "may not be scientifically valid." Quite a number of months later, the head of the WTR (successor organization to SAG) wrote a 6 page letter to the President of the University of Washington to try to get him to fire both Lai and Singh [114, 115]. Neither was fired, but this is what you face when you get results that the telecommunications industry does not like.

(My comments: The basic findings of the Lai and Singh studies have been replicated more than two dozen times, at this writing. There have also been many replicates of the findings of increased micronucleus formation and oxidized bases in the DNA following non-thermal EMF exposures. All of that replication and the 21 reviews that were listed in Chapter 1 each showing non-thermal cellular DNA damage have still not gotten the telecommunications industry to admit that these DNA effects are occurring. The industry apparently does not care about the replication but cares, rather, about having talking points. Furthermore, when the industry was trying to get Dr. Lai's research funding cut off or later was trying to get both Lai and Singh fired, they were trying to *prevent* replication rather than encouraging it).

So Dr. Henry Lai was the first major scientist who came under vicious attack from the telecommunications industry and their allies, but he was certainly not the last. There are many such scientists including Prof. Adlkofer in Germany and Prof. Rüdinger in Austria. I know of nine others who have been attacked in the U.S. or in Europe. But here is a situation where the U.S. instead of leading world science in the right direction has been leading it into corruption. There are others.

I want to talk about another especially important case of such an attack on a U.S. scientist, that of Professor Om Gandhi. Gandhi is a professor at the University of Utah who, for many years was doing modeling of cell phone EMF exposures on the brains of humans. He was modeling such exposures for a substantial period of time of time based on the head of what was called standard anthropomorphic man (SAM). SAM was modeled from a 6 foot 2 inch, 200 pound man, a man in the upper 10% of men for head size and estimated skull thickness. He was doing such cell phone modeling for the telecommunications industry and received an important honor for this research. Because the safety guidelines are based only on thermal effects, the modeling was aimed at determining heating of the human brain by cell phone radiation.

Prof. Gandhi became concerned about the fact that both the head size and skull thickness of SAM was greater than that of most men and essentially all women and children and consequently began modeling a typical woman and typical 10 year old child, When he did that he found that the cell phone EMF exposures to the brain were much too high, even based on their own standards, standards that were and are only based on heating. The timing of these events was from 1975 through 1996. I will be quoting on what occurred subsequently. I have received permission from Dr. Devra Davis to make these quotes from pages 81 through 88 of her book Disconnect [77]. I will use a different font for those quotes so that you can see them easily.

Based on the new work he had produced, Gandhi called for a revision of the safety standards that regulated cell phones. The industry was stunned. For years, Gandhi had been one of those on whom they had counted. If Gandhi's work went uncontested, it would mean that children, women and men with smaller heads could not safely use some electronic devices or that these devices would have to be redesigned to emit less radio frequency radiation. The industry's first response was to cut off all of Gandhi's funding.

Going to p. 86 from [77]:

Gandhi explained that something has gone very wrong with standard setting in the United States in the past few years.

"Starting in the late 1980s, I chaired the committee to set standards for radio-frequency exposures before all cell phones ever existed. About a decade ago, C.K. Chou, then at the City of Hope Hospital, replaced me. Within two years, Chou had moved. He became a senior executive with Motorola—a clear conflict of interest. The committee that advises as to cell phone standards is supposed to be independent and had never before been led by someone from the very industry it advises. Under Chou's leadership, the committee relaxed standards for cell phones as of 2005. Having spent my entire life developing models of the brain, I know how things work. I also know that what we have done here is to ratchet up exposures, without actually telling people we have done so. Today's standards for cell phones have more than doubled the amount of radio-frequency radiation allowed into the brain."

The next quote starts at 2002, before the more than doubling of those radiation standards (pp. 87-88 from [77]).

By 2002 the gloves were off and the industry made it clear to Gandhi that they would take him on directly. Gandhi remembers being told by an industry colleague who was once a student and friend, "If you insist on publishing these papers saying that children get more exposed than adults and saying our test procedure is not valid, you can expect that we will not fund you."

Gandhi replied, "I am a university professor. I don't need your money."

Next industry tried to place an article by Chou critiquing Gandhi's models in the journal of which Gandhi had been editor and chief and in which he had published dozens of articles, and asked that either his (that is Gandhi's) article criticizing the grounds for setting standards be removed, or that they be allowed to publish Chou's rejoinder.

Gandhi reports that four different peer reviews of Chou's critique of my work indicated that Chou's critique of my work was 'scientific junk.' Only when the editor of the journal balked did the industry finally relent. Despite this success in beating back one attempt to discredit Gandhi's work, the effort to increase allowable amounts of radio frequency radiation was won on a major front. As the new chief of the standard-setting committee, Chou masterminded changes in the standards, and the committee, which now included a large majority of industry experts, issued new recommendations, ignoring Gandhi's analysis showing that these would effectively double exposures.

(I want to comment on this. I've published three papers on the physics of EMF action [4,5,11]. In each of them, I have taken the industry arguments about the physics seriously. Even though it was clear that the industry arguments were wrong, because of the clear existence of so many effects that occur at non-thermal levels of exposure, the industry arguments claiming that there could only be thermal effects were substantive and therefore, had to be considered. What I find, in the previous six paragraph, is that the industry itself is ready to throw out its own arguments, when they conflict with their ability to make massive profits. The issues here are very simple. Anyone with the most elementary understanding of the geometry of the head and a high school knowledge or physics, will know that a person with a smaller head and thinner skull will be exposed to higher brain levels of radiation from cell phones.)

What is obvious about this is that the industry does not care about health impacts, as long as they can maintain some deniability. What is also obvious is that the telecommunications industry can act to systematically corrupt an organization that, in effect, regulates the telecommunications industry. That in turn means that other organizations that, in effect, regulate the industry must be scrutinized for possible corruption. Those include ICNIRP, SCENIHR, WHO, the FCC and the FDA.

When Have Somewhat Similar Things Happened in Other Situations in the U.S.?

Is this approach to obfuscating the science unusual? Not really, but it appears to be much more extreme than usual, with the telecommunications industry and EMF effects. I suggest looking at the book on "Doubt Is Their Product: How Industry's Assault on Science Threatens Your Health" by Dr. David Michaels. I've cited a book review of that book here [116]. The review starts out with the statement that "Creating doubt – at least enough to derail government regulation – is an art form long practiced and highly perfected by some sectors of private industry. In the book, Professor David Michaels vividly demonstrates how each such industry channels some of its profit to 'product defense firms' and 'self interested scientists' who conduct research designed to cast doubt on the science that supports regulation." (I will add that it also casts doubt on the science that may support lawsuits, as well.) "As a result of the doubt created, regulation is long-delayed and thousands of people (or perhaps millions) suffer and die unnecessarily." The industries that are covered in the book include tobacco, lead, asbestos, Merck (the maker of Vioxx), global warming, chromium, beryllium, artificial butter flavoring (diacetyl, the cause of often fatal popcorn lung). I think you will see parallels with what went on with SCENIHR (Chapter 5) and with the telecommunications industry actions (this chapter). Part of the problem with these precedents, is that nobody went to prison, despite the many deaths and injuries that were perpetrated and in most of these cases, the industries involved ended up making more money than they lost in the subsequent lawsuits. The precedent has been set that you can get away with almost anything if you are big enough and powerful enough and rich enough. That

may have been sufficient to encourage the telecommunications industry to follow a similar, although, in my opinion, much more aggressive pathway.

One question that can be asked is whether there are any major international political figures who appear to have a good understanding of the EMF/health issue? When I was asked that question, I was able to come up with only one person. That person is President Vladimir Putin of Russia. This inference comes from an interview of Dr. Dietrich Klinghardt, who practices in Seattle, by Dr. Joseph Mercola, that occurred in December 2017, an interview that was entirely focused on EMF health effects [117]. In that context Dr. Klinghardt states that a lecture that Putin gave to the Russian assembly said, "We do not need to go to war with America. America is committing collective suicide by the way they are using electricity. We just have to wait until they are all in the psychiatric hospital." When I saw that, I asked myself whether it is plausible that Vladimir Putin has a deep understanding of the neuropsychiatric effects of the EMFs? And then I thought, of course, Vladimir Putin was the head of the KGB when the latter studies reviewed by Dr. Karl Hecht [28] were being done in the Soviet Union. The most important effects that were shown to be produced by the EMFs, in those studies, were the neuropsychiatric effects. Furthermore, the Putin statement apparently shows not only a substantial understanding of those effects but also the fact that they are cumulative and become irreversible, as shown in those studies [28] and in other studies discussed in Chapter 4. One thing that I would add is that President Putin apparently practices what he preaches. He avoids smart phones [118].

It is my opinion, that the CIA and other international intelligence agencies should examine these issues very carefully to assess whether they see the kinds of threats that I see. Those agencies are very good at obtaining information from various sources and determining probable threats to national and international security. It should not be difficult to come to an assessment, especially because some of us have done much of the work that needs to be done. The threat here is self-inflicted, it is not caused by any foreign power or set of powers. But it is the most serious national or international security threat that we have faced, in my opinion, with the exception of nuclear annihilation.

Propaganda:

In the initial days of the controversy regarding cell phones, in 1993, the industry developed a huge public relations effort in the face of lawsuits and adverse press reports impacting the industry. Paul Staiano, President of Motorola General Systems stated in a 1993 ABC 20/20 interview [119] that, “Forty years of research and more than ten thousand studies have proved that cellular phones are safe.” So I asked how many studies of cell phone safety or lack there of had been published by the end of 1993. The way I did that was to search in the PubMed database under (cell phones or cellular phones or mobile phones). I found about 11,000 hits, roughly 99% of them having nothing to do with health safety, and then looked at the few studies that had been published before the end of 1993. The only study I found that had any connection with health or safety, was one on driving safety while using a cellular phone, giving equivocal results with regard to driving safety. So there, were apparently no studies done on cell phone safety at that time. Furthermore, even if there had been any studies, they could not possibly show that “cellular phones are safe.” At most they might show that there was no statistically significant evidence of an effect but that only shows that you have not proven an effect, not that you have proven the opposite. It can be seen, therefore, that this propaganda statement is complete nonsense. Furthermore, we know that the Panagopoulos et al [100] review, showed that 46 out of 48 genuine cell phone studies that they reviewed showed effects. So the facts are exactly opposite of the industry propaganda on this. If this was the beginning of propaganda in the U.S. let’s look at something much more recent.

Berezow and Bloom Op-Ed Document: Recommendation to Limit Maryland School Wi-Fi Is Based on "Junk Science"

Berezow and Bloom, [120] start their 2017 op-ed with the claim that "The CEHPAC, an agency within Maryland's Department of Health and Mental Hygeine, has recommended that schools reduce or eliminate students' exposure to Wi-Fi because it believes wireless signals might cause cancer. *This is pure, unadulterated junk science. At least three separate, major areas of scientific knowledge can unambiguously confirm that wireless radiation is completely safe* (italics added)."

They continue with the physics [120], stating that "CEHPAC fails to realize that all radiation is not created equal. The energy of nuclear radiation, X-rays and UV light is high enough to damage our bodies and cause cancer. But other forms of radiation are energetically weak by comparison. They cannot cause cancer." This argument has validity with regard to individual photons, as I stated in my first paper on the activation of VGCCs by EMFs [4], but it is completely bogus with regard to EMFs as a whole. It has been known for 70 years that a person walking in front of a high powered radar machine will rapidly die, but Berezow and Bloom claim that cannot happen because the fields are "energetically weak." Furthermore, as discussed in Chapter 2 and elsewhere [5,11], the voltage sensor that controls the opening of the VGCCs is extraordinarily sensitive to electrical forces of EMFs, with the forces on the voltage sensor being approximately 7.2 million times greater than the forces on singly charged groups in the aqueous parts of our cells and tissues. It can be seen, therefore, that Berezow and Bloom [120] while claiming to be experts, are profoundly ignorant of the relevant physics.

Berezow and Bloom [120] state that "According to the NIH's National Cancer Institute [121], well performed studies that included over one million people showed no connection between cell phone use and cancer." There is no such statement in the NCI 2016 [121] document – I suggest the reader look it up – it differs substantially from the op-ed characterization of it. The NCI 2016 [121] document, states that "there is currently no consistent evidence that non-ionizing radiation increases cancer risk" (sole supporting citation in NCI 2016 [121] was SCENIHR 2015 [73]). It has been shown above in Chapter 5, that SCENIHR 2015 is not a credible source of information on this and as shown, in Chapter 1, there are 35 different reviews that each provide strong evidence that EMFs do cause cancer. So claiming, that EMF causation of cancer is, in Berezow & Bloom's words, "pure, unadulterated junk science" is nonsense. What is amazing here is that the U.S. NTP study, published by Wyde et al [122], clearly shows that cell phones do cause cancer but it was completely left out of the Berezow & Bloom statement.

Let's go to their third "major area of scientific knowledge" – Berezow and Bloom [120] state that "the only known health effects from Wi-Fi are due to psychosomatics." That is, "people who believe that something will make them sick will report feeling ill, even if nothing is happening externally." Some of the Wi-Fi studies (Table 1 in [11]) are cell culture studies, some are animal model studies where EMF exposures are compared with sham exposures. While there may be a very weak argument regarding some but not other human studies when they are not done blinded, there is no argument that effects in any of the other studies are caused by "psychosomatics." Berezow and Bloom do not look at any of the 23 studies of Wi-Fi reviewed in [11], each of which showed effects and it is clear that most of them cannot possibly be due to psychosomatics. What is surprising here, is that the trillion dollar set of telecommunication industries, having been working on their propaganda for over a quarter of a century, is unable to produce a more convincing argument.

Have There Been Individual Research Studies Designed to Fail and Therefore Corrupt the Scientific Literature?

The first example, that I am aware of, where false science has been produced to supposedly show that an important EMF observation was unrepeatable also came from the U.S. It was described in Dr. Davis' book [77]. Dr. Allen H. Frey (pronounced Fry) published a paper in 1975 in Annals of the New York Academy of Science showing that low intensity pulsed EMF exposures produced a breakdown of the blood-brain barrier, the barrier in the blood vessels in the brain and the brain tissue that protects the brain from toxic chemicals and also infectious agents. The methodology that he used was to inject the fluorescent dye fluorescein into the blood (IV) and then use its fluorescence to detect whether and to what extent it penetrates into the brain tissue from the blood. A subsequent paper was published in 1978 [123], using similar methodology *except* that the fluorescein instead of being injected into the blood, was injected by intraperitoneal (IP) injection. When a compound is injected IP, it enters the blood only slowly over a substantial period of time, so that when one does a short term experiment looking at penetration through the blood-brain barrier, essentially nothing is seen. This was a transparent attempt to claim that the studies of Dr. Frey had been repeated with negative results, but the Frey studies had not be replicated.

I am aware of many papers that were flawed like the seven studies of simulated Wi-Fi, discussed near the end of Chapter 5 that were each touted by Foster and Moulder [110]. Let me remind you of what the flaws were in those seven studies. Firstly, each of them used EMFs that were the correct frequency for Wi-Fi but differed in pulsation from genuine Wi-Fi. Each of these studies used a reverberation exposure chamber which is predicted to decrease effects by both decreasing the polarization of the EMFs and increasing the destructive interference of the EMFs. They also used tiny numbers of animals for each study group, such that any statistics would have very low power. Finally, Foster and Moulder claimed each of them showed "no effect" when one can only at best claim there was no statistically significant evidence of an effect. Given the tiny numbers, the lack of statistical significance is of very little importance. I find that this pattern has been followed in a substantial number of additional studies.

What I want to discuss here is a paper that had each of those four properties but had several additional flaws, as well. I am aware of three legal proceedings in the U.S., where the industry side of that case touted the paper to be discussed, as being a particularly strong one. This paper by Ziemann et al [124] is entitled "Absence of genotoxic potential of 902 MHz (GSM) and 1747 MHz (DCS) wireless communication signals: In vivo two-year bioassay in B6C3F1 mice. In other words, the title claims that the 902 MHz frequency, studied and the 1747 MHz frequency also studied in the paper cannot cause DNA damage or other types of genotoxicity."

On p. 456 of Ziemann et al [124], the authors make clear that they are studying the effects of simulated cell phone radiation, not actual cell phone radiation. You will recall that Panagopoulos et al [110] found that almost all studies of genuine cell phone radiation found effects whereas less than half of simulated cell phone studies showed effects. This raises an important question about why Ziemann et al [124] opted to study simulated cell phone radiation. Much of the funding of the Ziemann et al paper (see pp. 462-463) came from industry sources. Funding source is not a flaw but it is a reason to look at the paper particularly closely. 2. The Ziemann et al [124] study used a stainless steel exposure chamber similar to the reverberation chambers discussed in Chapter 5 of this document. The chamber is predicted, to produce lower effects because of lowered polarization and increased destructive interference 3. The study is described as being a two year study of radiation effects. However the cells examined for micronuclei (their marker for genotoxicity (cellular DNA damage)), were mouse erythrocytes (red blood cells), and such

erythrocytes have a lifespan of only about 30 days; because of the inherent instability of micronuclei in replicating cells, such micronuclei in erythrocytes may possibly be generated over at most a 30 day period. It is misleading to describe this as a two year study when only the last 30 days are relevant to generating the marker being studied. 4. In rats and humans, erythrocytes containing micronuclei are selectively removed from circulation very quickly (see p. 459 of Ziemann et al [124]). While Ziemann et al claim that mice do not have a similar mechanism for selective rapid removal, the only citation that they provide is a study published by Chaubey et al (1993) showing that this was apparently true with Swiss mice; Ziemann et al [124] chose to use B6C3F1/CrlBR mice, a different inbred mouse strain which may well behave quite differently from Swiss mice. It follows from this that we have no idea whether the strain studied is similar to Swiss mice with regard to selective removal of erythrocytes containing micronuclei.

5. Ziemann et al [124] show that male and female mice behave quite differently with regard to levels of micronuclei (Tables I and III in [124]); however in their experimental study (Figure 2), males and females were combined in doing the statistics. What that inevitably does is to produce greater variations in micronuclei levels within different animal groups, making it substantially more difficult to detect any statistical significance among different animal groups in the study. It also means that it is important to use similar ratios of males and females in the experimental groups and we have no idea whether this was done or not. 6. In section A of Figure 2, there were only 8 animals in each group studied. In section B of Figure 2, there are only 5 to 9 animals in each animal group studied. These tiny numbers mean that there is only extremely low statistical power to detect any effects of EMF exposure and therefore these tiny studies make it almost impossible to say anything at all about the results. 7. The Ziemann et al study [124] provide none of their raw data; consequently we are in a situation where we have no way of judging whether their statistical analysis was done properly. We also have no way to use any such data as part of a meta-analysis of multiple studies, which may have much more power than do any single study (particularly such a tiny one). Consequently, the lack of statistical significance they report, cannot be properly assessed by the reader. 8. When one does a study looking at the possible effects of some variables, in this case a couple of simulated cell phone radiation studies, the most you can say about an apparent negative result is that "we did not see any statistically significant effects." When you have tiny studies such a described under 7 above, then the lack of statistical significance tells you almost nothing. But even with a very large study such as with thousands of mice including hundreds in each experimental group, all you can say is that "we did not see any statistically significant effects." 9. What do Ziemann et al conclude? They state in their title that there is an "Absence of genotoxic potential of 902 MHz (GSM) and 1747 (DCS) wireless communication signals." Did they study these EMFs in all organisms and all cell types? No of course not. Did they study all possible pulsation patterns of these two frequency EMFs? No of course not. Did they study all types of genotoxicity found following low-intensity EMF exposures? No, just one, micronuclei in erythrocytes in an inbred strain of mice. This title alone should tell any competent scientist that the paper is deeply flawed, completely apart from the preceding 8 flaws, with each of the 8 adding substantially to the flaws in this paper.

<u>George Carlo Letter</u>

Dr. George Carlo is an interesting and controversial figure who has both a law degree (JD) and a PhD in, I believe, epidemiology. He had worked in the telecommunications industry for years as head of the SAG and then WTR research arms. Dr. Carlo wrote an important letter to the heads of the telecommunications companies on October 7, 1999. The letter he sent to the head of AT&T is available on the internet [125]. In his book [126] Carlo lists all of the people sent the letter and also provides the text of the letter.

Carlo was, at that time the soon to be retiring head of the WTR, which was the CTIA/telecommunications industry research arm. In the letters to the heads of the telecommunications industry companies, Carlo discusses the types of evidence arguing that cell phones do apparently cause cancer and that they do cause DNA damage to our cellular DNA. The DNA damage, suggested that the apparent cancer causation was real. Carlo continues the letter as follows [125]:

"Today, I sit here extremely frustrated and concerned that appropriate steps have not been taken by the wireless industry to protect consumers during this time of uncertainty about safety." Continuing further down, Carlo adds:

"Alarmingly, indications are that some segments of the industry have ignored the scientific findings suggesting potential health effects, have repeatedly and falsely claimed that wireless phones are safe for all consumers including children, and have created an illusion of responsible follow up by calling for and supporting more research. The most important measures of consumer protection are missing: complete and honest factual information to allow informed judgment by consumers about assumption of risk; the direct tracking and monitoring of what happens to consumers who use wireless phones; and, the monitoring of changes in the technology that could impact health.

I am especially concerned about what appear to be actions by a segment of the industry to conscript the FCC, the FDA and WHO with them in following a non-effectual course that will likely result in a regulatory and consumer backlash."

This is an important letter for several reasons. After October 7, 1999 the heads of the telecommunications companies or, for that matter anyone else at those companies, could no longer legitimately claim that they did not know there were serious health concerns with cell phones, with targeting cell phones to young children, or with increasing allowable cell phone exposure radiation. The last of these was done a few years later, as you have already seen.

The concerns Carlo expresses about the FCC (Federal Communications Commission) and the FDA (U.S. Food and Drug Adminstration) are particularly important in the U.S., because both the FCC and the FDA had already been given important regulatory roles when the Carlo letter was written. The FCC had been given the power of regulating the location of cell phone towers by the 1996 telecommunications act, which also *prohibited, as I understand it, any state or local government from protecting their people's health by regulating cell phone tower positioning.* In other words, the 1996 telecommunications act *de facto* stated that the U.S. Federal government valued telecommunication industry profits over every single health impact of microwave frequency radiation, *no matter how serious* it is, to the American people. There have been several subsequent pieces of legislation that have made the situation still worse. The FDA had been given the power to regulate radiation emissions from cell phones and other devices that emit microwave/radiofrequency radiation, with cell phone regulation apparently being shared with the FCC.

<u>What Can We Say About the FCC?</u>

There was a very informative document about the FCC published by the Safra Institute for Ethics at Harvard University [127] entititled "Captured Agency: How the Federal Communications Commission Is Dominated by the Industries It Presumably Regulates." One of the sections in that document shows why both the FCC role and the telecommunications industry role were so important with regard to the 1996 telecommunications act:

Section 332(c)(7)(B)(iv) of the Act remarkably, and that adverb seems inescapably best here, wrests zoning authority from local governments. Specifically, they cannot cite health concerns about the effects of tower radiation to deny tower licenses so long as the towers comply with FCC regulations.

Congress Silences Public

Section 322(c)(7)(B0(iv) of the Communications Act Provides:
No State or local government or instrumentality thereof may regulate the placement, construction of personal wireless service facilities on the basis of environmental effects of radio frequency emissions to the extent that such facilities comply with the Commission's regulations concerning such emissions.

In preempting local zoning authority – along with the public's right to guard its own safety and health, Congress unleashed an orgy of infrastructure build-out. Emboldened by the government green light and the vast consumer appetite for wireless technology, industry has had a free hand in installing more than 300,000 sites. Church steeples, schoolyards, school rooftops, even trees can house these facilities.

What, then are the consequences of all of this? The 17 studies that have been done on people living near cell phone towers show that many people within 300 meters (about 1000 feet) of a cell phone tower are afflicted by six of the health effects found in those many reviews listed in Chapter 1. Two of those effects have not been looked at. According to this literature, people living within 300 meters of cell phone towers suffer from widespread neuropsychiatric effects, cellular DNA damage, cancer, oxidative stress, elevated apoptosis (cell death), and hormonal effects. They also suffer from cardiac effects like those discussed in Chapter 3 and from hypertension and also anemia. The two extremely well documented EMF health effects that have not been looked at are the reproductive effects and the high levels of intracellular calcium. That does not tell us these are not also caused in people living near cell phone towers, just that no one has looked. Roughly 30% of the people in this country live within 300 meters of a cell phone tower so the impact on health is major. But few know about this and the media and our government, including especially the FCC and FDA are keeping it all a deep dark secret. Not a single one of these 17 studies have been done in the U.S. Consequently, when the U.S. has ensured that we are irradiated by well over 300,000 of these cell phone towers, it has done absolutely nothing to determine what the consequences of exposure are. Of course we are impacted not only by cell phone towers near where we live but also near where we work or go to school and to some extent, when we are driving around town. These high levels of exposure are not necessary. Switzerland has safety guidelines that are 100 times more stringent than ours, Russia has safety guidelines that are 1000 times more stringent than ours. The health effects we see now will no doubt rise much further in the future without any increasing exposure, because many of these effects are cumulative, eventually becoming irreversible.

I would encourage you to look at the whole FCC as a captured agency document [127] – it can be downloaded at no cost from the internet [127]. It is very interesting and adds considerably to my short comments here regarding corruption.

So what does the FCC have to say about EMF effects on its web site [128]? I have copied some relevant sections as follows:

At relatively low levels of exposure to RF radiation, i.e., levels lower than those that would produce significant heating, the evidence for production of harmful biological effects is ambiguous and unproven. Such effects, if they exist, have been referred to as "non-thermal" effects. A number of reports have appeared in the scientific literature describing the observation of a range of biological effects resulting from exposure to low levels of RF energy. However, in most cases, further experimental research has been unable to reproduce these effects. Furthermore, since much of the research is not done on whole bodies (in vivo), there has been no determination that such effects constitute a human health hazard. It is generally agreed that further research is needed to determine the generality of such effects and their possible relevance, if any, to human health. In the meantime, standards-setting organizations and government agencies continue to monitor the latest experimental findings to confirm their validity and determine whether changes in safety limits are needed to protect human health. (Back to Index)

CAN PEOPLE BE EXPOSED TO LEVELS OF RADIOFREQUENCY RADIATION THAT COULD BE HARMFUL?

Studies have shown that environmental levels of RF energy routinely encountered by the general public are typically far below levels necessary to produce significant heating and increased body temperature. However, there may be situations, particularly in workplace environments near high-powered RF sources, where the recommended limits for safe exposure of human beings to RF energy could be exceeded. In such cases, restrictive measures or mitigation actions may be necessary to ensure the safe use of RF energy. (Back to Index)

CAN RADIOFREQUENCY RADIATION CAUSE CANCER?

Some studies have also examined the possibility of a link between RF exposure and cancer. Results to date have been inconclusive. While some experimental data have suggested a possible link between exposure and tumor formation in animals exposed under certain specific conditions, the results have not been independently replicated. Many other studies have failed to find evidence for a link to cancer or any related condition. The Food and Drug Administration has further information on this topic with respect to RF exposure from mobile phones at the following Web site: FDA Radiation-Emitting Products Page . (Back to Index)

Let's look at the first paragraph. In the third and fourth sentence, they state that there have been non-thermal effects reported but then say that "in most cases they have not been reproduced." Is that true? No. The 79 reviews listed in Chapter 1 have each found repeated studies documenting one or more of the EMF effects. You can't get a review published without multiple studies. And the fact that so many of these effects have been repeatedly reviewed, over many years shows that similar patterns of evidence have been found over long periods of time. *The FCC provides not one iota of evidence on its claims, despite the fact that such a claim of inability to reproduce findings absolutely requires extensive documentation to be scientifically valid. This difference in documentation, means that any one of those 79 reviews listed in Chapter 1 is vastly more scientific in showing the falsity of the FCC statement than is the FCC statement itself, which is completely undocumented.*

Let's go on to the cancer claim at the bottom of the copied section. The FCC states that "A number of reports have appeared in the scientific literature describing the observation of a range of biological effects resulting from exposure to low levels of RF energy. However, in most cases, further experimental research has been unable to reproduce these effects. Furthermore, since much of the research is not done on whole bodies (in vivo), there has been no determination that such effects constitute a human health hazard." You will note here that there are no specifics, nor were there any specifics on the section discussed in the previous paragraph. What we have here are completely undocumented FCC claims, with no specifics whatsoever and claims that are clearly contradicted by each of the 35 reviews on cancer causation by EMF exposure. They are also clearly contradicted by the 21 reviews on cellular DNA damage following EMF exposures, something that the FCC says nothing about. It has been known for decades, that the process of carcinogenesis (cancer causation) usually starts with one or more mutations in the cellular DNA, mutations that can be caused by each of the three types of cellular DNA damage known to be caused by EMF exposure.

The sort of pattern seen here, where we have gross generalizations followed by no or completely inadequate documentation goes on with the industry propaganda [119,120] as discussed earlier, as well as in the Speit/Schwarz discussion from early in Chapter 5. What you see in each of those cases is everything falls apart when you look carefully at the facts. The situation with the FCC statements is very similar. There can be little doubt that the FCC is acting as a propaganda organization here, as strongly suggested by the George Carlo letter [125,126] and the FCC as a captured agency [127] document.

Three questions: Does the FCC know that these statements that it has made are not factual? Does it know how non-thermal EMF effects actually are produced? Does it know that its safety guidelines do not protect our health? That answer to all three of these questions is yes. How do I know? I know because I did a PowerPoint presentation to the FCC in September 2016 which presented findings in each of these important areas. My account of that presentation, written two days after it occurred, follows:

Professor Emeritus Martin L. Pall presented Powerpoint presentation on the main mechanism of action of non-thermal microwave frequency EMFs to the FCC

I met with Julius Knapp, Chief of OET, Martin Doczkat, Branch Chief, OET/Technical Analysis Branch, and Ed Mantiply Engineer OET/Associate Chief at the Federal Communications Commission on September 21, 2016 to present a Powerpoint presentation and answer questions. The presentation showed that non-thermal microwave and lower frequency EMFs act via voltage-gated calcium channel (VGCC) activation. The most important findings demonstrating this mechanism are that various effects produced by such non-thermal exposures can be blocked or greatly lowered by calcium channel blockers, drugs that are highly specific for blocking VGCCs. The reason why such low intensity non-thermal exposures activate the VGCCs is because the voltage sensor of the VGCCs is exquisitely sensitive to the electrical forces produced by these EMFs. The forces on the voltage sensor are calculated to be about 7.2 million times higher than are the forces on singly charged chemical groups in the aqueous phases of the cell. This very high level sensitivity also predicts that the safety guidelines allow us to be exposed to EMF intensities that are approximately 7.2 million times too high.

The actions produced by such VGCC activation go mainly through the excessive intracellular calcium levels produced by such activation. Excessive calcium acts via three main pathways to produce effects in the body. Therapeutic effects are produced through the nitric oxide signaling pathway whereas many pathophysiological effects are produced by the peroxynitrite/oxidative stress pathway. Excessive calcium signaling also produces pathophysiological effects. Numerous effects produced following non-thermal EMF exposures can be produced by these pathways including oxidative stress, cellular DNA damage, cancer, widespread neuropsychiatric effects, breakdown of the blood brain barrier, lowered male and female fertility and various endocrine (that is hormonal) changes.

It has long been known that pulsed EMFs are usually much more biologically active than are non-pulsed (or continuous wave) EMFs and this difference appears to be consistent with the VGCC mechanism. Because all wireless communication devices communicate via pulsations, such devices may be of special concern.

Three concerns were expressed with regard to 5G: 1. The stronger absorption of the very high frequencies involved require the setting up of vast numbers of antennae, making it essentially impossible to avoid damaging exposures. 2. The stronger absorption suggests that these EMFs may be particularly active in activating the VGCC voltage sensor. 3. The very high level and complexity of pulsations also may make for much more biological damage via VGCC activation.

There was substantial discussion of the need for biological safety testing. That discussion focused on the using cells in culture that have high densities and different types of VGCCs. Responses can be monitored by either monitoring intracellular calcium levels or by measuring nitric oxide production using a nitric oxide electrode.

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We had what would be considered in diplomatic circles a good and productive meeting, but since that time the FCC has doubled down on their positions, pushed much further on 5G, leading us to the mega-crisis situation which we are faced with now. Instead of actually testing 5G radiation biologically for safety, using the methods that were discussed in that meeting, the FCC has instead opted to put out tens of millions of 5G antennae without any biological safety testing of genuine 5G radiation. That is the insanity that we are in.

What About the FDA?

The Food and Drug Administration (FDA) was given the power to regulate devices that emit microwave frequency EMFs. This was not an unreasonable decision, given that the FDA was already regulating the safety of medical devices, where one can argue that there are similar challenges involved. The FDA was given this responsibility without any additional funding. So obviously, it was and is distinctly limited in what it can do.

What the FDA did was to issue a Letter of Intent for Proposed Collaboration in Mobile Phone Research between the Food and Drug Administration and the Cellular Telecommunications

Industry Association (CTIA), [129] Dated October 20, 1999. This would involve a Cooperative Research and Development Agreement (CRADA). Later in their Letter of Intent, it states under Initial Research Under the CRADA [129]: "The first study to be conducted would follow up on the findings of studies previously conducted by WTR but not yet published using the micronucleus assay, a test which detects structural effects on genetic material. Research data in the literature from RF exposure studies using the micronucleus assay are conflicting, and warrant follow-up study." You will see here that the FDA is accepting the industry claim that these studies are conflicting even though, having been done under different circumstances, they are not.

The basic approach of the CRADA was that the industry would fund any research to be done and decide what research should be done by whom and how and what information would be published subsequently.

You may recall that Dr. George Carlo wrote a very important letter to the heads of the telecommunications companies, described earlier. That letter was dated two weeks before the date of the letter or intent. Carlo's letter stated: "I am especially concerned about what appear to be actions by a segment of the industry to conscript the FCC, the FDA and WHO… ." Carlo who had been up to that point, an industry insider, and apparently had reason to think that the FDA had been corrupted, or what he called conscripted by parts of the telecommunications industry two weeks before the letter of intent was written. I don't think this is definitive evidence that the FDA has been corrupted, and it can even be argued that it is not evidence at all. But it does suggest, however, that we need to look further into this issue.

Let's go on to the results of this CRADA [130]. The FDA reports the following findings from the CRADA: "FDA's cooperative research and development agreement (CRADA) with the Cellular Communication & Internet Association (CTIA) has resulted in research projects focused on two topics - mechanistic studies related to genotoxicity and exposure assessment studies. All studies funded through the CRADA have been completed, and no association was found between exposure to radiofrequency (RF) radiation from cell phones and adverse health effects." I have been unable to get copies of these studies and therefore cannot comment on them.

The CRADA also lead to a National Academy of Sciences (NAS) workshop on EMFs that lead, in turn, to a 2008 NAS report. That 2008 NAS report can be accessed from [130]. It is a useful report, in my view, albeit one that leaves out much of what was already known in 2008. It does ***not*** say that there are no clear non-thermal effects and specifically calls for study of the neurological effects, suggesting that "that neural networks are a sensitive biological target." It also calls for much research on biophysical or biochemical molecular mechanism(s) that may lead to the non-thermal effects. It also calls for much more study on cancer. There has been a large amount of progress in each of these three areas since 2008, including of course the identification of VGCC activation as the most important but not necessarily the only biophysical mechanism. The problem with regard to the FDA is that as far as one can tell, the FDA has paid no attention to either the 2008 report or to the subsequent progress we have had in these several areas.

Let's shift our attention to what the FDA currently says about the impacts of these EMFs? On their web site [131], the FDA states the following:

Is there a connection between certain health problems and exposure to radiofrequency fields via cell phone use?

The results of most studies conducted to date indicate that there is not. In addition, attempts to replicate and confirm the few studies that did show a connection have failed.

According to current data, the FDA believes that the weight of scientific evidence does not show an association between exposure to radiofrequency from cell phones and adverse health outcomes. Still, there is a consensus that additional research is warranted to address gaps in knowledge, such as the effects of cell phone use over the long-term and on pediatric populations.

There was a similar statement made by the FCC, in previous section, and also similar statement was made by Samsung, one of world's largest producers of cell phones which reads a follows [132]:

Over the past 15 years, scientists have conducted hundreds of studies looking at the biological effects of radio frequency energy emitted by cell phones. While some researchers have reported biological changes associated with RF energy, these studies have failed to be replicated. The majority of studies published have failed to show an association between between exposure to radio frequency from a cell phone and health problems.

Neither the FDA statement nor the Samsung statement give us any idea what possible effects are being considered here, what literature was used for such a consideration. These statements are completely undocumented and therefore must be viewed as being unscientific. In Chapter 1, 79 reviews were given that each showed the existence of one or more effects. Eignt different of effects were each documented in from 12 to 35 reviews. Such reviews must be extensively documented or one cannot get them published. Any one of those reviews provides, therefore, a much stronger argument for presence of one or more effects than do the FDA, FCC and Samsung statements put together arguing for the opposite. One thing that is strange about the FDA statement is that they are talking specifically about cell phones even though they are tasked with regulating safety on all such microwave/radiofrequency devices. What I have done below is to put together the 16 reviews which are completely or largely focused on cell phone radiation effects so that we can see what specific effects have been found to be caused by cell phone radiation. I will summarize those effects below.

Table 5: Reviews on Cell Phone Effects and the Effects Found in Each

Review on Cell Phone Effects	Effects Found
La Vignera S, Condorelli RA, Vicari E, D'Agata R, Calogero AE. 2012 Effects of the exposure to mobile phones on male reproduction: a review of the literature. J Androl 33:350-356.	Multiple effects on male reproduction
Makker K, Varghese A, Desai NR, Mouradi R, Agarwal A. 2009 Cell phones: modern man's nemesis? Reprod Biomed Online 18:148-157.	Cellular DNA damage, neurological/neuropsychiatric effects, apoptosis
Yakymenko IL, Sidorik EP, Tsybulin AS. 1999 [Metabolic changes in cells under electromagnetic radiation of mobile communication systems]. Ukr Biokhim Zh (1999), 2011 Mar-Apr:20-28.	Apoptosis, increased oxidative stress, increased intracellular calcium
K Sri N. 2015 Mobile phone radiation: physiological & pathophysiological considerations. Indian J Physiol Pharmacol 59:125-135.	Male infertility, cellular DNA damage, lowered melatonin, increased stress protein expression
Nazıroğlu M, Yüksel M, Köse SA, Özkaya MO. 2013 Recent reports of Wi-Fi and mobile phone-induced	Oxidative stress, male and female reproductive signaling dysfunction

radiation on oxidative stress and reproductive signaling pathways in females and males. J Membr Biol 246:869-875.	
Yakymenko I, Sidorik E. 2010 Risks of carcinogenesis from electromagnetic radiation and mobile telephony devices. Exp Oncol 32:729-736.	Cancer, cellular DNA damage, apoptosis; higher cancer incidence on ipsilateral side of the head, not contralateral
Zhang J, Sumich A, Wang GY. 2017 Acute effects of radiofrequency electromagnetic field emitted by mobile phone on brain function. Bioelectromagnetics 38:329-338. doi: 10.1002/bem.22052.	Neurological dysfunction
Kundi M, Mild K, Hardell L, Mattsson M. 2004 Mobile telephones and cancer – a review of the epidemiological evidence. J Toxicol Env Health, Part B 7:351-384.	Cancer – epidemiological review
Hardell L, Carlberg M, Soderqvist F, Hansson Mild K. 2008 Meta-analysis of long-term mobile phone use and the association with brain tumors. Int J Oncol 32:1097-1103.	Cancer – meta-analysis on long-term cell phone use and brain tumors
Hardell L, Carlberg M. 2013 Using the Hill viewpoints from 1965 for evaluating strengths of evidence of the risk for brain tumors associated with use of mobile and cordless phones. Rev Environ Health 28:97-106. doi: 10.1515/reveh-2013-0006.	Mobile and cordless phone radiation caused brain cancer based on the Hill criteria for causation (most important criteria for causation in epidemiology)
Hardell L, Carlberg M, Hansson Mild K. 2013 Use of mobile phones and cordless phones is associated with increased risk for glioma and acoustic neuroma. Pathophysiology 2013;20(2):85-110.	Mobile and cordless phone exposures associated with increased risk of glioma and acoustic neuroma; higher cancer increase on ipsilateral side of the head
Davis DL, Kesari S, Soskolne CL, Miller AB, Stein Y. 2013 Swedish review strengthens grounds for concluding that radiation from cellular and cordless phones is a probable human carcinogen. Pathophysiology 20:123-129.	Cell phone and cordless phone radiation are a probable carcinogens; cancer increase on ipsilateral side of the head, not contralateral side
Morgan LL, Miller AB, Sasco A, Davis DL. 2015 Mobile phone radiation causes brain tumors and should be classified as a probable human carcinogen (2A). Int J Oncol 46(5): 1865-1871.	Mobile phone radiation causes brain tumors and should be classified as a probable human carcinogen
Bielsa-Fernández P, Rodríguez-Martín B. 2017 [Association between radiation from mobile phones and tumour risk in adults]. Gac Sanit. 2017 Apr 12. pii: S0213-9111(17)30083-3. doi: 10.1016/j.gaceta.2016.10.014.	Association between mobile phone risk and tumor risk
Prasad M, Kathuria P, Nair P, Kumar A, Prasad K. 2017 Mobile phone use and risk of brain tumours: a systematic review of association between study quality, source of funding, and research outcomes. Neurol Sci. 2017 Feb 17. doi: 10.1007/s10072-017-2850-8.	The association between mobile phone use and brain cancer is higher in independently funded studies than in industry funded studies
Miller A. 2017 References on cell phone radiation and cancer. https://ehtrust.org/references-cell-phone-radio-	This is a bibliography of studies on cell phone radiation and cancer – most

frequency-radiation-cancer/ (Accessed Sept. 9, 2017)	support the view that cell phones do cause cancer

The effects of specifically cell phone radiation that have been found in these reviews (Table 5) include: lowered male reproductive function, lowered female reproductive function, increased cellular DNA damage, neurological/neuropsychiatric effects, increased stress protein synthesis, increased intracellular calcium, apoptosis, lowered melatonin, oxidative stress, cancer (10 reviews) and specifically increased ipsilateral cancer (3 reviews). So there are 11 different cell phone effects where there is substantial enough evidence to warrant publication in one or more review articles. Each of these effects has been shown to occur in response to other microwave frequency EMFs and therefore should be considered to be caused by EMFs more broadly.

The summary of Table 4, Chapter 5, the genuine cell phone primary literature studies that fell into the 2009-2013 time frame, started as follows: "If you look through the studies described in Table 4, you will see multiple studies in oxidative stress/free radical damage, on changes in tissue structure (sometimes called remodeling), on cellular DNA damage, on male fertility (and also one on female fertility), on behavioral changes and on neurological changes. There is also one study on insulin/type 2 diabetes (hormonal effect). It follows from this that five of the effects that were extensively documented in large numbers of reviews (Chapter 1) are further demonstrated to be produced by cell phone radiation in these studies. In addition the tissue remodeling and proteomic changes discussed in Chapter 3 are also further demonstrated here."

It can be seen from Tables 4 & 5 and the preceding two paragraphs, that there is a vast amount of literature on repeatedly found effects of cell phone radiation, effects which make a mockery of the *completely undocumented and non-specific* FDA claims to the contrary.

Let's look at another part of the FDA statement which also shows similarities to statements made elsewhere [131]:

The biological effects of radiofrequency energy should not be confused with the effects from other types of electromagnetic energy.

Very high levels of electromagnetic energy, such as is found in X-rays and gamma rays can ionize biological tissues. Ionization is a process where electrons are stripped away from their normal locations in atoms and molecules. It can permanently damage biological tissues including DNA, the genetic material.

The energy levels associated with radiofrequency energy, including both radio waves and microwaves, are not great enough to cause the ionization of atoms and molecules. Therefore, RF energy is a type of non-ionizing radiation. Other types of non-ionizing radiation include visible light, infrared radiation (heat) and other forms of electromagnetic radiation with relatively low frequencies.

This is almost identical to another Samsung statement and also to an FCC statement that I have not copied. Here is the Samsung statement [133]:

The biological effects of RF energy should not be confused with the effects from other types of electromagnetic energy.

Very high levels of electromagnetic energy, such as is found in X-rays and gamma rays, can ionize biological tissues. Ionization is a process where electrons are stripped away from their normal locations in atoms and molecules. It can permanently damage biological tissues including DNA, the genetic material.

The energy levels associated with radio frequency energy, including both radio waves and microwaves, are not great enough to cause ionization of atoms and molecules. Therefore, RF energy is a type of non-ionizing radiation. Other types of non-ionizing radiation include visible light, infrared radiation (heat), and other forms of electromagnetic radiation with relatively low frequencies.

While RF energy does not ionize particles, large amounts can increase body temperatures and cause tissue damage. Two areas of the body, the eyes and the testes, are particularly vulnerable to RF heating because there is relatively little blood flow in them to carry away excess heat.

The three paragraphs from the FDA statement are word for word identical to the first three paragraphs of the Samsung statement. The last paragraph in the Samsung statement was deleted from the FDA statement. It is clear from this that either the FDA statement is derived from the earlier industry statement rather than the other way around or both are derived from a previous statement similar to the Samsung statement.

These types of statements have given rise to shorter statements that are all something like the following:

Non-ionizing radiation consists of photons that do not have enough energy to break chemical bonds including the chemical bonds of DNA.

All of these statements are technically correct. They are also highly misleading. They are often falsely interpreted as meaning that there cannot be any effects of non-ionizing, non-thermal EMF exposures ***including indirect effects***. There are many possible indirect effects that may occur, given the complexity of biology. But our situation goes way beyond that, because we know that most of the effects are produced via VGCC activation which produces, as downstream effects, the free radical breakdown products of peroxynitrite (Fig. 1, Chapter 2). Those free radical breakdown products attack DNA, proteins and other biological constituents in ways that are very similar to the ways in which ionizing radiation attack these same molecules. Ionizing radiation was shown by Arthur Compton, who won the Nobel prize in physics in 1927, for showing that ionizing radiation produces large numbers of free radicals through what has become known as Compton scattering, with those free radicals being responsible for most of the biological effects of ionizing radiation. So the often repeated industry claim that ionizing radiation is dangerous but non-ionizing radiation is not, <u>is wrong</u> – both of them produce similar effects mediated through free radical generation. However the dangers of non-ionizing radiation may eclipse the dangers of ionizing radiation under some conditions because of something that is discussed early in Chapter 5, at the end of the Speit/Schwarz discussion. There are three processes which occur in the sequence by which EMF activation leads to peroxynitrite breakdown product radicals, each of which have high levels of amplification (each discussed on p. 29 in Chapter 5). Thus potentially and I believe actually microwave frequency EMFs can produce under suitable conditions, much more efficient free radical production than occurs from a similar energy level of ionizing radiation.

The FDA may have had a long history of playing fast and loose with the truth. For example, Microwave News article published in 2003, provides this account of what occurred at the FDA in 1993 [134]:

1993 FDA Memo Data "Strongly Suggest" Microwaves Can Promote Cancer.

In the spring of 1993 at the height of the public concern over cell phone brain tumor risks, the Food and Drug Adminstration (FDA) biologists concluded [134] that the available data "strongly suggest" that microwaves can "accelerate the development of cancer." This assessment is from an internal agency memo recently obtained by Microwave News under the Freedom of Information Act.

"Of approximately eight chronic animal experiments known to us, five resulted in increased numbers of malignancies, accelerated progression of tumors, or both" wrote Drs. Mays Swicord and Larry Cress of FDA's Center for Devices and Radiological Health (CDRH) in Rockville, MD. They also pointed to other evidence from laboratory (in vitro) studies which supported cancer risk.

Yet in its public statements at that time, the agency played down these findings [134]. For instance in a Talk Paper issued in early February, the FDA stated that there was "limited evidence that suggests that lower levels (of microwaves) might cause adverse effects."

"A few studies suggest that (microwave) levels (from cellular phones) can accelerate the development of cancer in laboratory animals," the FDA added [134], "but there is much uncertainty among scientists about whether these results apply to the use of cellular phones."

I have three comments. Firstly, if you look at the 35 citations in the list on cancer causation in Chapter 1, you will see that there are 8 citations (#s 2-7 & 15 & 19) which provide similar evidence of stimulation of tumor promotion, four of which (#s 3-6) were published around 1993, the time of the FDA memo and public statement described above. Therefore, there was a substantial literature including peer-reviewed primary literature and review articles which produced similar conclusions to those of the FDA internal memo. The importance of the memo is that the FDA knew about these findings and opted to cover them up.

Secondly if you compare the rhetoric in the 1993 memo with the first quote from the current FDA web site quoted in this section, you will see some striking similarities. They both first refer to "a few studies" which are not identified, followed by raising uncertainties and then finally raising doubt as to whether these findings apply to cell phone radiation. The pattern of the FDA rhetoric has not changed much in 25 years.

If one includes the middle statement also quoted from the FDA web site, we have three FDA statements each of which downplays any biological effects and each of which are strongly rebutted by extensive peer-reviewed independent scientific literature. I'm not sure we can say the FDA has been corrupted by the industry, but what we can say is that it has been functioning as if it has been corrupted for 25 years.

In mid-2009 Margaret A. Hamburg, the new commissioner of the FDA, and Joshua M. Sharfstein, her principal deputy commissioner, published a commentary article in the New England Journal of Medicine [135] which included the following:

"One of the greatest challenges facing any public health agency is that of risk communication. … The FDA's job is to minimize risks through education, regulation, and enforcement. To be credible in all these tasks, the agency must communicate frequently and clearly about risks and benefits—and about what organizations and individuals can do to minimize risk. When, like the FDA, Americans must make choices about medication, devices, foods, or nutrition in the absence of perfect information, the FDA cannot delay in providing reasonable guidance —guidance that informs rather than causes unnecessary anxiety. For these communications to have credibility, the public must trust the agency to base its decisions on science."

These were and are laudable goals. As far as I can tell, with regard to EMF effects, the FDA has failed to base either its communications or its decisions on science.

Summary of Chapter 6

In the areas discussed in Chapter 6 what used to be the primacy of U.S. science has completely disintegrated. It has disintegrated because of the cessation of U.S. government funding for either experimental studies or epidemiological studies. It has disintegrated due to attacks on U.S. and International scientists, attacks that started in the U.S. with the attacks on Dr. Henry Lai. It has disintegrated because of aggressive industry propaganda, propaganda that has no connection with the real science. It has disintegrated because of the outright corruption of the committee to set standards for radio-frequency exposures and the FCC and the possible and *de facto* corruption of the FDA. The telecommunications industry has been aware of much of the problems with their approach since the 1999 letter to them from George Carlo. The FCC has been aware of much more of the science since my presentation to them in September 2016. The FDA has been aware of contrary findings since 1993. Each of them has, if anything, doubled down on their fictions since those respective times.

Many of these things are going on internationally; however the U.S. has often been leading the world in these processes. All of the actions we have seen to corrupt the science and public understanding of the science have the effect of making it vastly more difficult for individuals impacted by the EMFs to protect themselves from further harm. We have many effects that are cumulative and become irreversible as they become more severe, effects that impact at a minimum, tens of millions of Americans and hundreds of millions of people elsewhere in the world. *Industrial and regulatory organizations make it difficult or impossible for people to have scientifically valid information also make it difficult or impossible for people to protect themselves from the accumulation of these effects, leading to severe irreversible effects. Each of the organizations involved, both U.S. and international that collaborate in this process, have important responsibility for the consequences.* I think damage goes way beyond tens and hundreds of millions of people, because I think we are looking at cumulative severe impact on our brain function, on our reproductive function and on our DNA, and that these, in turn will lead to the crash of every single technologically advanced country on earth, barring a major change in course. That will happen fairly quickly, in my opinion, even without 5G but 5G will greatly speed up the process and perhaps even add new egregious effects

Chapter 7: The Great Risks of 5G: What We Know and What We Don't Know

We have already discussed two issues that are essential to understanding 5G. One is that pulsed EMFs are, in most cases, much more biologically active than are non-pulsed (often called

continuous wave) EMFs. A second is that the EMFs act by putting forces on the voltage sensor of the VGCCs, opening these calcium channels and allowing excessive calcium ions to flow into the cell. The voltage sensor is extraordinarily sensitive to those electrical forces, such that the safety guidelines are allowing us to be exposed to EMFs that are something like 7.2 million times too high.

The reason that the industry has decided to go to the extremely high frequencies of 5G is that with such extremely high frequencies, it is possible to carry much more information via much more pulsation than it is possible to carry with lower frequencies even in the microwave range. We can be assured, therefore, that 5G will involve vastly more pulsation than do EMFs that we are currently exposed to. It follows from that, that any biological safety test of 5G must use the very rapid pulsations including whatever very short term spikes may be present, that are to be present in genuine 5G. There is an additional process that is planned to be used in 5G: phased arrays (https://en.wikipedia.org/wiki/Phased_array). Here multiple antenna elements act together to produce highly pulsed fields which are designed for 5G, to produce increased penetration. 5G will entail particularly powerful pulsations to be used, which may, therefore, be particularly hazardous.

The only data we have, to my knowledge, on millimeter wave frequencies of 5G used *non-pulsed EMFs in the millimeter frequency range of 5G, not genuine 5G*. Such millimeter waves have been shown to produce a number of downstream effects of VGCC activation. One millimeter wave study showed that it activated both the VGCCs and also the voltage-gated potassium channels, suggesting that it worked via the voltage sensor, as do other EMFs [136]. Any such data tells us almost nothing about how biologically active genuine very highly pulsed 5G will be. I take it that from their statements, that both Mr. Ryan and Dr. Vinciūnas are ready to put out 10s of millions of 5G antennae to afflict every single person in the EU with 5G radiation without even a single biological test of safety of genuine 5G. In the U.S., the FCC has taken a much worse position. The FCC is not only willing to allow such completely untested exposures but has also been has been aggressively pushing to promote installation of 5G antennae, such that antennae are already being installed in parts of the U.S. In a world where shocking behavior has become less and less shocking, I consider EU and U.S. views and actions to be shocking. The U.S. situation is mass insanity. I would have hoped that the Europeans, who think of themselves as being much more thoughtful than Americans, would have been genuinely more thoughtful.

Why does 5G need such high numbers of antennae? It is because the 5G radiation is much more absorbed as it enters various materials. The approach is to use many more antennae with one found every few houses, such that 5G can sufficiently penetrate local walls. Such absorption usually involves the interaction with electrically charged groups, such that such high absorption is likely to involve placing forces on electrically charged groups. Because such forces are the way in which EMFs activate the VGCCs, it seems highly likely, therefore, that 5G radiation will be particularly active in VGCC activation.

In summary, then, 5G is predicted to be particularly dangerous for each of four different reasons: 1. The extraordinarily high numbers of antennae that are planned. 2. The very high energy outputs which will be used to ensure penetration. 3. The extraordinarily high pulsation levels. 4. The apparent high level interactions of the 5G frequency on charged groups presumably including the voltage sensor charged groups.

Now what the telecommunications industry argues is that 5G radiation will be mostly absorbed in the outer 1 or 2 mm of the body, such that they claim that we don't have to worry about the effects. There is some truth to that, but there are also some caveats that make any conclusions

made from that, much more suspect. In any case, these surface effects of 5G will have especially strong impact on organisms with much higher surface to volume ratios. Consequently, I predict that many organisms will be much more impacted than we will. This includes insects and other arthropods, birds and small mammals and amphibia. It includes plants including even large trees, because trees have leaves and reproductive organs that are highly exposed. I predict there will be major ecological disasters as a consequence of 5G. This will include vast conflagrations because EMF exposures make plants much more flammable.

But let's get back to humans. The industry has also made claims that more conventional microwave frequency EMFs are limited in effect to the outer 1 cm of the body. We know that is not true, however because of the effects deep in the human brain, on the heart and on hormone systems. Perhaps the most important two studies demonstrating effects deep within the body are the studies of Professor Hässig and his colleagues in Switzerland on cataract formation in newborn calves [137,138]. These two studies clearly show that when pregnant cows are grazing near mobile phone base stations (also called cell phone towers), the calves are born with very greatly increased incidences of cataracts. It follows from these findings that even though the developing fetuses are very deep in the body of the mother and should be highly protected from the EMF exposures, they are not so protected. And because the EMF safety guidelines in Switzerland are 100 times more stringent than are the safety guidelines in most of the rest of Europe, in the U.S., Canada and most of the rest of the world, the more general safety guidelines allow greatly excessive exposures and penetration of effects. The claims of industry that microwave frequency EMFs only act in the outer centimeter of the body are clearly false.

How then can both conventional microwave frequency EMFs and 5G radiation act deeply within the body? You may correctly observe that the electrical effects of the EMFs activate the voltage sensor and that the direct electrical forces are rapidly attenuated in the body. So how can we get deep effects? I think the answer is that the magnetic parts of the EMFs have been known for decades to penetrate much more deeply than do the electrical parts. The magnetic fields put forces on mobile electrically charged groups dissolved in the aqueous phases of the body and small individual movements of the charged groups can regenerate electric fields that are essentially identical to the electric fields of the original EMFs, carrying the same frequency and same pulsation pattern, although with lower intensity. An example of this is given in the Lu and Ueno [139] study. Because the voltage sensor is so stunningly sensitive to electrical forces and part of the reason for that is the very high level of amplification of the electrical field across the plasma membrane, we have an almost perfect way in which to produce EMF effects deeply within our bodies.

I am very concerned that 5G may produce effects like those we already see produced from lower frequency EMFs but are much more severe. I am also concerned that we will also see responses that are qualitatively different. Let me give you three possible examples of the latter type and one quantitative example. Each of the four types of blindness, have downstream effects of VGCC activation as causal factors: cataracts, detached retinas, glaucoma and macular degeneration. The aqueous and vitreous humors in the eye may be an ideal environment for the regeneration of the electrical fields within the eye. We may, therefore have a gigantic epidemic of each of the four types of blindness. Another concern focuses on kidney dysfunction, which was shown in Chapter 5 to be impacted by EMFs. The kidneys have much fluid, both blood and also what will become urine, which may allow efficient the regeneration of electrical fields. Such regeneration may be expected to impact both the glomerular filtration and also the reabsorption, both essential to kidney function. Does this mean that 5G will produce very large increases in kidney failure? The only way to find out is to do biological safety testing of genuine 5G radiation. Let me give you a third example. Fetuses and very young babies have much more water in their bodies than do

adults. Therefore, they may be a special risk for impacts of 5G, because of great increases in the regeneration of the electrical fields. Here one can think of all kinds of possibilities. Let me suggest two. We may have a gigantic (sorry about using that word again) epidemic of spontaneous abortion due the teratogenic effects. Another possibility is that instead of autism being one birth in 38, however horrendous that is, it could be one out of two, or even a majority of births. I don't know that these will happen, but these are the kinds of risks we are taking and there are many others one can think of. Putting in tens of millions of 5G antennae without a single biological test of safety has got to be about the stupidest idea anyone has had in the history of the world.

This brings us back to the earlier point. The only way to do 5G safety testing is to do genuine 5G biological safety testing. I have published on how this can be done relatively easily at relatively low cost and have, as you saw in the Chapter 6, told the FCC how this can be done. Those tests must be done by organizations completely independent of industry and that leaves out both ICNIRP and SCENIHR and a lot of other organizations.

Now we will get into the precautionary principle which is specially relevant to the EU but may have lessons for all of us.

Dr. Vinciūnas' last full paragraph reads as follows: "The recourse to the EU's precautionary principle to stop distribution of 5G products appears too drastic a measure. We need first to see how this technology will be applied and how the scientific evidence will evolve. Please be assured that the Commission will keep abreast of the scientific evidence in view of safeguarding the health of European citizens at the highest level possible and in line with its mandate."

Article 191 defines the **Precautionary Principle** as follows:

"According to the European Commission the precautionary principle may be invoked when **a phenomenon, product or process may have a dangerous effect**, identified by a **scientific and objective evaluation**, **if this evaluation does not allow the risk to be determined with sufficient certainty**.

Recourse to the principle belongs in the general framework of **risk analysis** (which, besides risk evaluation, includes risk management and risk communication), and more particularly in the context of **risk management** which corresponds to the decision-making phase.

The Commission stresses that the precautionary principle may only be invoked in the event of a potential risk and that it can never justify arbitrary decisions.
The precautionary principle may only be invoked when the **three preliminary conditions** are met:

identification of potentially adverse effects;
evaluation of the scientific data available;
the extent of scientific uncertainty."

The question now is what about 5G? We have with 5G strong suspicions of similar or much more severe risk of effects documented elsewhere in this document. We have no biological safety testing of genuine 5G radiation. Therefore, we have no risk analysis or risk management because we have no risk assessment whatsoever on 5G. So here we have Dr. Vinciūnas arguing that the request for precautionary principle application is premature. But it is not the request for

the use of the precautionary principle that is premature, it is the Commission's claim that it has done the required risk analysis and risk assessment. This is the bizarre world that we live in.

The European Commission has done nothing to protect European citizens from the very serious health hazards and the U.S. FDA, EPA and National Cancer Institute have done nothing to protect U.S. citizens. The U.S. FCC has been worse than that, acting in wanton disregard for our health.

Let me close, as follows. There have been certain points in our history where people have stood up to strong destructive forces against what often appeared to be insurmountable odds. Those people are THE most honored people in our history. The people who failed to do so are among the most despised people in our history. I am not at all sure we will have historians to record us 100 years from now or even 30 years from now, given the direction in which we are heading. But if we do, rest assured that these are the standards by which we will all be judged.

Citations used in the text:

[1] Levine H, Jorgensen N, Martino-Andrade A, Mendiola J, Weksler-Derri D, Mindlis I, Pinotti R, Swan SH. 2017 Temporal trends in sperm count: a systematic review and meta-analysis. Human Reproduction Update, https://doi.org/10.1093/humupd/dmx022
[2] Magras IN, Xenos TD. 1997 RF radiation-induced changes in the prenatal development of mice. Bioelectromagnetics 18:455-461.
[3] Pall ML. 2016 Microwave frequency electromagnetic fields (EMFs) produce widespread neuropsychiatric effects including depression. J Chem Neuroanat 75(Pt B):43-51. doi: 10.1016/j.jchemneu.2015.08.001.
[4] Pall, ML. 2013. Electromagnetic fields act via activation of voltage-gated calcium channels to produce beneficial or adverse effects. J Cell Mol Med 17:958-965. doi: 10.1111/jcmm.12088.
[5] Pall, M. L. 2015 Scientific evidence contradicts findings and assumptions of Canadian Safety Panel 6: microwaves act through voltage-gated calcium channel activation to induce biological impacts at non-thermal levels, supporting a paradigm shift for microwave/lower frequency electromagnetic field action. Rev. Environ. Health 3, 99-116. doi: 10.1515/reveh-2015-0001.
[6] Pall ML. 2016 Electromagnetic fields act similarly in plants as in animals: Probable activation of calcium channels via their voltage sensor. Curr Chem Biol 10: 74-82.
[7] Pall, M. L., 2018. How cancer can be caused by microwave frequency electromagnetic field (EMF) exposures: EMF activation of voltage-gated calcium channels (VGCCs) can cause cancer including tumor promotion, tissue invasion and metastasis via 15 mechanisms. Chapter 7 in Markov, M. S., (Ed.), Mobile Communications and Public Health, CRC Press, Boca Raton, FL, in press.
[8] Belyaev, I., 2005. Non-thermal biological effects of microwaves. Microwave Rev. 11, 13-29.
[9] Belyaev, I., 2015. Biophysical mechanisms for nonthermal microwave effects. In: Markov M.S. (Ed), Electromagnetic Fields in Biology and Medicine, CRC Press, New York, pp 49-67.
[10] Panagopoulos, D. J., Johansson, O., Carlo, G. L., 2015. Polarization: a key difference between man-made and natural electromagnetic fields, in regard to biological activity. Sci. Rep. 2015 Oct 12;5:14914. doi: 10.1038/srep14914.
[11] Pall ML. 2018 Wi-Fi is an important threat to human health. Environ Res 164:405-416. doi: 10.1016/j.envres.2018.01.035.
[12] Pilla, A. A., 2012. Electromagnetic fields instantaneously modulate nitric oxide signaling in challenged biological systems. Biochem. Biophys. Res. Commun. 28, 426:330-333. doi: 10.1016/j.bbrc.2012.08.078.
[13] Lu, X. W., Du, L., Kou, L., Song, N., Zhang, Y. J., Wu, M. K., Shen, J. F., 2015. Effects of

moderate static magnetic fields on the voltage-gated sodium and calcium channels currents in trigeminal ganglion neurons. Electromagn. Biol. Med. 34, 285-292. doi: 10.3109/15368378.2014.906448.
[14] Tabor, K. M., Bergeron, S. A., Horstick, E. J., Jordan, D. C., Aho, V., Porkka-Heiskanen, T., Haspel, G, Burgess, H. A., 2014. Direct activation of the Mauthner cell by electric field pulses drives ultrarapid escape responses. J Neurophysiol 112:834-844. doi: 10.1152/jn.00228.2014.
[15] Zhang, J., Li, M., Kang, E. T., Neoh, K. G., 2016. Electrical stimulation of adipose-derived mesenchymal stem cells in conductive scaffolds and the roles of voltage-gated ion channels. Acta Biomater. 32, 46-56. doi: 10.1016/j.actbio.2015.12.024.
[16] Tekieh T, Sasanpour P, Rafii-Tabar H. 2016 Effects of electromagnetic field exposure on conduction and concentration of voltage gated calcium channels: A Brownian dynamics study. Brain Res 1646:560-569.
[17] ICNIRP 2009 International Commission on Non-ionizing Radiation Protection. ICNIRP statement on the "Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (up to 300 GHz). Health Phys 97:257-258.
[18] Bioinitiative Working Group. 2007 BioInitiative Report: A rationale for biologically-based public exposure standard for electromagnetic fields (ELF and RF). Sage C and Carpenter DO (Eds.), Available online: http://www.bioinitiative.org/table-of-contents/ (accessed March 19, 2018)
[19] Sypniewska, R. K., Millenbaugh, N. J., Kiel, J. L., Blystone, R. V., Ringham, H. N., Mason, P. A., Witzmann, F. A., 2010. Protein changes in macrophages induced by plasma from rats exposed to 35 GHz millimeter waves. Bioelectromagnetics 3, 656-663. doi: 0.1002/bem.20598.
[20] Kalns, J., Ryan, K. L., Mason, P. A., Bruno, J. G., Gooden, R., Kiel, J. L., 2000. Oxidative stress precedes circulatory failure induced by 35-GHz microwave heating. Shock 13, 52-59.
[21] Garbuz, D. G., 2017. Regulation of heat shock gene expression in response to stress. Mol. Biol. 51, 352-367. doi: 10.1134/S0026893317020108.
[22] Park, H. K., Lee, J. E., Lim, J. F., Kang, B. H., 2014. Mitochondrial Hsp90s suppress calcium-mediated stress signals propagating from the mitochondria to the ER in cancer cells. Mol. Cancer 13 Article Number: 148 doi: 10.1186/1476-4598-13-148.
[23] Krebs, J., Groenendyk, J., Michalek, M., 2011. Ca2+-signaling, alternative splicing and endoplasmic reticulum stress responses. Neurochem. Res. 36, 1198-1211. doi: 10.1007/s11064-011-0431-4.
[24] Pilla, A. A., 2013. Nonthermal electromagnetic fields: from first messenger to therapeutic applications. Electromagn Biol Med 32, 123-136. doi: 10.3109/15368378.2013.776335.
[25] Pall, M. L., 2014. Electromagnetic field activation of voltage-gated calcium channels: role in therapeutic effects. Electromagn. Biol. Med. 2014 Apr 8 doi: 10.3109/15368378.2014.906447.
[26] Raines JK. 1981. Electromagnetic Field Interactions with the Human Body: Observed Effects and Theories. Greenbelt, Maryland: National Aeronautics and Space Administration 1981; 116 p.
[27] Goldsmith JR. 1997 Epidemiologic evidence relevant to radar (microwave) effects. Env Health Perspect 105(Suppl 6):1579-1587.
[28] Hecht Karl. 2016 Health Implications of Long-Term Exposures to Electrosmog. Brochure 6 of A Brochure Series of the Competence Initiative for the Protection of Humanity, the Environment and Democracy. http://kompetenzinitiative.net/KIT/wp-content/uploads/2016/07/KI_Brochure-6_K_Hecht_web.pdf (accessed Feb. 11, 2018)
[29] Marha K. 1966 Biological Effects of High-Frequency Electromagnetic Fields (Translation). ATD Report 66-92. July 13, 1966 (ATD Work Assignment No. 78, Task 11).
[30] Glaser ZR, PhD. 1971 Naval Medical Research Institute Research Report, June 1971. Bibliography of Reported Biological Phenomena ("Effects") and Clinical Manifestations Attributed to Microwave and Radio-Frequency Radiation. Report No. 2 Revised.

https://scholar.google.com/scholar?q=Glaser+naval+medical+microwave+radio-frequency+1972&btnG=&hl=en&as_sdt=0%2C38 (Accessed Sept. 9, 2017)
[31] Bise W. 1978 Low power radio-frequency and microwave effects on human electroencephalogram and behavior. Physiol Chem Phys 10:387-398.
[32] Belyaev I, Dean A, Eger H, Hubmann G, Jandrisovits R, Kern M, Kundi M, Moshammer H, Lercher P, Müller K, Oberfeld G, Ohnsorge P, Pelzmann P, Scheingraber C, Thill R. 2016 EUROPAEM EMF Guideline 2016 for the prevention, diagnosis and treatment of EMF-related health problems and illnesses. Rev Environ Health DOI 10.1515/reveh-2016-0011.j
[33] Hedendahl L, Carlberg M, Hardell L. 2015 Electromagnetic hypersensitivity--an increasing challenge to the medical profession. Rev Environ Health 30:209-215. doi: 10.1515/reveh-2015-0012.
[34] Carpenter DO. 2015 The microwave syndrome or electro-hypersensitivity: historical background. Rev Environ Health 30:217-222. doi: 10.1515/reveh-2015-0016
[34] Havas M. 2013 Radiation from wireless technology affects the blood, the heart and the autonomic nervous system. Rev Environ Health 82:75-84.https://doi.org/10.1515/reveh-2013-0004
[35] Havas M, Marrongelle J, Pollmer, Kelley E, Rees C, Tully S. 2010 Provocation study using heart rate variability shows microwave radiation from 2.4 GHz cordless phone affects autonomic nervous system. Eur J Oncol 5:273-300.
[36] Gordon, ZV. 1966 [Problems of industrial hygiene and biological effects of super high frequency electromagne c fields.] Medizina, Moscow (in Russian)
[37] Presman, AS. Electromagnetic fields and life. New York: Plenum Press, 1970.
[38] Tolgskaya MS, Gordon ZV. 1973. Pathological Effects of Radio Waves, Translated from Russian by B Haigh. Consultants Bureau, New York/London, 146 pages.
[39] Siebert DM, Drezner JA. 2018 Sudden cardiac arrest on the field of play: turning tragedy into a survivable event. Neth Heart J 26:115-119. doi: 10.1007/s12471-018-1084-6.
[40] Pall ML. 2013 The NO/ONOO- cycle as the central cause of heart failure. Int J Mol Sci 14:22274-22330. doi: 10.3390/ijms141122274.
[41] Liu YQ, Gao YB, Dong J, Yao BW, Zhao L, Peng RY. 2015 Pathological changes in the sinoatrial node tissues of rats caused by pulsed microwave exposure. Biomed Environ Sci 28:72-75. doi: 10.3967/bes2015.007.
[42] Pritchard C, Mayers A, Baldwin D. 2013 Changing patterns of neurological mortality in the 10 major developed countries--1979-2010. Public Health 127:357-368. doi: 10.1016/j.puhe.2012.12.018.
[43] Pritchard C, Rosenorn-Lanng E. 2015 Neurological deaths of American adults (55-74) and the over 75's by sex compared with 20 Western countries 1989-2010: Cause for concern. Surg Neurol Int 2015 Jul 23;6:123. doi: 10.4103/2152-7806.161420.
[44] Vieira RT, Caixeta L, Machado S, Silva AC, Nardi AE, Arias-Carrión O, Carta MG. 2013 Epidemiology of early-onset dementia: a review of the literature. Clin Pract Epidemiol Ment Health 9:88-95. doi: 10.2174/1745017901309010088.
[45] Hallberg O, Johansson O. 2005 Alzheimer mortality—why does it increase so rapidly in sparsely populated areas? Eur Biol Bioelectromag 1;1-8
[46] [Dossey L. 2014 FOMO, digital dementia, and our dangerous experiment. Explore (NY) 2014 Mar-Apr;10(:69-73. doi: 10.1016/j.explore.2013.12.008.
[47] Moledina S, Khoja A. 2018 Letter to the Editor: Digital Dementia-Is Smart Technology Making Us Dumb? Ochsner J. 2018 Spring;18(1):12.
[48] Spitzer, Manfred. Digitale Demenz. Wie wir uns und unsere Kinder um den Verstand bringen. Droemer Verlag, Munich 2012.
[49] Mattson MP. 2007 Calcium and neurodegeneration. Aging Cell 6:337-350. doi: 10.1111/j.1474-9726.2007.00275.x

[50] Celsi F, Pizzo P, Brini M, Leo S, Fotino C, Pinton P, Rizzuto R. 2009 Mitochondria, calcium and cell death: a deadly triad in neurodegeneration. Biochim Biophys Acta 1787:335-344. doi: 10.1016/j.bbabio.2009.02.021.
[51] Carreiras MC, Mendes E, Perry MJ, Francisco AP, Marco-Contelles J. 2013 The multifactorial nature of Alzheimer's disease for developing potential therapeutics. Curr Top Med Chem 13:1745-1770.
[52] Jiang DP, Li J, Zhang J, Xu SL, Kuang F, Lang HY, Wang YF, An GZ, Li JH, Guo GZ. 2013 Electromagnetic pulse exposure induces overexpression of beta amyloid protein in rats. Arch Med Res 44:178-184. doi: 10.1016/j.arcmed.2013.03.005.
[53] Jiang DP, Li JH, Zhang J, Xu SL, Kuang F, Lang HY, Wang YF, An GZ, Li J, Guo GZ. 2016 Long-term electromagnetic pulse exposure induces Abeta deposition and cognitive dysfunction through oxidative stress and overexpression of APP and BACE1. Brain Res. 2016 Jul 1;1642:10-19. doi: 10.1016/j.brainres.2016.02.053.
[54] Dasdag S, Akdag MZ, Kizil G, Kizil M, Cakir DU, Yokus B. 2012 Effect of 900 MHz radio frequency radiation on beta amyloid protein, protein carbonyl, and malondialdehyde in the brain. Electromagn Biol Med. 2012 Mar;31(1):67-74. doi: 10.3109/15368378.2011.624654.
[55] Dasdag S, Akdag MZ, Erdal ME, Erdal N, Ay OI, Ay ME, Yilmaz SG, Tasdelen B, Yegin K. 2015 Long term and excessive use of 900 MHz radiofrequency radiation alter microRNA expression in brain. Int J Radiat Biol 91:306-311. doi: 10.3109/09553002.2015.997896.
[56] Arendash GW, Mori T, Dorsey M, Gonzalez R, Tajiri N, Borlongan C. 2012 Electromagnetic treatment to old Alzheimer's mice reverses β-amyloid deposition, modifies cerebral blood flow, and provides selected cognitive benefit. PLoS One. 2012;7(4):e35751. doi: 10.1371/journal.pone.0035751.
[57] Arendash GW. 2016 Review of the Evidence that Transcranial Electromagnetic Treatment will be a Safe and Effective Therapeutic Against Alzheimer's Disease. J Alzheimers Dis 53:753-771.
[58] García AM, Sisternas A, Hoyos SP. 2008 Occupational exposure to extremely low frequency electric and magnetic fields and Alzheimer disease: a meta-analysis. Int J Epidemiol 37:329-340. doi: 10.1093/ije/dym295.
[59] Hug K1, Röösli M, Rapp R. 2006 Magnetic field exposure and neurodegenerative diseases--recent epidemiological studies. Soz Praventivmed 51:210-220.
[59A] No author listed. 1997 Stronger evidence for an Alzheimer’s EMF connection. Microwave News XVII, Jan/Feb 1997, 1,6,7.
[60] Gandhi OP, Kang G. 2001 Calculation of induced current densities for humans by magnetic fields from electronic article surveillance devices. Phys Med Biol 46:2759-2771.
[61] Gandhi OP, Morgan LL, de Salles AA, Han YY, Herberman RB, Davis DL. 2012 Exposure Limits: The underestimation of absorbed cell phone radiation, especially in children. Electromagn Biol Med 31:34-51. doi: 10.3109/15368378.2011.622827.
[62] Belyaev IY, Markovà E, Hillert L, Malmgren LO, Persson BR. 2009 Microwaves from UMTS/GSM mobile phones induce long-lasting inhibition of 53BP1/gamma-H2AX DNA repair foci in human lymphocytes. Bioelectromagnetics 30:129-141. doi: 10.1002/bem.20445.
[63] Markovà E, Malmgren LO, Belyaev IY. 2010 Microwaves from Mobile Phones Inhibit 53BP1 Focus Formation in Human Stem Cells More Strongly Than in Differentiated Cells: Possible Mechanistic Link to Cancer Risk. Environ Health Perspect 118:394-399. doi: 10.1289/ehp.0900781
[64] Lee SS, Kim HR, Kim MS, Park SH, Kim DW. 2014 Influence of smart phone Wi-Fi signals on adipose-derived stem cells. Ja J Cranofac Surg 25:1902-1907. doi: 10.1097/SCS.0000000000000939.
[65] Czyz J, Guan K, Zeng Q, Nikolova T, Meister A, Schönborn F, Schuderer J, Kuster N, Wobus AM. 2004 High frequency electromagnetic fields (GSM signals) affect gene expression

levels in tumor suppressor p53-deficient embryonic stem cells. Bioelectromagnetic 25:296-307. doi:10.1002/bem.10199
[66] Xu F, Bai Q, Zhou K, Ma L, Duan J, Zhuang F, Xie C, Li W, Zou P, Zhu C. 2016 Age-dependent acute interference with stem and progenitor cell proliferation in the hippocampus after exposure to 1800 MHz electromagnetic radiation. Electromagn Biol Med 3:1-9. doi: 10.1080/15368378.2016.
[67] Odaci E, Bas O, Kaplan S. 2008 Effects of prenatal exposure to a 900 MHz electromagnetic field on the dentate gyrus of rats: a stereological and histopathological study. Brain Res 1238:224-229. doi: 10.1016/j.brainres.2008.08.013.
[68] Uchugonova A, Isemann A, Gorjup E, Tempea G, Bückle R, Watanabe W, König K. 2008 Optical knock out of stem cells with extremely ultrashort femtosecond laser pulses. J Biophotonics 1(6):463-469. doi: 10.1002/jbio.200810047.
[69] Wang C, Wang X, Zhou H, Dong G, Guan X, Wang L, Xu X, Wang S, Chen P, Peng R, Hu X. 2015 Effects of pulsed 2.856 GHz microwave exposure on BM-MSCs isolated from C57BL/6 mice. PLoS One. 2015 Feb 6;10(2):e0117550. doi: 10.1371/journal.pone.0117550.
[70] Teven CM, Greives M, Natale RB, Su Y, Luo Q, He BC, Shenaq D, He TC, Reid RR. 2012 Differentiation of osteoprogenitor cells is induced by high-frequency pulsed electromagnetic fields. J Craniofac Surg 23:586-593. doi: 10.1097/SCS.0b013e31824cd6de.
[71] Bhargav H, Srinivasan TM, Varambally S, Gangadhar BN, Koka P. 2015 Effect of Mobile Phone-Induced Electromagnetic Field on Brain Hemodynamics and Human Stem Cell Functioning: Possible Mechanistic Link to Cancer Risk and Early Diagnostic Value of Electronphotonic Imaging. J Stem Cells 10 (4): 287-294.
[72] Redmayne M, Johansson O. 2015 Radiofrequency exposure in young and old: different sensitivities in the light of age-relevant natural differences. Rev Environ Health 30: 323-335. doi: 10.1515/reveh-2015-0030.
[73] SCENIHR, 2015. Health effects of EMF – 2015 Scientific Committee on Emerging and Newly Identified Health Risks SCENIHR: opinion on potential health effects of exposure to electromagnetic fields (EMF).
https://ec.europa.eu/health/scientific_committees/emerging/docs/scenihr_o_041.pdf (accessed Sept. 7, 2017)
[74] Speit G, Gminski R, Tauber R. 2013 Genotoxic effects of exposure to radiofrequency electromagnetic fields (RF-EMF) in HL-60 cells are not reproducible. Mutat Res Genet Toxicol Environ Mutagen 755: 163-166.
{75] Schwarz C, Kratochvil E, Pilger A, Kuster N, Adlkofer F, Rüdiger HW. 2008 Radiofrequency electromagnetic fields (UMTS, 1,950 MHz) induce genotoxic effects in vitro in human fibroblasts but not in lymphocytes. Int Arch Occup Environ Health 81: 755-767.
[76] J. Lutz and F. Adlkofer, 2007 Objections against current limits for microwave radiation. Proceedings or the WFMN07, Chemnitz, Germany, pp. 119-123. http://www.mobilfunk-debatte.de/pdf/studien/Lutz_Adlkofer_WFMN07_III_A1.pdf (accessed March 36, 2018).
[77] Davis D. 2010 Disconnect: The Truth about Cell Phone Radiation, What the Industry Is Doing to Hide It, and How to Protect Your Family. Penguin Group, New York.
[78] Khurana VG, Teo C, Kundi M, Hardell L, Carlberg M. 2009 Cell phones and brain tumors: a review including the long-term epidemiologic data. Surg Neurol 72:205-214.
[79] Desai NR, Kesari KK, Agarwal A. 2009 Pathophysiology of cell phone radiation: oxidative stress and carcinogenesis with focus on the male reproductive system. Reproduct Biol Endocrinol 7:114.
[80] Makker K, Varghese A, Desai NR, Mouradi R, Agarwal A. 2009 Cell phones: modern man's nemesis? Reprod Biomed Online 18:148-157.
[81] Ruediger HW. 2009 Genotoxic effects of radiofrequency electromagnetic fields. Pathophysiology. 16:89-102.

[82] Phillips JL, Singh NP, Lai H. 2009 Electromagnetic fields and DNA damage. Pathophysiology 16:79-88.
[83] Davanipour Z, Sobel E. 2009 Long-term exposure to magnetic fields and the risks of Alzheimer's disease and breast cancer: Further biological research. Pathophysiology 16:149-156.
[84] Yakymenko I, Sidorik E. 2010 Risks of carcinogenesis from electromagnetic radiation and mobile telephony devices. Exp Oncol 32:729-736.
[85] Carpenter DO. 2010 Electromagnetic fields and cancer: the cost of doing nothing. Rev Environ Health 25:75-80.
[86] Giuliani L, Soffriti M (Eds). 2010 NON-THERMAL EFFECTS AND MECHANISMS OF INTERACTION BETWEEN ELECTROMAGNETIC FIELDS AND LIVING MATTER, RAMAZZINI INSTITUTE EUR. J. ONCOL. LIBRARY Volume 5, National Institute for the Study and Control of Cancer and Environmental Diseases "Bernardino Ramazzini" Bologna, Italy 2010, 400 page monograph.
[87] Khurana, V. G., Hardell, L., Everaert, J., Bortkiewicz, A., Carlberg, M., Ahonen, M. 2010 Epidemiological evidence for a health risk from mobile phone base stations. Int. J. Occup. Environ. Health 16, 263-267.
[88] Levitt, B. B., Lai, H. 2010. Biological effects from exposure to electromagnetic radiation emitted by cell tower base stations and other antenna arrays. Environ. Rev. 18, 369-395. doi.org/10.1139/A10-018
[89] Kang N, Shang XJ, Huang YF. 2010 [Impact of cell phone radiation on male reproduction]. Zhonghua Nan Ke Xue 16:1027-1030.
[90] Yakymenko, I., Sidorik, E., Kyrylenko, S., Chekhun, V. 2011. Long-term exposure to microwave radiation provokes cancer growth: evidences from radars and mobile communication systems. Exp. Oncol. 33(2), 62-70.
[91] Yakimenko IL, Sidorik EP, Tsybulin AS. 2011 [Metabolic changes in cells under electromagnetic radiation of mobile communication systems]. Ukr Biokhim Zh (1999). 2011 Mar-Apr;83(2):20-28.
[92] Gye MC, Park CJ. 2012 Effect of electromagnetic field exposure on the reproductive system. Clin Exp Reprod Med 39:1-9. doi.org/10.5653/cerm.2012.39.1.1
[93] La Vignera S, Condorelli RA, Vicari E, D'Agata R, Calogero AE. 2012 Effects of the exposure to mobile phones on male reproduction: a review of the literature. J Androl 33:350-356.
[94] Biointiative Working Group, David Carpenter and Cindy Sage (eds). 2012 Bioinitiative 2012: A rationale for biologically-based exposure standards for electromagnetic radiation. http://www.bioinitiative.org/participants/why-we-care/
[95} Nazıroğlu M, Yüksel M, Köse SA, Özkaya MO. 2013 Recent reports of Wi-Fi and mobile phone-induced radiation on oxidative stress and reproductive signaling pathways in females and males. J Membr Biol 246:869-875.
[96] Ledoigt G, Belpomme D. 2013 Cancer induction molecular pathways and HF-EMF irradiation. Adv Biol Chem 3:177-186.
[97] Hardell L, Carlberg M. 2013 Using the Hill viewpoints from 1965 for evaluating strengths of evidence of the risk for brain tumors associated with use of mobile and cordless phones. Rev Environ Health 28:97-106. doi: 10.1515/reveh-2013-0006.
[98] Hardell L, Carlberg M, Hansson Mild K. 2013 Use of mobile phones and cordless phones is associated with increased risk for glioma and acoustic neuroma. Pathophysiology 2013;20(2):85-110.
[99} Davis DL, Kesari S, Soskolne CL, Miller AB, Stein Y. 2013 Swedish review strengthens grounds for concluding that radiation from cellular and cordless phones is a probable human carcinogen. Pathophysiology 20:123-129.
[100] Panagopoulos DJ, Johansson O, Carlo GL. 2015. Real versus simulated mobile phone exposures in experimental studies. BioMed Res Int 2015, article ID 607053, 8 pages. doi: 10.1155/2015/607053.

[101] Meo SA, Alsubaie Y, Almubarak Z, Almutawa H, AlQasem Y, Hasanato RM. 2015 Association of Exposure to Radio-Frequency Electromagnetic Field Radiation (RF-EMFR) Generated by Mobile Phone Base Stations with Glycated Hemoglobin (HbA1c) and Risk of Type 2 Diabetes Mellitus. Int J Environ Res Public Health 13;12:14519-14528. doi: 10.3390/ijerph121114519.
[102] Othman, H., Ammari, M., Rtibi, K., Bensaid, N., Sakly, M., Abdelmelek, H. 2017. Postnatal development and behavior effects of in-utero exposure of rats to radiofrequency waves emitted from conventional WiFi devices. Environ. Toxicol. Pharmacol. 52:239-247. doi: 10.1016/j.etap.2017.04.016.
[103] Bas O, Sönmez OF, Aslan A, Ikinci A, Hanci H, Yildirim M, Kaya H, Akca M, Odaci E. 2013 Pyramidal Cell Loss in the Cornu Ammonis of 32-day-old Female Rats Following Exposure to a 900 Megahertz Electromagnetic Field During Prenatal Days 13-21. Neuroquantology 11: 591-599.
[104] Kumari K, Koivisto H, Myles C, Jonne N, Matti V, Heikki T, Jukka J. 2017 Behavioural phenotypes in mice after prenatal and early postnatal exposure to intermediate frequency magnetic fields. Environ Res 162: 27-34
[105] Othman H, Ammari M, Sakly M, Abdelmelek H. 2017 Effects of prenatal exposure to WIFI signal (2.45GHz) on postnatal development and behavior in rat: Influence of maternal restraint. Behav Brain Res 326: 291-302.
[106] Stasinopoulou M, Fragopoulou AF, Stamatakis A, Mantziaras G, Skouroliakou K, Papassideri IS, Stylianopoulou F, Lai H, Kostomitsopoulos N, Margaritis LH. 2016 Effects of pre- and postnatal exposure to 1880-1900 MHz DECT base radiation on development in the rat. Reprod Toxicol 2016; 65: 248-262.
[107] Divan HA, Kheifets L, Obel C, Olsen J. 2008 Prenatal and postnatal exposure to cell phone use and behavioral problems in children. Epidemiology 19:523-529. doi: 10.1097/EDE.0b013e318175dd47.
[108] Divan HA, Kheifets L, Obel C, Olsen J. 2012 Cell phone use and behavioural problems in young children. J Epidemiol Community Health. 2012 Jun;66(6):524-9. doi: 10.1136/jech.2010.115402.
[109] Kabir ZD, Martínez-Rivera A, Rajadhyaksha AM. 2017 From Gene to Behavior: L-Type Calcium Channel Mechanisms Underlying Neuropsychiatric Symptoms. Neurotherapeutics. 2017 Jul;14(3):588-613. doi: 10.1007/s13311-017-0532-0.
[110] Foster KR, Moulder JE. 2013 Wi-Fi and health: review of current status of research. Health Phys 105:561-565. doi: 10.1097/HP.0b013e31829b49bb.
[111] Diamond Jared. 2005 Collapse: How Societies Choose to Fail or Succeed. Viking Group, New York.
[112] NCRP Report No. 86. 1986 Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields. Recommendations of the National Council on Radiation Protection and Measurements. 400 pp. Bethesda MD 20814
[113] Motorala, Microwaves and DNA Breaks: "War-Gaming"the Lai-Singh Experiments. Dec. 13, 1994. Reprinted in Microwave News January/February 1997 https://www.rfsafe.com/wp-content/uploads/2014/06/cell-phone-radiation-war-gaming-memo.pdf (Accessed April 4, 2018).
[114] WTR and betrayal of the public trust. Microwave News, March 2005. http://microwavenews.com/docs/MWN.March-05.pdf (accessed April 4, 2018)
[115] Wakeup Call Cover Story. Rob Harrill University of Washington Alumni News, March 2005. http://www.washington.edu/alumni/columns/march05/wakeupcall01.html (Accessed April 4, 2018)
[116] Schneider, Scott. 2008 Book Review of "Doubt is Their Product: How Industry's Assault on Science Threatens Your Health." By David Michaels.

https://www.lhsfna.org/index.cfm/lifelines/june-2008/book-review-doubt-is-their-product/ (accessed April 4, 2018).
[117] Interview of Dr. Dietrich Klinghardt by Dr. Joe Mercola, December 28, 2017. https://idocslide.com/the-philosophy-of-money.html?utm_source=interview-klinghardt-emf (Accessed April 6, 2018). Please note: There is also youtube video of this interview.
[118] http://www.newsweek.com/why-does-vladimir-putin-avoid-smartphones-801406 (Accessed April 9, 2018).
[119] Goldberg RB. 1993 The cellular phone controversy: real or contrived? EMF Health Report 1(1): 1993. EPI1793
[120] Berezow A, Bloom A. 2017 Recommendation to limit Md. School Wi-Fi based on 'junk science'. Baltimore Sun op-ed piece, March 12. http://www.baltimoresun.com/news/opinion/oped/bs-ed-wifi-school-20170312-story.html (Accessed June 17, 2017).
[121] NCI, 2016 National Cancer Institute Statement on Electromagnetic Fields and Cancer May 2016. https://www.cancer.gov/about-cancer/causes-prevention/risk/radiation/electromagnetic-fields-fact-sheet (accessed Sept. 7, 2017)
[122] Wyde M, Cesta M, Blystone C, et al. 2016 Report of Partial findings from the National Toxicology Program Carcinogenesis Studies of Cell Phone Radiofrequency Radiation in Hsd: Sprague Dawley® SD rats (Whole Body Exposure). bioRXiv doi.org/10.1101/055699
[123] Merritt, JH, Chamness AF, Allen SJ. 1978 Studies on blood-brain barrier permeability after microwave-radiation. Rad Environ Biophys 15:367-377.
[124] Ziemann C, Brockmeyer H, Reddy SB, Vijayalaxmi, Prihoda TJ, Kuster N, Tillmann T, Dasenbrock C. 2009 Absence of genotoxic potential of 902 MHz (GSM) and 1747 MHz (DCS) wireless communication signals: In vivo two-year bioassay in B6C3F1 mice. Int J Radiat Biol 85:454-464. doi: 10.1080/09553000902818907.
[125] Dr. George L. Carlo Letter To AT&T Chairman on Cell Phone Radiation, October 7, 1999. https://www.rfsafe.com/dr-george-l-carlo-letter-to-att-chairman-on-cell-phone-radiation/ (Accessed April 8, 2018).
[126] Carlo, George and Schram, Martin. 2001 Cell Phones: Invisible Hazards in the Wireless Age: An Insider's Alarming Discoveries about Cancer and Genetic Damage. Carroll and Graf, New York.
[127] Alster, Norm. 2015 Captured Agency: How the Communications Commission Is Dominated by the Industry It Presumably Regulates. Edmund J. Safra Institute for Ethics, Harvard University, Cambridge, MA, USA
[128] FCC Federal Communication RF Safety FAQ. No date given https://www.fcc.gov/engineering-technology/electromagnetic-compatibility-division/radio-frequency-safety/faq/rf-safety#top
[129] FDA Letter of Intent for Collaboration with the CTIA. October 18, 1999. https://www.rfsafe.com/fda-letter-intent-collaboration-ctia/ (Accessed April 14, 2018).
[130] Cooperative Research and Development Agreement (CRADA). Updated on Dec. 4, 2017 https://www.fda.gov/Radiation-EmittingProducts/RadiationEmittingProductsandProcedures/HomeBusinessandEntertainment/CellPhones/ucm116340.htm
[131] fda.gov site Cell Phones > Current Research Results. No Date given. https://www.fda.gov/Radiation-EmittingProducts/RadiationEmittingProductsandProcedures/HomeBusinessandEntertainment/CellPhones/ucm116335.htm
[132] Samsung Health and Safety and Warrantee Guide. 2015 https://www.samsung.com/us/Legal/PHONE-HS_GUIDE_English.pdf (Accessed April 15, 2018)

[133] Samsung Gear S Black (AT&T) last updated July 17, 1017. https://www.samsung.com/us/support/service/warranty/SM-R750AZKAATT (Accessed April 15, 2018).
[134] 1993 FDA Memo: Data "Strongly Suggest" Microwaves Can Promote Cancer. Jan/Feb 1993, p. 1, 5. https://pdfs.semanticscholar.org/776f/b8ea63bd5c3c32699e90301af123eea6c6c7.pdf (Accessed Apr 15, 2018)
[135] Hamburg MA, Sharfstein JM. 2009 The FDA as a public health agency. N Engl J Med 360:2493-2495. doi: 10.1056/NEJMp0903764
[136] Alekseev SI, Ziskin MC. 1999 Effects of millimeter waves on ionic currents of Lymnaea neurons. Bioelectromagnetics 20:24-33.
[137] Hässig M, Jud F, Naegeli H, Kupper J, Spiess BM. 2009 Prevalence of nuclear cataract in Swiss veal calves and its possible association with mobile telephone antenna base stations. Schweiz Arch Tierheilkd 151:471-478.
[138] Hässig M, Jud F, Spiess B. 2012 [Increased occurrence of nuclear cataract in the calf after erection of a mobile phone base station]. Schweiz Arch Tierheilkd 154:82-86.
[139] Lu M, Ueno S. 2013 Calculating the induced electromagnetic fields in real human heads by deep transcranial magnetic stimulation. 35th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Book Series. Osaka Japan, pp. 795-798.

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Thursday, October 24, 2019

Cell Towers, Antennas Problematic for Buyers

July 25, 2014

An overwhelming 94 percent of home buyers and renters surveyed by the National Institute for Science, Law & Public Policy (NISLAPP) say they are less interested and would pay less for a property located near a cell tower or antenna.

What's more, of the 1,000 survey respondents, 79 percent said that under no circumstances would they ever purchase or rent a property within a few blocks of a cell tower or antennas, and almost 90 percent said they were concerned about the increasing number of cell towers and antennas in their residential neighborhood.

The survey, “Neighborhood Cell Towers & Antennas—Do They Impact a Property’s Desirability?” also found that properties where a cell tower or group of antennas are placed on top of or attached to a building (condominium high-rise, for instance) is problematic for buyers.

Trouble Spots for Buyers:

- Home Owners Object to Cell Tower Installations
- Field Guide to Cell Phone Towers
- 6 Ways a Home May Turn Off Buyers
- 6 Ways to Turn Off Buyers at Open Houses

“A study of real estate sales prices would be beneficial at this time in the Unites States to determine what discounts home buyers are currently placing on properties near cell towers and antennas,” says Jim Turner, chair of NISLAPP.

The NISLAPP survey echoes the findings of a study by Sandy Bond of the New Zealand Property Institute and past president of the Pacific Rim Real Estate Society (PRRES). "The Impact of Cell Phone Towers on House Prices in Residential Neighborhoods," which was published in The Appraisal Journal in 2006, found that buyers would pay as much as 20 percent less for a property near a cell tower or antenna.

Source: “Neighborhood Cell Towers & Antennas—Do They Impact a Property’s Desirability?” National Institute for Science, Law & Public Policy (June 2014)

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Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	
Amendment of Parts 1 and 22 of the Commission's Rules with Regard to the Cellular Service, Including Changes in Licensing of Unserved Area	)	WT Docket No. 12-40 (*terminated*) RM No. 11510 (*terminated*)
	)	
Amendment of the Commission's Rules with Regard to Relocation of Part 24 to Part 27	)	
	)	
Interim Restrictions and Procedures for Cellular Service Applications	)	
	)	
Amendment of Parts 0, 1, and 22 of the Commission's Rules with Regard to Frequency Coordination for the Cellular Service	)	
	)	
Amendment of Part 22 of the Commission's Rules Regarding Certain Administrative and Filing Requirements	)	
	)	
Amendment of the Commission's Rules Governing Radiated Power Limits for the Cellular Service	)	RM No. 11660 (*terminated*)
	)	
Amendment of Parts 1, 22, 24, 27, 74, 80, 90, 95, and 101 to Establish Uniform License Renewal, Discontinuance of Operation, and Geographic Partitioning and Spectrum Disaggregation Rules and Policies for Certain Wireless Radio Services	)	WT Docket No. 10-112
	)	
2016 Biennial Review of Telecommunications Regulations	)	WT Docket No. 16-138

THIRD REPORT AND ORDER

Adopted: July 12, 2018 **Released: July 13, 2018**

By the Commission: Chairman Pai issuing a statement.

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I. INTRODUCTION

1. In this Third Report and Order, we take additional steps to reduce unnecessary regulatory burdens for licensees in the 800 MHz Cellular Radiotelephone (Cellular) Service as well as other Part 22 licensees, thereby freeing up more resources for investment in new technologies and greater spectrum efficiency to meet increasing consumer demand for advanced wireless services. Specifically, we modernize our rules by eliminating several Part 22 recordkeeping and reporting obligations that were adopted more than two decades ago—obligations for which there is no longer a benefit to outweigh the compliance costs and burdens imposed on licensees. We also eliminate certain Cellular Service-specific rules that are no longer necessary. Our revisions today will provide Cellular and other Part 22 licensees with enhanced flexibility and advance our goal of ensuring more consistency in licensing across commercial wireless services, while taking into account unique features of each service. With this Third Report and Order we conclude an important chapter in the Commission's extensive regulatory reform agenda and terminate the proceeding in WT Docket No. 12-40, including RM Nos. 11510 and 11660.

II. BACKGROUND

2. In 1981, the Commission adopted its initial Cellular Service rules; these provided the foundation of the commercial wireless industry and made mobile services broadly available to the American public nationwide.[1] In 2012, the Commission released a Cellular Reform *Notice of Proposed Rulemaking,* which was intended to modernize the legacy site-based Cellular licensing scheme and transition it to a geographically based licensing model.[2] In 2014, the Commission adopted a *Report and Order* (*R&*O)*,* which modernized Cellular Service licensing in several respects.[3] The centerpiece of the *R&O* was the adoption of a geographically-based licensing regime, with licenses based on Cellular Geographic Service Area (CGSA) boundaries; this added significant new flexibility for licensees to

[1] *See generally An Inquiry Into the Use of the Bands 825-845 MHz and 870-890 MHz for Cellular Communications Systems; and Amendment of Parts 2 and 22 of the Commission's Rules Relative to Cellular Communications Systems,* CC Docket No. 79-318, Report and Order*,* 86 F.C.C.2d 469 (1981).

[2] *Amendment of Parts 1 and 22 of the Commission's Rules with Regard to the Cellular Service, Including Changes in Licensing of Unserved Area*; *Amendment of the Commission's Rules with Regard to Relocation of Part 24 to Part 27*; *Interim Restrictions and Procedures for Cellular Service Applications*, WT Docket No. 12-40, RM No. 11510, Notice of Proposed Rulemaking and Order, 27 FCC Rcd 1745, 1747 n.3, 1750-52, 1758 (2012) (*NPRM*). Under the legacy site-based model, applications with comprehensive technical data and prior FCC approval had been required for new Cellular systems and for modifications of an existing system that would expand the licensee's authorized Cellular Geographic Service Area (CGSA), no matter how slight the expansion. Based on Commission data when it released the *NPRM*, approximately 80 percent of the 1,468 Cellular Market Area (CMA) channel blocks were almost completely licensed already, with only limited unlicensed area remaining, primarily in Alaska and other rural areas in the western United States. *See NPRM*, 27 FCC Rcd at 1747, 1750-55, 1768-1769.

[3] *Amendment of Parts 1 and 22 of the Commission's Rules with Regard to the Cellular Service, Including Changes in Licensing of Unserved Area, et al.,* WT Docket No. 12-40, RM Nos. 11510 and 11660, Report and Order and Further Notice of Proposed Rulemaking, 29 FCC Rcd 14100 (2014) (*R&O* and *Further Notice,* respectively).

improve their systems within those boundaries.[4] The *R&O* also added significant opportunities for licensees to expand their service coverage without prior authorization, resulting in a substantial reduction in administrative burdens for both licensees and FCC staff.[5] In the *Further Notice*, the Commission proposed additional Cellular licensing reforms and overdue reforms of the Cellular radiated power and related technical rules that could facilitate the ability of Cellular licensees to deploy advanced broadband services.[6]

3. In the 2017 *Second Report and Order*, the Commission modernized numerous Cellular technical rules, including the outdated radiated power and related rules, to permit power measurement using power spectral density.[7] These changes facilitate the use of Cellular spectrum to provide advanced mobile broadband services, such as 4G long term evolution (LTE), while protecting public safety communications from increased potential for unacceptable interference.[8] The *Second R&O* also revised rules to further eliminate unnecessary filings and other regulatory burdens for Cellular licensees.[9] The Commission's reforms resulted in Cellular Service rules more akin to the flexible licensing schemes found in other similar mobile services, such as the Broadband Personal Communications Service (PCS),[10] the commercial service in the 700 MHz band (700 MHz Service),[11] the 600 MHz Service,[12] and the Advanced Wireless Services (AWS),[13] to help ensure that carriers are treated similarly regardless of technology choice.

4. In the *Second Further Notice*, to build on reforms adopted in the *R&O* and *Second R&O* and to respond to certain submissions by commenters in the Commission's 2016 Biennial Review proceeding,[14] the Commission proposed and sought comment on additional reforms of its Part 22 rules

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[4] See the *R&O* for the full discussion of the revised rules adopted (29 FCC Rcd at 14102-26 (Section II) and 14156-63 (Appendix A (Final Rules)).

[5] *See id*., 29 FCC Rcd at 14115-18. The *R&O* also established a field strength limit rule tailored to reflect the continued ability to expand Cellular service area coverage. *See id*. at 14109-10.

[6] *Further Notice*, 29 FCC Rcd at 14126-52.

[7] *See Amendment of Parts 1 and 22 of the Commission's Rules with Regard to the Cellular Service, Including Changes in Licensing of Unserved Area*, *Amendment of the Commission's Rules with Regard to Relocation of Part 24 to Part 27; Interim Restrictions and Procedures for Cellular Service Applications*; *Amendment of Parts 0, 1, and 22 of the Commission's Rules with Regard to Frequency Coordination for the Cellular Service*; *Amendment of the Commission's Rules Governing Radiated Power Limits for the Cellular Service*; *Amendment of Parts 1, 22, 24, 27, 74, 80, 90, 95, and 101 to Establish Uniform License Renewal, Discontinuance of Operation, and Geographic Partitioning and Spectrum Disaggregation Rules and Policies for Certain Wireless Radio Services; 2016 Biennial Review of Telecommunications Regulations*, WT Docket Nos. 12-40, 10-112, and 16-138, RM Nos. 11510 and 11660, Second Report and Order, Report and Order, and Second Further Notice of Proposed Rulemaking, 32 FCC Rcd 2518 (2017). Herein, we reference the Second Report and Order and the Report and Order collectively as "*Second R&O*"; we reference the Second Further Notice of Proposed Rulemaking as "*Second Further Notice*."

[8] *Second R&O*, 32 FCC Rcd at 2535-56; *see also id*. at 2562-64.

[9] *Id*., 32 FCC Rcd at 2557-61, 2567-70 (adopting a more flexible rule concerning permanent discontinuance of operations, eliminating certain filing requirements for minor system changes, and deleting the Part 22 rules pertaining to Cellular Service license renewals).

[10] *See generally* 47 CFR §§ 24.1 *et seq*.

[11] *See generally* 47 CFR Part 27.

[12] *See generally Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, GN Docket No. 12-268, Report and Order, 29 FCC Rcd 6567 (2014) (*BIA Report and Order*) (subsequent history omitted); 47 CFR § 27.5(l).

[13] *See generally* 47 CFR Part 27.

[14] *Second Further Notice*, 32 FCC Rcd at 2570-75. The Commission had solicited comments in a public notice in its 2016 Biennial Review of Telecommunications Regulations proceeding. *Commission Seeks Public Comment in 2016 Biennial Review of Telecommunications Regulations*, WT Docket No. 16-138 (other docket numbers omitted),

governing not only the Cellular Service but other Part 22 Public Mobile Services (PMS) as well.[15] The Commission also invited comment on whether other measures could be taken to allow Part 22 licensees to benefit from the same level of flexibility available to other commercial wireless licensees.[16] In that context, the Commission raised the possibility of relocating—to Part 27 of the Commission's rules—certain Part 22 rules, as well as the Part 24 PCS rules and other rules governing geographically licensed wireless services.[17]

5. In response to the *Second Further Notice*, five parties filed comments and one party filed reply comments; three parties subsequently filed *ex parte* letters.[18] Commenters generally support the Commission's proposed deletion of the Part 22 rules addressed in the *Second Further Notice*. Only two commenters address the issue of possible relocation of rules to Part 27 and possible reorganization of that rule part—one favoring the idea and the other opposing it. In addition, some commenters propose deleting other rules that had not been previously considered by the Commission in this proceeding. The record and our decisions are set forth below under specific headings pertaining to these various rules and issues.

III. ELIMINATION OF UNNECESSARY RULES

6. In the sections below, we delete the following administrative and recordkeeping rules for Part 22 licensees: Sections 22.301 and 22.303, concerning station inspections and the retention of hard copies of station authorizations and other station records; and Section 22.325, concerning station control points and personnel on duty at those control points.[19] Removing these provisions will eliminate needless burdens that are inconsistent with the Commission's practices and the now-predominant use of electronic records storage and access, and it will also eliminate asymmetry across competing commercial mobile radio services (CMRS), as the Commission's rules for newer wireless services such as PCS, certain AWS, and the 700 MHz Service do not include such provisions. We also delete Section 22.321, concerning equal employment opportunities, as duplicative, as well as Sections 22.3 and 22.927, which set forth service provider obligations concerning their authorizations and subscribers' Cellular mobile stations.[20] These rules are no longer necessary, as explained below.

A. Sections 22.301, 22.303—Station Inspection, Retention of Station Authorizations

7. In the *Second Further Notice*, the Commission proposed and sought comment on deletion of Sections 22.301 and 22.303 of the Commission's rules, which collectively require that hard copies of license authorizations and other records be maintained by all Part 22 licensees for each station and that such records and the station itself be made available for inspection upon request.[21] The Commission

(Continued from previous page)
Public Notice, 31 FCC Rcd 12166, 12174-75 (2016) (*Biennial Review PN*). Although the Commission has considered in this Cellular Reform proceeding certain issues that were initially raised by commenters in response to the *Biennial Review PN* in WT Docket No. 16-138 (WT Biennial Review proceeding), such consideration does not otherwise impact review of other comments and issues raised in response to that *PN*.

[15] The other services governed by Part 22 of our rules are Paging, Air-Ground, Rural, and Offshore Radiotelephone.

[16] *Second Further Notice*, 32 FCC Rcd at 2571, 2574.

[17] *Id*., 32 FCC Rcd at 2574-75.

[18] *See* Appendix C for a list of parties that submitted comments, reply comments, and *ex parte* letters.

[19] 47 CFR §§ 22.301, 22.303, 22.325.

[20] 47 CFR §§ 22.321, 22.3, 22.927.

[21] *Second Further Notice*, 32 FCC Rcd at 2571-72 (citing comments submitted by CTIA and Verizon in response to the *Further Notice*, and by CTIA and T-Mobile USA, Inc. in response to the *Biennial Review PN*). Section 22.301 specifically requires that, "[u]pon reasonable request, the licensee of any station authorized in the Public Mobile Services must make the station and station records available for inspection by authorized representatives of the Commission at any reasonable hour." 47 CFR § 22.301. Noting the rule's requirement that the *station itself*, not just the station's records, be available for inspection by the Commission, the Commission emphasized that,

questioned whether the benefits of maintaining hard copies outweigh the costs and burdens to Part 22 licensees in the age of electronic licensing and recordkeeping, particularly as license authorizations are maintained in the Commission's Universal Licensing System (ULS).[22] The Commission also sought comment on a suggestion that, even if we eliminate Sections 22.301 and 22.303, we should nonetheless affirmatively require Part 22 licensees "to have electronic copies [of licenses] easily accessible to personnel and FCC inspectors."[23]

8. Commenters addressing this issue unanimously endorse the Commission's proposal to delete Sections 22.301 and 22.303; they assert that these administrative requirements are burdensome and inconsistent with today's licensing practices.[24] AT&T and Verizon point out that, since 2014, the Commission has deemed the electronic version of an authorization—stored in ULS—to be the official Commission record, and it no longer sends printed copies of authorizations through the U.S. Postal Service unless so requested by the licensee.[25] The Enterprise Wireless Alliance (EWA) adds that a "physical copy of a license can never be more and could be less up-to-date than ULS data."[26] The commenters further argue that, with the movement to geographic-based licensing (which provides licensees with the flexibility to make certain changes to their systems without Commission filings), individual authorizations are no longer relevant and may not include all operating parameters.[27] This fact of current-day operations, the Critical Messaging Association (CMA) claims, can create problems when state and local officials, unfamiliar with the Commission's geographic licensing model, do not find paper

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regardless of whether we retain a rule in Part 22 explicitly requiring licensees to make their stations available for inspection, we retain our general station inspection authority under Section 303(n) of the Communications Act, 47 U.S.C. § 303(n). *See Second Further Notice,* 32 FCC Rcd at 2572. Section 22.303 more broadly requires Part 22 licensees to retain, among other documentation, the authorization for each station as a permanent part of station records.

[22] *Second Further Notice*, 32 FCC Rcd at 2572.

[23] *Id*., 32 FCC Rcd at 2572 (citing comments submitted by Public Knowledge in the WT Biennial Review proceeding). Public Knowledge did not submit comments or reply comments following release of the *Second Further Notice*.

[24] AT&T Comments at 2-3 (May 15, 2017); CMA Comments at 2-3 (May 15, 2017); CTIA Comments at 2-4 (May 15, 2017); EWA *Ex Parte* Letter at 2-3 (June 15, 2017); Verizon Comments at 2-3 (May 15, 2017). EWA's submission (styled as "Reply Comments") was filed outside the pleading cycle (*see Federal Register*, 82 Fed. Reg. 17959 (April 14, 2017) (summarizing the *Second Further Notice* and establishing the pleading cycle)). We consider EWA's submission as an *ex parte* letter in the interest of having a complete record, ensuring full and fair participation in this proceeding.

[25] AT&T Comments at 2 (citing *Wireless Telecommunications Bureau Implements Enhancements to the Commission's Universal Licensing System and Antenna Structure Registration System and Adopts Final Procedures for Providing Access to Official Electronic Authorizations*, WT Docket No. 14-161, Public Notice, 29 FCC Rcd 15252 (WTB 2014) (*Official Electronic Authorizations PN*); Verizon Comments at 2 (citing same). *See also* EWA *Ex Parte* Letter at 3.

[26] EWA *Ex Parte* Letter at 3.

[27] E.g., AT&T Comments at 2-3 (noting, at 3, that internal base stations whose Service Area Boundaries (SABs) "do not comprise the outer edge" of the CGSA are no longer issued site-specific authorizations, and that even a Cellular Service station that defines the SAB might today have a license that no longer includes all operating parameters," because Cellular licensees can now operate much like Part 24 and Part 27 licensees without having to report every modification to a system).

records at stations to reflect all sites as operated, leading in some cases to erroneous accusations by such authorities of unauthorized operations.[28]

9. *Discussion*. We find that Sections 22.301 and 22.303 have outlived the usefulness they may have had in the past and now impose administrative burdens without any corresponding public benefit. Because the Commission no longer routinely mails printed authorizations, licensees cannot comply with the rule's hard-copy requirement unless they themselves print, or request that the Bureau print and mail, an authorization every time an application is granted. Such a requirement does not serve the public interest. ULS is available electronically at all times: licensees have access to their official authorizations, while members of the public have access to reference copies reflecting the most up-to-date information concerning all authorizations.[29] And as AT&T observes, the movement away from site-specific filings renders on-site comparison of paper records and operating parameters unnecessary and largely infeasible.[30] Moreover, the Commission has not imposed the recordkeeping and station inspection requirements of Sections 22.301 and 22.303 on licensees in competing wireless services governed by Parts 24 and 27 of our rules. For all these reasons, we delete both of these rules.[31]

B. Section 22.325—Control Points

10. Section 22.325 of the Commission's rules requires that "[e]ach station in the Public Mobile Services [ ] have at least one control point and a person on duty who is responsible for station operation."[32] The Commission proposed and sought comment on eliminating Section 22.325 in the *Second Further Notice*.[33] It queried whether today automatic and remote monitoring render this rule unnecessary from a technological standpoint.[34]

11. Commenters addressing this issue agree with the proposal to delete this rule on grounds that it does not reflect licensees' existing automatic and remote monitoring facilities and is unnecessary.[35] AT&T adds that Cellular licensees have "developed extensive expertise in working with their counterparts" to comply with Commission rules governing coordination with adjacent channel and adjacent market licensees, interference avoidance, especially with respect to Part 90 public safety

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[28] CMA Comments at 2. According to CMA, while deleting the two rules might not "100% solve that problem," it would at least remove the "ostensible . . . requirement that all such sites be reflected" in hard copy records retained at every station. *Id*. at 2-3.

[29] *Official Electronic Authorizations PN*, 29 FCC Rcd at 15252-53.

[30] AT&T Comments at 2-3.

[31] *See* Final Rules (Appendix A). As was also noted in the *Second Further Notice*, the Commission retains station inspection authority under 47 U.S.C. § 303(n). With respect to Public Knowledge's request, given that electronic copies of authorizations are easily accessible to the public and FCC inspectors via ULS, we see no need to require Part 22 licensees "to have electronic copies [of licenses] easily accessible to personnel and FCC inspectors." *See supra* note 23.

[32] 47 CFR § 22.325. While the rule does not require that the person on duty be at the control point or continuously monitor all transmissions of the station, the control point must have facilities that enable the person on duty to turn off the transmitters in the event of a malfunction.

[33] *Second Further Notice*, 32 FCC Rcd at 2573.

[34] *Id*., 32 FCC Rcd at 2573.

[35] *See* AT&T Comments at 3 (stating that Cellular licensees "remotely monitor their network usage and operation and by necessity retain the ability to deactivate the radios as needed in the event of interference"); CMA Comments at 3 (stating that automatic and remote monitoring facilities are "routinely used by CMA members"); CTIA Comments at 3-4 (asserting that the rule is unique to Part 22 and is "another example of unnecessary and asymmetrical regulation," and that most licensees have centralized operations); EWA *Ex Parte* Letter at 4; Verizon Comments at 3 (stating that it maintains "Network Operations Centers that monitor all of its Commission-licensed operations and have the ability to power down transmitters due to malfunction . . . or any other reason," and claiming that this network architecture "is commonplace among wireless carriers.").

licensees operating in the 800 MHz band, and international agreements.[36] EWA contends that "licensees have every incentive to ensure that their facilities are operating properly and in compliance with FCC requirements," and the Commission "no longer needs to prescribe how licensees must accomplish that task."[37]

12. *Discussion*. Based on the record before us, we find that Section 22.325 is now technologically obsolete, as licensees today routinely monitor their network operations by automatic and remote mechanisms. And one commenter claims that the rule inhibits efficiencies in licensees' operations.[38] We therefore conclude that Section 22.325 no longer serves the public interest. As with Sections 22.301 and 22.303, discussed above, there is no similar provision in Part 24 or Part 27 of the Commission's rules related to station control points or the requirement to have a person on duty who is responsible for station operation. Part 22 licensees should have the same flexibility as Part 24 and Part 27 commercial wireless licensees to determine how to manage their networks to ensure compliance with the Commission's rules, including how best to avoid interference. Accordingly, we delete Section 22.325.[39]

C. Section 22.321(c)—Equal Employment Opportunities

13. Section 22.321(c) requires all Part 22 licensees (i.e., PMS licensees), regardless of their size, to submit an annual report to the Commission indicating whether any EEO complaints have been filed at the federal, state, or local level against the licensee.[40] For any such complaint, the report must state the parties involved, date of filing, court or agencies reviewing the complaint, appropriate file number, and disposition of the complaint.[41] All common carriers (i.e., not only Part 22 licensees) with at least 16 full-time employees are subject to the same requirement under Section 1.815 of the Commission's rules, which specifies that an annual employment report is to be submitted on FCC Form 395.[42] Pursuant to comments on the record in the WT Biennial Review proceeding arguing that Section 22.321(c) should be repealed, the *Second Further Notice* sought comment on whether there is any need to retain this provision.[43]

14. While the WT Biennial Review comments regarding EEO requirements focused on Section 22.321, Section 90.168 of the Commission's rules, "Equal Employment Opportunities," contains the same provisions as those in Section 22.321, including paragraph (c), which requires a complaints report annually regardless of the licensee's size. Section 90.168 states that it applies to *all* CMRS (which includes the Part 22 PMS), and thus it entirely subsumes Section 22.321.

15. AT&T, CMA, EWA, and Verizon endorse the Commission's proposal to delete Section 22.321(c),[44] with CMA also asserting that, if the Commission eliminates Section 22.321(c), then common

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[36] AT&T Comments at 3.

[37] EWA *Ex Parte* Letter at 4.

[38] *See*, *e.g*., CMA Comments at 3 (indicating that CMA members routinely use automatic and remote monitoring facilities and that Section 22.325 "should be deleted as an unnecessary regulation that inhibits efficiencies in critical messaging operations").

[39] *See* Final Rules (Appendix A).

[40] 47 CFR § 22.321(c).

[41] *Id*.

[42] 47 CFR § 1.815.

[43] *Second Further Notice*, 32 FCC Rcd at 2573 (citing Verizon Biennial Review Comments). The *Second Further Notice* did not seek comment on the other subsections of Section 22.321, which set forth licensee obligations for equal opportunity programs and policies to assure nondiscriminatory practices in recruitment, placement, promotion, and other areas of employment practices. 47 CFR § 22.321.

[44] *See* AT&T Comments at 4; CMA Comments at 3-4 (arguing that deletion of Section 22.321(c)'s complaints report requirement for licensees with fewer than 16 employees is warranted); EWA *Ex Parte* Letter at 3-4 (arguing that deletion of Section 22.321(c)'s complaints report requirement for licensees with fewer than 16 employees is

carrier licensees and permittees with fewer than 16 full-time employees would no longer be subject to an EEO complaints report filing requirement at the Commission.[45] None of the commenters in this Cellular Reform proceeding or the WT Biennial Review proceeding addressed Section 90.168.

16. *Discussion*. Given that all CMRS licensees are subject to Section 90.168, including Section 90.168(c), Section 22.321 is duplicative and, accordingly, we delete the rule in its entirety.[46] As to the Part 90 reporting requirement, the Commission did not propose to remove that requirement, nor did any commenters suggest doing so. Part 90 rules are therefore beyond the scope of this proceeding and we decline at this time to eliminate the complaints reporting requirement in Section 90.168.[47]

D. Section 22.927—Responsibility for Mobile Stations, and Section 22.3—Authorization Required

17. As noted above, the *Second Further Notice* invited comment generally on other steps or measures the Commission could take to ensure that Cellular licensees benefit from the same level of flexibility available to other commercial wireless licensees.[48] In response, CTIA argues that repeal of Section 22.927, entitled "Responsibility for mobile stations,"[49] would be "consistent with this objective," because the rule is another example of asymmetric regulation.[50] Under Section 22.927, Cellular licensees are "responsible for exercising effective operational control over mobile stations receiving service through their Cellular systems," including mobile stations operated by subscribers to a different Cellular licensee. Section 22.927 thus addresses service to "roamers," although it does not use that particular term.

18. *Discussion*. Pursuant to Section 1.903(c) of the Commission's rules, the "[a]uthority for subscribers to operate mobile or fixed stations in the Wireless Radio Services [WRS]," which includes the Cellular Service, "is included in the authorization held by the licensee providing service to them."[51] Thus, when a WRS licensee, as the host carrier, provides service to a subscriber of another carrier (i.e., a subscriber that is outside its own provider's service area), the subscriber's use of his or her mobile phone

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warranted, and asserting that Section 22.321 is unnecessary in its entirety); Verizon Comments at 4-5 (arguing that deletion of Section 22.321(c) is a "good first step," but that the Commission should go further and eliminate Section 1.815 as well).

[45] CMA Comments at 3. *See also* EWA *Ex Parte* Letter at 3-4.

[46] *See* Final Rules (Appendix A). As noted above, Verizon also argues that Section 1.815 should be deleted (Verizon Comments at 4-5). Verizon's request is beyond the scope of this proceeding, and we decline to consider it here.

[47] In any event, neither CMA nor EWA adequately demonstrates why licensees with fewer than 16 employees should be exempt from this requirement; they merely claim that complaints are rarely filed against small carriers with fewer than 16 employees. CMA Comments at 3; EWA *Ex Parte* Letter at 4.

[48] *Second Further Notice*, 32 FCC Rcd at 2573 (asking specifically if commenters deem unnecessary any other rules that apply to Part 22 licensees but not to the flexibly licensed services under Part 24 or 27).

[49] 47 CFR § 22.927.

[50] CTIA Comments at 4-5. CTIA also argues that the rule is "superfluous" because, according to CTIA, licensees are subject to "specific technical and operating rules set forth elsewhere in Parts 1, 20, and 22 of the Commission's rules," but does not cite to any specific rules in support of its statement. *See id.*

[51] 47 CFR § 1.903(c) (indicating limited exceptions not relevant here). Section 1.903 was adopted in 1998 as part of an omnibus consolidation, revision, and streamlining of Commission rules governing license application procedures for many wireless services, to facilitate full implementation of what was then the Commission's new ULS. *See Biennial Regulatory Review—Amendment of Parts 0, 1, 13, 22, 24, 26, 27, 80, 87, 90, 95, 97, and 101 of the Commission's Rules to Facilitate the Development and Use of the Universal Licensing System in the Wireless Telecommunications Services, et al.*, WT Docket No. 98-20 (other docket nos. omitted), Report and Order, 13 FCC Rcd 21027 (1998) (*ULS R&O*); *see also id*. at Appendix F (consolidating certain service-specific rules into 47 CFR § 1.903).

to access the spectrum falls under that host carrier's authorization. Section 1.903(c) thus captures the purpose underlying Section 22.927, albeit with less detail.[52] While the detailed provision in Section 22.927 regarding the host carrier's responsibility under its authorization may have been warranted when the Cellular Service was in its nascency, we find that this additional rule is unnecessary these many decades later. As CTIA observes, the rule creates asymmetry, as the rules for commercial wireless services established much later than the Cellular Service—such as PCS and AWS—do not have a counterpart to Section 22.927. Consistent with one of our key goals in this proceeding to eliminate unnecessary asymmetric regulations, we delete Section 22.927.[53]

19. Further, a related legacy rule that applies to all Part 22 licensees, Section 22.3,[54] is also no longer necessary. This rule specifies that PMS stations must be used and operated only in accordance with applicable Commission rules and only with a valid authorization granted by the Commission. It further specifies that authority for subscribers to operate mobile or fixed PMS stations is included in the authorization of the licensee providing service to them. The same provisions are included in the later-adopted Section 1.903, which applies more broadly to numerous wireless services in addition to the PMS.[55] We therefore find it in the public interest to delete it from our rules as duplicative.[56]

IV. POSSIBLE RELOCATION OF RULES TO PART 27

20. The Commission sought comment in the *Second Further Notice* on whether to migrate the Part 22 Cellular and Part 24 PCS rules to Part 27, and on whether the Commission should initiate a separate rulemaking to revise the Part 27 rules and reserve the possible relocation of Cellular and PCS rules to that separate proceeding.[57] It specified that commenters should address "whether the Commission should reorganize Part 27 in order to accommodate these additional Part 22 and Part 24 rules more efficiently."[58] In addition, the Commission noted that there are other geographically-licensed, auctioned services that are not included in Part 27, including Public Coast (Part 80), Specialized Mobile Radio (SMR), Location and Monitoring, and 220 MHz (Part 90), and 218-219 MHz (Part 95), and that of these, only SMR is used today by wireless carriers to provide services directly to consumers nationwide. The Commission sought comment on whether it should move the Part 22 Cellular and Part 24 PCS rules

[52] We also note that Cellular licensees today typically have two-way roaming agreements in place with other Cellular licensees. *See* 47 CFR § 20.12.

[53] *See* Final Rules (Appendix A).

[54] 47 CFR § 22.3.

[55] *See ULS R&O*, *supra* note 51; 47 CFR § 1.903.

[56] *See* Final Rules (Appendix A).

[57] *Second Further Notice*, 32 FCC Rcd at 2574-75 (noting that it was seeking to revisit the issues and refresh the record, as the Commission had sought comment on these same issues when this Cellular Reform proceeding was launched in 2012). In connection with the 2012 proposal to issue geographic-area (CMA-based) "overlay licenses" through competitive bidding in two stages, the Commission had queried whether, in the event that it were to adopt a geographic-based regime that would include overlay licenses, the new Cellular rules should be incorporated into Part 27. *See NPRM,* 27 FCC Rcd at 1771 (also suggesting that, if the Cellular rules were moved into Part 27, then the rules for PCS should also be moved into Part 27). The only commenter that responded, the Rural Wireless Association, opposed a relocation of any Part 22 and Part 24 rules to Part 27. *See R&O*, 29 FCC Rcd at 14125 (citing RWA's Comments filed May 15, 2012). In the *R&O*, the Commission's transition of the Cellular Service to a geographic-based regime did not entail an auction of overlay licenses, which commenters by and large opposed; instead, based in part on a new proposal by an industry coalition, the Commission adopted a transition approach for the Cellular Service that preserves direct site-based access to Unserved Area while dramatically reducing licensees' regulatory burdens, and in that context, the Commission decided not to pursue a relocation of Part 22 Cellular and Part 24 PCS rules. *See Second R&O*, 32 FCC Rcd at 2575 (citing *R&O*, 29 FCC Rcd at 14125*).*

[58] *Second Further Notice*, 32 FCC Rcd at 2575.

to Part 27 in conjunction with moving those other service rule parts to Part 27 as well.[59]

21. CTIA states support in broad terms for migrating the Part 22 Cellular and Part 24 PCS rules to Part 27.[60] EWA argues that there are important reasons for distinguishing Part 90 SMR systems in the context of a possible rule migration, and "strongly recommends against a wholesale relocation of the [Part 90] SMR service to Part 27 . . . ."[61] In particular, it urges that the Commission leave under Part 90 the rules governing non-Enhanced SMR (non-ESMR) systems.[62] No other commenter addressed our queries on these issues.

22. *Discussion*. While CTIA recommends that we evaluate "whether and how to consolidate the rules" and resolve inconsistencies among different service rules (absent unique circumstances for particular services), it offers only one example of rules that could be consolidated for multiple services.[63] EWA focuses solely on the difficulties associated with relocation of Part 90 SMR rules and does not address any other rules in this context. As EWA's comments highlight, disparate types of operations found in certain rule parts would make it challenging to consolidate Part 22 Cellular, Part 24 PCS, and other wireless mobile service rules into a single set of regulations. Such an exercise would entail painstaking review of numerous rules to determine those that can be consolidated and those that must be retained for individual services. In the absence of strong support on the record for this endeavor, which would require a significant investment of staff resources to complete, we decline to pursue the issue at this time.

V. OTHER REGULATIONS RAISED BY COMMENTERS

23. In response to the Commission's query in the *Second Further Notice* as to whether any other Part 22 rules are ripe for removal in light of changed technology, electronic licensing/recordkeeping, or other modernizations that have occurred over the past two decades, commenters request deletion of two Cellular Service rules—Sections 22.921 and 22.925.[64] In addition, one commenter requests deletion of paragraph (a) of Section 22.143,[65] which applies to all Part 22 licensees. We discuss the commenters' specific proposals below.[66]

24. *Section 22.921—911 Call Processing Procedures*. AT&T argues that Section 22.921 of

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[59] *Id*., 32 FCC Rcd at 2575.

[60] CTIA Comments at 5 (contending that this would significantly reduce the number of pages comprising the rules in Parts 22, 24, and 27, and assist with training and compliance). It adds that, while a benefit of considering consolidation would be to determine whether inconsistencies are warranted by unique circumstances of a particular service, retention of certain service-specific technical requirements would be warranted "because of the particular spectrum bands involved," and it notes as examples the Cellular radiated power rule and the rule for determining a Cellular licensee's CGSA. *Id*. at 5-6.

[61] For example, it contends, the "intermingling of channels among [Part 90] site-based licensees and the substantial commonality of operational characteristics among site-based Part 90 systems, both private internal and commercial SMR, argue strongly in favor of regulating these systems under the well-established Part 90 rules." EWA Comments at 4 (adding its contention that the purpose of the Part 27 rules is "not intended for nor particularly aligned with site-specific based private internal and commercial SMR operations.").

[62] EWA Comments at 2 (noting that Sprint Corporation (Sprint) and Southern Communications Services, d/b/a Southern Linc (Southern) operate ESMR systems and are members of EWA). While EWA states that it would support the decision of ESMR entities if they prefer to have their rules migrated, neither Sprint nor Southern filed comments in response to the *Second Further Notice*.

[63] CTIA Comments at 5 (suggesting that a single rule should be adopted for all CMRS licensees that establishes the same license term absent unique circumstances).

[64] 47 CFR §§ 22.921, 22.925.

[65] 47 CFR § 22.143(a).

[66] *Second Further Notice*, 32 FCC Rcd at 2573.

our rules, pursuant to which certain Cellular Service mobile telephones that are capable of operating in the analog mode "must incorporate a special procedure for processing 911 calls,"[67] is now obsolete because, among other reasons, it is "unaware of any carrier that still offers analog devices or operates an analog Cellular system."[68] We disagree. Commission data show that, contrary to AT&T's understanding, some carriers are still using analog technology in the Cellular Service band[69]—and Section 22.921 ensures that 911 calls get through in those circumstances.[70] Under these circumstances, the deletion of this rule would not serve the public interest, and, accordingly, we decline to take such action in this proceeding.

25. *Section 22.925—Prohibition on Airborne Operation of Cellular Telephones*. AT&T and Qualcomm Incorporated (Qualcomm) argue that Section 22.925, which prohibits the operation of Cellular Service telephones aboard "airplanes, balloons or any other type of aircraft . . . while such aircraft are airborne . . . ,"[71] should be eliminated, or at least modified.[72] The Commission has an open proceeding in WT Docket No. 13-301 that addresses the use of mobile services aboard aircraft.[73] The issues that AT&T and Qualcomm raise regarding the use of Cellular Service spectrum for communications to, from, and onboard aircraft are being dealt with in that proceeding, and we therefore decline to consider the issues here.[74]

26. *Section 22.143(a)—Commencement of Construction Prior to Grant of Application*. Section 22.143 permits applicants to begin construction of PMS facilities prior to grant of their applications; paragraph (a) specifies that such construction may begin "35 days after the date of the Public Notice listing the application for that facility as acceptable for filing."[75] EWA argues that Section 22.143(a) should be deleted, asserting that comparable provisions do not exist for other wireless services, and that other portions of the rule put applicants on notice that they assume the risk of constructing prior

[67] 47 CFR § 22.921 (specifying "analog mode described in the standard document ANSI TIA/EIA-553-A-1999 Mobile Station—Base Station Compatibility Standard (approved October 14, 1999 . . .)" and indicating where it is available for purchase). Specifically, the rule states that the incorporated procedure "must recognize when a 911 call is made and, at such time, must override any programming in the mobile unit that determines the handling of a non-911 call and permit the call to be transmitted through the analog systems of other carriers." *Id*. In addition, at least one of the 911 call system selection processes endorsed or approved by the Commission must be incorporated into the special procedure under this rule. *Id*.

[68] AT&T Comments at 4.

[69] *See* Mobile Deployment Form 477 Data, https://www.fcc.gov/mobile-deployment-form-477-data.

[70] Although AT&T is correct in noting (*see* AT&T Comments at 4) that wireless 911 provisions reside in 47 CFR § 20.18, there is no provision in that rule addressing the specific requirements that apply to Cellular analog systems under 47 CFR § 22.921.

[71] 47 CFR § 22.925. This rule also requires a notice to be posted on or near each Cellular telephone installed in any aircraft, stating that use of Cellular telephones while the aircraft is on the ground is subject to Federal Aviation Administration regulations. *See id*.

[72] AT&T Comments at 4-5; Qualcomm Reply Comments at 2-3 (June 13, 2017). *See also* Letter from Colleen Thompson, Area Manager, Federal Regulatory, AT&T Services, Inc., to Marlene H. Dortch, Secretary FCC (filed Nov. 15, 2017) (AT&T *Ex Parte* Letter) (reporting on a meeting on Nov. 13, 2017, with Commission staff from several bureaus to discuss Section 22.925).

[73] *See Expanding Access to Mobile Wireless Service Onboard Aircraft*, WT Docket No. 13-301, Notice of Proposed Rulemaking, 29 FCC Rcd 17132 (2013) (Airborne Wireless proceeding).

[74] AT&T filed reply comments in the Airborne Wireless proceeding (i.e., WT Docket No. 13-301); it also filed in that docket a copy of the AT&T *Ex Parte* Letter filed in the instant Cellular Reform docket.

[75] 47 CFR § 22.143 (specifying also, however, that applicants must not *operate* such facilities until the Commission grants the application).

to grant.[76] We disagree. The same Public-Notice-plus-35-day period is specified in Section 90.169 of our rules for several other commercial wireless radio services.[77] Pre-grant construction under Section 22.143 is subject to several conditions, including, among others, that no petitions to deny or mutually exclusive (competing) applications have been filed.[78] When the Commission reduced the waiting period from the original 60-day and 90-day post-Public Notice periods to the existing "Public-Notice-plus-35-days" provision, it agreed that applicants should know within that timeframe whether any petition to deny or competing application had been filed, and retained these conditions to disallow construction "when we can not be reasonably certain that we will be able to grant the application."[79] The Commission has also recognized that, "[b]ecause construction of [PMS] facilities entails not only the financial risk to the applicant . . . but also environmental and other consequences affecting the public, . . . it would not be in the public interest to allow construction . . . until it is reasonably certain that the facilities can be authorized."[80] In a similar vein, it is in the public interest to minimize the Commission's risk of having to expend taxpayer resources to issue notification to the applicant, pursuant to Section 22.143(b), to stop construction.[81] For all these reasons, we decline to delete Section 22.143(a) at this time.

VI. PROCEDURAL MATTERS

27. *Paperwork Reduction Act Analysis*. The Third Report and Order contains new and modified information collection requirements subject to the Paperwork Reduction Act of 1995 (PRA).[82] It will be submitted to the Office of Management and Budget (OMB) for review under Section 3507(d) of the PRA. OMB, the general public, and other Federal agencies will be invited to comment on the new and modified information collection requirements contained in the rules adopted in this proceeding.[83] In addition, pursuant to the Small Business Paperwork Relief Act of 2002,[84] the Commission previously sought specific comment on how the Commission might further reduce the information collection burden for small business concerns with fewer than 25 employees. We have assessed the effects of the rule changes we are adopting on small business concerns and find that businesses with fewer than 25 people will benefit from the additional reforms, i.e., deletion of Sections 22.3, 22.301, 22.303, 22.321, 22.325, and 22.927, which will provide added flexibility for Cellular licensees no matter their size.

28. *Congressional Review Act*. The Commission will send a copy of today's Third Report and Order to Congress and the Government Accountability Office pursuant to the Congressional Review

[76] EWA *Ex Parte* Letter at 4.

[77] 47 CFR § 90.169(a).

[78] 47 CFR § 22.143(d)(1), (2).

[79] *Revision of Part 22 of the Commission's Rules Governing the Public Mobile Services, et al*., CC Docket Nos. 95-115, 94-46, and 93-116, RM No. 8367, Report and Order, 9 FCC Rcd 6513, 6552-63 (1994) (*Part 22 Rewrite Order*) (adding that, if a petition to deny is filed, "it brings into question whether the application can be granted"; also noting that the previous waiting period was 60 days after the date of the public notice announcing tentative selectees for the Cellular Service, and 90 days after release of the applicable acceptable for filing public notice for the Paging and Radiotelephone Service).

[80] *Part 22 Rewrite Order*, 9 FCC Rcd at 6553. Note that, for applicants for licenses awarded by competitive bidding, which includes commercial wireless services such as PCS and AWS, the Commission has also established a waiting period, tailored to our competitive bidding process: pre-grant construction is permitted only upon release of the Public Notice listing the post-auction long-form application for that facility as acceptable for filing (by which time, mutual exclusivity has been eliminated and the Commission is reasonably certain that the application can be granted). *See* 47 CFR § 1.2113.

[81] 47 CFR § 22.143(b).

[82] Pub. L. No. 104-13.

[83] The Commission will publish a notice in the *Federal Register* inviting the public to comment on the new and modified requirements, as required by the PRA. *See* 44 U.S.C. §§ 3501-3520.

[84] Public Law 107-198, *see* 44 U.S.C. § 3506(c)(4).

Act.[85]

29. *Final Regulatory Flexibility Analysis*. The Regulatory Flexibility Act of 1980, as amended (RFA), requires that an agency prepare a regulatory flexibility analysis for notice and comment rulemakings, unless the agency certifies that "the rule will not, if promulgated, have a significant economic impact on a substantial number of small entities."[86] Accordingly, we have prepared a Final Regulatory Flexibility Analysis (FRFA) concerning the possible impact on small entities of the rule changes contained in the Third Report and Order. The FRFA is attached as Appendix B. The Commission will send a copy of this Third Report and Order, including the FRFA, to the Chief Counsel for Advocacy of the Small Business Administration.

30. *Contact Information*. For further information regarding this Third Report and Order, contact Nina Shafran at (202) 418-2781, or Nina.Shafran@fcc.gov.

VII. ORDERING CLAUSES

31. Accordingly, IT IS ORDERED, pursuant to Sections 1, 2, 4(i), 4(j), 7, 301, 303, 307, 308, 309, and 332 of the Communications Act of 1934, as amended, 47 U.S.C. §§ 151, 152, 154(i), 154(j), 157, 301, 303, 307, 308, 309, and 332, that this THIRD REPORT AND ORDER in WT Docket No. 12-40 IS ADOPTED.

32. IT IS FURTHER ORDERED that the THIRD REPORT AND ORDER SHALL BE EFFECTIVE 30 days after publication of a summary in the *Federal Register*.

33. IT IS FURTHER ORDERED that Part 22 of the Commission's rules, 47 CFR Part 22, IS AMENDED as specified in Appendix A, effective 30 days after publication in the *Federal Register* except as otherwise provided herein.

34. IT IS FURTHER ORDERED that the amendment adopted in this THIRD REPORT AND ORDER, and specified in Appendix A, to 47 CFR § 22.303, which contains new or modified information collection requirements that require approval by the Office of Management and Budget (OMB) under the Paperwork Reduction Act, WILL BECOME EFFECTIVE after OMB review and approval, on the effective date specified in a notice that the Commission will publish in the *Federal Register* announcing such approval and effective date.

35. IT IS FURTHER ORDERED that this Cellular Reform proceeding in WT Docket No. 12-40, including RM Nos. 11510 and 11660, IS HEREBY TERMINATED.

36. IT IS FURTHER ORDERED, pursuant to Section 801(a)(1)(A) of the Congressional Review Act, 5 U.S.C. § 801(a)(1)(A), that the Commission SHALL SEND a copy of the THIRD REPORT AND ORDER to Congress and to the Government Accountability Office.

[85] *See* 5 U.S.C. § 801(a)(1)(A).

[86] 5 U.S.C. §§ 601 *et seq*.

37. IT IS FURTHER ORDERED that the Commission's Consumer and Governmental Affairs Bureau, Reference Information Center, SHALL SEND a copy of the THIRD REPORT AND ORDER, including the Final Regulatory Flexibility Analysis, to the Chief Counsel for Advocacy of the Small Business Administration.

FEDERAL COMMUNICATIONS COMMISSION

Marlene H. Dortch
Secretary

APPENDIX A

Final Rules

Part 22 of Title 47 of the Code of Federal Regulations is amended as follows:

PART 22—PUBLIC MOBILE SERVICES

1. The authority citation for part 22 continues to read as follows:

   Authority: 47 U.S.C. 154, 222, 303, 309 and 332.

2. Section 22.3 is removed and reserved.

§ 22.3 [Reserved]

3. Section 22.301 is removed and reserved.

§ 22.301 [Reserved]

4. Section 22.303 is removed and reserved.

§ 22.303 [Reserved]

5. Section 22.321 is removed and reserved.

§ 22.321 [Reserved]

6. Section 22.325 is removed and reserved.

§ 22.325 [Reserved]

7. Section 22.927 is removed and reserved.

§ 22.927 [Reserved]

APPENDIX B

Final Regulatory Flexibility Analysis

1. As required by the Regulatory Flexibility Act of 1980, as amended (RFA),[1] an Initial Regulatory Flexibility Analysis (IRFA) was incorporated in the *Second Further Notice of Proposed Rulemaking* (*Second Further Notice*), released in March 2017.[2] The Commission sought written public comment on the proposals in the *Second Further Notice*, including comment on the IRFA. This present Final Regulatory Flexibility Analysis (FRFA) conforms to the RFA.[3]

A. Need for and Objectives of the Rules

2. In the *Third Report and Order*, the Commission takes additional steps to reduce unnecessary regulatory burdens, not only for licensees in the 800 MHz Cellular Radiotelephone (Cellular) Service, but for other Part 22 licensees as well. The revisions will provide Cellular and other Part 22 licensees with more consistency in licensing across commercial wireless services as well as enhanced flexibility, thereby freeing up more resources for investment in new technologies and greater spectrum efficiency to meet increasing consumer demand for advanced wireless services. With this *Third Report and Order*, we conclude an important chapter in the Commission's extensive regulatory reform agenda, and we terminate the proceeding in WT Docket No. 12-40, including RM Nos. 11510 and 11660.

3. Specifically, we delete the following administrative and recordkeeping rules for all Part 22 licensees: Sections 22.301 and 22.303, concerning station inspections and the retention of hard copies of station authorizations and other station records; and Section 22.325, concerning station control points and personnel on duty at those control points.[4] Removing these provisions will eliminate needless burdens that are inconsistent with the Commission's practices and with the predominant use of electronic records storage and access, and will also eliminate asymmetry across competing commercial mobile radio services (CMRS), as the Commission's rules for newer wireless services such as PCS, certain AWS, and the 700 MHz Service do not include such provisions. These rules were adopted more than two decades ago, establishing obligations for which there is no longer a benefit to outweigh the costs and burdens of compliance imposed on licensees. In addition, we delete Sections 22.3 and 22.927, which set forth service provider obligations concerning their authorizations and subscribers' Cellular mobile stations, as these rules are no longer necessary. We also delete Section 22.321, concerning equal employment opportunity programs, policies, and complaint reports, as duplicative of other regulations.

4. In the absence of strong support on the record, the Commission declines at this time to pursue the issues of possible relocation of the Part 22 Cellular, Part 24 PCS, and other wireless mobile service rules into a single set of regulations, and possible reorganization of the Part 27 rules. The

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[1] *See* 5 U.S.C. § 603. The RFA, *see* 5 U.S.C. §§ 601 – 612, has been amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA), Pub. L. No. 104-121, Title II, 110 Stat. 857 (1996).

[2] *See Amendment of Parts 1 and 22 of the Commission's Rules with Regard to the Cellular Service, Including Changes in Licensing of Unserved Area*, *Amendment of the Commission's Rules with Regard to Relocation of Part 24 to Part 27; Interim Restrictions and Procedures for Cellular Service Applications*; *Amendment of Parts 0, 1, and 22 of the Commission's Rules with Regard to Frequency Coordination for the Cellular Service*; *Amendment of the Commission's Rules Governing Radiated Power Limits for the Cellular Service*; *Amendment of Parts 1, 22, 24, 27, 74, 80, 90, 95, and 101 to Establish Uniform License Renewal, Discontinuance of Operation, and Geographic Partitioning and Spectrum Disaggregation Rules and Policies for Certain Wireless Radio Services; 2016 Biennial Review of Telecommunications Regulations*, WT Docket Nos. 12-40, 10-112, and 16-138, RM Nos. 11510 and 11660, Second Report and Order, Report and Order, and Second Further Notice of Proposed Rulemaking, 32 FCC Rcd 2518 (2017) (herein, "*Second Further Notice*").

[3] *See* 5 U.S.C. § 604.

[4] 47 CFR §§ 22.301, 22.303, 22.325.

Commission also declines to delete, as requested by certain commenters, two Cellular Service rules—Sections 22.921 and 22.925—and Section 22.143(a), which applies to all Part 22 licensees. The Commission finds that Sections 22.921 and 22.143(a) continue to serve the public interest, and the restrictions in Section 22.925 are being addressed in a separate proceeding.

B. Summary of Significant Issues Raised by Public Comments in Response to the IRFA

5. There were no comments filed that specifically addressed the rules and policies proposed in the IRFA.

C. Response to Comments by the Chief Counsel for Advocacy of the Small Business Administration

6. Pursuant to the Small Business Jobs Act of 2010, which amended the RFA, the Commission is required to respond to any comments filed by the Chief Counsel for Advocacy of the Small Business Administration (SBA), and to provide a detailed statement of any change made to the proposed rules as a result of those comments.[5]

7. The Chief Counsel did not file any comments in response to the proposed rules in this proceeding.

D. Description and Estimate of the Number of Small Entities to Which the Rules Will Apply

8. The RFA directs agencies to provide a description of, and where feasible, an estimate of the number of small entities that may be affected by the rules adopted herein.[6] The RFA generally defines the term "small entity" as having the same meaning as the terms "small business," "small organization," and "small governmental jurisdiction."[7] In addition, the term "small business" has the same meaning as the term "small business concern" under the Small Business Act.[8] A "small business concern" is one which: (1) is independently owned and operated; (2) is not dominant in its field of operation; and (3) satisfies any additional criteria established by the SBA.[9]

9. *Small Businesses, Small Organizations, and Small Governmental Jurisdictions*. Our actions, over time, may affect small entities that are not easily categorized at present. We therefore describe here, at the outset, three broad groups of small entities that could be directly affected herein.[10] First, while there are industry specific size standards for small businesses that are used in the regulatory flexibility analysis, according to data from the SBA's Office of Advocacy, in general a small business is an independent business having fewer than 500 employees.[11] These types of small businesses represent 99.9% of all businesses in the United States, which translates to 28.8 million businesses.[12]

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[5] 5 U.S.C. § 604(a)(3).

[6] *See* 5 U.S.C. § 604(a)(3).

[7] 5 U.S.C. § 601(6).

[8] 5 U.S.C. § 601(3) (incorporating by reference the definition of "small-business concern" in the Small Business Act, 15 U.S.C. § 632). Pursuant to 5 U.S.C. § 601(3), the statutory definition of a small business applies "unless an agency, after consultation with the Office of Advocacy of the Small Business Administration and after opportunity for public comment, establishes one or more definitions of such term which are appropriate to the activities of the agency and publishes such definition(s) in the Federal Register."

[9] 15 U.S.C. § 632(a).

[10] *See* 5 U.S.C. § 601(3)-(6).

[11] *See* SBA, Office of Advocacy, "Frequently Asked Questions, Question 1 – What is a small business?" https://www.sba.gov/sites/default/files/advocacy/SB-FAQ-2016_WEB.pdf (June 2016).

10. Next, the type of small entity described as a "small organization" is generally "any not-for-profit enterprise which is independently owned and operated and is not dominant in its field."[13] Nationwide, as of August 2016, there were approximately 356,494 small organizations based on registration and tax data filed by nonprofits with the Internal Revenue Service (IRS).[14]

11. Finally, the small entity described as a "small governmental jurisdiction" is defined generally as "governments of cities, counties, towns, townships, villages, school districts, or special districts, with a population of less than fifty thousand."[15] U.S. Census Bureau data from the 2012 Census of Governments[16] indicate that there were 90,056 local governmental jurisdictions consisting of general purpose governments and special purpose governments in the United States.[17] Of this number there were 37,132 general purpose governments (county,[18] municipal and town or township[19]) with populations of less than 50,000 and 12,184 special purpose governments (independent school districts[20] and special districts[21]) with populations of less than 50,000. The 2012 U.S. Census Bureau data for most types of governments in the local government category show that the majority of these governments have

(Continued from previous page)

[12] *See* SBA, Office of Advocacy, "Frequently Asked Questions, Question 2- How many small businesses are there in the U.S.?" https://www.sba.gov/sites/default/files/advocacy/SB-FAQ-2016_WEB.pdf (June 2016).

[13] 5 U.S.C. § 601(4).

[14] Data from the Urban Institute, National Center for Charitable Statistics (NCCS) reporting on nonprofit organizations registered with the IRS was used to estimate the number of small organizations. Reports generated using the NCCS online database indicated that as of August 2016 there were 356,494 registered nonprofits with total revenues of less than $100,000. Of this number, 326,897 entities filed tax returns with 65,113 registered nonprofits reporting total revenues of $50,000 or less on the IRS Form 990-N for Small Exempt Organizations and 261,784 nonprofits reporting total revenues of $100,000 or less on some other version of the IRS Form 990 within 24 months of the August 2016 data release date. *See* http://nccs.urban.org/sites/all/nccs-archive/html//tablewiz/tw.php where the report showing this data can be generated by selecting the following data fields: Report: "The Number and Finances of All Registered 501(c) Nonprofits"; Show: "Registered Nonprofits"; By: "Total Revenue Level (years 1995, Aug to 2016, Aug)"; and For: "2016, Aug" then selecting "Show Results".

[15] 5 U.S.C. § 601(5).

[16] *See* 13 U.S.C. § 161. The Census of Government is conducted every five (5) years compiling data for years ending with "2" and "7". *See also* Program Description Census of Government https://factfinder.census.gov/faces/affhelp/jsf/pages/metadata.xhtml?lang=en&type=program&id=program.en.COG#

[17] *See* U.S. Census Bureau, 2012 Census of Governments, Local Governments by Type and State: 2012 - United States-States. https://factfinder.census.gov/bkmk/table/1.0/en/COG/2012/ORG02.US01. Local governmental jurisdictions are classified in two categories - General purpose governments (county, municipal and town or township) and Special purpose governments (special districts and independent school districts).

[18] *See* U.S. Census Bureau, 2012 Census of Governments, County Governments by Population-Size Group and State: 2012 - United States-States. https://factfinder.census.gov/bkmk/table/1.0/en/COG/2012/ORG06.US01. There were 2,114 county governments with populations less than 50,000.

[19] *See* U.S. Census Bureau, 2012 Census of Governments, Subcounty General-Purpose Governments by Population-Size Group and State: 2012 - United States – States. https://factfinder.census.gov/bkmk/table/1.0/en/COG/2012/ORG07.US01. There were 18,811 municipal and 16,207 town and township governments with populations less than 50,000.

[20] *See* U.S. Census Bureau, 2012 Census of Governments, Elementary and Secondary School Systems by Enrollment-Size Group and State: 2012 - United States-States. https://factfinder.census.gov/bkmk/table/1.0/en/COG/2012/ORG11.US01. There were 12,184 independent school districts with enrollment populations less than 50,000.

[21] *See* U.S. Census Bureau, 2012 Census of Governments, Special District Governments by Function and State: 2012 - United States-States, https://factfinder.census.gov/bkmk/table/1.0/en/COG/2012/ORG09.US01. The U.S. Census Bureau data did not provide a population breakout for special district governments.

populations of less than 50,000.[22] Based on this data, we estimate that at least 49,316 local government jurisdictions fall in the category of "small governmental jurisdictions."[23]

12. *Wireless Telecommunications Carriers (except Satellite)*. This industry comprises establishments engaged in operating and maintaining switching and transmission facilities to provide communications via the airwaves. Establishments in this industry have spectrum licenses and provide services using that spectrum, such as cellular services, paging services, wireless internet access, and wireless video services.[24] The appropriate size standard under SBA rules is that such a business is small if it has 1,500 or fewer employees.[25] For this industry, U.S. Census Bureau data for 2012 show that there were 967 firms that operated for the entire year.[26] Of this total, 955 firms had employment of 999 or fewer employees and 12 had employment of 1000 employees or more.[27] Thus, under this category and the associated size standard, the Commission estimates that the majority of wireless telecommunications carriers (except satellite) are small entities.

13. The Commission's own data—available in its Universal Licensing System (ULS)—indicate that, as of May 17, 2018, there are 264 Cellular Service licensees that will be affected by our actions today.[28] The Commission does not know how many of these licensees are small, as the Commission does not collect that information for these types of entities. Also, according to internally developed Commission data, 413 carriers reported that they were engaged in the provision of wireless telephony, including the Cellular Service, PCS, and Specialized Mobile Radio (SMR) services.[29] Of this total, an estimated 261 have 1,500 or fewer employees.[30] Thus, using available data, we estimate that the majority of wireless firms can be considered small.

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[22] *See* U.S. Census Bureau, 2012 Census of Governments, County Governments by Population-Size Group and State: 2012 - United States-States - https://factfinder.census.gov/bkmk/table/1.0/en/COG/2012/ORG06.US01; Subcounty General-Purpose Governments by Population-Size Group and State: 2012 - United States–States - https://factfinder.census.gov/bkmk/table/1.0/en/COG/2012/ORG07.US01; and Elementary and Secondary School Systems by Enrollment-Size Group and State: 2012 - United States-States. https://factfinder.census.gov/bkmk/table/1.0/en/COG/2012/ORG11.US01. While U.S. Census Bureau data did not provide a population breakout for special district governments, if the population of less than 50,000 for this category of local government is consistent with the other types of local governments, the majority of the 38, 266 special district governments have populations of less than 50,000.

[23] *Id.*

[24] U.S. Census Bureau, 2012 NAICS Definitions, "517210 Wireless Telecommunications Carriers (Except Satellite)," *See* https://factfinder.census.gov/faces/affhelp/jsf/pages/metadata.xhtml?lang=en&type=ib&id=ib.en./ECN.NAICS2012.517210.

[25] 13 CFR § 121.201, NAICS code 517210.

[26] U.S. Census Bureau, *2012 Economic Census of the United States*, Table EC1251SSSZ5, Information: Subject Series: Estab and Firm Size: Employment Size of Firms for the U.S.: 2012 NAICS Code 517210. https://factfinder.census.gov/bkmk/table/1.0/en/ECN/2012_US/51SSSZ5//naics~517210.

[27] *Id*. Available census data does not provide a more precise estimate of the number of firms that have employment of 1,500 or fewer employees; the largest category provided is for firms with "1000 employees or more."

[28] *See* http://wireless.fcc.gov/uls. For the purposes of this FRFA, consistent with Commission practice for wireless services, the Commission estimates the number of licensees based on the number of unique FCC Registration Numbers.

[29] *See* Federal Communications Commission, Wireline Competition Bureau, Industry Analysis and Technology Division, Trends in Telephone Service at Table 5.3 (Sept. 2010), https://apps.fcc.gov/edocs_public/attachmatch/DOC-301823A1.pdf.

[30] *Id.*

E. Description of Projected Reporting, Recordkeeping, and Other Compliance Requirements for Small Entities

14. The *Third Report and Order* does not impose any additional reporting, recordkeeping, or other compliance requirements on small entities, nor on any other entities. Rather, it eliminates several existing reporting and recordkeeping requirements, which will benefit small entities as well as all other entities that operate Cellular Service facilities. The deleted rules include Sections 22.301 and 22.303, which collectively require that hard copies of license authorizations and other records be maintained by all Part 22 licensees for each station, and that such records and the station itself be made available for inspection upon request.[31] Small entities as well as other Part 22 entities will no longer be burdened by these requirements. Licensees will continue to have access to their official authorizations in the ULS, which is available electronically at all times. Similarly, members of the public will continue to have access to reference copies in the ULS, which reflects the most up-to-date information concerning all authorizations.

15. The *Third Report and Order* also deletes Section 22.325, which requires that "[e]ach station in the Public Mobile Services [ ] have at least one control point and a person on duty who is responsible for station operation."[32] The requirement has become technologically obsolete, as commercial wireless licensees routinely monitor their network operations by automatic and remote mechanisms. Part 22 licensees, including small entities, will no longer be burdened by it, thus freeing up their resources and providing them with the same flexibility as other CMRS licensees to determine how to manage their networks to comply with the Commission's operational rules.

16. All CMRS licensees will continue to be subject to the current annual equal employment opportunity (EEO) complaints report filing requirement. The requirement is set forth in Section 22.321(c), which applies to Part 22 licensees regardless of size, and is also set forth in the later-adopted Section 90.168(c), which applies more broadly to *all* CMRS licensees regardless of size.[33] Section 90.168 contains the same provisions as Section 22.321, including Section 22.321(c), and thus it subsumes Section 22.321 in its entirety. On this basis, the Commission deletes Section 22.321 in its entirety as duplicative.

17. The *Third Report and Order* deletes two other rules: Section 22.3, which applies to all Part 22 licensees, and Section 22.927, which applies only to Cellular Service licensees. Both rules set forth certain licensee obligations concerning operations pursuant to a valid FCC authorization, and service to subscribers of a different commercial wireless system (i.e., "roamers"). A later-adopted rule, Section 1.903, which applies to numerous wireless services, including all Part 22 licensees, imposes essentially the same obligations as Sections 22.3 and 22.927, thus rendering these Part 22 rules duplicative. By deleting Sections 22.321, 22.3, and 22.927, the Commission removes licensees' compliance obligations under one group of regulations where the same obligations exist under different provisions, and thereby simplifies compliance by eliminating regulations that are largely duplicative.

18. Small entities and other licensees will also continue to be subject to Section 22.921, requiring certain Cellular Service mobile telephones that are capable of operating in the analog mode to "incorporate a special procedure for processing 911 calls,"[34] and Section 22.143(a), which allows applicants to begin construction of Public Mobile Services (PMS) facilities "35 days after the date of the

[31] Deletion of these rules does not affect the Commission's statutory station inspection authority. *See* 47 U.S.C. § 303(n).

[32] 47 CFR § 22.325.

[33] 47 CFR § 22.321(c).

[34] 47 CFR § 22.921.

Public Notice listing the application for that facility as acceptable for filing."[35] Commenters have not demonstrated that these rules are burdensome or no longer needed. Moreover, the Commission finds that these regulations continue to serve the public interest.

F. Steps Taken to Minimize the Significant Economic Impact on Small Entities, and Significant Alternatives Considered

19. The RFA requires an agency to describe any significant alternatives that it has considered in reaching its approach, which may include the following four alternatives (among others): "(1) the establishment of differing compliance or reporting requirements or timetables that take into account the resources available to small entities; (2) the clarification, consolidation, or simplification of compliance and reporting requirements under the rule for such small entities; (3) the use of performance rather than design standards; and (4) an exemption from coverage of the rule, or any part thereof, for such small entities."[36]

20. The rules eliminated in the *Third Report and Order* are expected to have a beneficial economic impact on small entities because all Cellular Service and other Part 22 licensees will be subject to fewer recordkeeping, reporting, and compliance burdens. While the record does not enable a precise quantification of costs and benefits, we know that these requirements impose burdens that require expenditures of personnel and other resources. Specifically, removal of the requirements under Sections 22.301 and 22.303 to print (or request that the Commission print and mail) hard copies of FCC authorizations and retain them as part of each station's records every time the Commission grants an application will allow small entities and other Part 22 licensees to rely on the electronic availability of such authorizations in ULS, thereby realizing long-term cost savings. Similarly, elimination of the requirement under Section 22.325 to maintain control points for each station and to have a person on duty in charge of station operations is expected to decrease the costs of maintaining facilities and to allow small entities as well as licensees of all sizes to realize the cost savings inherent in remote monitoring and automatic functions for station operations. Likewise, the deletion of Sections 22.3, 22.321, and 22.927 will simplify compliance burdens by removing duplicative regulations. In addition, all of the rule deletions adopted in the *Third Report and Order* put Cellular Service and other Part 22 licensees more on regulatory par with licensees in competing CMRS such as PCS, AWS, and the 700 MHz Service.

21. A few commenters suggested that the Commission could eliminate the annual EEO complaints report requirement for licensees with fewer than 16 full-time employees. However, the commenters failed to take note of the fact that same requirement is also in another rule part that applies to *all* CMRS licensees—a rule that is outside the scope of this proceeding. Thus, the Commission declined to eliminate this requirement. In any event, the commenters that focused on Section 22.321(c) failed to demonstrate adequately why licensees with fewer than 16 employees should be exempt from the requirement.

22. The Commission also declined to delete three rules—Sections 22.925, 22.921, and 22.143(a)—raised by commenters. Section 22.925 prohibits the operation of Cellular Service mobiles aboard "airplanes, balloons or any other type of aircraft . . . while such aircraft are airborne . . . ."[37] The issues raised by commenters regarding this prohibition are being addressed by the Commission in another proceeding, WT Docket No. 13-301, and therefore the Commission declines to consider them here. Regarding Section 22.921, contrary to commenters' understanding, Commission data show that analog technology is still being used in the Cellular Service band.[38] The specific requirements in Section 22.921 thus continue to ensure that 911 calls get through even when analog technology is used by Cellular carriers. The other rule that was considered but not deleted is Section 22.143(a), which permits applicants

[35] 47 CFR § 22.143(a).

[36] 5 U.S.C. § 603(c)(1) - (4).

[37] 47 CFR § 22.925.

[38] *See* Mobile Deployment Form 77 Data, https://www.fcc.gov/mobile-deployment-form-477-data.

to begin construction of PMS facilities prior to grant of their applications.[39] The Commission finds that this rule also continues to serve the public interest. The 35-day waiting period for commencing pre-grant construction, which a commenter raised for deletion, allows time for the Commission to be reasonably certain that it will be able to grant the application for the facility at issue (including determining that no petitions to deny or competing applications have been timely filed).

Report to Congress

The Commission will send a copy of the *Third Report and Order*, including this FRFA, in a report to Congress pursuant to the Congressional Review Act.[40] In addition, the Commission will send a copy of the *Third Report and Order*, including this FRFA, to the Chief Counsel for Advocacy of the SBA. A copy of the *Third Report and Order* and FRFA (or summaries thereof) also will be published in the *Federal Register*.[41]

[39] 47 CFR § 22.143 (specifying also, however, that applicants must not *operate* such facilities until the Commission grants the application).

[40] 5 U.S.C. § 801(a)(1)(A).

[41] 5 U.S.C. § 604(b).

APPENDIX C

List of Commenters

Comments

AT&T Services, Inc. (AT&T)
CTIA
Critical Messaging Association
Enterprise Wireless Alliance (EWA)
Verizon

Reply Comments

Qualcomm Incorporated

Ex Parte Letters

AT&T
EWA
Gogo Inc.

STATEMENT OF
CHAIRMAN AJIT PAI

Re: *Amendment of Parts 1 and 22 of the Commission's Rules with Regard to the Cellular Service, Including Changes in Licensing of Unserved Area*, WT Docket No. 12-40, RM No. 11510; *Amendment of the Commission's Rules with Regard to Relocation of Part 24 to Part 27; Interim Restrictions and Procedures for Cellular Service Applications; Amendment of Parts 0, 1, and 22 of the Commission's Rules with Regard to Frequency Coordination for the Cellular Service; Amendment of Part 22 of the Commission's Rules Regarding Certain Administrative and Filing Requirements; Amendment of the Commission's Rules Governing Radiated Power Limits for the Cellular Service*, RM No. 11660; *Amendments of Parts 1, 22, 24, 27, 74, 80, 90, 95, and 101 to Establish Uniform License Renewal, Discontinuance of Operation, and Geographic Partitioning and Spectrum Disaggregation Rules and Policies for Certain Wireless Radio Services*, WT Docket No. 10-112; *2016 Biennial Review of Telecommunications Regulations*, WT Docket No. 16-138.

Throughout my tenure, I've emphasized the need to eliminate unnecessary and outdated regulations. And in this *Order* alone, we're eliminating six such rules. Three of them impose antiquated administrative and recordkeeping burdens on a subset of wireless licensees, including those in the 800 MHz cellular band. For instance, licensees have to maintain hard copies of such authorizations and make them available for inspection by the Commission. Given that license authorizations are now available electronically through the Commission's Universal Licensing System (ULS), this is pointless. The other three rules that we're removing from the Code of Federal Regulations apply to the same subset of wireless licensees but are duplicative of rules contained elsewhere. They serve no purpose but to clutter our rulebook.

Many thanks to the staff who worked on this item. From the Wireless Telecommunications Bureau: Linda Chang, Thomas Derenge, Chas Eberle, Jessica Greffenius, Roger Noel, Thomas Reed, Moslem Sawez, Nina Shafran, Don Stockdale, Cecelia Sulhoff, and Suzanne Tetreault; from the Office of General Counsel: Deborah Broderson, David Horowitz, and Bill Richardson; from the Office of Communications Business Opportunities: Sanford Williams and Chana Wilkerson; from the Wireline Competition Bureau: Suzanne Yellen; and from the Media Bureau: Lewis Pulley.

Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	
Amendment of Parts 1 and 22 of the Commission's Rules with Regard to the Cellular Service, Including Changes in Licensing of Unserved Area	)	WT Docket No. 12-40 (*terminated*) RM No. 11510 (*terminated*)
	)	
Amendment of the Commission's Rules with Regard to Relocation of Part 24 to Part 27	)	
	)	
Interim Restrictions and Procedures for Cellular Service Applications	)	
	)	
Amendment of Parts 0, 1, and 22 of the Commission's Rules with Regard to Frequency Coordination for the Cellular Service	)	
	)	
Amendment of Part 22 of the Commission's Rules Regarding Certain Administrative and Filing Requirements	)	
	)	
Amendment of the Commission's Rules Governing Radiated Power Limits for the Cellular Service	)	RM No. 11660 (*terminated*)
	)	
Amendment of Parts 1, 22, 24, 27, 74, 80, 90, 95, and 101 to Establish Uniform License Renewal, Discontinuance of Operation, and Geographic Partitioning and Spectrum Disaggregation Rules and Policies for Certain Wireless Radio Services	)	WT Docket No. 10-112
	)	
2016 Biennial Review of Telecommunications Regulations	)	WT Docket No. 16-138

THIRD REPORT AND ORDER

Adopted: July 12, 2018 **Released: July 13, 2018**

By the Commission: Chairman Pai issuing a statement.

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I. INTRODUCTION

1. In this Third Report and Order, we take additional steps to reduce unnecessary regulatory burdens for licensees in the 800 MHz Cellular Radiotelephone (Cellular) Service as well as other Part 22 licensees, thereby freeing up more resources for investment in new technologies and greater spectrum efficiency to meet increasing consumer demand for advanced wireless services. Specifically, we modernize our rules by eliminating several Part 22 recordkeeping and reporting obligations that were adopted more than two decades ago—obligations for which there is no longer a benefit to outweigh the compliance costs and burdens imposed on licensees. We also eliminate certain Cellular Service-specific rules that are no longer necessary. Our revisions today will provide Cellular and other Part 22 licensees with enhanced flexibility and advance our goal of ensuring more consistency in licensing across commercial wireless services, while taking into account unique features of each service. With this Third Report and Order we conclude an important chapter in the Commission's extensive regulatory reform agenda and terminate the proceeding in WT Docket No. 12-40, including RM Nos. 11510 and 11660.

II. BACKGROUND

2. In 1981, the Commission adopted its initial Cellular Service rules; these provided the foundation of the commercial wireless industry and made mobile services broadly available to the American public nationwide.[1] In 2012, the Commission released a Cellular Reform *Notice of Proposed Rulemaking,* which was intended to modernize the legacy site-based Cellular licensing scheme and transition it to a geographically based licensing model.[2] In 2014, the Commission adopted a *Report and Order* (*R&*O)*,* which modernized Cellular Service licensing in several respects.[3] The centerpiece of the *R&O* was the adoption of a geographically-based licensing regime, with licenses based on Cellular Geographic Service Area (CGSA) boundaries; this added significant new flexibility for licensees to

[1] *See generally An Inquiry Into the Use of the Bands 825-845 MHz and 870-890 MHz for Cellular Communications Systems; and Amendment of Parts 2 and 22 of the Commission's Rules Relative to Cellular Communications Systems,* CC Docket No. 79-318, Report and Order*,* 86 F.C.C.2d 469 (1981).

[2] *Amendment of Parts 1 and 22 of the Commission's Rules with Regard to the Cellular Service, Including Changes in Licensing of Unserved Area*; *Amendment of the Commission's Rules with Regard to Relocation of Part 24 to Part 27*; *Interim Restrictions and Procedures for Cellular Service Applications*, WT Docket No. 12-40, RM No. 11510, Notice of Proposed Rulemaking and Order, 27 FCC Rcd 1745, 1747 n.3, 1750-52, 1758 (2012) (*NPRM*). Under the legacy site-based model, applications with comprehensive technical data and prior FCC approval had been required for new Cellular systems and for modifications of an existing system that would expand the licensee's authorized Cellular Geographic Service Area (CGSA), no matter how slight the expansion. Based on Commission data when it released the *NPRM*, approximately 80 percent of the 1,468 Cellular Market Area (CMA) channel blocks were almost completely licensed already, with only limited unlicensed area remaining, primarily in Alaska and other rural areas in the western United States. *See NPRM*, 27 FCC Rcd at 1747, 1750-55, 1768-1769.

[3] *Amendment of Parts 1 and 22 of the Commission's Rules with Regard to the Cellular Service, Including Changes in Licensing of Unserved Area, et al.,* WT Docket No. 12-40, RM Nos. 11510 and 11660, Report and Order and Further Notice of Proposed Rulemaking, 29 FCC Rcd 14100 (2014) (*R&O* and *Further Notice,* respectively).

improve their systems within those boundaries.[4] The *R&O* also added significant opportunities for licensees to expand their service coverage without prior authorization, resulting in a substantial reduction in administrative burdens for both licensees and FCC staff.[5] In the *Further Notice*, the Commission proposed additional Cellular licensing reforms and overdue reforms of the Cellular radiated power and related technical rules that could facilitate the ability of Cellular licensees to deploy advanced broadband services.[6]

3. In the 2017 *Second Report and Order*, the Commission modernized numerous Cellular technical rules, including the outdated radiated power and related rules, to permit power measurement using power spectral density.[7] These changes facilitate the use of Cellular spectrum to provide advanced mobile broadband services, such as 4G long term evolution (LTE), while protecting public safety communications from increased potential for unacceptable interference.[8] The *Second R&O* also revised rules to further eliminate unnecessary filings and other regulatory burdens for Cellular licensees.[9] The Commission's reforms resulted in Cellular Service rules more akin to the flexible licensing schemes found in other similar mobile services, such as the Broadband Personal Communications Service (PCS),[10] the commercial service in the 700 MHz band (700 MHz Service),[11] the 600 MHz Service,[12] and the Advanced Wireless Services (AWS),[13] to help ensure that carriers are treated similarly regardless of technology choice.

4. In the *Second Further Notice*, to build on reforms adopted in the *R&O* and *Second R&O* and to respond to certain submissions by commenters in the Commission's 2016 Biennial Review proceeding,[14] the Commission proposed and sought comment on additional reforms of its Part 22 rules

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[4] See the *R&O* for the full discussion of the revised rules adopted (29 FCC Rcd at 14102-26 (Section II) and 14156-63 (Appendix A (Final Rules)).

[5] *See id*., 29 FCC Rcd at 14115-18. The *R&O* also established a field strength limit rule tailored to reflect the continued ability to expand Cellular service area coverage. *See id*. at 14109-10.

[6] *Further Notice*, 29 FCC Rcd at 14126-52.

[7] *See Amendment of Parts 1 and 22 of the Commission's Rules with Regard to the Cellular Service, Including Changes in Licensing of Unserved Area*, *Amendment of the Commission's Rules with Regard to Relocation of Part 24 to Part 27; Interim Restrictions and Procedures for Cellular Service Applications*; *Amendment of Parts 0, 1, and 22 of the Commission's Rules with Regard to Frequency Coordination for the Cellular Service*; *Amendment of the Commission's Rules Governing Radiated Power Limits for the Cellular Service*; *Amendment of Parts 1, 22, 24, 27, 74, 80, 90, 95, and 101 to Establish Uniform License Renewal, Discontinuance of Operation, and Geographic Partitioning and Spectrum Disaggregation Rules and Policies for Certain Wireless Radio Services; 2016 Biennial Review of Telecommunications Regulations*, WT Docket Nos. 12-40, 10-112, and 16-138, RM Nos. 11510 and 11660, Second Report and Order, Report and Order, and Second Further Notice of Proposed Rulemaking, 32 FCC Rcd 2518 (2017). Herein, we reference the Second Report and Order and the Report and Order collectively as "*Second R&O*"; we reference the Second Further Notice of Proposed Rulemaking as "*Second Further Notice*."

[8] *Second R&O*, 32 FCC Rcd at 2535-56; *see also id*. at 2562-64.

[9] *Id*., 32 FCC Rcd at 2557-61, 2567-70 (adopting a more flexible rule concerning permanent discontinuance of operations, eliminating certain filing requirements for minor system changes, and deleting the Part 22 rules pertaining to Cellular Service license renewals).

[10] *See generally* 47 CFR §§ 24.1 *et seq*.

[11] *See generally* 47 CFR Part 27.

[12] *See generally Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, GN Docket No. 12-268, Report and Order, 29 FCC Rcd 6567 (2014) (*BIA Report and Order*) (subsequent history omitted); 47 CFR § 27.5(l).

[13] *See generally* 47 CFR Part 27.

[14] *Second Further Notice*, 32 FCC Rcd at 2570-75. The Commission had solicited comments in a public notice in its 2016 Biennial Review of Telecommunications Regulations proceeding. *Commission Seeks Public Comment in 2016 Biennial Review of Telecommunications Regulations*, WT Docket No. 16-138 (other docket numbers omitted),

governing not only the Cellular Service but other Part 22 Public Mobile Services (PMS) as well.[15] The Commission also invited comment on whether other measures could be taken to allow Part 22 licensees to benefit from the same level of flexibility available to other commercial wireless licensees.[16] In that context, the Commission raised the possibility of relocating—to Part 27 of the Commission's rules—certain Part 22 rules, as well as the Part 24 PCS rules and other rules governing geographically licensed wireless services.[17]

5. In response to the *Second Further Notice*, five parties filed comments and one party filed reply comments; three parties subsequently filed *ex parte* letters.[18] Commenters generally support the Commission's proposed deletion of the Part 22 rules addressed in the *Second Further Notice*. Only two commenters address the issue of possible relocation of rules to Part 27 and possible reorganization of that rule part—one favoring the idea and the other opposing it. In addition, some commenters propose deleting other rules that had not been previously considered by the Commission in this proceeding. The record and our decisions are set forth below under specific headings pertaining to these various rules and issues.

III. ELIMINATION OF UNNECESSARY RULES

6. In the sections below, we delete the following administrative and recordkeeping rules for Part 22 licensees: Sections 22.301 and 22.303, concerning station inspections and the retention of hard copies of station authorizations and other station records; and Section 22.325, concerning station control points and personnel on duty at those control points.[19] Removing these provisions will eliminate needless burdens that are inconsistent with the Commission's practices and the now-predominant use of electronic records storage and access, and it will also eliminate asymmetry across competing commercial mobile radio services (CMRS), as the Commission's rules for newer wireless services such as PCS, certain AWS, and the 700 MHz Service do not include such provisions. We also delete Section 22.321, concerning equal employment opportunities, as duplicative, as well as Sections 22.3 and 22.927, which set forth service provider obligations concerning their authorizations and subscribers' Cellular mobile stations.[20] These rules are no longer necessary, as explained below.

A. Sections 22.301, 22.303—Station Inspection, Retention of Station Authorizations

7. In the *Second Further Notice*, the Commission proposed and sought comment on deletion of Sections 22.301 and 22.303 of the Commission's rules, which collectively require that hard copies of license authorizations and other records be maintained by all Part 22 licensees for each station and that such records and the station itself be made available for inspection upon request.[21] The Commission

(Continued from previous page)
Public Notice, 31 FCC Rcd 12166, 12174-75 (2016) (*Biennial Review PN*). Although the Commission has considered in this Cellular Reform proceeding certain issues that were initially raised by commenters in response to the *Biennial Review PN* in WT Docket No. 16-138 (WT Biennial Review proceeding), such consideration does not otherwise impact review of other comments and issues raised in response to that *PN*.

[15] The other services governed by Part 22 of our rules are Paging, Air-Ground, Rural, and Offshore Radiotelephone.

[16] *Second Further Notice*, 32 FCC Rcd at 2571, 2574.

[17] *Id*., 32 FCC Rcd at 2574-75.

[18] *See* Appendix C for a list of parties that submitted comments, reply comments, and *ex parte* letters.

[19] 47 CFR §§ 22.301, 22.303, 22.325.

[20] 47 CFR §§ 22.321, 22.3, 22.927.

[21] *Second Further Notice*, 32 FCC Rcd at 2571-72 (citing comments submitted by CTIA and Verizon in response to the *Further Notice*, and by CTIA and T-Mobile USA, Inc. in response to the *Biennial Review PN*). Section 22.301 specifically requires that, "[u]pon reasonable request, the licensee of any station authorized in the Public Mobile Services must make the station and station records available for inspection by authorized representatives of the Commission at any reasonable hour." 47 CFR § 22.301. Noting the rule's requirement that the *station itself*, not just the station's records, be available for inspection by the Commission, the Commission emphasized that,

questioned whether the benefits of maintaining hard copies outweigh the costs and burdens to Part 22 licensees in the age of electronic licensing and recordkeeping, particularly as license authorizations are maintained in the Commission's Universal Licensing System (ULS).[22] The Commission also sought comment on a suggestion that, even if we eliminate Sections 22.301 and 22.303, we should nonetheless affirmatively require Part 22 licensees "to have electronic copies [of licenses] easily accessible to personnel and FCC inspectors."[23]

8. Commenters addressing this issue unanimously endorse the Commission's proposal to delete Sections 22.301 and 22.303; they assert that these administrative requirements are burdensome and inconsistent with today's licensing practices.[24] AT&T and Verizon point out that, since 2014, the Commission has deemed the electronic version of an authorization—stored in ULS—to be the official Commission record, and it no longer sends printed copies of authorizations through the U.S. Postal Service unless so requested by the licensee.[25] The Enterprise Wireless Alliance (EWA) adds that a "physical copy of a license can never be more and could be less up-to-date than ULS data."[26] The commenters further argue that, with the movement to geographic-based licensing (which provides licensees with the flexibility to make certain changes to their systems without Commission filings), individual authorizations are no longer relevant and may not include all operating parameters.[27] This fact of current-day operations, the Critical Messaging Association (CMA) claims, can create problems when state and local officials, unfamiliar with the Commission's geographic licensing model, do not find paper

(Continued from previous page)
regardless of whether we retain a rule in Part 22 explicitly requiring licensees to make their stations available for inspection, we retain our general station inspection authority under Section 303(n) of the Communications Act, 47 U.S.C. § 303(n). *See Second Further Notice,* 32 FCC Rcd at 2572. Section 22.303 more broadly requires Part 22 licensees to retain, among other documentation, the authorization for each station as a permanent part of station records.

[22] *Second Further Notice*, 32 FCC Rcd at 2572.

[23] *Id*., 32 FCC Rcd at 2572 (citing comments submitted by Public Knowledge in the WT Biennial Review proceeding). Public Knowledge did not submit comments or reply comments following release of the *Second Further Notice*.

[24] AT&T Comments at 2-3 (May 15, 2017); CMA Comments at 2-3 (May 15, 2017); CTIA Comments at 2-4 (May 15, 2017); EWA *Ex Parte* Letter at 2-3 (June 15, 2017); Verizon Comments at 2-3 (May 15, 2017). EWA's submission (styled as "Reply Comments") was filed outside the pleading cycle (*see Federal Register*, 82 Fed. Reg. 17959 (April 14, 2017) (summarizing the *Second Further Notice* and establishing the pleading cycle)). We consider EWA's submission as an *ex parte* letter in the interest of having a complete record, ensuring full and fair participation in this proceeding.

[25] AT&T Comments at 2 (citing *Wireless Telecommunications Bureau Implements Enhancements to the Commission's Universal Licensing System and Antenna Structure Registration System and Adopts Final Procedures for Providing Access to Official Electronic Authorizations*, WT Docket No. 14-161, Public Notice, 29 FCC Rcd 15252 (WTB 2014) (*Official Electronic Authorizations PN*); Verizon Comments at 2 (citing same). *See also* EWA *Ex Parte* Letter at 3.

[26] EWA *Ex Parte* Letter at 3.

[27] E.g., AT&T Comments at 2-3 (noting, at 3, that internal base stations whose Service Area Boundaries (SABs) "do not comprise the outer edge" of the CGSA are no longer issued site-specific authorizations, and that even a Cellular Service station that defines the SAB might today have a license that no longer includes all operating parameters," because Cellular licensees can now operate much like Part 24 and Part 27 licensees without having to report every modification to a system).

records at stations to reflect all sites as operated, leading in some cases to erroneous accusations by such authorities of unauthorized operations.[28]

9. *Discussion*. We find that Sections 22.301 and 22.303 have outlived the usefulness they may have had in the past and now impose administrative burdens without any corresponding public benefit. Because the Commission no longer routinely mails printed authorizations, licensees cannot comply with the rule's hard-copy requirement unless they themselves print, or request that the Bureau print and mail, an authorization every time an application is granted. Such a requirement does not serve the public interest. ULS is available electronically at all times: licensees have access to their official authorizations, while members of the public have access to reference copies reflecting the most up-to-date information concerning all authorizations.[29] And as AT&T observes, the movement away from site-specific filings renders on-site comparison of paper records and operating parameters unnecessary and largely infeasible.[30] Moreover, the Commission has not imposed the recordkeeping and station inspection requirements of Sections 22.301 and 22.303 on licensees in competing wireless services governed by Parts 24 and 27 of our rules. For all these reasons, we delete both of these rules.[31]

B. Section 22.325—Control Points

10. Section 22.325 of the Commission's rules requires that "[e]ach station in the Public Mobile Services [ ] have at least one control point and a person on duty who is responsible for station operation."[32] The Commission proposed and sought comment on eliminating Section 22.325 in the *Second Further Notice*.[33] It queried whether today automatic and remote monitoring render this rule unnecessary from a technological standpoint.[34]

11. Commenters addressing this issue agree with the proposal to delete this rule on grounds that it does not reflect licensees' existing automatic and remote monitoring facilities and is unnecessary.[35] AT&T adds that Cellular licensees have "developed extensive expertise in working with their counterparts" to comply with Commission rules governing coordination with adjacent channel and adjacent market licensees, interference avoidance, especially with respect to Part 90 public safety

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[28] CMA Comments at 2. According to CMA, while deleting the two rules might not "100% solve that problem," it would at least remove the "ostensible . . . requirement that all such sites be reflected" in hard copy records retained at every station. *Id*. at 2-3.

[29] *Official Electronic Authorizations PN*, 29 FCC Rcd at 15252-53.

[30] AT&T Comments at 2-3.

[31] *See* Final Rules (Appendix A). As was also noted in the *Second Further Notice*, the Commission retains station inspection authority under 47 U.S.C. § 303(n). With respect to Public Knowledge's request, given that electronic copies of authorizations are easily accessible to the public and FCC inspectors via ULS, we see no need to require Part 22 licensees "to have electronic copies [of licenses] easily accessible to personnel and FCC inspectors." *See supra* note 23.

[32] 47 CFR § 22.325. While the rule does not require that the person on duty be at the control point or continuously monitor all transmissions of the station, the control point must have facilities that enable the person on duty to turn off the transmitters in the event of a malfunction.

[33] *Second Further Notice*, 32 FCC Rcd at 2573.

[34] *Id*., 32 FCC Rcd at 2573.

[35] *See* AT&T Comments at 3 (stating that Cellular licensees "remotely monitor their network usage and operation and by necessity retain the ability to deactivate the radios as needed in the event of interference"); CMA Comments at 3 (stating that automatic and remote monitoring facilities are "routinely used by CMA members"); CTIA Comments at 3-4 (asserting that the rule is unique to Part 22 and is "another example of unnecessary and asymmetrical regulation," and that most licensees have centralized operations); EWA *Ex Parte* Letter at 4; Verizon Comments at 3 (stating that it maintains "Network Operations Centers that monitor all of its Commission-licensed operations and have the ability to power down transmitters due to malfunction . . . or any other reason," and claiming that this network architecture "is commonplace among wireless carriers.").

licensees operating in the 800 MHz band, and international agreements.[36] EWA contends that "licensees have every incentive to ensure that their facilities are operating properly and in compliance with FCC requirements," and the Commission "no longer needs to prescribe how licensees must accomplish that task."[37]

12. *Discussion*. Based on the record before us, we find that Section 22.325 is now technologically obsolete, as licensees today routinely monitor their network operations by automatic and remote mechanisms. And one commenter claims that the rule inhibits efficiencies in licensees' operations.[38] We therefore conclude that Section 22.325 no longer serves the public interest. As with Sections 22.301 and 22.303, discussed above, there is no similar provision in Part 24 or Part 27 of the Commission's rules related to station control points or the requirement to have a person on duty who is responsible for station operation. Part 22 licensees should have the same flexibility as Part 24 and Part 27 commercial wireless licensees to determine how to manage their networks to ensure compliance with the Commission's rules, including how best to avoid interference. Accordingly, we delete Section 22.325.[39]

C. Section 22.321(c)—Equal Employment Opportunities

13. Section 22.321(c) requires all Part 22 licensees (i.e., PMS licensees), regardless of their size, to submit an annual report to the Commission indicating whether any EEO complaints have been filed at the federal, state, or local level against the licensee.[40] For any such complaint, the report must state the parties involved, date of filing, court or agencies reviewing the complaint, appropriate file number, and disposition of the complaint.[41] All common carriers (i.e., not only Part 22 licensees) with at least 16 full-time employees are subject to the same requirement under Section 1.815 of the Commission's rules, which specifies that an annual employment report is to be submitted on FCC Form 395.[42] Pursuant to comments on the record in the WT Biennial Review proceeding arguing that Section 22.321(c) should be repealed, the *Second Further Notice* sought comment on whether there is any need to retain this provision.[43]

14. While the WT Biennial Review comments regarding EEO requirements focused on Section 22.321, Section 90.168 of the Commission's rules, "Equal Employment Opportunities," contains the same provisions as those in Section 22.321, including paragraph (c), which requires a complaints report annually regardless of the licensee's size. Section 90.168 states that it applies to *all* CMRS (which includes the Part 22 PMS), and thus it entirely subsumes Section 22.321.

15. AT&T, CMA, EWA, and Verizon endorse the Commission's proposal to delete Section 22.321(c),[44] with CMA also asserting that, if the Commission eliminates Section 22.321(c), then common

[36] AT&T Comments at 3.

[37] EWA *Ex Parte* Letter at 4.

[38] *See*, *e.g*., CMA Comments at 3 (indicating that CMA members routinely use automatic and remote monitoring facilities and that Section 22.325 "should be deleted as an unnecessary regulation that inhibits efficiencies in critical messaging operations").

[39] *See* Final Rules (Appendix A).

[40] 47 CFR § 22.321(c).

[41] *Id*.

[42] 47 CFR § 1.815.

[43] *Second Further Notice*, 32 FCC Rcd at 2573 (citing Verizon Biennial Review Comments). The *Second Further Notice* did not seek comment on the other subsections of Section 22.321, which set forth licensee obligations for equal opportunity programs and policies to assure nondiscriminatory practices in recruitment, placement, promotion, and other areas of employment practices. 47 CFR § 22.321.

[44] *See* AT&T Comments at 4; CMA Comments at 3-4 (arguing that deletion of Section 22.321(c)'s complaints report requirement for licensees with fewer than 16 employees is warranted); EWA *Ex Parte* Letter at 3-4 (arguing that deletion of Section 22.321(c)'s complaints report requirement for licensees with fewer than 16 employees is

carrier licensees and permittees with fewer than 16 full-time employees would no longer be subject to an EEO complaints report filing requirement at the Commission.[45] None of the commenters in this Cellular Reform proceeding or the WT Biennial Review proceeding addressed Section 90.168.

16. *Discussion*. Given that all CMRS licensees are subject to Section 90.168, including Section 90.168(c), Section 22.321 is duplicative and, accordingly, we delete the rule in its entirety.[46] As to the Part 90 reporting requirement, the Commission did not propose to remove that requirement, nor did any commenters suggest doing so. Part 90 rules are therefore beyond the scope of this proceeding and we decline at this time to eliminate the complaints reporting requirement in Section 90.168.[47]

D. Section 22.927—Responsibility for Mobile Stations, and Section 22.3—Authorization Required

17. As noted above, the *Second Further Notice* invited comment generally on other steps or measures the Commission could take to ensure that Cellular licensees benefit from the same level of flexibility available to other commercial wireless licensees.[48] In response, CTIA argues that repeal of Section 22.927, entitled "Responsibility for mobile stations,"[49] would be "consistent with this objective," because the rule is another example of asymmetric regulation.[50] Under Section 22.927, Cellular licensees are "responsible for exercising effective operational control over mobile stations receiving service through their Cellular systems," including mobile stations operated by subscribers to a different Cellular licensee. Section 22.927 thus addresses service to "roamers," although it does not use that particular term.

18. *Discussion*. Pursuant to Section 1.903(c) of the Commission's rules, the "[a]uthority for subscribers to operate mobile or fixed stations in the Wireless Radio Services [WRS]," which includes the Cellular Service, "is included in the authorization held by the licensee providing service to them."[51] Thus, when a WRS licensee, as the host carrier, provides service to a subscriber of another carrier (i.e., a subscriber that is outside its own provider's service area), the subscriber's use of his or her mobile phone

(Continued from previous page)
warranted, and asserting that Section 22.321 is unnecessary in its entirety); Verizon Comments at 4-5 (arguing that deletion of Section 22.321(c) is a "good first step," but that the Commission should go further and eliminate Section 1.815 as well).

[45] CMA Comments at 3. *See also* EWA *Ex Parte* Letter at 3-4.

[46] *See* Final Rules (Appendix A). As noted above, Verizon also argues that Section 1.815 should be deleted (Verizon Comments at 4-5). Verizon's request is beyond the scope of this proceeding, and we decline to consider it here.

[47] In any event, neither CMA nor EWA adequately demonstrates why licensees with fewer than 16 employees should be exempt from this requirement; they merely claim that complaints are rarely filed against small carriers with fewer than 16 employees. CMA Comments at 3; EWA *Ex Parte* Letter at 4.

[48] *Second Further Notice*, 32 FCC Rcd at 2573 (asking specifically if commenters deem unnecessary any other rules that apply to Part 22 licensees but not to the flexibly licensed services under Part 24 or 27).

[49] 47 CFR § 22.927.

[50] CTIA Comments at 4-5. CTIA also argues that the rule is "superfluous" because, according to CTIA, licensees are subject to "specific technical and operating rules set forth elsewhere in Parts 1, 20, and 22 of the Commission's rules," but does not cite to any specific rules in support of its statement. *See id.*

[51] 47 CFR § 1.903(c) (indicating limited exceptions not relevant here). Section 1.903 was adopted in 1998 as part of an omnibus consolidation, revision, and streamlining of Commission rules governing license application procedures for many wireless services, to facilitate full implementation of what was then the Commission's new ULS. *See Biennial Regulatory Review—Amendment of Parts 0, 1, 13, 22, 24, 26, 27, 80, 87, 90, 95, 97, and 101 of the Commission's Rules to Facilitate the Development and Use of the Universal Licensing System in the Wireless Telecommunications Services, et al.*, WT Docket No. 98-20 (other docket nos. omitted), Report and Order, 13 FCC Rcd 21027 (1998) (*ULS R&O*); *see also id.* at Appendix F (consolidating certain service-specific rules into 47 CFR § 1.903).

to access the spectrum falls under that host carrier's authorization. Section 1.903(c) thus captures the purpose underlying Section 22.927, albeit with less detail.[52] While the detailed provision in Section 22.927 regarding the host carrier's responsibility under its authorization may have been warranted when the Cellular Service was in its nascency, we find that this additional rule is unnecessary these many decades later. As CTIA observes, the rule creates asymmetry, as the rules for commercial wireless services established much later than the Cellular Service—such as PCS and AWS—do not have a counterpart to Section 22.927. Consistent with one of our key goals in this proceeding to eliminate unnecessary asymmetric regulations, we delete Section 22.927.[53]

19. Further, a related legacy rule that applies to all Part 22 licensees, Section 22.3,[54] is also no longer necessary. This rule specifies that PMS stations must be used and operated only in accordance with applicable Commission rules and only with a valid authorization granted by the Commission. It further specifies that authority for subscribers to operate mobile or fixed PMS stations is included in the authorization of the licensee providing service to them. The same provisions are included in the later-adopted Section 1.903, which applies more broadly to numerous wireless services in addition to the PMS.[55] We therefore find it in the public interest to delete it from our rules as duplicative.[56]

IV. POSSIBLE RELOCATION OF RULES TO PART 27

20. The Commission sought comment in the *Second Further Notice* on whether to migrate the Part 22 Cellular and Part 24 PCS rules to Part 27, and on whether the Commission should initiate a separate rulemaking to revise the Part 27 rules and reserve the possible relocation of Cellular and PCS rules to that separate proceeding.[57] It specified that commenters should address "whether the Commission should reorganize Part 27 in order to accommodate these additional Part 22 and Part 24 rules more efficiently."[58] In addition, the Commission noted that there are other geographically-licensed, auctioned services that are not included in Part 27, including Public Coast (Part 80), Specialized Mobile Radio (SMR), Location and Monitoring, and 220 MHz (Part 90), and 218-219 MHz (Part 95), and that of these, only SMR is used today by wireless carriers to provide services directly to consumers nationwide. The Commission sought comment on whether it should move the Part 22 Cellular and Part 24 PCS rules

[52] We also note that Cellular licensees today typically have two-way roaming agreements in place with other Cellular licensees. *See* 47 CFR § 20.12.

[53] *See* Final Rules (Appendix A).

[54] 47 CFR § 22.3.

[55] *See ULS R&O*, *supra* note 51; 47 CFR § 1.903.

[56] *See* Final Rules (Appendix A).

[57] *Second Further Notice*, 32 FCC Rcd at 2574-75 (noting that it was seeking to revisit the issues and refresh the record, as the Commission had sought comment on these same issues when this Cellular Reform proceeding was launched in 2012). In connection with the 2012 proposal to issue geographic-area (CMA-based) "overlay licenses" through competitive bidding in two stages, the Commission had queried whether, in the event that it were to adopt a geographic-based regime that would include overlay licenses, the new Cellular rules should be incorporated into Part 27. *See NPRM,* 27 FCC Rcd at 1771 (also suggesting that, if the Cellular rules were moved into Part 27, then the rules for PCS should also be moved into Part 27). The only commenter that responded, the Rural Wireless Association, opposed a relocation of any Part 22 and Part 24 rules to Part 27. *See R&O*, 29 FCC Rcd at 14125 (citing RWA's Comments filed May 15, 2012). In the *R&O*, the Commission's transition of the Cellular Service to a geographic-based regime did not entail an auction of overlay licenses, which commenters by and large opposed; instead, based in part on a new proposal by an industry coalition, the Commission adopted a transition approach for the Cellular Service that preserves direct site-based access to Unserved Area while dramatically reducing licensees' regulatory burdens, and in that context, the Commission decided not to pursue a relocation of Part 22 Cellular and Part 24 PCS rules. *See Second R&O*, 32 FCC Rcd at 2575 (citing *R&O*, 29 FCC Rcd at 14125*).*

[58] *Second Further Notice*, 32 FCC Rcd at 2575.

to Part 27 in conjunction with moving those other service rule parts to Part 27 as well.[59]

21. CTIA states support in broad terms for migrating the Part 22 Cellular and Part 24 PCS rules to Part 27.[60] EWA argues that there are important reasons for distinguishing Part 90 SMR systems in the context of a possible rule migration, and "strongly recommends against a wholesale relocation of the [Part 90] SMR service to Part 27 . . . ."[61] In particular, it urges that the Commission leave under Part 90 the rules governing non-Enhanced SMR (non-ESMR) systems.[62] No other commenter addressed our queries on these issues.

22. *Discussion*. While CTIA recommends that we evaluate "whether and how to consolidate the rules" and resolve inconsistencies among different service rules (absent unique circumstances for particular services), it offers only one example of rules that could be consolidated for multiple services.[63] EWA focuses solely on the difficulties associated with relocation of Part 90 SMR rules and does not address any other rules in this context. As EWA's comments highlight, disparate types of operations found in certain rule parts would make it challenging to consolidate Part 22 Cellular, Part 24 PCS, and other wireless mobile service rules into a single set of regulations. Such an exercise would entail painstaking review of numerous rules to determine those that can be consolidated and those that must be retained for individual services. In the absence of strong support on the record for this endeavor, which would require a significant investment of staff resources to complete, we decline to pursue the issue at this time.

V. OTHER REGULATIONS RAISED BY COMMENTERS

23. In response to the Commission's query in the *Second Further Notice* as to whether any other Part 22 rules are ripe for removal in light of changed technology, electronic licensing/recordkeeping, or other modernizations that have occurred over the past two decades, commenters request deletion of two Cellular Service rules—Sections 22.921 and 22.925.[64] In addition, one commenter requests deletion of paragraph (a) of Section 22.143,[65] which applies to all Part 22 licensees. We discuss the commenters' specific proposals below.[66]

24. *Section 22.921—911 Call Processing Procedures*. AT&T argues that Section 22.921 of

[59] *Id*., 32 FCC Rcd at 2575.

[60] CTIA Comments at 5 (contending that this would significantly reduce the number of pages comprising the rules in Parts 22, 24, and 27, and assist with training and compliance). It adds that, while a benefit of considering consolidation would be to determine whether inconsistencies are warranted by unique circumstances of a particular service, retention of certain service-specific technical requirements would be warranted "because of the particular spectrum bands involved," and it notes as examples the Cellular radiated power rule and the rule for determining a Cellular licensee's CGSA. *Id*. at 5-6.

[61] For example, it contends, the "intermingling of channels among [Part 90] site-based licensees and the substantial commonality of operational characteristics among site-based Part 90 systems, both private internal and commercial SMR, argue strongly in favor of regulating these systems under the well-established Part 90 rules." EWA Comments at 4 (adding its contention that the purpose of the Part 27 rules is "not intended for nor particularly aligned with site-specific based private internal and commercial SMR operations.").

[62] EWA Comments at 2 (noting that Sprint Corporation (Sprint) and Southern Communications Services, d/b/a Southern Linc (Southern) operate ESMR systems and are members of EWA). While EWA states that it would support the decision of ESMR entities if they prefer to have their rules migrated, neither Sprint nor Southern filed comments in response to the *Second Further Notice*.

[63] CTIA Comments at 5 (suggesting that a single rule should be adopted for all CMRS licensees that establishes the same license term absent unique circumstances).

[64] 47 CFR §§ 22.921, 22.925.

[65] 47 CFR § 22.143(a).

[66] *Second Further Notice*, 32 FCC Rcd at 2573.

our rules, pursuant to which certain Cellular Service mobile telephones that are capable of operating in the analog mode "must incorporate a special procedure for processing 911 calls,"[67] is now obsolete because, among other reasons, it is "unaware of any carrier that still offers analog devices or operates an analog Cellular system."[68] We disagree. Commission data show that, contrary to AT&T's understanding, some carriers are still using analog technology in the Cellular Service band[69]—and Section 22.921 ensures that 911 calls get through in those circumstances.[70] Under these circumstances, the deletion of this rule would not serve the public interest, and, accordingly, we decline to take such action in this proceeding.

25. *Section 22.925—Prohibition on Airborne Operation of Cellular Telephones*. AT&T and Qualcomm Incorporated (Qualcomm) argue that Section 22.925, which prohibits the operation of Cellular Service telephones aboard "airplanes, balloons or any other type of aircraft . . . while such aircraft are airborne . . . ,"[71] should be eliminated, or at least modified.[72] The Commission has an open proceeding in WT Docket No. 13-301 that addresses the use of mobile services aboard aircraft.[73] The issues that AT&T and Qualcomm raise regarding the use of Cellular Service spectrum for communications to, from, and onboard aircraft are being dealt with in that proceeding, and we therefore decline to consider the issues here.[74]

26. *Section 22.143(a)—Commencement of Construction Prior to Grant of Application*. Section 22.143 permits applicants to begin construction of PMS facilities prior to grant of their applications; paragraph (a) specifies that such construction may begin "35 days after the date of the Public Notice listing the application for that facility as acceptable for filing."[75] EWA argues that Section 22.143(a) should be deleted, asserting that comparable provisions do not exist for other wireless services, and that other portions of the rule put applicants on notice that they assume the risk of constructing prior

[67] 47 CFR § 22.921 (specifying "analog mode described in the standard document ANSI TIA/EIA-553-A-1999 Mobile Station—Base Station Compatibility Standard (approved October 14, 1999 . . .)" and indicating where it is available for purchase). Specifically, the rule states that the incorporated procedure "must recognize when a 911 call is made and, at such time, must override any programming in the mobile unit that determines the handling of a non-911 call and permit the call to be transmitted through the analog systems of other carriers." *Id*. In addition, at least one of the 911 call system selection processes endorsed or approved by the Commission must be incorporated into the special procedure under this rule. *Id*.

[68] AT&T Comments at 4.

[69] *See* Mobile Deployment Form 477 Data, https://www.fcc.gov/mobile-deployment-form-477-data.

[70] Although AT&T is correct in noting (*see* AT&T Comments at 4) that wireless 911 provisions reside in 47 CFR § 20.18, there is no provision in that rule addressing the specific requirements that apply to Cellular analog systems under 47 CFR § 22.921.

[71] 47 CFR § 22.925. This rule also requires a notice to be posted on or near each Cellular telephone installed in any aircraft, stating that use of Cellular telephones while the aircraft is on the ground is subject to Federal Aviation Administration regulations. *See id*.

[72] AT&T Comments at 4-5; Qualcomm Reply Comments at 2-3 (June 13, 2017). *See also* Letter from Colleen Thompson, Area Manager, Federal Regulatory, AT&T Services, Inc., to Marlene H. Dortch, Secretary FCC (filed Nov. 15, 2017) (AT&T *Ex Parte* Letter) (reporting on a meeting on Nov. 13, 2017, with Commission staff from several bureaus to discuss Section 22.925).

[73] *See Expanding Access to Mobile Wireless Service Onboard Aircraft*, WT Docket No. 13-301, Notice of Proposed Rulemaking, 29 FCC Rcd 17132 (2013) (Airborne Wireless proceeding).

[74] AT&T filed reply comments in the Airborne Wireless proceeding (i.e., WT Docket No. 13-301); it also filed in that docket a copy of the AT&T *Ex Parte* Letter filed in the instant Cellular Reform docket.

[75] 47 CFR § 22.143 (specifying also, however, that applicants must not *operate* such facilities until the Commission grants the application).

to grant.[76] We disagree. The same Public-Notice-plus-35-day period is specified in Section 90.169 of our rules for several other commercial wireless radio services.[77] Pre-grant construction under Section 22.143 is subject to several conditions, including, among others, that no petitions to deny or mutually exclusive (competing) applications have been filed.[78] When the Commission reduced the waiting period from the original 60-day and 90-day post-Public Notice periods to the existing "Public-Notice-plus-35-days" provision, it agreed that applicants should know within that timeframe whether any petition to deny or competing application had been filed, and retained these conditions to disallow construction "when we can not be reasonably certain that we will be able to grant the application."[79] The Commission has also recognized that, "[b]ecause construction of [PMS] facilities entails not only the financial risk to the applicant . . . but also environmental and other consequences affecting the public, . . . it would not be in the public interest to allow construction . . . until it is reasonably certain that the facilities can be authorized."[80] In a similar vein, it is in the public interest to minimize the Commission's risk of having to expend taxpayer resources to issue notification to the applicant, pursuant to Section 22.143(b), to stop construction.[81] For all these reasons, we decline to delete Section 22.143(a) at this time.

VI. PROCEDURAL MATTERS

27. *Paperwork Reduction Act Analysis*. The Third Report and Order contains new and modified information collection requirements subject to the Paperwork Reduction Act of 1995 (PRA).[82] It will be submitted to the Office of Management and Budget (OMB) for review under Section 3507(d) of the PRA. OMB, the general public, and other Federal agencies will be invited to comment on the new and modified information collection requirements contained in the rules adopted in this proceeding.[83] In addition, pursuant to the Small Business Paperwork Relief Act of 2002,[84] the Commission previously sought specific comment on how the Commission might further reduce the information collection burden for small business concerns with fewer than 25 employees. We have assessed the effects of the rule changes we are adopting on small business concerns and find that businesses with fewer than 25 people will benefit from the additional reforms, i.e., deletion of Sections 22.3, 22.301, 22.303, 22.321, 22.325, and 22.927, which will provide added flexibility for Cellular licensees no matter their size.

28. *Congressional Review Act*. The Commission will send a copy of today's Third Report and Order to Congress and the Government Accountability Office pursuant to the Congressional Review

[76] EWA *Ex Parte* Letter at 4.

[77] 47 CFR § 90.169(a).

[78] 47 CFR § 22.143(d)(1), (2).

[79] *Revision of Part 22 of the Commission's Rules Governing the Public Mobile Services, et al*., CC Docket Nos. 95-115, 94-46, and 93-116, RM No. 8367, Report and Order, 9 FCC Rcd 6513, 6552-63 (1994) (*Part 22 Rewrite Order*) (adding that, if a petition to deny is filed, "it brings into question whether the application can be granted"; also noting that the previous waiting period was 60 days after the date of the public notice announcing tentative selectees for the Cellular Service, and 90 days after release of the applicable acceptable for filing public notice for the Paging and Radiotelephone Service).

[80] *Part 22 Rewrite Order*, 9 FCC Rcd at 6553. Note that, for applicants for licenses awarded by competitive bidding, which includes commercial wireless services such as PCS and AWS, the Commission has also established a waiting period, tailored to our competitive bidding process: pre-grant construction is permitted only upon release of the Public Notice listing the post-auction long-form application for that facility as acceptable for filing (by which time, mutual exclusivity has been eliminated and the Commission is reasonably certain that the application can be granted). *See* 47 CFR § 1.2113.

[81] 47 CFR § 22.143(b).

[82] Pub. L. No. 104-13.

[83] The Commission will publish a notice in the *Federal Register* inviting the public to comment on the new and modified requirements, as required by the PRA. *See* 44 U.S.C. §§ 3501-3520.

[84] Public Law 107-198, *see* 44 U.S.C. § 3506(c)(4).

Act.[85]

29. *Final Regulatory Flexibility Analysis*. The Regulatory Flexibility Act of 1980, as amended (RFA), requires that an agency prepare a regulatory flexibility analysis for notice and comment rulemakings, unless the agency certifies that "the rule will not, if promulgated, have a significant economic impact on a substantial number of small entities."[86] Accordingly, we have prepared a Final Regulatory Flexibility Analysis (FRFA) concerning the possible impact on small entities of the rule changes contained in the Third Report and Order. The FRFA is attached as Appendix B. The Commission will send a copy of this Third Report and Order, including the FRFA, to the Chief Counsel for Advocacy of the Small Business Administration.

30. *Contact Information*. For further information regarding this Third Report and Order, contact Nina Shafran at (202) 418-2781, or Nina.Shafran@fcc.gov.

VII. ORDERING CLAUSES

31. Accordingly, IT IS ORDERED, pursuant to Sections 1, 2, 4(i), 4(j), 7, 301, 303, 307, 308, 309, and 332 of the Communications Act of 1934, as amended, 47 U.S.C. §§ 151, 152, 154(i), 154(j), 157, 301, 303, 307, 308, 309, and 332, that this THIRD REPORT AND ORDER in WT Docket No. 12-40 IS ADOPTED.

32. IT IS FURTHER ORDERED that the THIRD REPORT AND ORDER SHALL BE EFFECTIVE 30 days after publication of a summary in the *Federal Register*.

33. IT IS FURTHER ORDERED that Part 22 of the Commission's rules, 47 CFR Part 22, IS AMENDED as specified in Appendix A, effective 30 days after publication in the *Federal Register* except as otherwise provided herein.

34. IT IS FURTHER ORDERED that the amendment adopted in this THIRD REPORT AND ORDER, and specified in Appendix A, to 47 CFR § 22.303, which contains new or modified information collection requirements that require approval by the Office of Management and Budget (OMB) under the Paperwork Reduction Act, WILL BECOME EFFECTIVE after OMB review and approval, on the effective date specified in a notice that the Commission will publish in the *Federal Register* announcing such approval and effective date.

35. IT IS FURTHER ORDERED that this Cellular Reform proceeding in WT Docket No. 12-40, including RM Nos. 11510 and 11660, IS HEREBY TERMINATED.

36. IT IS FURTHER ORDERED, pursuant to Section 801(a)(1)(A) of the Congressional Review Act, 5 U.S.C. § 801(a)(1)(A), that the Commission SHALL SEND a copy of the THIRD REPORT AND ORDER to Congress and to the Government Accountability Office.

[85] *See* 5 U.S.C. § 801(a)(1)(A).

[86] 5 U.S.C. §§ 601 *et seq*.

37. IT IS FURTHER ORDERED that the Commission's Consumer and Governmental Affairs Bureau, Reference Information Center, SHALL SEND a copy of the THIRD REPORT AND ORDER, including the Final Regulatory Flexibility Analysis, to the Chief Counsel for Advocacy of the Small Business Administration.

FEDERAL COMMUNICATIONS COMMISSION

Marlene H. Dortch
Secretary

APPENDIX A

Final Rules

Part 22 of Title 47 of the Code of Federal Regulations is amended as follows:

PART 22—PUBLIC MOBILE SERVICES

1. The authority citation for part 22 continues to read as follows:

   Authority: 47 U.S.C. 154, 222, 303, 309 and 332.

2. Section 22.3 is removed and reserved.

§ 22.3 [Reserved]

3. Section 22.301 is removed and reserved.

§ 22.301 [Reserved]

4. Section 22.303 is removed and reserved.

§ 22.303 [Reserved]

5. Section 22.321 is removed and reserved.

§ 22.321 [Reserved]

6. Section 22.325 is removed and reserved.

§ 22.325 [Reserved]

7. Section 22.927 is removed and reserved.

§ 22.927 [Reserved]

APPENDIX B

Final Regulatory Flexibility Analysis

1. As required by the Regulatory Flexibility Act of 1980, as amended (RFA),[1] an Initial Regulatory Flexibility Analysis (IRFA) was incorporated in the *Second Further Notice of Proposed Rulemaking* (*Second Further Notice*), released in March 2017.[2] The Commission sought written public comment on the proposals in the *Second Further Notice*, including comment on the IRFA. This present Final Regulatory Flexibility Analysis (FRFA) conforms to the RFA.[3]

A. Need for and Objectives of the Rules

2. In the *Third Report and Order*, the Commission takes additional steps to reduce unnecessary regulatory burdens, not only for licensees in the 800 MHz Cellular Radiotelephone (Cellular) Service, but for other Part 22 licensees as well. The revisions will provide Cellular and other Part 22 licensees with more consistency in licensing across commercial wireless services as well as enhanced flexibility, thereby freeing up more resources for investment in new technologies and greater spectrum efficiency to meet increasing consumer demand for advanced wireless services. With this *Third Report and Order*, we conclude an important chapter in the Commission's extensive regulatory reform agenda, and we terminate the proceeding in WT Docket No. 12-40, including RM Nos. 11510 and 11660.

3. Specifically, we delete the following administrative and recordkeeping rules for all Part 22 licensees: Sections 22.301 and 22.303, concerning station inspections and the retention of hard copies of station authorizations and other station records; and Section 22.325, concerning station control points and personnel on duty at those control points.[4] Removing these provisions will eliminate needless burdens that are inconsistent with the Commission's practices and with the predominant use of electronic records storage and access, and will also eliminate asymmetry across competing commercial mobile radio services (CMRS), as the Commission's rules for newer wireless services such as PCS, certain AWS, and the 700 MHz Service do not include such provisions. These rules were adopted more than two decades ago, establishing obligations for which there is no longer a benefit to outweigh the costs and burdens of compliance imposed on licensees. In addition, we delete Sections 22.3 and 22.927, which set forth service provider obligations concerning their authorizations and subscribers' Cellular mobile stations, as these rules are no longer necessary. We also delete Section 22.321, concerning equal employment opportunity programs, policies, and complaint reports, as duplicative of other regulations.

4. In the absence of strong support on the record, the Commission declines at this time to pursue the issues of possible relocation of the Part 22 Cellular, Part 24 PCS, and other wireless mobile service rules into a single set of regulations, and possible reorganization of the Part 27 rules. The

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[1] *See* 5 U.S.C. § 603. The RFA, *see* 5 U.S.C. §§ 601 – 612, has been amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA), Pub. L. No. 104-121, Title II, 110 Stat. 857 (1996).

[2] *See Amendment of Parts 1 and 22 of the Commission's Rules with Regard to the Cellular Service, Including Changes in Licensing of Unserved Area*, *Amendment of the Commission's Rules with Regard to Relocation of Part 24 to Part 27; Interim Restrictions and Procedures for Cellular Service Applications*; *Amendment of Parts 0, 1, and 22 of the Commission's Rules with Regard to Frequency Coordination for the Cellular Service*; *Amendment of the Commission's Rules Governing Radiated Power Limits for the Cellular Service*; *Amendment of Parts 1, 22, 24, 27, 74, 80, 90, 95, and 101 to Establish Uniform License Renewal, Discontinuance of Operation, and Geographic Partitioning and Spectrum Disaggregation Rules and Policies for Certain Wireless Radio Services; 2016 Biennial Review of Telecommunications Regulations*, WT Docket Nos. 12-40, 10-112, and 16-138, RM Nos. 11510 and 11660, Second Report and Order, Report and Order, and Second Further Notice of Proposed Rulemaking, 32 FCC Rcd 2518 (2017) (herein, "*Second Further Notice*").

[3] *See* 5 U.S.C. § 604.

[4] 47 CFR §§ 22.301, 22.303, 22.325.

Commission also declines to delete, as requested by certain commenters, two Cellular Service rules—Sections 22.921 and 22.925—and Section 22.143(a), which applies to all Part 22 licensees. The Commission finds that Sections 22.921 and 22.143(a) continue to serve the public interest, and the restrictions in Section 22.925 are being addressed in a separate proceeding.

B. Summary of Significant Issues Raised by Public Comments in Response to the IRFA

5. There were no comments filed that specifically addressed the rules and policies proposed in the IRFA.

C. Response to Comments by the Chief Counsel for Advocacy of the Small Business Administration

6. Pursuant to the Small Business Jobs Act of 2010, which amended the RFA, the Commission is required to respond to any comments filed by the Chief Counsel for Advocacy of the Small Business Administration (SBA), and to provide a detailed statement of any change made to the proposed rules as a result of those comments.[5]

7. The Chief Counsel did not file any comments in response to the proposed rules in this proceeding.

D. Description and Estimate of the Number of Small Entities to Which the Rules Will Apply

8. The RFA directs agencies to provide a description of, and where feasible, an estimate of the number of small entities that may be affected by the rules adopted herein.[6] The RFA generally defines the term "small entity" as having the same meaning as the terms "small business," "small organization," and "small governmental jurisdiction."[7] In addition, the term "small business" has the same meaning as the term "small business concern" under the Small Business Act.[8] A "small business concern" is one which: (1) is independently owned and operated; (2) is not dominant in its field of operation; and (3) satisfies any additional criteria established by the SBA.[9]

9. *Small Businesses, Small Organizations, and Small Governmental Jurisdictions*. Our actions, over time, may affect small entities that are not easily categorized at present. We therefore describe here, at the outset, three broad groups of small entities that could be directly affected herein.[10] First, while there are industry specific size standards for small businesses that are used in the regulatory flexibility analysis, according to data from the SBA's Office of Advocacy, in general a small business is an independent business having fewer than 500 employees.[11] These types of small businesses represent 99.9% of all businesses in the United States, which translates to 28.8 million businesses.[12]

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[5] 5 U.S.C. § 604(a)(3).

[6] *See* 5 U.S.C. § 604(a)(3).

[7] 5 U.S.C. § 601(6).

[8] 5 U.S.C. § 601(3) (incorporating by reference the definition of "small-business concern" in the Small Business Act, 15 U.S.C. § 632). Pursuant to 5 U.S.C. § 601(3), the statutory definition of a small business applies "unless an agency, after consultation with the Office of Advocacy of the Small Business Administration and after opportunity for public comment, establishes one or more definitions of such term which are appropriate to the activities of the agency and publishes such definition(s) in the Federal Register."

[9] 15 U.S.C. § 632(a).

[10] *See* 5 U.S.C. § 601(3)-(6).

[11] *See* SBA, Office of Advocacy, "Frequently Asked Questions, Question 1 – What is a small business?" https://www.sba.gov/sites/default/files/advocacy/SB-FAQ-2016_WEB.pdf (June 2016).

10. Next, the type of small entity described as a "small organization" is generally "any not-for-profit enterprise which is independently owned and operated and is not dominant in its field."[13] Nationwide, as of August 2016, there were approximately 356,494 small organizations based on registration and tax data filed by nonprofits with the Internal Revenue Service (IRS).[14]

11. Finally, the small entity described as a "small governmental jurisdiction" is defined generally as "governments of cities, counties, towns, townships, villages, school districts, or special districts, with a population of less than fifty thousand."[15] U.S. Census Bureau data from the 2012 Census of Governments[16] indicate that there were 90,056 local governmental jurisdictions consisting of general purpose governments and special purpose governments in the United States.[17] Of this number there were 37,132 general purpose governments (county,[18] municipal and town or township[19]) with populations of less than 50,000 and 12,184 special purpose governments (independent school districts[20] and special districts[21]) with populations of less than 50,000. The 2012 U.S. Census Bureau data for most types of governments in the local government category show that the majority of these governments have

(Continued from previous page)

[12] *See* SBA, Office of Advocacy, "Frequently Asked Questions, Question 2- How many small businesses are there in the U.S.?" https://www.sba.gov/sites/default/files/advocacy/SB-FAQ-2016_WEB.pdf (June 2016).

[13] 5 U.S.C. § 601(4).

[14] Data from the Urban Institute, National Center for Charitable Statistics (NCCS) reporting on nonprofit organizations registered with the IRS was used to estimate the number of small organizations. Reports generated using the NCCS online database indicated that as of August 2016 there were 356,494 registered nonprofits with total revenues of less than $100,000. Of this number, 326,897 entities filed tax returns with 65,113 registered nonprofits reporting total revenues of $50,000 or less on the IRS Form 990-N for Small Exempt Organizations and 261,784 nonprofits reporting total revenues of $100,000 or less on some other version of the IRS Form 990 within 24 months of the August 2016 data release date. *See* http://nccs.urban.org/sites/all/nccs-archive/html//tablewiz/tw.php where the report showing this data can be generated by selecting the following data fields: Report: "The Number and Finances of All Registered 501(c) Nonprofits"; Show: "Registered Nonprofits"; By: "Total Revenue Level (years 1995, Aug to 2016, Aug)"; and For: "2016, Aug" then selecting "Show Results".

[15] 5 U.S.C. § 601(5).

[16] *See* 13 U.S.C. § 161. The Census of Government is conducted every five (5) years compiling data for years ending with "2" and "7". *See also* Program Description Census of Government https://factfinder.census.gov/faces/affhelp/jsf/pages/metadata.xhtml?lang=en&type=program&id=program.en.COG#

[17] *See* U.S. Census Bureau, 2012 Census of Governments, Local Governments by Type and State: 2012 - United States-States. https://factfinder.census.gov/bkmk/table/1.0/en/COG/2012/ORG02.US01. Local governmental jurisdictions are classified in two categories - General purpose governments (county, municipal and town or township) and Special purpose governments (special districts and independent school districts).

[18] *See* U.S. Census Bureau, 2012 Census of Governments, County Governments by Population-Size Group and State: 2012 - United States-States. https://factfinder.census.gov/bkmk/table/1.0/en/COG/2012/ORG06.US01. There were 2,114 county governments with populations less than 50,000.

[19] *See* U.S. Census Bureau, 2012 Census of Governments, Subcounty General-Purpose Governments by Population-Size Group and State: 2012 - United States – States. https://factfinder.census.gov/bkmk/table/1.0/en/COG/2012/ORG07.US01. There were 18,811 municipal and 16,207 town and township governments with populations less than 50,000.

[20] *See* U.S. Census Bureau, 2012 Census of Governments, Elementary and Secondary School Systems by Enrollment-Size Group and State: 2012 - United States-States. https://factfinder.census.gov/bkmk/table/1.0/en/COG/2012/ORG11.US01. There were 12,184 independent school districts with enrollment populations less than 50,000.

[21] *See* U.S. Census Bureau, 2012 Census of Governments, Special District Governments by Function and State: 2012 - United States-States, https://factfinder.census.gov/bkmk/table/1.0/en/COG/2012/ORG09.US01. The U.S. Census Bureau data did not provide a population breakout for special district governments.

populations of less than 50,000.[22] Based on this data, we estimate that at least 49,316 local government jurisdictions fall in the category of "small governmental jurisdictions."[23]

12. *Wireless Telecommunications Carriers (except Satellite)*. This industry comprises establishments engaged in operating and maintaining switching and transmission facilities to provide communications via the airwaves. Establishments in this industry have spectrum licenses and provide services using that spectrum, such as cellular services, paging services, wireless internet access, and wireless video services.[24] The appropriate size standard under SBA rules is that such a business is small if it has 1,500 or fewer employees.[25] For this industry, U.S. Census Bureau data for 2012 show that there were 967 firms that operated for the entire year.[26] Of this total, 955 firms had employment of 999 or fewer employees and 12 had employment of 1000 employees or more.[27] Thus, under this category and the associated size standard, the Commission estimates that the majority of wireless telecommunications carriers (except satellite) are small entities.

13. The Commission's own data—available in its Universal Licensing System (ULS)—indicate that, as of May 17, 2018, there are 264 Cellular Service licensees that will be affected by our actions today.[28] The Commission does not know how many of these licensees are small, as the Commission does not collect that information for these types of entities. Also, according to internally developed Commission data, 413 carriers reported that they were engaged in the provision of wireless telephony, including the Cellular Service, PCS, and Specialized Mobile Radio (SMR) services.[29] Of this total, an estimated 261 have 1,500 or fewer employees.[30] Thus, using available data, we estimate that the majority of wireless firms can be considered small.

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[22] *See* U.S. Census Bureau, 2012 Census of Governments, County Governments by Population-Size Group and State: 2012 - United States-States - https://factfinder.census.gov/bkmk/table/1.0/en/COG/2012/ORG06.US01; Subcounty General-Purpose Governments by Population-Size Group and State: 2012 - United States–States - https://factfinder.census.gov/bkmk/table/1.0/en/COG/2012/ORG07.US01; and Elementary and Secondary School Systems by Enrollment-Size Group and State: 2012 - United States-States. https://factfinder.census.gov/bkmk/table/1.0/en/COG/2012/ORG11.US01. While U.S. Census Bureau data did not provide a population breakout for special district governments, if the population of less than 50,000 for this category of local government is consistent with the other types of local governments, the majority of the 38, 266 special district governments have populations of less than 50,000.

[23] *Id.*

[24] U.S. Census Bureau, 2012 NAICS Definitions, "517210 Wireless Telecommunications Carriers (Except Satellite)," *See* https://factfinder.census.gov/faces/affhelp/jsf/pages/metadata.xhtml?lang=en&type=ib&id=ib.en./ECN.NAICS2012.517210.

[25] 13 CFR § 121.201, NAICS code 517210.

[26] U.S. Census Bureau, *2012 Economic Census of the United States*, Table EC1251SSSZ5, Information: Subject Series: Estab and Firm Size: Employment Size of Firms for the U.S.: 2012 NAICS Code 517210. https://factfinder.census.gov/bkmk/table/1.0/en/ECN/2012_US/51SSSZ5//naics~517210.

[27] *Id*. Available census data does not provide a more precise estimate of the number of firms that have employment of 1,500 or fewer employees; the largest category provided is for firms with "1000 employees or more."

[28] *See* http://wireless.fcc.gov/uls. For the purposes of this FRFA, consistent with Commission practice for wireless services, the Commission estimates the number of licensees based on the number of unique FCC Registration Numbers.

[29] *See* Federal Communications Commission, Wireline Competition Bureau, Industry Analysis and Technology Division, Trends in Telephone Service at Table 5.3 (Sept. 2010), https://apps.fcc.gov/edocs_public/attachmatch/DOC-301823A1.pdf.

[30] *Id.*

E. Description of Projected Reporting, Recordkeeping, and Other Compliance Requirements for Small Entities

14. The *Third Report and Order* does not impose any additional reporting, recordkeeping, or other compliance requirements on small entities, nor on any other entities. Rather, it eliminates several existing reporting and recordkeeping requirements, which will benefit small entities as well as all other entities that operate Cellular Service facilities. The deleted rules include Sections 22.301 and 22.303, which collectively require that hard copies of license authorizations and other records be maintained by all Part 22 licensees for each station, and that such records and the station itself be made available for inspection upon request.[31] Small entities as well as other Part 22 entities will no longer be burdened by these requirements. Licensees will continue to have access to their official authorizations in the ULS, which is available electronically at all times. Similarly, members of the public will continue to have access to reference copies in the ULS, which reflects the most up-to-date information concerning all authorizations.

15. The *Third Report and Order* also deletes Section 22.325, which requires that "[e]ach station in the Public Mobile Services [ ] have at least one control point and a person on duty who is responsible for station operation."[32] The requirement has become technologically obsolete, as commercial wireless licensees routinely monitor their network operations by automatic and remote mechanisms. Part 22 licensees, including small entities, will no longer be burdened by it, thus freeing up their resources and providing them with the same flexibility as other CMRS licensees to determine how to manage their networks to comply with the Commission's operational rules.

16. All CMRS licensees will continue to be subject to the current annual equal employment opportunity (EEO) complaints report filing requirement. The requirement is set forth in Section 22.321(c), which applies to Part 22 licensees regardless of size, and is also set forth in the later-adopted Section 90.168(c), which applies more broadly to *all* CMRS licensees regardless of size.[33] Section 90.168 contains the same provisions as Section 22.321, including Section 22.321(c), and thus it subsumes Section 22.321 in its entirety. On this basis, the Commission deletes Section 22.321 in its entirety as duplicative.

17. The *Third Report and Order* deletes two other rules: Section 22.3, which applies to all Part 22 licensees, and Section 22.927, which applies only to Cellular Service licensees. Both rules set forth certain licensee obligations concerning operations pursuant to a valid FCC authorization, and service to subscribers of a different commercial wireless system (i.e., "roamers"). A later-adopted rule, Section 1.903, which applies to numerous wireless services, including all Part 22 licensees, imposes essentially the same obligations as Sections 22.3 and 22.927, thus rendering these Part 22 rules duplicative. By deleting Sections 22.321, 22.3, and 22.927, the Commission removes licensees' compliance obligations under one group of regulations where the same obligations exist under different provisions, and thereby simplifies compliance by eliminating regulations that are largely duplicative.

18. Small entities and other licensees will also continue to be subject to Section 22.921, requiring certain Cellular Service mobile telephones that are capable of operating in the analog mode to "incorporate a special procedure for processing 911 calls,"[34] and Section 22.143(a), which allows applicants to begin construction of Public Mobile Services (PMS) facilities "35 days after the date of the

[31] Deletion of these rules does not affect the Commission's statutory station inspection authority. *See* 47 U.S.C. § 303(n).

[32] 47 CFR § 22.325.

[33] 47 CFR § 22.321(c).

[34] 47 CFR § 22.921.

Public Notice listing the application for that facility as acceptable for filing."[35] Commenters have not demonstrated that these rules are burdensome or no longer needed. Moreover, the Commission finds that these regulations continue to serve the public interest.

F. Steps Taken to Minimize the Significant Economic Impact on Small Entities, and Significant Alternatives Considered

19. The RFA requires an agency to describe any significant alternatives that it has considered in reaching its approach, which may include the following four alternatives (among others): "(1) the establishment of differing compliance or reporting requirements or timetables that take into account the resources available to small entities; (2) the clarification, consolidation, or simplification of compliance and reporting requirements under the rule for such small entities; (3) the use of performance rather than design standards; and (4) an exemption from coverage of the rule, or any part thereof, for such small entities."[36]

20. The rules eliminated in the *Third Report and Order* are expected to have a beneficial economic impact on small entities because all Cellular Service and other Part 22 licensees will be subject to fewer recordkeeping, reporting, and compliance burdens. While the record does not enable a precise quantification of costs and benefits, we know that these requirements impose burdens that require expenditures of personnel and other resources. Specifically, removal of the requirements under Sections 22.301 and 22.303 to print (or request that the Commission print and mail) hard copies of FCC authorizations and retain them as part of each station's records every time the Commission grants an application will allow small entities and other Part 22 licensees to rely on the electronic availability of such authorizations in ULS, thereby realizing long-term cost savings. Similarly, elimination of the requirement under Section 22.325 to maintain control points for each station and to have a person on duty in charge of station operations is expected to decrease the costs of maintaining facilities and to allow small entities as well as licensees of all sizes to realize the cost savings inherent in remote monitoring and automatic functions for station operations. Likewise, the deletion of Sections 22.3, 22.321, and 22.927 will simplify compliance burdens by removing duplicative regulations. In addition, all of the rule deletions adopted in the *Third Report and Order* put Cellular Service and other Part 22 licensees more on regulatory par with licensees in competing CMRS such as PCS, AWS, and the 700 MHz Service.

21. A few commenters suggested that the Commission could eliminate the annual EEO complaints report requirement for licensees with fewer than 16 full-time employees. However, the commenters failed to take note of the fact that same requirement is also in another rule part that applies to *all* CMRS licensees—a rule that is outside the scope of this proceeding. Thus, the Commission declined to eliminate this requirement. In any event, the commenters that focused on Section 22.321(c) failed to demonstrate adequately why licensees with fewer than 16 employees should be exempt from the requirement.

22. The Commission also declined to delete three rules—Sections 22.925, 22.921, and 22.143(a)—raised by commenters. Section 22.925 prohibits the operation of Cellular Service mobiles aboard "airplanes, balloons or any other type of aircraft . . . while such aircraft are airborne . . . ."[37] The issues raised by commenters regarding this prohibition are being addressed by the Commission in another proceeding, WT Docket No. 13-301, and therefore the Commission declines to consider them here. Regarding Section 22.921, contrary to commenters' understanding, Commission data show that analog technology is still being used in the Cellular Service band.[38] The specific requirements in Section 22.921 thus continue to ensure that 911 calls get through even when analog technology is used by Cellular carriers. The other rule that was considered but not deleted is Section 22.143(a), which permits applicants

[35] 47 CFR § 22.143(a).

[36] 5 U.S.C. § 603(c)(1) - (4).

[37] 47 CFR § 22.925.

[38] *See* Mobile Deployment Form 77 Data, https://www.fcc.gov/mobile-deployment-form-477-data.

to begin construction of PMS facilities prior to grant of their applications.[39] The Commission finds that this rule also continues to serve the public interest. The 35-day waiting period for commencing pre-grant construction, which a commenter raised for deletion, allows time for the Commission to be reasonably certain that it will be able to grant the application for the facility at issue (including determining that no petitions to deny or competing applications have been timely filed).

Report to Congress

The Commission will send a copy of the *Third Report and Order*, including this FRFA, in a report to Congress pursuant to the Congressional Review Act.[40] In addition, the Commission will send a copy of the *Third Report and Order*, including this FRFA, to the Chief Counsel for Advocacy of the SBA. A copy of the *Third Report and Order* and FRFA (or summaries thereof) also will be published in the *Federal Register*.[41]

[39] 47 CFR § 22.143 (specifying also, however, that applicants must not *operate* such facilities until the Commission grants the application).

[40] 5 U.S.C. § 801(a)(1)(A).

[41] 5 U.S.C. § 604(b).

APPENDIX C

List of Commenters

Comments

AT&T Services, Inc. (AT&T)
CTIA
Critical Messaging Association
Enterprise Wireless Alliance (EWA)
Verizon

Reply Comments

Qualcomm Incorporated

Ex Parte Letters

AT&T
EWA
Gogo Inc.

STATEMENT OF
CHAIRMAN AJIT PAI

Re: *Amendment of Parts 1 and 22 of the Commission's Rules with Regard to the Cellular Service, Including Changes in Licensing of Unserved Area*, WT Docket No. 12-40, RM No. 11510; *Amendment of the Commission's Rules with Regard to Relocation of Part 24 to Part* 27*; Interim Restrictions and Procedures for Cellular Service Applications; Amendment of Parts 0, 1, and 22 of the Commission's Rules with Regard to Frequency Coordination for the Cellular Service; Amendment of Part 22 of the Commission's Rules Regarding Certain Administrative and Filing Requirements; Amendment of the Commission's Rules Governing Radiated Power Limits for the Cellular Service*, RM No. 11660; *Amendments of Parts 1, 22, 24, 27, 74, 80, 90, 95, and 101 to Establish Uniform License Renewal, Discontinuance of Operation, and Geographic Partitioning and Spectrum Disaggregation Rules and Policies for Certain Wireless Radio Services*, WT Docket No. 10-112; *2016 Biennial Review of Telecommunications Regulations*, WT Docket No. 16-138.

Throughout my tenure, I've emphasized the need to eliminate unnecessary and outdated regulations. And in this *Order* alone, we're eliminating six such rules. Three of them impose antiquated administrative and recordkeeping burdens on a subset of wireless licensees, including those in the 800 MHz cellular band. For instance, licensees have to maintain hard copies of such authorizations and make them available for inspection by the Commission. Given that license authorizations are now available electronically through the Commission's Universal Licensing System (ULS), this is pointless. The other three rules that we're removing from the Code of Federal Regulations apply to the same subset of wireless licensees but are duplicative of rules contained elsewhere. They serve no purpose but to clutter our rulebook.

Many thanks to the staff who worked on this item. From the Wireless Telecommunications Bureau: Linda Chang, Thomas Derenge, Chas Eberle, Jessica Greffenius, Roger Noel, Thomas Reed, Moslem Sawez, Nina Shafran, Don Stockdale, Cecelia Sulhoff, and Suzanne Tetreault; from the Office of General Counsel: Deborah Broderson, David Horowitz, and Bill Richardson; from the Office of Communications Business Opportunities: Sanford Williams and Chana Wilkerson; from the Wireline Competition Bureau: Suzanne Yellen; and from the Media Bureau: Lewis Pulley.

FCC NEWS from the Federal Communications Commission

Media Contact:
Cecilia Sulhoff, 202-418-0587
cecilia.sulhoff@fcc.gov

For Immediate Release

FCC ELIMINATES UNNECESSARY CELLULAR SERVICE RULES

WASHINGTON, July 12, 2018—The Federal Communications Commission took additional steps today to modernize its Cellular Service rules by eliminating obsolete and unnecessary regulatory burdens applicable to the Cellular Service and other Part 22 licensees. In the *Third Report & Order* adopted today, the Commission furthers its efforts to repeal outdated regulations.

Today's Order eliminates impediments placed upon Cellular service licensees as well as other Part 22 licensees. The revisions will streamline the Commission's rules by reversing obsolete or unnecessarily burdensome rules, and they will allow licensees to focus resources on investment in new technologies and services to meet increasing consumer demand.

Among other things, the *Third Report and Order*:

- Modernizes record-keeping rules by deleting rules requiring licensees to retain hard copies of station authorizations and other station records.
- Eliminates the outdated requirement for licensees to maintain station control points and personnel on duty at those control points.
- Eliminates duplicative rules pertaining to operation of mobile stations, operational control of mobile devices, and equal opportunity regulations.

The actions taken in this *Third Report and Order* will provide Cellular and other Part 22 licensees with increased flexibility and will align the Cellular rules with rules applicable to other commercial wireless services.

Action by the Commission July 12, 2018 by Report and Order (FCC 18-92). Chairman Pai, Commissioners O'Rielly, Carr, and Rosenworcel approving. Chairman Pai and Commissioner Carr issuing separate statements.

WT Docket Nos. 12-40, 10-112, 16-138; RM Nos. 11510, 11660;

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This is an unofficial announcement of Commission action. Release of the full text of a Commission order constitutes official action. See MCI v. FCC, 515 F.2d 385 (D.C. Cir. 1974).

STATEMENT OF
CHAIRMAN AJIT PAI

Re: *Amendment of Parts 1 and 22 of the Commission's Rules with Regard to the Cellular Service, Including Changes in Licensing of Unserved Area*, WT Docket No. 12-40, RM No. 11510; *Amendment of the Commission's Rules with Regard to Relocation of Part 24 to Part* 27*; Interim Restrictions and Procedures for Cellular Service Applications; Amendment of Parts 0, 1, and 22 of the Commission's Rules with Regard to Frequency Coordination for the Cellular Service; Amendment of Part 22 of the Commission's Rules Regarding Certain Administrative and Filing Requirements; Amendment of the Commission's Rules Governing Radiated Power Limits for the Cellular Service*, RM No. 11660; *Amendments of Parts 1, 22, 24, 27, 74, 80, 90, 95, and 101 to Establish Uniform License Renewal, Discontinuance of Operation, and Geographic Partitioning and Spectrum Disaggregation Rules and Policies for Certain Wireless Radio Services*, WT Docket No. 10-112; *2016 Biennial Review of Telecommunications Regulations*, WT Docket No. 16-138.

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Many thanks to the staff who worked on this item. From the Wireless Telecommunications Bureau: Linda Chang, Thomas Derenge, Chas Eberle, Jessica Greffenius, Roger Noel, Thomas Reed, Moslem Sawez, Nina Shafran, Don Stockdale, Cecelia Sulhoff, and Suzanne Tetreault; from the Office of General Counsel: Deborah Broderson, David Horowitz, and Bill Richardson; from the Office of Communications Business Opportunities: Sanford Williams and Chana Wilkerson; from the Wireline Competition Bureau: Suzanne Yellen; and from the Media Bureau: Lewis Pulley.

Kathy Noel

From: Annemarie Clisby
Sent: Monday, September 23, 2019 12:54 PM
To: Roy Sapau
Subject: FW: 5 G

-----Original Message-----
From: Kelowna <kelownagiuliano@gmail.com>
Sent: Monday, September 23, 2019 11:43 AM
To: Council Members <council@encinitasca.gov>; Catherine Blakespear <cblakespear@encinitasca.gov>; Jody Hubbard <jhubbard@encinitasca.gov>; Tony Kranz <tkranz@encinitasca.gov>; Joe Mosca <jmosca@encinitasca.gov>; Kellie Shay Hinze <khinze@encinitasca.gov>
Subject: 5 G

Dear Council Members,

I do not agree with the installation of 5 G cell towers in the city of Encinitas, especially in residential areas. Please do not allow 5 G here.
Thank you,
Kelowna Giuliano

Sent from my iPhone

Kathy Noel

From: Annemarie Clisby
Sent: Wednesday, August 21, 2019 8:16 AM
To: Roy Sapau
Subject: FW: Encinitas Small Cell Antenna Urgency Ordinance

From: Keri Jackson <kerijac@gmail.com>
Sent: Tuesday, August 20, 2019 7:49 PM
To: Catherine Blakespear <cblakespear@encinitasca.gov>; Jody Hubbard <jhubbard@encinitasca.gov>; Council Members <council@encinitasca.gov>; Tony Kranz <tkranz@encinitasca.gov>; Joe Mosca <jmosca@encinitasca.gov>; Kellie Shay Hinze <khinze@encinitasca.gov>
Subject: Encinitas Small Cell Antenna Urgency Ordinance

Keri Jackson
1948 Swallow Lane
Carlsbad, CA 92009

August 20, 2019

City of Encinitas Council
Mayor Blakespear, Deputy Mayor Hubbard, and City Council Members Kellie Shay Hinze, Tony Kranz, and Joe Mosca

Re: Encinitas Small Cell Antenna Urgency Ordinance

I have a perception of harm from microwave antennas in close proximity to my home and to the businesses I frequent in Encinitas. I'm afraid for my physical well-being, for my family, and for my property value should an antenna be placed in front of my home. The FCC exposure limits protect us from adverse thermal effects such as shock, burns and being heated, but not from the harmful biological effects known by our scientists for more than 50 years. I implore you to protect me, us.

I perceive that small cell antenna in the right-of-way in front of a home means 20 percent devaluation in property value and sickness and untold suffering to one or more members of that household.

The city of Encinitas needs a small cell ordinance immediately so that there is oversight about placement of small cell antennas in our community and especially our sensitive and residential areas.

As written this urgency ordinance provides a convenient administrative process for the Telecom to put small cell antennas anywhere they want. I say this because there is an absence of administrative teeth that would empower the city of Encinitas to enforce the location preference (e.g. prevent small cell antenna installation in front of homes), control the application and shot clock process and installation quality.

My request for the City of Encinitas is that this ordinance be sent back to staff for major upgrade that would reflect the protective aspects of the Calabasas and Hercules ordinances that are part of this record. Please note that these ordinances have been certified by their city councils to meet all requirements of the FCC directives, and therefore serve as appropriate baselines for our community. Let's not open the door to indiscriminate placement of small cell antennas in our residential areas and the cluttering of our visual space.

If the city deems it necessary to have an ordinance in place immediately, then please make approval conditional on adding the following protective features garnered from the Calabasas municipal code section

17.12.050(C) and Hercules Title 10 Chapter 16 ordinances as a condition of approval. These are a few of many important examples from these ordinances.

Location Preference: remove the residential areas from Encinitas Section 10.a. This would be consistent with Calabasas 17.12.050(C) 3. "Preferred Zones and Locations" which does not include residential areas. (Note: Calabasas ordinance re-enforces this zoning preference in sections that specifically address small cell location in right of way… and asserts in the preamble that the ordinance is compliant to FCC directives.)

Application Process:

- Require a pre-application site inspection and pre-application meeting for verification that all application requirements have been met before accepting an application (Hercules Section 10-16.108 General Policies, General Application Process, para 8)
- Require that all support structures are certified to meet ANSI 222 as part of the application process (Hercules Section 10-16.113.E.14 Small Cell and Small Wireless Facilities).

Controlling the Shot Clock: Add these notes from Hercules, with edits applicable to Encinitas

Section 10-16.108 General Policies: (policy 19) *To prevent confusion and any loss of the City's rights under the FCC's 'Shot Clock' rule pursuant to the FCC Report and Order 14-153 as reference to the date an Application was officially filed and the start of the Shot Clock regarding the limited time allowed to determine if an Application is complete, at the time of the initial filing of an Application, it must contain a cover letter stating i) whether the Application is filed as an 'Eligible Facility' Application including the justification for such, or a 'Substantial Modification', or involves a new support structure; and ii) a statement that the Application contains all of the information required under Section 10.16 of the City's Code for that type of Application, and be signed by a person with first-hand personal knowledge of such.*

Section 10-16.113 Batched Applications: *An Applicant, or its agent of record, may submit Applications for multiple facilities or locations with the following conditions that are intended in order to assure compliance with the FCC's 'Shot Clock' requirements:*

a. No single batched submittal shall contain more than five (5) Applications;
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c. No more than 4 batched Applications shall be accepted in any thirty (30) consecutive day period.

Controlling the Shot Clock: add these notes from the Calabasas 17.12.050(C) Section 6.G.4 "Application Review" … *Each application in a batch must meet all the requirements for a complete application. If any application in a batch is incomplete, the entire batch shall be deemed incomplete*

Stealth Installations: the Encinitas ordinance displays pictures of approved small cell antenna installations that include telephone poles with small cell antennas, radio boxes and all the supporting cabling attached to the poles when Encinitas favors stealth installation and could require metal poles with attractive features. Require that all small cell antennas on light poles and power poles be stealth installations. This is consistent with both the Calabasas and Hercules ordinances, and the existing Encinitas ordinance for macro antenna installations. Remove all of the preapproved telephone pole installation examples from the Encinitas ordinance since these increase visual clutter and are not stealth.

Add definitions: "least intrusive means", "significant gap", "stealth facility" and "reasonable and compelling evidence".

I believe that our ordinance can be more protective. I ask that as a condition of approval of the ordinance that the Council orders a community meeting ASAP for the purpose of bringing together the citizens of Encinitas

with the staff to review every available option that would make the ordinance more protective. It would be appropriate to have other legal opinions as inputs to our ordinance; we don't want to be less conservative than we have to especially when the safety of our community is at stake. There are aspects of the Calabasas ordinance, the Hercules ordinance, and ordinances from other cities that are more protective and we should consider these in the Encinitas ordinance.

Thank you for being proactive for all of our safety.

Sincerely,

Keri Jackson

Kathy Noel

From: Annemarie Clisby
Sent: Wednesday, August 28, 2019 1:20 PM
To: Roy Sapau
Subject: FW: Make the Encinitas Small Cell Antenna Ordinance Protective for Our Residential Areas Immediately

From: Keri Jackson <kerijac@gmail.com>
Sent: Wednesday, August 28, 2019 12:33 PM
To: Catherine Blakespear <cblakespear@encinitasca.gov>; Jody Hubbard <jhubbard@encinitasca.gov>; Council Members <council@encinitasca.gov>; Tony Kranz <tkranz@encinitasca.gov>; Joe Mosca <jmosca@encinitasca.gov>; Kellie Shay Hinze <khinze@encinitasca.gov>
Subject: Make the Encinitas Small Cell Antenna Ordinance Protective for Our Residential Areas Immediately

Dear City of Encinitas Council:
Mayor Blakespear, Deputy Mayor Hubbard, and City Council Members Kellie Shay Hinze, Tony Kranz, and Joe Mosca

Re: Protective Small Cell Antenna Ordinance Needed Immediately

I am concerned about the timing of the urgency ordinance:

- scheduled for a City Council with three business days' notice;
- the last agenda item on an already full schedule;
- brought to the City Council many months after the FCC directive was issued and other local communities had implemented ordinances;
- the ordinance is not protective of sensitive and residential areas; and
- the ordinance provides a streamlined process for small cell antenna applications;

While I hope this is not true, I suspect that the urgency was a ploy to deflect and minimize the participation of citizens in Encinitas that are concerned about the environment in their community.

The urgency ordinance as it stands is not protective for sensitive areas and residential areas. There are no setbacks to sensitive areas which would be expected based on setbacks in the wireless ordinance for macro antennas. There is no protection of residential areas. And even though residential roads are one of the least preferred categories, the ordinance does not prevent Telecom installation of small cell antennas in front of our homes, which is most of Encinitas. (Note: there are 32 small cell antennas already installed on light poles in Encinitas residential areas via a business agreement that the City made with Crown Castle a few years ago. I suspect that this was organized without community participation.)

We want the ordinance to be more protective immediately, applied to all applications in process, before there is a flood of small cell antenna applications/installations in our neighborhoods. We can't wait for a small cell antenna community meeting.

I ask that the Encinitas small cell antenna ordinance incorporate the best practices of protective small cell antennas ordinances of the California Cities of Mill Valley and Los Altos; Calabasas; Fairfield, Petaluma and San Ramon; and Hercules.

- Mill Valley and Los Altos ordinances, prepared by Gail Karish – telecommunications attorney for Best Best & Krieger LLP, prohibit small cell antennas in residential areas.
- The Calabasas ordinance does not allow small cell antennas in residential areas.
- The Fairfield, Petaluma and San Ramon ordinances require substantial setbacks to sensitive area and residential areas and structures.
- The Hercules ordinance is the best administration for control of the application and shot clock process, requires ANSI 222 class III poles for all small cell installations, and prohibits new antenna support structures in residential areas.

For me and many of my friends and colleagues, there is a perception of harm associated with microwave antennas. We know this in our guts and this is validated by frequent news and science reports that show great biological harm from microwave radiation exposure. We are afraid for our property values.

Thank you for amending the Encinitas small cell antenna ordinance immediately for our collective safety.

Sincerely,

Keri Jackson
1948 Swallow Lane
Carlsbad, CA 92009

Kathy Noel

From: Annemarie Clisby
Sent: Monday, September 23, 2019 12:52 PM
To: Roy Sapau
Subject: FW: voice against 5G

-----Original Message-----
From: Krista Watts <krista.watts@outlook.com>
Sent: Monday, September 23, 2019 11:55 AM
To: Council Members <council@encinitasca.gov>
Subject: voice against 5G

Good Morning,

I am a 21 year resident of Encinitas and I am very much against adding 5G towers to our community. In my opinion we cannot go back but we can hold where we are which is more than adequate. We need to stand up and protect our beautiful community. Make them prove it is safe before we allow this potentially predatory technology into Encinitas.

Cordially,
Krista Watts

Kathy Noel

From: Annemarie Clisby
Sent: Thursday, August 22, 2019 7:52 AM
To: Roy Sapau
Subject: FW: 5 G cell tower opposition

From: Kristen Kurtz <kksurfhanalei@gmail.com>
Sent: Wednesday, August 21, 2019 7:45 PM
To: Council Members <council@encinitasca.gov>
Subject: 5 G cell tower opposition

Kristen Kurtz August 20, 2019 539 Hygeia Avenue Encinitas CA 92024 City of Encinitas Council Mayor Blakespear, Deputy Mayor Hubbard, and City Council Members Kellie Shay Hinze, Tony Kranz, and Joe Mosca Re: Encinitas Small Cell Antenna Urgency Ordinance I have a perception of harm from microwave antennas in close proximity to my home and to the businesses I frequent in Encinitas. I'm afraid for my physical well-being, for my family, and for my property value should an antenna be placed in front of my home. The FCC exposure limits protect us from adverse thermal effects such as shock, burns and being heated, but not from the harmful biological effects known by our scientists for more than 50 years. I implore you to protect me, us. I perceive that small cell antenna in the right-of-way in front of a home means 20 percent devaluation in property value and sickness and untold suffering to one or more members of that household. The city of Encinitas needs a small cell ordinance immediately so that there is oversight about placement of small cell antennas in our community and especially our sensitive and residential areas. As written this urgency ordinance provides a convenient administrative process for the Telecom to put small cell antennas anywhere they want. I say this because there is an absence of administrative teeth that would empower the city of Encinitas to enforce the location preference (e.g. prevent small cell antenna installation in front of homes), control the application and shot clock process and installation quality. My request for the City of Encinitas is that this ordinance be sent back to staff for major upgrade that would reflect the protective aspects of the Calabasas and Hercules ordinances that are part of this record. Please note that these ordinances have been certified by their city councils to meet all requirements of the FCC directives, and therefore serve as appropriate baselines for our community. Let's not open the door to indiscriminate placement of small cell antennas in our residential areas and the cluttering of our visual space. If the city deems it necessary to have an ordinance in place immediately, then please make approval conditional on adding the following protective features garnered from the Calabasas municipal code section 17.12.050(C) and Hercules Title 10 Chapter 16 ordinances as a condition of approval. These are a few of many important examples from these ordinances. Location Preference: remove the residential areas from Encinitas Section 10.a. This would be consistent with Calabasas 17.12.050(C) 3. "Preferred Zones and Locations" which does not include residential areas. (Note: Calabasas ordinance re-enforces this zoning preference in sections that specifically address small cell location in right of way… and asserts in the preamble that the ordinance is compliant to FCC directives.) Application Process: Require a pre-application site inspection and pre-application meeting for verification that all application requirements have been met before accepting an application (Hercules Section 10-16.108 General Policies, General Application Process, para 8) Require that all support structures are certified to meet ANSI 222 as part of the application process (Hercules Section 10-16.113.E.14 Small Cell and Small Wireless Facilities). Controlling the Shot Clock: Add these notes from Hercules, with edits applicable to Encinitas Section 10-16.108 General Policies: (policy 19) To prevent confusion and any loss of the City's rights under the FCC's 'Shot Clock' rule pursuant to the FCC Report and Order 14-153 as reference to the date an Application was officially filed and the start of the Shot Clock regarding the limited time allowed to determine if an Application is complete, at the time of the initial filing of an Application, it must contain a cover letter stating i) whether the Application is filed as an 'Eligible Facility' Application including the justification for such, or a 'Substantial Modification', or involves a new support structure; and ii) a statement that the Application contains all of the information required under Section 10.16 of the City's Code for that type of Application, and be signed by a person with first-hand personal knowledge of such. Section 10-16.113 Batched Applications: An Applicant, or its agent of record, may submit Applications for multiple facilities or locations with the following conditions that are intended in order to assure compliance with the FCC's 'Shot Clock' requirements: No single batched submittal shall contain more than five (5) Applications; There must be a minimum of seven days between submittals of batched Applications; No more than 4

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Kathy Noel

From: Annemarie Clisby
Sent: Tuesday, September 3, 2019 1:08 PM
To: Roy Sapau
Subject: FW: NO CELL PHONE TOWERS HERE, please.

From: Kristina Smaagaard <kristina.smaagaard@gmail.com>
Sent: Tuesday, September 3, 2019 12:59 PM
To: Council Members <council@encinitasca.gov>
Subject: NO CELL PHONE TOWERS HERE, please.

Hello,

I am a citizen at 466 Summer View Cir, Encinitas, CA 92024.
I oppose the cell phone towers being installed in the surrounding area.

Kristina Smaagaard

Kathy Noel

From: Annemarie Clisby
Sent: Wednesday, August 21, 2019 8:13 AM
To: Roy Sapau
Subject: FW: Encinitas Small Cell Antenna Urgency Ordinance

From: LAURA A ROSS <laura.ross@mac.com>
Sent: Tuesday, August 20, 2019 9:38 PM
To: Catherine Blakespear <cblakespear@encinitasca.gov>; Jody Hubbard <jhubbard@encinitasca.gov>; Council Members <council@encinitasca.gov>; Tony Kranz <tkranz@encinitasca.gov>; Joe Mosca <jmosca@encinitasca.gov>; Kellie Shay Hinze <khinze@encinitasca.gov>
Subject: Encinitas Small Cell Antenna Urgency Ordinance

Laura A. Ross
1816 Eucalyptus Ave
Encinitas, CA 92024

August 20, 2019

To: City of Encinitas Council

Mayor Blakespear, Deputy Mayor Hubbard, and City Council Members Kellie Shay Hinze, Tony Kranz, and Joe Mosca

Re: Encinitas Small Cell Antenna Urgency Ordinance

I have a perception of harm from microwave antennas in close proximity to my home and to the businesses I frequent in Encinitas. I'm afraid for my physical well-being, for my family, and for my property value should an antenna be placed in front of my home. The FCC exposure limits protect us from adverse thermal effects such as shock, burns and being heated, but not from the harmful biological effects known by our scientists for more than 50 years. I implore you to protect me, us.

I perceive that small cell antenna in the right-of-way in front of a home means 20 percent devaluation in property value and sickness and untold suffering to one or more members of that household.

The city of Encinitas needs a small cell ordinance immediately so that there is oversight about placement of small cell antennas in our community and especially our sensitive and residential areas.

As written this urgency ordinance provides a convenient administrative process for the Telecom to put small cell antennas anywhere they want. I say this because there is an absence of administrative teeth that would empower the city of Encinitas to enforce the location preference (e.g. prevent small cell antenna installation in front of homes), control the application and shot clock process and installation quality.

My request for the City of Encinitas is that this ordinance be sent back to staff for major upgrade that would reflect the protective aspects of the Calabasas and Hercules ordinances that are part of this record. Please note that these ordinances have been certified by their city councils to meet all requirements of the FCC directives, and therefore serve as appropriate baselines for our community. Let's not open the door to indiscriminate placement of small cell antennas in our residential areas and the cluttering of our visual space.

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Add definitions: "least intrusive means", "significant gap", "stealth facility" and "reasonable and compelling evidence".

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Thank you for being proactive for all of our safety.

Sincerely,

Laura A. Ross

Kathy Noel

From: Annemarie Clisby
Sent: Wednesday, August 21, 2019 2:04 PM
To: Roy Sapau
Subject: FW: Encinitas Small Cell Antenna Urgency Ordinance

From: Leslie Rucker <leslierucker@mac.com>
Sent: Wednesday, August 21, 2019 12:46 PM
To: Catherine Blakespear <cblakespear@encinitasca.gov>; Jody Hubbard <jhubbard@encinitasca.gov>; Council Members <council@encinitasca.gov>; Tony Kranz <tkranz@encinitasca.gov>; Joe Mosca <jmosca@encinitasca.gov>; Kellie Shay Hinze <khinze@encinitasca.gov>
Subject: Encinitas Small Cell Antenna Urgency Ordinance

Leslie Rucker
311 Via Julita
Encinitas CA 92024

August 20, 2019

City of Encinitas Council
Mayor Blakespear, Deputy Mayor Hubbard, and City Council Members Kellie Shay Hinze, Tony Kranz, and Joe Mosca

Re: Encinitas Small Cell Antenna Urgency Ordinance

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Thank you for being proactive for all of our safety.

Sincerely,

Leslie Rucker

Kathy Noel

From: Annemarie Clisby
Sent: Tuesday, September 3, 2019 11:36 AM
To: Roy Sapau
Subject: FW: Protective Small Cell Antenna Ordinance Needed Immediately

From: Linda Edmiston <lindae209@gmail.com>
Sent: Sunday, September 1, 2019 7:17 PM
To: Catherine Blakespear <cblakespear@encinitasca.gov>; Jody Hubbard <jhubbard@encinitasca.gov>; Council Members <council@encinitasca.gov>; Tony Kranz <tkranz@encinitasca.gov>; Joe Mosca <jmosca@encinitasca.gov>; Kellie Shay Hinze <khinze@encinitasca.gov>
Subject: Re: Protective Small Cell Antenna Ordinance Needed Immediately

Linda Edmiston
1753 Vesper Ln
Carlsbad, CA

September 1, 2019

City of Encinitas Council
Mayor Blakespear, Deputy Mayor Hubbard, and City Council Members Kellie Shay Hinze, Tony Kranz, and Joe Mosca

Re: Protective Small Cell Antenna Ordinance Needed Immediately

I am concerned that if Northern California has already Banned 5G due to the proven health issues, why Southern California is not following their example.
I do a lot of work in Encinitas and have many friends who live there. This is a huge safety issue.

I am concerned about the timing of the urgency ordinance:

A meeting was scheduled for a City Council with three business days' notice;
it was the last agenda item on an already full schedule;
brought to the City Council many months after the FCC directive was issued and other local communities had implemented ordinances; most citizens were not even aware of the meeting or the potentially tragic dangers,
the ordinance is not protective of sensitive and residential areas, and the ordinance provides a streamlined process for small cell antenna applications;

While I hope this is not true, I suspect that the urgency was a ploy to deflect and minimize the participation of citizens in Encinitas that are concerned about the environment in their community.

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32 small cell antennas already installed on light poles in Encinitas residential areas via a business agreement that the City made with Crown Castle a few years ago. I suspect that this was organized without community participation.)

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Thank you for amending the Encinitas small cell antenna ordinance immediately for our collective safety.

Here are some articles concerning the issues with 5G.
Quoting a former Brussels environmental minister who opposed 5G rollout there, Golomb wrote, "We hope our elected leaders and government officials show equal courage in defense of their people. Pressures to prioritize industry over human interest will be strong. Lucrative industries and PR operations with which they work have well learned the lessons pioneered by Big Tobacco, heavily funding science and scientists to generate doubt and deny health problems, using resources to influence or 'capture' legislators, legislation, nonprofits, media, journalists and regulators."
From the Coast News page A23 8-30-19

Excellent Daily Summit revealing the deadly danger of 5G in our environment. Thank you for caring.
I remember the old saying:
"Better safe than sorry!"

https://the5gsummit.com/?utm_source=ActiveCampaign&utm_medium=email&utm_content=Own+the+expert+talks+starting+at+%2459+%28plus+%24245+in+bonuses%29%21&utm_campaign=5G19

https://www.smart-safe.com/blogs/news/petition-26-000-scientists-oppose-5g-roll-out

Sincerely,

Linda Edmiston

www.LindaEdmiston.com

PS: When you are ready to start your day the most successfully and energetically as possible, Download the 5 Steps to Success for free.

"Life isn't about how to survive the storm, but how you dance in the rain." (unknown)

5G CRISIS
AWARENESS & ACCOUNTABILITY

Register below to access these expert talks
FREE for 7 days!

First Name

Email

GET THEM NOW!

100% secure. We never share your email. By submitting this form, I consent to receive offers and related promotional communications from the content provider and HealthMeans. I can withdraw consent at any time.
Click here to view our Privacy Policy

5G wireless… the industry HAS NOT shown it to be safe for your health or privacy – yet THOUSANDS of peer-reviewed, independent studies show the risks it presents. Learn about the dangers and find solutions in your community!

You may have heard of 5G, it stands for fifth-generation cellular wireless. In a February 2019 US Senate hearing, the wireless industry was forced to admit they have no safety studies on 5G, and don't plan to do any. Meanwhile, there are thousands of independent studies concluding that **wireless radiation causes biological harm.**

Despite this, the wireless industry is working with government to deploy 5G — it's a global, for-profit, human experiment... without our consent.

What does it mean? Millions of "small" cell towers will be added to every block (which is a serious privacy concern). Each tower emitting radiation at levels known to cause **cancer, sterility, DNA damage and other harm**... especially to our children, who are most at risk.

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HOME / EMR NEWS - THE LATEST ON MOBILE PHONE RADIATION / PETITION: 26,000 SCIENTISTS OPPOSE 5G ROLL OUT

Petition: 26,000 Scientists Oppose 5G Roll Out

Posted on March 11 2019

Message Us

Concerns about the upcoming launch of 5G radio telecommunications technology have prompted a mass petition against the move on safety grounds by thousands of scientists and related professionals.

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Arthur Firstenberg writes:

Wireless Radiation: Stop The 5G Network On Earth And In Space, Devastating Impacts On Health And The Environment

To the UN, WHO, EU, Council of Europe and governments of all nations

We the undersigned scientists, doctors, environmental organizations and citizens from (__) countries, urgently call for a halt to the deployment of the 5G (fifth generation) wireless network, including 5G from space satellites. 5G will massively increase exposure to radio frequency (RF) radiation on top of the 2G, 3G and 4G networks for telecommunications already in place. RF radiation has been proven harmful for humans and the environment. The deployment of 5G constitutes an experiment on humanity and the environment that is defined as a crime under international law.

Executive summary

Telecommunications companies worldwide, with the support of governments, are poised within the next two years to roll out the fifth-generation wireless network (5G). This is set to deliver what is acknowledged to be unprecedented societal change on a global scale. We will have “smart” homes, “smart” businesses, “smart” highways, “smart” cities and self-driving cars. Virtually everything we own and buy, from refrigerators and washing machines to milk cartons, hairbrushes, and infants’ diapers, will contain antennas and microchips and will be connected wirelessly to the Internet. Every person on Earth will have instant access to super-high-speed, low- latency wireless communications from any point on the planet, even in rainforests, mid-ocean and the Antarctic.

What is not widely acknowledged is that this will also result in an unprecedented environmental change on a global scale. The planned density of radio frequency transmitters is impossible to envisage. In addition to millions of new 5G base stations on Earth and 20,000 new satellites in space, 200 billion transmitting objects, according to estimates, will be part of the Internet of Things by 2020, and one trillion objects a few years later. Commercial 5G at lower frequencies and slower speeds was deployed in Qatar, Finland, and Estonia in mid-2018. The rollout of 5G at extremely high (millimeter wave) frequencies is planned to begin at the end of 2018.

Despite the widespread denial, the evidence that radio frequency (RF) radiation is harmful to life is already overwhelming. The accumulated clinical evidence of sick and injured human beings, experimental evidence of damage to DNA, cells and organ systems in a wide variety of plants and animals, and epidemiological evidence that the major diseases of modern civilization—cancer, heart disease, and diabetes—are in large part caused by electromagnetic pollution, forms a literature base of well over 10,000 peer-reviewed studies.

If the telecommunications industry’s plans for 5G come to fruition, **no person, no animal, no bird, no insect and no plant on Earth will be able to avoid exposure, 24 hours a day, 365 days a year, to levels of RF radiation that are tens to hundreds of times greater than what exists today,** without any possibility of escape anywhere on the planet. These 5G plans threaten to provoke serious effects on humans and permanent damage to all of the Earth’s ecosystems.

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Immediate measures must be taken to protect humanity and the environment, by ethical imperatives and international agreements.

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5G will result in a massive increase in inescapable, involuntary exposure to wireless radiation

Ground-based 5G

To transmit the enormous amounts of data required for the Internet of Things (IoT), 5G technology, when fully deployed, will use millimeter waves, which are poorly transmitted through solid material. This will require every carrier to install base stations every 100 meters [1] in every urban area in the world. Unlike previous generations of wireless technology, in which a single antenna broadcasts over a wide area, 5G base stations and 5G devices will have multiple antennas arranged in "phased arrays" [2],[3] that work together to emit focused, steerable, laser-like beams that track each other.

Each 5G phone will contain dozens of tiny antennas, all working together to track and aim a narrowly focused beam at the nearest cell tower. The US Federal Communications Commission (FCC) has adopted rules[4]permitting the effective power of those beams to be as much as 20 watts, ten times more powerful than the levels permitted for current phones.

Each 5G base station will contain hundreds or thousands of antennas aiming multiple laser-like beams simultaneously at all cell phones and user devices in its service area. This technology is called "multiple inputs multiple output" or MIMO. FCC rules permit the effective radiated power of a 5G base station's beams to be as much as 30,000 watts per 100 MHz of spectrum,[2] or equivalently 300,000 watts per GHz of spectrum, tens to hundreds of times more powerful than the levels permitted for current base stations.

Space-based 5G

At least five companies[5] are proposing to provide 5G from space from a combined 20,000 satellites in low- and medium-Earth orbit that will blanket the Earth with powerful, focused, steerable beams. Each satellite will emit millimeter waves with an effective radiated power of up to 5 million watts[6] from thousands of antennas arranged in a phased array. Although the energy reaching the ground from satellites will be less than that from ground-based antennas, it will irradiate areas of the Earth not reached by other transmitters and will be additional to ground-based 5G transmissions from billions of IoT objects. Even more importantly, the satellites will be located in the Earth's magnetosphere, which exerts a significant influence over the electrical properties of the atmosphere. **The alteration of the Earth's electromagnetic environment may be an even greater threat to life than the radiation from ground-based antennas (see below).**

Please go to **Global Research** to read the entire article.

Message Us

Source: Health Impact News

20,000 Satellites For 5G To Be Launched Sending Focused Beams Of Intense Microwave Radiation Over Entire Earth

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by John P. Thomas • Health Impact News • January 11, 2018

Public attention about 5G has been focused on the plans of telecom companies to install millions of small cell towers on electric utility poles, on public buildings and schools, on bus stop shelters, in public parks, and anywhere they want in national parks and on federally owned land.

In local urban communities, there would be a cell tower approximately every 500 feet along every street.

As bad as these small cell towers might seem from the standpoint of constant exposure to radio frequency (RF) radiation in close proximity to the source, perhaps an even more alarming prospect will be the beaming of millimeter length microwaves at the earth from thousands of new communication satellites.

The FCC approved SpaceX on March 29, 2018, to launch 4,425 satellites into low orbit around the Earth. [1]

The total number of satellites that are expected to be put into low and high orbit by several companies will be 20,000 satellites. [1]

5G will use Phased Array Antennas to shoot Beams of Radiation at Cell Phones

These satellites will use the same type of phased array antennas as will be used by the ground-based 5G systems.

This means that they will send tightly focused beams of intense microwave radiation at each specific 5G device that is on the Earth and each device will send a beam of radiation back to the satellite. [2]

Previous generations of RF cellular communication used large antennas to send a blanket of radiation in all directions. The lower frequencies they used and the broad distribution of microwaves li numbers of cellular devices that could connect through an individual tall tower.

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The much shorter length microwaves used for 5G will make it possible to use small phased array antennas to send and receive signals.

Phased array antennas consist of clusters of hundreds of tiny antennas that work together to shoot a ray of energy at a target just like a bullet. A cluster of these tiny antennas can be arranged in a 4 inch by 4-inch matrix.

The rays of microwaves they produce will be strong enough to pass through walls and human bodies. If they were not strong enough to do this, then everyone with a 5G smartphone would have to stand outside when using the devices. [2]

Each 5G product will also have multiple phased array antennas which will be used to create a powerful beam of radiation back to the 5G devices mounted on electrical utility poles or toward a specific satellite in space.

These beams of radiation will also need to be strong enough to pass through walls and human flesh such as a hand or head to reach the intended destination. [2]

This means that if you are in a crowded location, such as an airport or on a train, there will be hundreds if not thousands of invisible beams of radiation flying through the environment at the speed of light.

As people move in that environment, their bodies will be penetrated by numerous beams of radiation as they walk or as other people walk around them with their 5G smartphones. [2]

5G Phones will be much more Powerful than Previous Phones

The effective radiated power of the 5G phased array antennas in phones will be ten times more powerful than 4G phones.

No one will be free from exposure.

In addition, 5G beams of microwave radiation will be received and transmitted from new computer equipment, household appliances, and automobiles.

Stationary equipment such as Wi-Fi hubs in homes and offices will be permitted to use microwave beams that are 15 times stronger (300 watts) than the signals from 5G phones or 150 times stronger than 4G phones. [2]

Please go to **Health Impact News** to read the entire article.

SOURCE: https://principia-scientific.org/petition-26000-scientists-oppose-5g-roll-out/?fbclid=IwAR2nkHAiVb4jIzfpfWfp-mBBcmRoHe1I_X0GA6HwDvBKHn4s17-rjXpp8Jo

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Kathy Noel

From: Annemarie Clisby
Sent: Tuesday, August 20, 2019 2:12 PM
To: Roy Sapau
Subject: FW: 5G ordinance

From: LINDSY RICHARDS <lindsyrichards@me.com>
Sent: Tuesday, August 20, 2019 1:47 PM
To: Catherine Blakespear <cblakespear@encinitasca.gov>; Council Members <council@encinitasca.gov>; Jody Hubbard <jhubbard@encinitasca.gov>
Subject: 5G ordinance

Your Name: ____Lindsy Richards _____
Your Street Address: __880 Cornish Dr_____
City, state, zip: ___Encinitas CA 92024_____
Your phone # _____8587229067_____
Your email address: ____lindsyrichards@mac.com_____

_____8/20_____ 2019
(Date)

Encinitas City Council Chambers
505 South Vulcan Avenue
Encinitas, California 92024
cblakespear@encinitasca.gov , jhubbard@encinitasca.gov , council@encinitasca.gov

Attn: Catherine S.Blakespear, Mayor, Jody Hubbard, Deputy Mayor, Council Members:
Kellie Shay Hinze, Tony Kranz, and Joe Mosca

Dear Mayor Blakespear, Deputy Mayor Hubbard, and City Council Members,

The deployment of 5G will create very unhappy and unhealthy citizens of Encinitas. This is a violation of our rights and disruption to our lives. If there were a cell box installed on the telephone pole by my house I would have to move. I have been a resident at 880 Cornish for 19 years. We just remodeled and it would a tragedy for us to have to leave.

Why can't we be the town that stands for something higher than profits for FCC. Why can't we say NO!!! This will be impossible to reverse so the powers that be need should think long and hard about this.

The studies on such intense radio waves are out there. We know that it is not compatible with human biology. This is just insanity what humanity has come to. We all have enough wifi and don't need any more. You know this in your heart and mind so please stand up for humanity. Stand up for Encinitas. Stand up for children and pregnant women. The buck needs to stop here!!

I am writing to express my concern about the installment of 5G/small-cell antennas throughout the city of Encinitas. The threats to public health, safety, privacy, security, property values, landscapes, and more must be addressed in any small cell or other wireless ordinance. Both an Urgency Ordinance and a more permanent ordinance require built-in protections for the residents of Encinitas. I do not feel that enough time and effort, including enough residents' input into the Urgency Ordinance before you, has been undertaken. *This ordinance and Staff Report appears to be derived from a template produced through consultation with an outside agent apparently representing industry interests and the FCC guidelines, rather than residents' concerns. It has been hastily scheduled and placed at the end of a long agenda. This is not operating in good faith for such an important and controversial decision, which can literally be a*

matter of life and death for many in our community. **Therefore I request a continuance of this Agenda Item, with one or more workshops held to obtain residents input, and work directly with community groups to produce an updated proposed Urgency Ordinance, as well as the more permanent small cell wireless ordinance to follow**, and that during this time period, until a permanent ordinance is approved, no small cells shall be permitted within the city limits.

Based on review of this Urgency ordinance draft, there are still a number of ways it could be improved to ensure the best for the residents of the City of Encinitas, which I trust is your primary goal.

I ENCOURAGE YOU NOT TO VOTE IN FAVOR OF THE ANY CURRENT OR FUTURE DRAFT ORDINANCE UNTIL IT CONTAINS THE FOLLOWING:

- **Restrict small cells in residential areas, and sensitive zones where children, elderly and those with special/medical needs will be.** No small cell should be allowed within (a minimum) of 1000 feet from a residential property line, in any direction. Or within 1500 – 3,000 ft of civic areas, including schools, hospitals, libraries, churches, daycares, community centers, senior facilities, police and fire stations, parks, and sports fields - to the property lines. Verizon has a commercial on YouTube where they measured the distance of a 5G signal (through hills and obstacles) at a distance of greater than 3,000 feet, so there should be zero issue with these setbacks, they are a necessity. This will also reduce the ugly clutter that results from unrestricted small cell installations.
- **Restrict proximity of small cells in business areas.** No small cell should be allowed within (a minimum) of 500 feet from a business, in any direction.
- **Strong language.** Use words which are definitive, instead of suggestions which can be ignored.
- **Small cells and their related equipment weigh 90 lbs each according to industry sources.** These can lead to top-heavy, dangerous poles. Require certification by an independent engineer hired by City and paid for by permit applicants, to assure that the pole can handle this additional weight.
- **Permit approvals must be made to be discretionary rather than ministerial,** with the entire shot clock used**,** so the public can provide input *that can be acted on*, with a new streamlined system to accommodate objections and ADA Accommodations Requests.
- **ADA language and provisions.** The ordinance lacks language that protects Americans with disabilities, and their use of these rights-of-way and travel paths, where the small cells structures will be deployed. Small cells may make it impossible to occupy one's home or yard, as well, if sensitive to rf radiation. ADA protection must not be discriminatory toward those who have physical mobility disabilities only. What about citizens with EHS, pacemakers, ADD/ADHD, autoimmune, etc? Also, provide a set of directions for these requests with a timeline for granting them and incorporate into the shot clocks and beyond (which can then hold up the shot clock). These rights-of-way and public streets belong to us too, and this liability belongs to San Diego County.
- **Require a Master Plan.** The master plan needs to be coordinated across all carriers, and provide information for each antenna project like RF exposure levels, power levels, frequencies, and location address. The master plan should also be published online with ample notice, such that citizens can provide input BEFORE the antenna is installed. REQUIRE that these companies have a plan and strategy for where they place the antennas,and enforce their compliance. This will minimize excessive, haphazard installments. If there is no plan, require it as part of permit application.
- **Require undergrounding of all equipment except antennas,** with supportive independent documentation explaining how each component works, under penalty of perjury, if challenged.
- **No Colocation!** Co-location means multiple antennas to a single pole. And despite the thinking, it does not reduce clutter. Actually, it produces a huge eyesore of a pole will multiple projections hanging off of it. It DRAWS more attention because of the extra hardware. Colocation allows poles to become scarily top-heavy, and also exposes citizens to higher doses of radiation since multiple antennas will emit from a single location. One antenna per pole, and
- **Distance between poles:** no small cells or antennas shall be permitted within 1500 feet of ANY other antenna, even from other providers, whether on new or existing street poles.
- **No cutting or disturbance of trees and landscaping – at all.** This must be forbidden! There are other towns and cities with gorgeous, old trees being chopped down or excessively trimmed to allow for small cell deployment. Not going to happen in Encinitas!
- **Provide clear-easy-to-reach Encinitas support for citizens.** We need to have a dedicated hotline/service to contact the City when issues with the small cells arise, such as noise, safety, health problems, or other complaints need to be reported. This service can be funded by the wireless providers as a part of their application/bond/yearly renewal fees.
- **Insurance for rf radiation and other injuries, and Bonds.** Require proof that the companies, annually, have adequate liability insurance ($2 million dollars each small cell) and bonds of $500,000 per small cell to protect against malfunction, accidents, damages, and injuries, including from exposure to nonionizing radiation for the entire year. These provide protection for the City too. Indemnification is not enough!
- **RF emissions third-party testing.** Independent third party inspections, by companies contracting with the City, must be required at least once annually, or upon request, at the expense of the telecom company owning the small cells, to ensure

compliance with FCC guidelines for each pole (in total) and for each small cell on the pole, and for any collective antennas within 100 feet of each other.

- **Require notice for any residence within a mile** of a proposed small cell site, to provide ample time for residents to come forward and provide input, particularly those with medical reasons to avoid rf radiation. During noticing, large signage noticing must also be placed on prospective poles with full details of application plans in large print, including frequencies and power, size of small cell.
- **Approvals for permits may only be reissued yearly with new re-application,** with proof of having met all criteria including noticing, liability insurance as above, and bonds. *Small cells may not be upgraded without a full new application process.*
- **Require safety signage on all poles.** All poles must have necessary warning signs and RF safety information as well as company and County contact names and phone numbers. *Include total rf emission levels near bottom ten feet of poles or general area if more than one pole.*

Thank you for taking the time to consider and apply these suggestions. I look forward to seeing these changes in any future ordinance draft before it is voted on.

Sincerely,

Signature **Lindsy Richards** **Printed name**

Kathy Noel

From: Annemarie Clisby
Sent: Wednesday, August 28, 2019 10:19 AM
To: Roy Sapau
Subject: FW: Small cell towers in residential areas

From: LINDSY RICHARDS <lindsyrichards@me.com>
Sent: Tuesday, August 27, 2019 7:35 PM
To: Catherine Blakespear <cblakespear@encinitasca.gov>; Jody Hubbard <jhubbard@encinitasca.gov>; Council Members <council@encinitasca.gov>; Tony Kranz <tkranz@encinitasca.gov>; Joe Mosca <jmosca@encinitasca.gov>; Kellie Shay Hinze <khinze@encinitasca.gov>
Subject: Small cell towers in residential areas

Lindsy Richards
880 Cornish Dr
Encinitas, CA

August 27, 2019

City of Encinitas Council
Mayor Blakespear, Deputy Mayor Hubbard, and City Council Members Kellie Shay Hinze, Tony Kranz, and Joe Mosca

Re: Protective Small Cell Antenna Ordinance Needed Immediately

I am concerned about the timing of the urgency ordinance:

- scheduled for a City Council with three business days' notice;
- the last agenda item on an already full schedule;
- brought to the City Council many months after the FCC directive was issued and other local communities had implemented ordinances;
- the ordinance is not protective of sensitive and residential areas; and
- the ordinance provides a streamlined process for small cell antenna applications;

While I hope this is not true, I suspect that the urgency was a ploy to deflect and minimize the participation of citizens in Encinitas that are concerned about the environment in their community.

The urgency ordinance as it stands is not protective for sensitive areas and residential areas. There are no setbacks to sensitive areas which would be expected based on setbacks in the wireless ordinance for macro antennas. There is no protection of residential areas. And even though residential roads are one of the least preferred categories, the ordinance does not prevent Telecom installation of small cell antennas in front of our homes, which is most of Encinitas. (Note: there are 32 small cell antennas already installed on light poles in Encinitas residential areas via a business agreement that the City made with Crown Castle a few years ago. I suspect that this was organized without community participation.)

We want the ordinance to be more protective immediately, applied to all applications in process, before there is a flood of small cell antenna applications/installations in our neighborhoods. We can't wait for a small cell antenna community meeting.

I ask that the Encinitas small cell antenna ordinance incorporate the best practices of protective small cell

antennas ordinances of the California Cities of Mill Valley and Los Altos; Calabasas; Fairfield, Petaluma and San Ramon; and Hercules.

- Mill Valley and Los Altos ordinances, prepared by Gail Karish – telecommunications attorney for Best Best & Krieger LLP, prohibit small cell antennas in residential areas.
- The Calabasas ordinance does not allow small cell antennas in residential areas.
- The Fairfield, Petaluma and San Ramon ordinances require substantial setbacks to sensitive area and residential areas and structures.
- The Hercules ordinance is the best administration for control of the application and shot clock process, requires ANSI 222 class III poles for all small cell installations, and prohibits new antenna support structures in residential areas.

For me and many of my friends and colleagues, there is a perception of harm associated with microwave antennas. We know this in our guts and this is validated by frequent news and science reports that show great biological harm from microwave radiation exposure. We are afraid for our property values.

Thank you for amending the Encinitas small cell antenna ordinance immediately for our collective safety.

Sincerely,

Lindsy

Kathy Noel

From: Annemarie Clisby
Sent: Wednesday, August 28, 2019 10:19 AM
To: Roy Sapau
Subject: FW: Protective Small Cell Antenna Ordinance

From: Lisa Hochman <lisahochman@gmail.com>
Sent: Tuesday, August 27, 2019 9:27 PM
To: Catherine Blakespear <cblakespear@encinitasca.gov>; Jody Hubbard <jhubbard@encinitasca.gov>; Council Members <council@encinitasca.gov>; Tony Kranz <tkranz@encinitasca.gov>; Joe Mosca <jmosca@encinitasca.gov>; Kellie Shay Hinze <khinze@encinitasca.gov>
Subject: Protective Small Cell Antenna Ordinance

Lisa Hochman
1475 Hymettus Avenue
Encinitas, CA 92024

August 27, 2019

City of Encinitas Council
Attn: Mayor Blakespear, Deputy Mayor Hubbard, and City Council Members Kellie Shay Hinze, Tony Kranz, and Joe Mosca

Re: Protective Small Cell Antenna Ordinance Needed Immediately

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- scheduled for a City Council with three business days' notice;
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I ask that the Encinitas small cell antenna ordinance incorporate the best practices of protective small cell antennas ordinances of the California Cities of Mill Valley and Los Altos; Calabasas; Fairfield, Petaluma and San Ramon; and Hercules.

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For me and many of my friends and colleagues, there is a perception of harm associated with microwave antennas. We know this in our guts and this is validated by frequent news and science reports that show great biological harm from microwave radiation exposure. We are also afraid for our property values.

Thank you for amending the Encinitas small cell antenna ordinance immediately for our collective safety.

Sincerely,

Lisa Hochman

Kathy Noel

From: Annemarie Clisby
Sent: Tuesday, September 3, 2019 11:51 AM
To: Roy Sapau
Subject: FW: Please BLOCK 5G In Your Area...

From: Liz Barris <mandatoryussmartgridblock@gmail.com>
Sent: Friday, August 30, 2019 2:24 PM
To: Catherine Blakespear <cblakespear@encinitasca.gov>; Jody Hubbard <jhubbard@encinitasca.gov>; Council Members <council@encinitasca.gov>; Tony Kranz <tkranz@encinitasca.gov>; Joe Mosca <jmosca@encinitasca.gov>; Kellie Shay Hinze <khinze@encinitasca.gov>
Subject: Please BLOCK 5G In Your Area...

Dear City Councilmen/women of Encinitas;

I write you today urging you to reject 5G as it is a higher frequency/more damaging wave length than its predecessors, 2G, 3G and 4G (also very damaging) however the antennas of 5G have been given the rights by the FCC to actually be placed in front of residences and at a much greater number than 3 and 4G.

I won't send you the usual materials others may be submitting regarding Mill Valley, set backs, etc., suffice to say other areas are PROHIBITING this deadly millimeter infrastructure in their areas. I will however tell you that I am EHS (electrohypersenstive- civilian term, microwave radiation poisoning - military term) and have very sever reactions to 3 and 4G which include but are not limited to: migraine headaches that last for 48 hours, extreme loss of energy, stabbing pains in the ears, head, breast and glands, dizziness, nausea, vomiting and now my doctors think I may have cancer which I am having checked very soon. And this is all from the EXISTING microwave infrastructure, 4G and 3G. 5G would quite possibly put me over the top and kill me. People should not have to die and produce a "body count' for their governments to take protective actions in the face of SO MUCH EVIDENCE OF HARM. One such study was published by our own NTP (National Toxicology Program), part of NIH (National Institute of Health). Here is a link...

https://ntp.niehs.nih.gov/results/areas/cellphones/index.html

Highlight from article...

- **Clear evidence of tumors in the hearts of male rats.** The tumors were malignant schwannomas.
- **Some evidence of tumors in the brains of male rats.** The tumors were malignant gliomas.
- **Some evidence of tumors in the adrenal glands of male rats.** The tumors were benign, malignant, or complex combined pheochromocytoma.

Here is a press release of a study we published showing what I and some of your constituents have, EHS in pictures on an fMRI (functional MRI). Some of your constituents even participated in this study...

https://www.prnewswire.com/news-releases/pilot-study-shows-dramatic-difference-in-brain-activity-with-ehs-electrohypersensitive-cases-as-compared-to-controls-non-ehs-300566854.html

And here is the abstract...
https://www.ncbi.nlm.nih.gov/pubmed/28678737

Due to the overwhelming evidence of harm we are asking that our local governments BLOCK the illegal orders from the FCC mandating exposure to a known carcinogen, stating these antennas should be placed every 70 feet or so throughout our neighborhoods. It makes one wonder if this industry is in fact in bed with the pharmaceutical industry who will be the main beneficiaries of 5G given the extreme cancer, neurological and genetic damage increase with this high frequency exposure.

Thank you and sincerely,
Liz,
sent from my HARD WIRED internet connection

National Toxicology Program
U.S. Department of Health and Human Services

Share This:
https://ntp.niehs.nih.gov/go/cellphone

Cell Phone Radio Frequency Radiation

Final reports from the rat and mouse studies, plus the press release and fact sheet, are now available.

Research Overview

Status: Completed
Substances: Cell Phone Radiation: GSM, Cell Phone Radiation: CDMA
Nominated: May 1999

BACKGROUND INFORMATION

Cell phones are currently used by 95% of American adults. The U.S. Food and Drug Administration (FDA) nominated radio frequency radiation (RFR) used by cell phones for an NTP study because of widespread public use of cell phones and limited knowledge about potential health effects from long-term exposure.

NTP STUDIES & FINDINGS

NTP conducted toxicology studies in rats and mice to help clarify potential health hazards, including cancer risk, from exposure to RFR like that used in 2G and 3G cell phones which operate within a range of frequencies from about 700 – 2700 megahertz (MHz).

What did the studies find?

The NTP studies found that high exposure to RFR (900 MHz) used by cell phones was associated with:

- **Clear evidence of tumors in the hearts of male rats.** The tumors were malignant schwannomas.
- **Some evidence of tumors in the brains of male rats.** The tumors were malignant gliomas.
- **Some evidence of tumors in the adrenal glands of male rats.** The tumors were benign, malignant, or complex combined pheochromocytoma.

It was unclear if tumors observed in the studies were associated with exposure to RFR in female rats (900 MHz) and male and female mice (1900MHz). This is also known as equivocal evidence.

The final conclusions represent the consensus between NTP and a panel of external scientific experts who thoroughly reviewed the draft NTP technical reports at a public meeting in March 2018.

The results are based on NTP's four categories of evidence that a substance may cause cancer: clear evidence (highest), some evidence, equivocal evidence, no evidence (lowest).

What are NTP's future plans for studying cell phone RFR and 5G wireless technology?

5G is currently emerging and will eventually overtake the existing 2G, 3G, and 4G technology. In the meantime, consumers will continue to be exposed to RFR from these sources in the 700-2700 MHz range. As the 5G network is implemented, some of the signals will use the same lower frequencies as the older technology previously studied by NTP. Additionally, concern has been raised because the 5G network will also use higher frequencies, up to 60,000 MHz, thereby exposing wireless consumers to a much broader spectrum of frequencies. The higher frequencies, known as millimeter waves, can rapidly transmit enormous amounts of data with increased network capacity compared to current technologies. Millimeter waves do not travel as far and do not penetrate the body as deep as the wavelengths from the lower frequencies. Millimeter waves are likely to penetrate no deeper than the skin, as opposed to the lower frequencies that have been shown to penetrate at least three to four inches into the human body.

NTP is currently evaluating the existing literature on the higher frequencies intended for use in the 5G network and is working to better understand the biological basis for the cancer findings reported in earlier studies on RFR with 2G and 3G technologies. Additionally, work is ongoing to develop smaller RFR exposure chambers for additional short-term studies that will take weeks and months rather than years. The exposure system is also being designed with the capability of conducting studies with various RFR frequencies and modulations to keep up with the changing technologies in the telecommunications industry.

NTP is also hoping to identify biomarkers of damage from RFR exposure. These would be measurable physical changes that can be seen in shorter periods of time than it takes to develop cancer. Examples could be changes in behavior after exposure or molecular changes

that might be predictive of cancer. If scientists can better understand biological changes in animals, they will know more about what to look for in humans.

INFORMATIONAL RESOURCES

Fact Sheet and FAQ

- NIEHS Health Topic: Cell Phone Radiofrequency Radiation Studies
- Cell Phone Radiofrequency Radiation Studies
  Updated November 2018

Media Briefing and Interviews

- News Release: High Exposure to Radio Frequency Radiation Associated with Cancer in Male Rats
  November 1, 2018
- News Release: NTP Draft Conclusions for Radiofrequency Radiation Studies in Rats and Mice
  February 2, 2018
- Media Telebriefing: NTP Cell Phone Radiofrequency Radiation Study: Partial Release of Findings
  May 27, 2016

Newsletters

- High Exposure to Radio Frequency Radiation Associated with Cancer in Male Rats
  Environmental Factor, November 2018
- NTP Cell Phone Studies — Experts Recommend Elevated Conclusions
  Environmental Factor, April 2018
- NTP Releases Rodent Studies on Cell Phone Radiofrequency Radiation
  Environmental Factor, June 2016

Presentations

- NTP Board of Scientific Counselors Meeting, Research Triangle Park, NC, June 2018
  - Report on March 26-28, 2018 Peer Review of NTP Technical Reports
- BioEM2016 Meeting, Ghent, Belgium, June 8, 2016
  - Slides: NTP Toxicology and Carcinogenicity Studies of Cell Phone Radiofrequency Radiation

Publications

- Wyde ME, Horn TL, Capstick MH, Ladbury JM, Koepke G, Wilson PF, Kissling GE, Stout MD, Kuster N, Melnick RL, Gauger J, Bucher JR, McCormick DL. Effect of cell phone radiofrequency radiation on body temperature in rodents: Pilot studies of the National Toxicology Program's reverberation chamber exposure system. Bioelectromagnetics. 2018; 39:190-199 https://doi.org/10.1002/bem.22116
- Capstick MH, Kuehn S, Berdinas-Torres V, Gong Y, Wilson PF, Ladbury JM, Koepke G, McCormick DL, Gauger J, Melnick RL, Kuster N. A radio frequency radiation exposure system for rodents based on reverberation chambers. IEEE Trans Electromagn Compat. 2017; 59(4):1041-1052 https://doi.org/10.1109/TEMC.2017.2649885
- Gong Y, Capstick MH, Kuehn S, Wilson PF, Ladbury JM, Koepke G, McCormick DL, Melnick R, Kuster N. Life-time dosimetric assessment for mice and rats exposed in reverberation chambers for the two-year NTP cancer bioassay study on cell phone radiation. IEEE Trans Electromagn Compat. 2017; 59(6):1798-1808 https://doi.org/10.1109/TEMC.2017.2665039
- Wyde M, Cesta M, Blystone C, Elmore S, Foster P, Hooth M, Kissling G, Malarkey D, Sills R, Stout M, Walker N, Witt K, Wolfe M, Bucher J. Report of partial findings from the National Toxicology Program carcinogenesis studies of cell phone radiofrequency radiation in Hsd: Sprage Dawley SD rats (whole body exposure). BioRxiv 055699 [Preprint] May 26, 2016 (modified Feb 01, 2018). https://doi.org/10.1101/055699

Photos of the Radiofrequency Radiation Research Facility

Click on the thumbnail to see a larger version of the photo.

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Subscribe to receive email to stay informed about cell phone radio frequency radiation research and other NTP information.

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For questions or additional information, email us or use our contact form.

Web page last updated on Aug. 15, 2019

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Pilot Study Shows Dramatic Difference In Brain Activity With EHS (Electrohypersensitive) Cases As Compared To Controls (Non EHS).

PRESS TELE-CONFERENCE, THURS., Dec. 7th, 12 NOON PST.

This is the first known published study to show pictures of EHS on an fMRI.

NEWS PROVIDED BY
The Peoples Initiative Foundation →
Dec 05, 2017, 09:37 ET

LOS ANGELES, Dec. 5, 2017 /PRNewswire/ -- The Peoples Initiative Foundation has announced the conclusion of a pilot study they organized, headed up by Dr. Gunnar Heuser, showing EHS on an fMRI. This study was originally published by Degruyter in July of 2017, but was absent pictures of the controls. The company waited until the pictures were placed in the study to issue this press release, as the visual difference between the cases and controls is quite dramatic.

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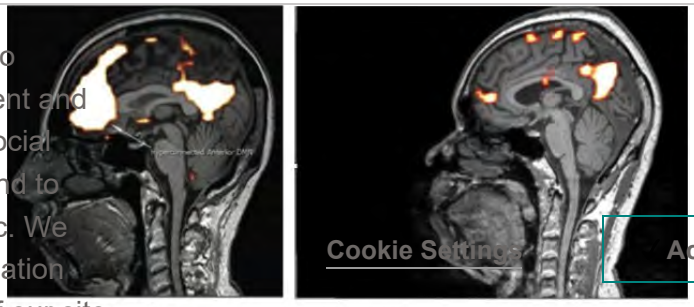

Figure 11. Lateral view of a normal fMRI. Note absence of abnormal white areas seen in our patient group.

Exposure to wireless devices and infrastructure is believed to have been the cause of the EHS in the cases.

Below are 2 sample pictures from the study. The large white area on the left side of the left picture shows hyperconnectivity in the brain of a case (EHS person). The same small white area in the picture to the right shows normal brain activity in a control (non EHS person).

EHS or "electrohypersensitivity" in civilian terms, "microwave radiation poisoning" in military terms, is an RF (radio frequency) or microwave radiation induced illness who's very existence is hotly debated by government and wireless industry scientists and personnel. This study provides evidence that abnormalities exist in the EHS brain that are not present in the non EHS brain and could put an end to the debate on the existence of EHS. It also defies the widely held governmental and wireless industry stance that wireless devices and infrastructure have no consequences to human health and could impact the prevailing opinion of wireless radiation being deemed safe.

The Peoples Initiative Foundation will be holding a tele-press conference to take questions from the media Thurs. Dec. 7th @ 12 noon PST. The study's principle author, Dr. Gunnar Heuser will be on the call to take questions about the study, as well as Liz Barris, study organizer and one of the EHS cases in the study to take questions about EHS.

Journalists on deadline who RSVP by emailing: contact@thepeoplesinitiative.org with the # they will be calling in from will be given first priority in the tele-press conference queue.

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Please call 515-739-1219 access code 283521#

Emergency back up # only in case above # has problem:
605-472-5616 access code 106520#

For free abstract and purchase of full text of the study with case pictures go here… https://www.degruyter.com/view/j/reveh.2017.32.issue-3/reveh-2017-0014/reveh-2017-0014.xml

Corrigendum and control pictures here… https://www.degruyter.com/view/j/reveh.2017.32.issue-4/reveh-2017-0027/reveh-2017-0027.xml?format=INT

www.thepeoplesinitiative.org
contact@thepeoplesinitiative.org
310-281-9639

SOURCE The Peoples Initiative Foundation

PubMed

Format: Abstract

Full text links

Rev Environ Health. 2017 Sep 26;32(3):291-299. doi: 10.1515/reveh-2017-0014.

Functional brain MRI in patients complaining of electrohypersensitivity after long term exposure to electromagnetic fields.

Heuser G[1], Heuser SA[1].

Author information

1 .

Erratum in

Corrigendum to: Functional brain MRI in patients complaining of electrohypersensitivity after long term exposure to electromagnetic fields. [Rev Environ Health. 2017]

Abstract

INTRODUCTION: Ten adult patients with electromagnetic hypersensitivity underwent functional magnetic resonance imaging (fMRI) brain scans. All scans were abnormal with abnormalities which were consistent and similar. It is proposed that fMRI brain scans be used as a diagnostic aid for determining whether or not a patient has electromagnetic hypersensitivity. Over the years we have seen an increasing number of patients who had developed multi system complaints after long term repeated exposure to electromagnetic fields (EMFs). These complaints included headaches, intermittent cognitive and memory problems, intermittent disorientation, and also sensitivity to EMF exposure. Regular laboratory tests were within normal limits in these patients. The patients refused to be exposed to radioactivity. This of course ruled out positron emission tomography (PET) and single-photon emission computed tomography (SPECT) brain scanning. This is why we ordered fMRI brain scans on these patients. We hoped that we could document objective abnormalities in these patients who had often been labeled as psychiatric cases.

MATERIALS AND METHODS: Ten patients first underwent a regular magnetic resonance imaging (MRI) brain scan, using a 3 Tesla Siemens Verio MRI open system. A functional MRI study was then performed in the resting state using the following sequences: A three-dimensional, T1-weighted, gradient-echo (MPRAGE) Resting state network. The echo-planar imaging (EPI) sequences for this resting state blood oxygenation level dependent (BOLD) scan were then post processed on a 3D workstation and the independent

component analysis was performed separating out the various networks. Arterial spin labeling. Tractography and fractional anisotropy.

RESULTS: All ten patients had abnormal functional MRI brain scans. The abnormality was often described as hyper connectivity of the anterior component of the default mode in the medial orbitofrontal area. Other abnormalities were usually found. Regular MRI studies of the brain were mostly unremarkable in these patients.

CONCLUSION: We propose that functional MRI studies should become a diagnostic aid when evaluating a patient who claims electrohypersensitivity (EHS) and has otherwise normal studies. Interestingly, the differential diagnosis for the abnormalities seen on the fMRI includes head injury. It turns out that many of our patients indeed had a history of head injury which was then followed sometime later by the development of EHS. Many of our patients also had a history of exposure to potentially neurotoxic chemicals, especially mold. Head injury and neurotoxic chemical exposure may make a patient more vulnerable to develop EHS.

KEYWORDS: electrohypersensitivity (EHS); electromagnetic field (EMF); fMRI; multiple chemical sensitivity (MCS)

PMID: 28678737 DOI: 10.1515/reveh-2017-0014

[Indexed for MEDLINE]

MeSH terms

LinkOut - more resources

Kathy Noel

From: Annemarie Clisby
Sent: Wednesday, August 28, 2019 10:20 AM
To: Roy Sapau
Subject: FW: Cell Towers in our Neighborhoods

From: Lori Smith McGrath <thelorismith@hotmail.com>
Sent: Wednesday, August 28, 2019 7:45 AM
To: Catherine Blakespear <cblakespear@encinitasca.gov>; Jody Hubbard <jhubbard@encinitasca.gov>; Council Members <council@encinitasca.gov>; Tony Kranz <tkranz@encinitasca.gov>; Joe Mosca <jmosca@encinitasca.gov>; Kellie Shay Hinze <khinze@encinitasca.gov>
Subject: Cell Towers in our Neighborhoods

August 28, 2019

Lori and Daniel McGrath
304 Countrywood Lane
Encinitas, CA 92024

City of Encinitas Council
Mayor Blakespear, Deputy Mayor Hubbard, and City Council Members Kellie Shay Hinze, Tony Kranz, and Joe Mosca

Re: Protective Small Cell Antenna Ordinance Needed Immediately

I am concerned about the timing of the urgency ordinance:

- scheduled for a City Council with three business days' notice;
- the last agenda item on an already full schedule;
- brought to the City Council many months after the FCC directive was issued and other local communities had implemented ordinances;
- the ordinance is not protective of sensitive and residential areas; and
- the ordinance provides a streamlined process for small cell antenna applications;

While I hope this is not true, I suspect that the urgency was a ploy to deflect and minimize the participation of citizens in Encinitas that are concerned about the environment in their community.

The urgency ordinance as it stands is not protective for sensitive areas and residential areas. There are no setbacks to sensitive areas which would be expected based on setbacks in the wireless ordinance for macro antennas. There is no protection of residential areas. And even though residential roads are one of the least preferred categories, the ordinance does not prevent Telecom installation of small cell antennas in front of our homes, which is most of Encinitas. (Note: there are 32 small cell antennas already installed on light poles in Encinitas residential areas via a business agreement that the City made with Crown Castle a few years ago. I suspect thatthis was organized without community participation.)

We want the ordinance to be more protective immediately, applied to all applications in process, before there is a flood of small cell antenna applications/installations in our neighborhoods. We can't wait for a small cell

antenna community meeting.

I ask that the Encinitas small cell antenna ordinanceincorporate the best practices of protective small cell antennas ordinances of the California Cities of Mill Valley and Los Altos; Calabasas; Fairfield, Petaluma and San Ramon; and Hercules.

- Mill Valley and Los Altos ordinances, prepared by Gail Karish – telecommunications attorney for Best Best & Krieger LLP, prohibit small cell antennas in residential areas.
- The Calabasas ordinance does not allow small cell antennas in residential areas.
- The Fairfield, Petaluma and San Ramon ordinances require substantial setbacks to sensitive area and residential areas and structures.
- The Hercules ordinance is the best administration for control of the application and shot clock process, requires ANSI 222 class III poles for all small cell installations, and prohibits new antenna support structures in residential areas.

For me and many of my friends and colleagues, there is a perception of harm associated with microwave antennas. We know this in our guts and this is validated by frequent news and science reports that show great biological harm from microwave radiation exposure. We are afraid for our property values.

Thank you for amending the Encinitas small cell antenna ordinance immediately for our collective safety.

Sincerely,

Lori and Daniel McGrath

Kathy Noel

From: Annemarie Clisby
Sent: Wednesday, August 21, 2019 11:01 AM
To: Roy Sapau
Subject: FW: small cell safety

From: Mair Rathburn <mairrathburn@sbcglobal.net>
Sent: Wednesday, August 21, 2019 10:35 AM
To: Catherine Blakespear <cblakespear@encinitasca.gov>; Jody Hubbard <jhubbard@encinitasca.gov>; Council Members <council@encinitasca.gov>; Tony Kranz <tkranz@encinitasca.gov>; Joe Mosca <jmosca@encinitasca.gov>; Kellie Shay Hinze <khinze@encinitasca.gov>
Subject: small cell safety

Ms Rathburn **August 20, 2019**
San Diego CA

City of Encinitas Council
Mayor Blakespear, Deputy Mayor Hubbard, and City Council Members Kellie Shay Hinze, Tony Kranz, and Joe Mosca

Re: Encinitas Small Cell Antenna Urgency Ordinance

I have a perception of harm from microwave antennas in close proximity to the businesses I frequent in Encinitas. I'm afraid for my physical well-being, for my family. The FCC exposure limits protect us from adverse thermal effects such as shock, burns and being heated, but not from the harmful biological effects known by our scientists for more than 50 years. I implore you to protect me, us.

I perceive that small cell antenna in the right-of-way in front of a home means 20 percent devaluation in property value and sickness and untold suffering to one or more members of that household

The city of Encinitas needs a small cell ordinance immediately so that there is oversight about placement of small cell antennas in our community and especially our sensitive and residential areas.

As written this urgency ordinance provides a convenient administrative process for the Telecom to put small cell antennas anywhere they want. I say this because there is an absence of administrative teeth that would empower the city of Encinitas to enforce the location preference (e.g. prevent small cell antenna installation in front of homes), control the application and shot clock process and installation quality.

My request for the City of Encinitas is that this ordinance be sent back to staff for major upgrade that would reflect the protective aspects of the Calabasas and Hercules ordinances that are part of this record. Please note that these ordinances have been certified by their city councils to meet all requirements of the FCC directives, and therefore serve as appropriate baselines for our community. Let's not open the door to indiscriminate placement of small cell antennas in our residential areas and the cluttering of our visual space.

If the city deems it necessary to have an ordinance in place immediately, then please make approval conditional on adding the protective features garnered from the Calabasas municipal code section 17.12.050(C) and Hercules Title 10 Chapter 16 ordinances as a condition of approval.

Kathy Noel

From: Shari Watson
Sent: Thursday, August 22, 2019 1:27 PM
To: Maria Gualda
Cc: Planning; Kathy Hollywood
Subject: RE: 5G Meeting

Good afternoon,

We appreciate your comments Ms. Gualda. I've copied our Planning Division and the City Clerk's office on your request for additional community outreach on the 5G item. City Council meeting agendas are posted at least 72 hours prior to the meeting on the City's website. Here's a link to the agenda webpage:

Agendas & Webcasts

While the City often posts information on Facebook, Twitter and Nextdoor, we encourage residents and community stakeholders to register for electronic notifications at http://encinitasca.gov/Home/City-Updates . Information is shared with community members more frequently via this process. If you click on the link you'll find a number of different categories – just check the categories that are of interest to you and you'll receive information via email as soon as it's posted on our website. The 5G item would most likely be shared in the following notifications:

- City Council Agendas and Updates
- City News and City Manager Weekly Updates
- Development Services Public Notices
- Planning Commission Agendas and Updates

Again, we appreciate your feedback, and thank you for your time in communicating with us.

Kind Regards,

Shari Watson
City of Encinitas
Development Services
760-633-2770
swatson@encinitasca.gov

From: Maria Gualda [mailto:mariatgualda@gmail.com]
Sent: Thursday, August 22, 2019 10:54 AM
To: Shari Watson
Subject: 5G Meeting

This item needs more advance notice than one day on Nextdoor. Please schedule another meeting with several notifications. I have very strong opposing opinions about putting 5G in my community. Let's have a community forum about it. This is a big deal. Thanks.
--
Maria

Thrifty Threader
Thoughtful Inhabitant of Planet Earth

760-525-1816
mariatgualda@gmail.com

Kathy Noel

From: Annemarie Clisby
Sent: Wednesday, August 21, 2019 11:45 AM
To: Roy Sapau
Subject: FW: PLease forward the following email to the Council, Mayor, City Manager, City Attorney

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From: Kathy Hollywood <khollywood@encinitasca.gov>
Sent: Wednesday, August 21, 2019 11:37 AM
To: Karen Brust <kbrust@encinitasca.gov>; Mark Delin <Mdelin@encinitasca.gov>; Glenn Sabine <GSabine@encinitasca.gov>; Brenda Wisneski <Bwisneski@encinitasca.gov>; Roy Sapau <RSapau@encinitasca.gov>
Cc: Claudia Bingham <CBingham@encinitasca.gov>
Subject: FW: PLease forward the following email to the Council, Mayor, City Manager, City Attorney

Mayor and Council have been blind copied on this email.

Kathy Hollywood, City Clerk
City of Encinitas
760-633-2601

From: Marie Dardarian <imzmd@roadrunner.com>
Sent: Wednesday, August 21, 2019 11:28 AM
To: Kathy Hollywood <khollywood@encinitasca.gov>
Subject: PLease forward the following email to the Council, Mayor, City Manager, City Attorney

To: Encinitas Council, Mayor, City Manager, City Attorney

From: Marie Dardarian and Dietmar Rothe

RE: Item 10 C on August 21 Agenda 5 G

Dear Council Member,

We are concerned that you are pushing through this “Urgent” resolution to deploy 5 G installations and infrastructure within our city.

I light of the fact there is an Appeal in the Ninth Circuit Court by Senator Feinstein rescinding FCC ruling on 5G deployments I would advise you to:

1. Remove this agenda item from today's agenda

2. Postpone any action until the Ninth Circuit Court decides this issue

Sincerely,

Marie Dardarian

Dietmar Rothe

Kathy Noel

From: Annemarie Clisby
Sent: Wednesday, August 21, 2019 4:28 PM
To: Roy Sapau
Subject: FW: MUST AMEND Encinitas Small Cell Antenna Urgency Ordinance

---

From: MAUREEN RAFAEL <morafael@cox.net>
Sent: Wednesday, August 21, 2019 4:18 PM
To: Catherine Blakespear <cblakespear@encinitasca.gov>; Jody Hubbard <jhubbard@encinitasca.gov>; Council Members <council@encinitasca.gov>; Tony Kranz <tkranz@encinitasca.gov>; Joe Mosca <jmosca@encinitasca.gov>; Kellie Shay Hinze <khinze@encinitasca.gov>
Subject: MUST AMEND Encinitas Small Cell Antenna Urgency Ordinance

TO:

The Encinitas City Council: Mayor Blakespear, Deputy Mayor Hubbard, and City Council Members Kellie Shay Hinze, Tony Kranz, and Joe Mosca

FROM:

Maureen Rafael, 180 W. Jason Street, Encinitas, CA 92024

Re: Encinitas Small Cell Antenna Urgency Ordinance

I am strongly against the placement of microwave antennas in close proximity to my home, the homes of any residents of this city, and the

heavily trafficked business zones of Encinitas.

Having studied what scientists report about the myriad ill effects of exposure to high frequency technologies on humans, I am highly concerned for the physical and mental well-being of my family, my community and myself. Additionally, I am concerned about the effect on property values should antennas be placed in residential neighborhoods.

The FCC-mandated exposure limits protect us from adverse thermal effects of technologies (such as shock, burns and heat) but the FCC remains deplorably silent, inactive and disengaged when it comes to addressing and mitigating the multitude of harmful biological effects (especially the non-visible internal health effects) of prolonged exposure to high frequency technologies. A myriad of deleterious effects on the health of humans (and other species) have been known to scientists for over 50 years (http://emfsafetynetwork.org/how-to-oppose-small-cell-5g-towers/),

yet the FCC has utterly failed to take action in our best interests. In the absence of such FCC mandates, the technology industry has free rein to run roughshod over the ignorant public. And run they do! (Much like the invasion of Smart Meters, the proliferation of 5G infrastructure appears to be a foregone conclusion. Were you or I ever asked if we wanted it?. . .If we understood the potential effects it might have on our health? . . . If we choose to risk our health -- and that of our children and the beneficial insects we rely upon, all for “faster and more saturated connectivity”?)

The city of Encinitas needs to address this issue with as much knowledge and foresight as possible, given the fact that 5G is being foisted upon us at breakneck speed. So let's start with the most basic, tell-tale fact: the frequency of 4G technology is below 6 GHz. The frequency of 5G is 30 to 300 GHz.

The "urgency ordinance" currently under consideration is a wholesale sell-out. It provides a convenient administrative process for the Telecom industries to put small cell antennas anywhere they want. Why on earth would we give them carte blanche to suffocate us with their technology while disempowering our city from having any real oversight and jurisdiction?

We must not let them roll over us – especially when so very much is at stake. The city of Encinitas to take a front seat, not a back seat here! The city needs to (1) enforce our residents' location preferences by preventing small cell antenna installations from being placed in front of our homes, (2) control the application and shot clock process, and (3) insist on oversight of installation quality.

I strongly request that the City of Encinitas send this ordinance back to staff for major upgrades that would first and foremost protect the health and safety of Encinitans. Our Encinitas ordinance needs to reflect the protective aspects of the Calabasas and Hercules ordinances that are part

of this record. Please note that these ordinances have been certified by their city councils to meet all requirements of the FCC directives, and can therefore serve as appropriate baseline references for our community.

Let's close the door to indiscriminate placement of small cell antennas in our residential areas and the cluttering of our visual space.

If the city deems it necessary to have an ordinance in place immediately, then please make approval conditional on adding the following protective features garnered from the Calabasas

municipal code section 17.12.050(C) and Hercules Title 10 Chapter 16 ordinances as a condition of approval. These are a few of many important examples from these ordinances:

Location Preference: remove the residential areas from Encinitas Section 10.a. This would be consistent with Calabasas 17.12.050(C) 3. "Preferred Zones and Locations" which does not include residential areas. (Note: Calabasas ordinance re-enforces this zoning preference in sections that specifically address small cell location in right of way... and asserts in the preamble that the ordinance is compliant to FCC directives.)

Application Process:

- Require a pre-application site inspection and pre-application meeting for

verification that all application requirements have been met before accepting an application (Hercules Section 10-16.108 General Policies, General Application Process, para 8)

- Require that all support structures are certified to meet ANSI 222 as part of the application process (Hercules Section 10-16.113.E.14 Small Cell and Small Wireless Facilities)

Controlling the Shot Clock: Add these notes from Hercules, with edits applicable to Encinitas:

Section 10-16.108 General Policies: (policy 19) To prevent confusion and any loss of the City's rights under the FCC's 'Shot Clock' rule pursuant to the FCC Report and Order 14-153 as reference to the date an Application was officially filed and the start of the Shot Clock regarding the limited time allowed to determine if an Application is complete, at the time of the initial filing of an Application, it must contain a cover letter stating i) whether the Application is filed as an 'Eligible Facility' Application including the

justification for such, or a 'Substantial Modification', or involves a new support structure; and ii) a statement that the Application contains all of the information required under Section 10.16 of the City's Code for that type of Application, and be signed by a person with first-hand personal knowledge of such.

Section 10-16.113 Batched Applications:

An Applicant, or its agent of record, may submit Applications for multiple facilities or locations with the following conditions that are intended in order to assure compliance with the FCC's 'Shot Clock' requirements:

1. No single batched submittal shall contain more than five (5) Applications;
2. There must be a minimum of seven days between submittals of batched

Applications;

1. No more than 4 batched Applications shall be accepted in any thirty (30)

consecutive day period.

Controlling the Shot Clock: add these notes from the Calabasas 17.12.050(C) Section 6.G.4 "Application Review"

... Each application in a batch must meet all the requirements for a

complete application. If any application in a batch is incomplete, the entire batch shall be deemed incomplete

Stealth Installations: the Encinitas ordinance displays pictures of approved small cell antenna installations that include telephone poles with small cell antennas, radio boxes and all the supporting cabling attached to the poles when Encinitas favors stealth installation and could require metal poles with attractive features. Require that all small cell antennas on light poles and power poles be stealth installations. This is consistent with both the Calabasas and Hercules ordinances, and the existing Encinitas ordinance for macro antenna installations. Remove all of the preapproved telephone pole installation examples from the Encinitas ordinance since these increase visual clutter and are not stealth.

Add definitions: "least intrusive means," "significant gap." "stealth facility" and "reasonable and compelling evidence."

I believe that our ordinance can be more protective. I ask that as a condition of approval of the ordinance that the Council orders a community meeting ASAP for the purpose of bringing together the citizens of Encinitas with the staff to review every available option that would make the ordinance as community health protective as possible.

Because the stakes of this ordinance are so high, now is the time to make sure that we do our homework! A concerted effort to solicit well-informed legal opinion and scientific data is in order. We want to be as comprehensive as possible in safeguarding the health and safety of our community.

So, where should we begin in our reconsideration of this ordinance? Good places to start would be to use the Calabasas ordinance, the Hercules

ordinance, and well-honed ordinances from other cities as points of reference. Considering the high risk of long-term and ongoing health consequences to the people of Encinitas, it should be our city's policy to seek that the most health-protective and safety-oriented provisions be written into the Encinitas ordinance on the design, placement and effects of, plus the jurisdiction over, small cell antennas.

Thank you so much for taking such a proactive role in safeguarding the health and well-being of the residents of Encinitas and its future generations, our non-resident employees, and our welcome visitors!

Sincerely,

Maureen Rafael

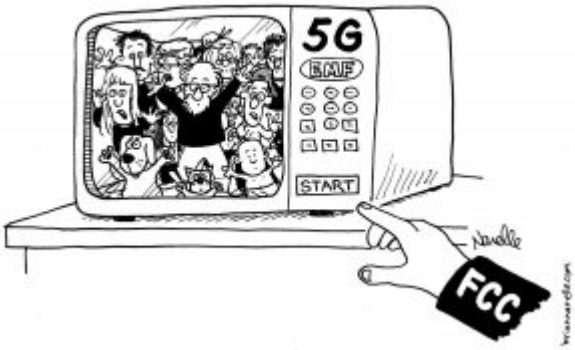
EMF Safety Network

We envision a world free of EMF pollution where children, communities, and nature thrive!

How to oppose 5G “small cell” towers

5G, or fifth generation cell phone technology requires an entirely different cell tower system. Adding to the existing macro cell towers are “small cell” towers planned for nearly every other block. In some cities, like Sacramento CA. 5G is already installed and many other cities have applications pending. *The following information is focused on the “small cell”, but the “how to oppose” can apply to larger towers too.*

The Federal Communications Commission and the federal government have been promoting and supporting rapid expansion of 5G. Some states have already passed laws forcing them onto communities. However people are pushing back and defeating installations. In Seaside California 5 cell towers were denied. In Hillsborough 16 cell towers were denied. Danville denied Verizon based on the placement was not the least intrusive means. (*see video excerpt below*). In California SB649, which would have restricted cities ability to regulate 5G, was vetoed by Governor Jerry Brown.



The industry wants wireless everywhere with “small cell” towers every couple hundred feet apart! That means cell towers in our neighborhoods, near schools and

parks, where we live, work and play. The industry vision for 5G is to enable the Internet of Things, Smart Communities, driverless cars (*and more*), where roads and appliances (*even baby diapers!*) are embedded with wireless radiation transmitters that connect to cell phones, smart meters and the internet.

"small cell" tower in Santa Rosa CA. (Alvin Jornada / The Press Democrat)

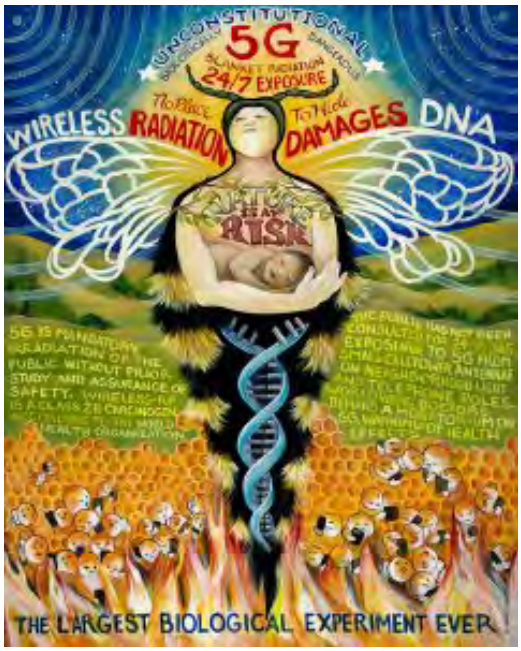
There's already too much harmful wireless radiation in our environment. People are already getting sick from wi-fi, cell towers, smart meters and cell phones. Peer reviewed published science shows harmful effects of cell tower radiation include: **fatigue, headaches, sleep problems, anxiety, ringing in the ears, heart problems, learning and memory disorders, increased cancer risk, and more.** Studies found wireless radiation harms trees, birds, bees and insects. (See links to studies in this **letter**.)

Hundreds of scientists and public health experts are calling for a moratorium on 5G. They state, *"We the undersigned, more than 180 scientists and doctors from 35 countries, recommend a moratorium on the roll-out of the fifth generation, 5G, for telecommunication until potential hazards for human health and the environment have been fully investigated by scientists independent from industry."*

5G would use a combination of microwaves and millimeter waves, which are scientifically shown to harm people and nature. For a quick overview of the problem see this video of a press conference with U.S. senator Blumenthal, who demands proof of safety from the FCC, and listen to comments by Blake Levitt. For more information on 5G see What is 5G?

We need a moratorium on 5G, and we need to reduce wireless radiation throughout our communities.

Oppose 5G! The following information has been compiled to help you stop 5G to protect your neighborhood, community, people, pets, and environment.



Artwork by Shelley Masters

1. **Keep a watch on your [city or county] planning or permit department for applications for "small cell" towers.** *You'll need to call the city or county to find out who handles the telecommunications applications. Note they might deny the "small cell" is 5G but call it 4G instead. 4G small cell are the precursor to 5G and should be opposed.*
2. **Educate and engage the community about EMF/wireless health risks.** Here is a brochure about EMFs and a Stop 5G fact sheet and a Stop 5G bee flyer you can use to start a conversation. Mobilizing other people to get involved to take action is important. Even a few people can make a big difference. It is important to educate decision makers on the science of harm, because this will motivate them to find ways to deny the application. People can also argue aesthetics, location, loss of scenic views, property devaluation, and no significant coverage gap.
3. **If you live in California:** This legal letter from Best Best and Krieger, outlines what a California community can do to legally deny "small cell" towers in the public rights of way. * April 24 2018 Letter to EMF Safety Network re small cells. ***Update:*** *FCC WT Docket 17-79 went into effect on 1/13/2019. This info is not included in the above letter.* The order adopts: new deadlines [shot clocks] for actions on small cell applications; limits on fees and rents that can be charged for small cells; new standards governing when a locality can say "no"; new standards for permissible aesthetic, under grounding, and spacing requirements. See: https://www.bbklaw.com/BBK/media/Library/pdf/IMLA-General-Presentation-Final.PDF (*Please note: BBK's letter and smart meter representation have been helpful to us, however we have re-*

ceived complaints that their attorneys have not been helpful for cities on 5G ordinance updates.)

4. **Speak at public comments at city and county meetings and meet in person with city and county decision makers.** Speak to those issues with the strongest science, boil it down to basic terms and concepts, and document the claims you make. For example: Peer-reviewed published science shows harmful effects of cell tower radiation include: fatigue, headaches, sleep problems, anxiety, ringing in the ears, heart problems, learning and memory disorders, increased cancer risk, and more. Children, the ill and the elderly are more vulnerable. This **Letter to Sebastopol 5G** includes studies and quotes you can use. See also: Biological Effects from Radiofrequency Radiation and www.emfscientist.org Studies of radiation impacts on wild birds documented nest abandonment, plumage deterioration and death. https://www.ntia.doc.gov/files/ntia/us_doi_comments.pdf Peer reviewed published science shows millimeter waves adversely affect health. https://goo.gl/gbBKHL More studies here. See also: EU 5G Appeal. International Society of Doctors for Environment 5G Appeal
5.

Santa Rosa on Link Lane, this one is partly dismantled due to resident protests and the city halting the installation.

Santa Rosa on Sebastopol Road.

"Small cell" tower is a junkyard on a pole! In reality these often do not look like the representational drawings the industry presents. Click on the photos to the left for a closer look.

6. **Share important news:** Democracy Now reported on an investigation by The Nation "How Big Wireless Made Us Think That Cell Phones Are Safe." and "How Big Wireless War-Gamed the Science on Risks, While Making Cus-

tomers Addicted to Their Phones" For current news follow EMF Safety Network on Facebook.

7. **When there is an application pending:** Send a letter by mail and email to the decision makers and go to the public meetings to speak out and oppose. Gather others to go to the meeting to also speak out. Make signs for the meeting! *Please note: decision makers are often volunteers and they need to be educated about complex EMF science and laws. While some people feel aggressive tactics is the only way to get them to understand, practicing courtesy is also effective.* You may want to ask the city to hire an independent RF specialist to prove there is a coverage gap. Here is an independent RF firm: http://www.emfservices.com/cell-towers.htm
8. **Create a flyer** to circulate to let people know what's happening and where to complain. See this sample flyer to adapt and create your own.
9. **Donate!** ***Your donation will help support and expand this important work.*** To donate via Paypal (or credit card) click on the yellow button below. For more information on how to donate by check or for non-profit donations click here.

9. **Sign up** with EMF Safety Network to stay informed. click here For current news follow EMF Safety Network on Facebook.

Further suggestions:

- Sign the international 5G space appeal. 143,586 people and organizations from 207 nations and territories have signed this Appeal as of 9/20/2019.
- Make posters of Shelley Masters 5G Artwork (see image above) and ask shop owners to put them up. *To obtain a higher resolution file for reproduction contact emfsafe at sonic.net.*
- Make use of social media, online community bulletin boards to warn others about where the towers are planned and where to complain. Start a Facebook page for your group.
- Circulate a petition.
- Send letters to the editor of your local newspapers.
- Table at a farmers market, or simply go to a farmers market and hand out flyers. Work in pairs.
- Take Action to Oppose 5G and Federal Wireless Expansion: click here

Thank you for your support and let us know the outcome of your action!

Other posts on 5G on EMFSN:

Make your own Stop 5G sign!

From Europe to USA! Thank you to graphic artist Valérie Jacquemet from Switzerland who designed this symbol of resistance to 5G. Her goal is to imagine fun solutions to raise awareness of the problem of 5G. How to make a double sided 8 inch round sign. Print out both images below full size on card stock letter size paper. … Continue reading

EMF Safety Network 0

UK Prime Minister on Smart City Risks

UK Prime Minister Boris Johnson Calls for ethical and responsible technology Excerpts from his speech to the United Nations: “You may keep your secrets from your friends, from your parents, your children, your doctor, even your personal trainer, but it takes real effort to conceal your thoughts from Google. And if that is true today, … Continue reading

EMF Safety Network 0

City of Seaside CA denies 5 cell towers

On September 19, 2019, the City of Seaside California denied four 4G “small cell” towers and another cell tower on a church. The reasons for denial were primarily based on visual/view shed impacts and their municipal code that states projects will not adversely impact the character of the community and its rights of way. A council … Continue reading

EMF Safety Network 0

Interview with Dr. Martin Pall on the health impacts of 5G

This is a great 9 minute interview by Full Measure TV with Martin Pall, PhD, Professor Emeritus of Biochemistry and Basic Medical Sciences in the School of Molecular Biology at Washington State University. Excerpts: “Chances are you haven’t met many people like Professor Martin Pall. Sharyl: Is it true that you do not carry a cell … Continue reading

EMF Safety Network 0

Stop 5G March in San Rafael CA

Thanks to Ecological Options Network (EON) for this video of the Stop 5G March in Marin County on July 27.

EMF Safety Network 0

Pollinators at risk: Honey Bee Says STOP 5G

Peer-reviewed studies show that wireless radiation harms bees, birds, and humans. In 2018 Newsweek reported “Technology is quite literally destroying nature” and 5G could make it even worse. Click on the flyer below to learn more, and then TAKE ACTION! What is 5G? See this fact sheet. TAKE ACTION! Contact your local, state and federal … Continue reading

EMF Safety Network 4

Senator Blumenthal Raises Concerns on 5G Health Risks

Blumenthal criticizes the FCC & FDA for inadequate answers on outstanding public health questions. Wireless carriers concede they are not aware of any independent scientific studies on safety of 5G technologies [WASHINGTON, DC]— During today’s Senate Commerce, Science, and Transportation Committee hearing on the future of 5G wireless technology and their impact on the American people … Continue reading

EMF Safety Network 4

New 5G Network Spurs Health Concerns

From Project Censored: The popularity and widespread use of wireless technologies has spawned a telecommunications revolution with increasing public exposure to broader and higher frequencies of the electro-magnetic spectrum as we transmit data through a variety of devices. The Telecom industry is promoting the replacement of our current cellular network, 4G (fourth generation) with a … Continue reading

EMF Safety Network 3

Verizon withdraws application for “small cell” towers in Sebastopol.

On February 6, 2018 Verizon applied for a major use permit to install two “small cell” towers in Sebastopol at Hutchins and S. Gravenstein, and at McFarlane and Woodland. EMF Safety Network (EMFSN) opposed Verizon’s application in a letter sent May 29 stating, “The proposed towers would add unsightly equipment, overload poles, devalue property, and … Continue reading

EMF Safety Network 6

Take Action to oppose 5G and federal wireless expansion

We need your help! Yesterday we mailed 541 joint letters to Congress members. The letter is signed by dozens of health, environment and justice advocates and organizations asking them to oppose the many federal bills related to 5G and wireless radiation expansion. It is packed with peer-reviewed science references and solid reasons to oppose. Please contact your own US Senators and Representative … Continue reading

EMF Safety Network 17

Take Action! Send your comments on 5G to the FCC by March 8

[mashshare] The Federal Communications Commission (FCC) is accepting comments on whether or not to fast-track 5G wireless networks. 5G will use a dense distribution of antennas (called “small cell”) on power and light poles throughout our towns, cities and rural areas. Fast tracking 5G deployment will thwart public participation and impede local control. Mobilitie, the … Continue reading

EMF Safety Network 0

FCC approves 5G

Today the FCC Commissioners unanimously approved a nationwide 5G network. 5G is 24GHz frequencies and higher, also known as millimeter waves. They expressed concern about security risks, and the need to ensure localities, that’s your town and mine, accept the smaller cell sites which will require a higher density deployment. How will these higher frequencies … Continue reading

EMF Safety Network 3

STOP cell towers on every block in California #STOPSB649

Cell towers emit harmful radiation. If Senate Bill 649 passes you could awake in 2018 to find a cell tower outside your bedroom window, or on your children’s school. Senate Bill 649 would create a state mandated system of cell towers every couple hundred feet apart. SB 649 would harm California. SB 649 would eliminate … Continue reading

EMF Safety Network 10

Unlocking the door: How to successfully get through to people about wireless radiation.

By: Rachel Gaunt: For years I have been talking to people about the risks of wireless radiation. People who already “get it” are an easy audience. They nod and agree vehemently. But conversing with people who are new to this subject has not been so easy. Too often I see their eyes glaze over, watch … Continue reading

EMF Safety Network 10

32 thoughts on “How to oppose 5G “small cell” towers”

Kim

March 24, 2019 at 8:27 am

I am appalled that people don’t get it, why do you want 5 g in your community? It is pathetic! You push away Christianity but welcome your sickness with more technology that doesn’t have to be it is just a money maker for the elite get it? Dah

Anonymous

March 27, 2019 at 10:35 am

I will pray for everyone !!!

Paul Lux

April 4, 2019 at 10:27 am

One minute standing in sunlight, which is over 1,000 watts/sq meter, is more than 10 years of radiation from a 5 G cell tower. It is also of a higher frequency

for the most part. Further more neither one is harmful in moderation. Consider, too much water will drown you but too little and you will also die. What is too much of anything? Please consider power levels which I notice you ignore.

M

April 5, 2019 at 8:42 am

Paul, the radiation is inescapable, and would always be present. How would you suggest we use it in “moderation”? When they show you scientific, peer-reviewed proof that it is extremely harmful, why would you argue otherwise? Add common sense, and think about it …To those that always have to bring up “the rich”, please stop! Such a tired, ineffective attempt to divide. We need to unite and solve. I’m pretty sure no one wants to bake in the EMF’s- so let’s get it stopped. I don’t care about who has the most money. Our mission should be to stop those doing the most EVIL, (and there is a difference).

Simon Xu

April 5, 2019 at 7:12 pm

Cell towers keep running 24/7 like a slow cooker – affect your cells from inside . Mother nature does not do this as I know

B Present

April 10, 2019 at 10:58 pm

From what I know the Earth heals us, but we still mess it up. This must be be stopped. I don’t see it any other way.

Jerry N

April 12, 2019 at 7:29 pm

I’m a systems engineer. I’m very concerned about 5G FR2.
FR2 is going to use the 24Ghz – 86Ghz spectrum. We are not talking Wifi 5Ghz.. it’s much higher than that. I guess one way to explain the danger to a non tech-

ie is the higher the frequency is, the lower power needs to be to penetrate organic tissue.
I told my wife if 5G rolls out in our town maybe it would be time to check out her Grandfather’s property in St. Michaels.

If 5G does get rolled out and there’s a damn 5G antenna outside my house, I’ll sue the wireless carrier for the loss of value to our property. Maybe if everyone sues them it would be a deterrent to a 5G roll out.

The Wireless Telecom industry brought some good but a lot of bad to society. It’s a social disease. People are too addicted to their smartphones.

SOXY

April 14, 2019 at 9:17 pm

5g is comprised of what is known as “nonionized radiation”. This means it is not capable of damaging DNA, the way uv and other ionized radiations do. Further, there has never been a single sickness or cancer attributed to cellphones. Brain tumors have risen by 34% in the last 20 years, but doctors believe this increase reflects our ability to find them better due to increases in technology, rather than a genuine increase in existing tumors.

This article is fear mongering and lacks any backing evidence beyond conjecture and hearsay.

Anonymous

April 15, 2019 at 7:12 am

Crazy. I work in the industry and this is pseuodo-science. Not all 5G is created equal. One carrier it launching at 600Mhz as an example. Cell phones have been in use for decades which is ample enough time to see long term studies. The amount of “radiation” coming from a modile handset is less that half of a microwave oven at much less power and roughly 1000x that of a FM radio transmission.
You have RF everywhere from everything. Radio, television, wi-fi, bluetooth, walkie talkies, satellites, etc. It just goes and goes.

Small cell is a way to enrich the end user experience by removing the bottle-necks and bring service to the user. The more compression and the higher the frequency the less penetration the signals have. A high compression frequency does not penetrate buildings, trees, etc very well so small cell is put into place to ensure good service in an area that has more users or has a weaker signal. There are also TONS of sites (towers) you dont even know about because they are hidden.
Please, do your research because this is almost as bad as flat earth logic.

Mark Trippe

April 15, 2019 at 7:47 am

This must stop!

X. Engineer

April 18, 2019 at 2:54 pm

The photo at the top of this page is of the “first” attempt to erect a Verizon 5G rig. You should see my pictures! The thing was installed at an angle to the street (not quite vertically). I passed it every day after work and could swear the thing was leaning more and more. This January, it collapsed in the rain and fell to the ground. They’ve just started a redo; The radios are on a short wooden pole with no antennas in sight. (Keep up the good work, tower guys!)

Anonymous

April 22, 2019 at 9:34 am

we must stop the cell companies from putting up 5g tower’s at all cost . The cell companies don’t care about our children’s future health and freedom.

Anonymous

May 2, 2019 at 7:59 am

This has to stop. I am getting headaches EVERY time I’m in an area with 5G. It shows on my phone. As I leave the area and the 5G disappears from my phone the headache dissipates. Also I’m getting burning itching on my arms and I left my phone in another part of the house last night just to see what might be different. The burning went away until I used my phone this morning.
Why do they have to make it so hard and complicated to stop this? Who can I sue?

Anonymous

May 3, 2019 at 11:39 am

Anyone who agrees with 5g is a human-race traitor and needs to be HUNG!!!

Linda

May 4, 2019 at 1:27 pm

I have been hand writing different kinds of fact sheets with resource lists and spending a small fortune at Staples to copy…then i fold each and tuck them into product right in the store (calendar planning books, portfolios, etc). Also, in libraries, books on shelves. i drop them in random neighborhoods, in mailboxes, never returning. not setting any sort of driving pattern, so as not to be noticed, or targeted. Everywhere i can tuck them, i do.

---

dennis ward

May 6, 2019 at 12:28 am

Smart Meters are toxic and dangerous.
5G is nothing more than microwave genocide.
WiFi is toxic to every living thing in your home. Get a router, and hardwire your computers. You will be amazed at the difference!
Throw out your Microwave oven today!
DO NOT SLEEP WITH YOUR CELL PHONES IN THE SAME ROOM.
GET A LANDLINE PHONE AGAIN, AND ANSWERING MACHINE.
THERE IS A MASSIVE BACKBONE FIBER OPTIC NETWORK THAT WAS PUT IN PLACE BACK IN THE MID TO LATE 1980’S!

I KNOW AS I HELPED PUT IN JUST A SMALL SECTION OF THE NATIONWIDE NETWORK! IT IS ALREADY THERE, DEMAND ACCESS NOW!

John Delaroche

May 8, 2019 at 9:12 am

Please GOOGLE “Telecommunications Act of 1996 | Federal Communications Commission”.

“No state or local government or instrumentality thereof may regulate the placement, construction and modification of personal wireless service facilities on the basis of the environmental effects of radio frequency emissions to the extent that such facilities comply with the Commission’s regulations concerning such emission.”

The Federal Government has jurisdiction over the placement of any and all of these broadcasting devices. No lower government has any jurisdiction, including “we, the people”. Very scary. So when did the FCC acquire the medical credentials to study the effects of this proposed radiation on we, the people? 5G has major world-wide organizations warning of its dangers. Do we really believe that there’s a wise government looking out for our best interests or do we believe what we see every day? That is, it’s about money and those who can profit from this while the only concern for the health of the population is handled through publications written to minimize interference with this financial opportunity.

Georgina

May 11, 2019 at 6:56 pm

Dr. Martin Pall has research on the damage caused through voltage gated calcium channel receptors and how RF/EMF damage cell function/mitochondrial function. To say we would know by now if cell phones cause damage would be true if we had unbiased parties doing systematic double blinded studies- which we never get when it comes to industrial production. As a physician, I am dealing with massive deception by pharmaceutical/chemical
Companies and it is all about soft kill depopulation tactics that are extremely

profitable. We see increasing removal of rights to receive chemical treatments – all without placebo trial for any meaningful amount of time and all done in-house. International chemical monopolies determine the standard of care. The educated will leave this country as we are still a colonial nation used to build wealth for European bankers and conglomerates.

Ashlie

May 13, 2019 at 11:00 am

Thank you! I think this will be helpful to determine which patients has EHS.

Please consider signing and posting about my petition regarding 5G near schools.

https://www.change.org/p/robert-duncan-assistant-manager-of-the-township-of-lower-merion-urgency-ordinance-restricting-5g-cell-towers-from-being-placed-near-schools

Dr. Ashlie L Burkart, MD

---

aleksandra wasylyk

May 15, 2019 at 7:36 am

Please watch two videos on you tube: Take Back Your Power and InPower Movement. The second video suggests an effective strategy to stop smart meters, etc… Let’s get more info on it and put it into action en mass. We the people have the power and authority to change the tide but we must persist and stay focused and be united in stopping this outrage against humanity, More souls are waking up to this and we can do it Health, peace, freedom, and justice for all. There are safer and healthier solutions.

Gina

May 19, 2019 at 9:13 am

Sprint has turned off and is dismantling a tower in Ripon California due to parents protesting because 4 children came up with cancer. Homeland towers and my neighboring town in Dutchess co. NY want to put up a tower on my street because the neighboring town happens to own land that is part of their park and extends onto my street . We are fighting this. They are ignoring there are deed restrictions and 2 endangered/threatened species in the park. It is a 150ft monopole monster that will devalue our properties. It will slowly cook us in our homes. We have only 7 homes on our dirt road. We need help. I’m doing my best but it’s David and Goliath.

Goldie Top

May 26, 2019 at 9:49 am

5G tech was created by DARPA and the incestuous relationship with the FCC and leading lobbyists organizations for the telecom industry are getting to self regulate without being accountable to independent safety studies. Hmmm, sounds exactly like the pharma industry, and the vaccine industry, and the food industry, and the… wow, everything the government “regulates.”

Emily

May 26, 2019 at 11:02 pm

How can you see the applications for the planning department? I am looking on my city’s site and I would love some help figuring this out!

---

admin

May 27, 2019 at 8:19 am

call or visit them in person

CaroleXyla

May 29, 2019 at 5:32 am

No one was informed about the 5G antenna being placed on a telephone poll. They are putting it up now and not one person on this street knew about it or it’s risk associated with this
How and what can we do to stop it?
1000 block of Tree Street Philadelphia Pa 19148

Hailey

June 1, 2019 at 10:04 pm

I am so upset that a tower just went up in my neighborhood! It is not even a block from a Junior High School. I will do my best and try and fight this!!!!

Tracy

June 25, 2019 at 2:34 pm

For those who say this is pseudoscience, can you show, scientifically, that this level of radiation is safe? Comparing cell phones to microwaves does not come close to acknowledging the potential cumulative effects of EMF exposure at the increasing scale we are pursuing. Additionally, what is your response to the documentation of EHS? Do you believe that just because one person doesn’t get Lyme disease from a tic carrying it, that means that it doesn’t exist? Or because two people have similar lifestyles and only one gets cancer, that cancer is not real? I see no carefully considered, scientifically sound responses to the 1,000s of studies documenting negative effects—there is not even pseudo science to support the rollout of 5G and how it will affect current and future generations of humans, other animals, plants and insects.

Nick Ricketts

June 30, 2019 at 8:45 am

This is purely social and genetic engineering that was born out of the, “political” Zionist agenda. (nothing to do with Jewish individuals or Jewish faith) 5G was implemented in conjunction with Silicon Valley and was pushed through US congress by the FCC. No testing was done. They wanted to FORCE it through and use the, “excuse” of beating China to it by using, “national security” as the

buzz word. Much akin to the lie of the space race to show Russia that America had clout. I am British and 5G is here in the UK also. Donald Trump has a passion. I see his strength to fight the narrative. I just hope he does the right thing but in the meantime, WE ARE BILLIONS AGAINST A FEW. WE, THE PEOPLE HAVE THE POWER.

Bruce Cain

July 3, 2019 at 4:41 am

An interview with Bruce Cain about 5G and activism [07/02/2019, 77']
Great interview with Ahava from Israel on the growing global movement against 5G/Smart Meters
https://www.youtube.com/watch?v=CAw3rPjdWfk&feature=youtu.be

Read the Essay: Template for activists to demand an end to 5G and Smart Meters
Stop 5G – Stop Smart Meters. Go to your City Council and say "I will not be subjected to a 5G Lab Experiment."
Bruce Cain. Dearborn Heights City Council Meeting results in special study session on 5G. (05/14/2019)
https://www.youtube.com/watch?v=n66bDszxfbs
Bruce Cain discusses dangers of 5G and Censorship. Dearborn City Council Meeting (May 21, 2019)
My discussion begins at 45:05
https://cdtv.viebit.com/player.php?hash=s7nPgR9338E1
https://www.facebook.com/notes/bruce-cain/a-template-for-activists-to-demand-an-end-to-5g-and-smart-meters-in-their-commun/3133538826672084/

Nadezhda Chernysheva

July 17, 2019 at 4:02 pm

It's bad idea!

Anonymous

September 16, 2019 at 10:10 pm

It will lead to the mark of the beast! If you want to get into heaven, try to stop 5g now… It is the precursor to the mark!

Duane Mitchell

September 30, 2019 at 10:52 am

A 4G tower (upgradeable to 5G) has been approved to be installed across the street from my house in Escondido (PHG19-0038). I have testified (3/7/19 and 9/19/19) about the dangers to my health and family’s. I have auto-immune disease (Chrohn’s) which makes me extremely vulnerable to RF/EMF emissions. I watch my grandsons (4 &1 years old) on a regular basis. They are particularly at risk of malignancy as their youthful, thin skulls cannot resist the radiation exposure (24/7/365).
I am at my wit’s end as to how to stop the installation. The City acts to facilitate AT&T’s plans. The appeal process is a sham: $1415 to appeal, and if overturned, AT&T can appeal that ruling.
The City Council and Mayor are unresponsive. The activism of Encintas is encouraging in applying a moratorium on installs, but Escondido is all about paving the way for future tower installs by AT&T (and T-Mobile, Verizon). I am hoping someone sees this post and responds with names and contact information to help me protect my family and others like mine. STOP 5G!

This site uses Akismet to reduce spam. Learn how your comment data is processed.

Proudly powered by WordPress

Kathy Noel

From: Annemarie Clisby
Sent: Wednesday, September 4, 2019 5:30 PM
To: Annemarie Clisby
Cc: Roy Sapau
Subject: Letter from Maureen Rafael
Attachments: Maureen Rafael 09.04.19.pdf

Mayor and City Council are blind copied.

Good afternoon,

Please see the attached letter from Maureen Rafael that was addressed to the Encinitas City Council regarding Small Cell Ordinance.

*Maureen Rafael * 180 W. Jason Street * Encinitas, CA 92024*

Date: August 28, 2019
To: The Encinitas City Council
Mayor Blakespear, Deputy Mayor Hubbard, and City Council Members Kellie Shay Hinze, Tony Kranz, and Joe Mosca

Re: Protective Small Cell Antenna Ordinance Needed Immediately

Dear Mayor, Deputy Mayor and Council Members:

First and foremost, I want to offer my sincere gratitude for the magnanimous service that you provide, day in and day out, for the residents of Encinitas and for this city that we love so much. I want to recognize you for your unstinting efforts to maintain the exceptional quality of life that we get to enjoy here in Encinitas, and I want to thank you for tackling the multiplicity of issues, large and small, that come before you every day as our duly elected representatives.

I would also like to weigh in on the issue of 5G and the infrastructure that this new technology necessitates. You see, I am highly concerned about the nature and timing of the above-cited urgency ordinance for the following reasons:

- it is scheduled for a City Council meeting with only three business days' notice;
- it has been scheduled as the last item on an already full agenda, although it is clearly an issue that deserves to be given top, i.e., first, priority;
- it has not been brought to the City Council until many months after the FCC directive was issued and other local communities have implemented their ordinances. If we have waited this long, then we can surely wait longer still in the interest of "getting it right";
- as the ordinance currently stands, it is **not at all** protective of sensitive and residential areas; and
- as the ordinance currently stands, it unabashedly favors the telecom industry while disfavoring the people of Encinitas by offering a streamlined application process for AND flat-out, uncontested license to telecom companies to install small cell antennas as, when and where they choose.

The "urgency" behind this ordinance has the highly unfortunate effect of minimizing, even marginalizing, the participation of Encinitas residents -- residents who would want to voice their concerns about 5G, its requirement of antennas being installed every 500 feet, and its irrevocable, cumulative and irreversible effects on biological life, but who will never be aware that their chance to weigh in on the issue of 5G has come and gone

because the council's decision is being railroaded through. WHAT, INDEED, IS THE RUSH? Simply because the telecom industry has decided that the world must have 5G ASAP is **not** reason to fall prey to their efforts to railroad Encinitas into giving them what they want, and precisely how and when they want it!

The following are among the concerns that I-- and perhaps many of my fellow Encinitans might--want to voice to you: (1) the high risk for negative 5G antenna EMF effects on human health; (2) the unwarranted, undemocratic licensing of (read: "handing over of") ***the Commons*** to private industry for their monetary gain -- *the Commons*, in the case of 5G, will by definition become the bodies of every living biological organism (that includes your bodies and mine) exposed to the ultra high intensity and ultra high EMF frequencies of 5G, i.e., 30 to 300 GHz, potentially precipitating a *Tragedy of the Commons* of unspeakable and unprecedented proportions; (3) and the unacceptable environmental, physical and aesthetic effects of the proliferation of small cell 5G antennas in our neighborhoods. (Note: 5G transmission requires that antennas be located every 2 to 8 houses.)

The urgency ordinance as it stands offers no protections for sensitive areas and residential neighborhoods. There are no setbacks for sensitive areas in spite of the fact that setbacks would be expected based on the existing setbacks in the wireless ordinance for macro antennas. There is no proposed protection of residential areas: the ordinance does not prevent telecom installation of small cell antennas in front of our homes. (Note: there are already 32 small cell antennas installed on light poles in our Encinitas residential areas. This was accomplished via a business agreement that the City made with Crown Castle a few years ago. I suspect that this agreement set a most unfortunate precedent of bypassing community participation. Please, let us not repeat this mistake!)

Yes, we want Encinitas residents to have a real say on this issue. But we also want the ordinance to be made more protective immediately and to be applied to all applications in process, even before there is a flood of small cell antenna applications that will impact our neighborhoods. We can't wait for a small cell antenna community meeting because "telecom" is clearly not planning to wait for us to choose if we actually want what they are offering -- and then under what terms that would be.

I ask that the Encinitas small cell antenna ordinance incorporate the best practices of the protective ordinances of these California cities: Mill Valley, Los Altos, Calabasas, and Hercules. (Fairfield, Petaluma and San Ramon's, while too lenient, may be helpful to see.)

- Mill Valley and Los Altos ordinances, prepared by Gail Karish (telecommunications attorney for Best, Best & Krieger LLP), which prohibit entirely the installation of small cell antennas in residential areas.
- The Calabasas ordinance denies small cell antenna installations in residential areas.
- The Hercules ordinance (which is the best administrative process for controlling the application and shot clock processes) requires ANSI 222 class III poles for all small cell installations and prohibits new antenna support structures in residential areas.

Speaking for myself and so many of my friends and colleagues, the scientific findings about the health effects of the frequencies associated with 5G microwave antennas are highly alarming, **at best**. Because the biological and pathophysiological harm caused by microwave radiation exposure would be cumulative and irreversible, there is EVERY REASON to take our time to decide how Encinitas will deal with 5G and its necessary infrastructure. And beyond the grave prospect of 5G laying waste to human health, there is the negative effect that 5G could have on our property values across the board.

It is imperative that we put 5G into a real and human-value-based perspective -- that we not allow the industry that will profit from sales to dupe us into buying into its products hook, line and sinker. (Do we really and truly need faster connectivity and self-driving cars?) Let us learn from the corporate dupings of the past, e.g., by the tobacco and opioid industries, that have taken unconscionable tolls on human health and caused needless suffering and death to millions of people. The scientific literature on the health effects of 5G make it clear that the effects of 5G microwave antennas could be far, far more devastating and widespread – and not to human health alone, but to all biological life. (What earthly reason would any rational human being choose to usher in such outcomes?)

We humans, ever a race of Doubting Thomases, are severely handicapped in this contest against big Telecom. **We *cannot see* the frequencies 5G would marinate us in.** Nor can we truly imagine its health consequences. As with global warming, we must heed science's 5G warnings because the very quality of our lives requires that we act upon them.

I thank you, in advance, for wisely and thoughtfully amending the Encinitas small cell antenna ordinance immediately for our collective safety.

Sincerely yours,

Maureen Rafael

Maureen Rafael

Kathy Noel

From: Annemarie Clisby
Sent: Monday, September 9, 2019 8:53 AM
To: Roy Sapau
Subject: FW: WE ARE MAKING A DIFFERENCE! "T-Mobile Cancels 5G installation Nationwide. Anonymous Employee Blames 15 States' Lawsuits Against Sprint Merger:

From: Melanie ElGhoroury <melaniewode@gmail.com>
Sent: Friday, September 6, 2019 9:18 PM
To: Council Members <council@encinitasca.gov>
Subject: WE ARE MAKING A DIFFERENCE! "T-Mobile Cancels 5G installation Nationwide. Anonymous Employee Blames 15 States' Lawsuits Against Sprint Merger:

This is incredible news!

Begin forwarded message:

From: Karen Rich <karenlorainerich@gmail.com>
Subject: WE ARE MAKING A DIFFERENCE! "T-Mobile Cancels 5G installation Nationwide. Anonymous Employee Blames 15 States' Lawsuits Against Sprint Merger:
Date: September 6, 2019 at 1:58:52 PM PDT
To: Karen Rich <karenlorainerich@gmail.com>

T-Mobile Cancels 5G installation Nationwide. Anonymous Employee Blames 15 States' Lawsuits Against Sprint Merger

https://www.activistpost.com/2019/09/t-mobile-cancels-5g-installation-nationwide-anonymous-employee-blames-15-states-lawsuits-against-sprint-merger.html

By B.N. Frank

Activist Post has already reported about states filing lawsuits against the proposed Sprint / T-Mobile merger (see 1, 2, 3).

According to the Wireless Estimator, T-Mobile is postponing new builds and 5G upgrades at least for now. A construction manager who wants to remain

anonymous blames the 15 state attorneys general for filing lawsuits against the T-Mobile / Sprint Merger. Lawsuits have also been filed against the Federal Communications Commission (FCC) for promoting and forcing 5G installation throughout American communities (see 1, 2, 3, 4, 5).

Anyone who lives where T-Mobile planned to start operating 5G can breathe a sigh of relief – at least for now. The American Academy of Pediatrics and other health experts warn that children are more susceptible to illness from exposure to all sources of wireless radiation. Warnings about widespread 5G installation have been issued for a variety of reasons by

- Doctors and scientists (see 1, 2, 3)
- Environmentalists (see 1, 2, 3)
- Engineers (see 1, 2)
- Meteorologists, NASA, NOAA, the U.S. Navy
- Security experts
- Utility companies

5G is already operating in some communities and adults, kids, and pets are suffering from exposure (see 1, 2, 3).

In February, telecom executives gave congressional testimony that they had NO scientific evidence that exposure isn't harmful.

(There are a few videos in this article. See link to view)

T-Mobile Cancels 5G installation Nationwide. Anonymous Employee Blames 15 States' Lawsuits Against Sprint Merger

TOPICS: 5G BN Frank Consumer Rights Telecom

SEPTEMBER 2, 2019

By **B.N. Frank**

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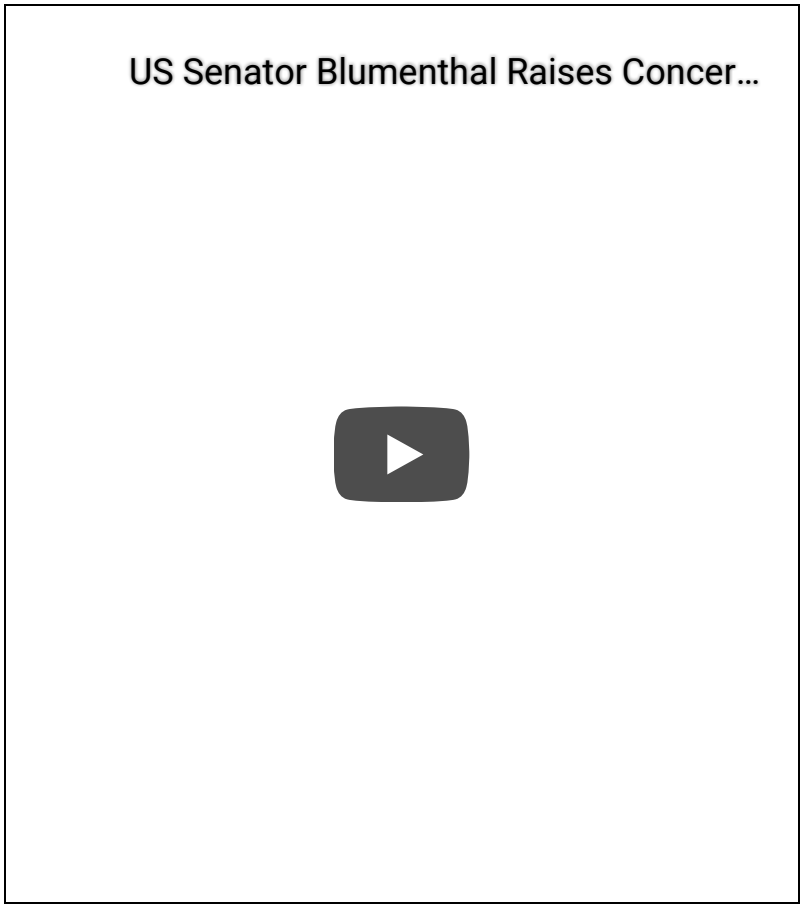

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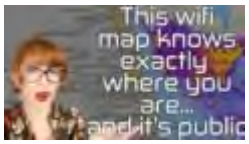

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4 More States Join Original 10 in Lawsuit Opposing Sprint / T-Mobile Merger So They Can Compete With Verizon and AT&T in Unleashing Harmful 5G Everywhere

TOPICS: 5G BN Frank Consumer Rights FCC Telecom

JUNE 25, 2019

By **B.N. Frank**

In February, **telecom industry** representatives gave congressional testimony that they have no scientific evidence that 5G is safe. Many studies have proved **it's not**. Despite this and the **growing U.S. opposition** to 5G from **cybersecurity experts**, doctors, elected officials, **environmentalists,** meteorologists, NASA, NOAA, scientists, and the U.S. Navy, the despicable "Race for 5G" continues and Sprint and T-Mobile want a more competitive edge in unleashing it too. It's all very gross.

Activist Post reported about **the original 10 states** that filed a lawsuit against this merger. Four more have joined them.

From *RCRWireless*:

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Reuters **reported** that the chief of the antitrust bureau in the New York attorney general's office said during a Friday hearing on the case that Hawaii, Massachusetts, Minnesota and Nevada will be listed on an amended complaint that would be filed with the court. That amended complaint was not yet available on Monday morning.

Those four states have joined the state AGs, led by New York and California and including the District of Columbia, which **filed a suit** in Southern District of New York earlier this month seeking to head off the merger before the Department of Justice and the Federal Communications Commission give their final decisions on whether to allow it.

The state attorneys general of Colorado, California, New York, Wisconsin, Maryland, Mississippi, Michigan, Connecticut, Virginia and the District of Columbia originally filed the suit. In their **filing**, they argued that the merger will harm competition and that "preserving vigorous competition for mobile wireless telecommunications services is essential to ensure continued innovation and low prices for American consumers.

[...]

Although the Department of Justice and the Federal Communications Commission have not yet officially weighed in on the merger, the outlook appeared positive for the New T-Mobile (as the would-be merged company is called) in recent weeks. FCC Chairman Ajit

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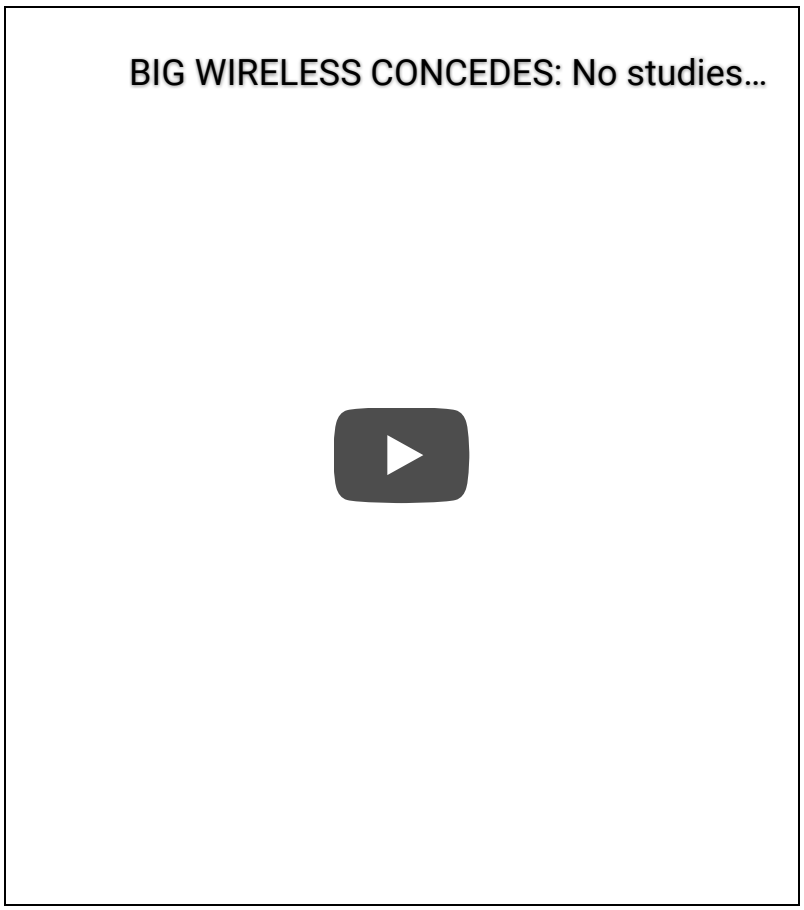
> Pai **indicated that the merger has his support** after public commitments from T-Mobile US and Sprint on items such as its timeline for nationwide 5G deployment, service to rural areas and divesting prepaid brand Boost Mobile. FCC Commissioner Brendan Carr also said publicly that he will support the merger.

The Federal Communications Commission (FCC) is supposed to protect the public by regulating the telecom industry. They've been doing the exact opposite for many years now. Current FCC employees have taken this to a whole new level of selling out (see 1, 2, 3, 4, 5, 6, 7, 8).



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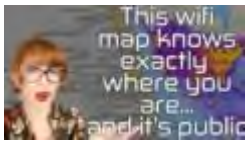

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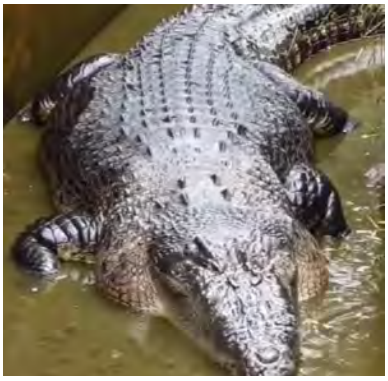

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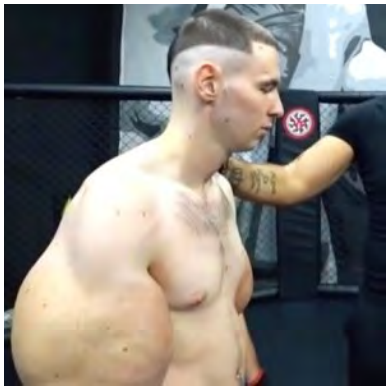

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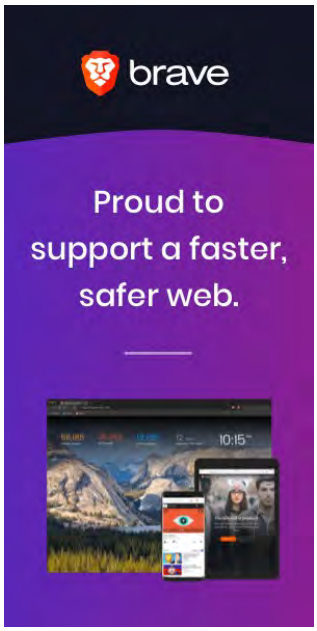

10 States Sue to Stop Sprint T-Mobile From Merging So They Can Compete with Verizon and AT&T on Unleashing 5G Even Though No Studies Show It's Safe

TOPICS: 5G BN Frank Consumer Rights FCC Telecom

JUNE 14, 2019

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By **B.N. Frank**

These states are not messing around and their lawsuits are getting a lot of media coverage. There is also increasing U.S. opposition to widespread 5G installation which now includes **the U.S. Navy, NASA, meteorologists** and **utility companies**. Even more disturbing – the telecom industry has still provided **no evidence that 5G is safe** and plenty of **researchers say it isn't.**

From KTIA:

12x More Efficient Than Solar Panels? Scientists Screaming In Disbelief

The state attorneys general said the promised benefits, such as better networks in rural areas and faster service overall, cannot be verified, while eliminating a major wireless company will immediately harm consumers by reducing competition and driving up prices for cellphone service.

New York Attorney General Letitia James said in a statement that combining the two companies would reduce access to affordable, reliable wireless service nationwide and would particularly affect lower-income and minority communities in New York and other urban areas.

Other attorneys general joining Tuesday's lawsuit are from Colorado, Connecticut, the District of Columbia, Maryland, Michigan, Mississippi, Virginia and Wisconsin. All 10 attorneys general are Democrats. The lawsuit was filed in U.S. District Court in New York.

The lawsuit is an unusual step by state officials ahead of a decision by federal antitrust authorities. The Justice Department's decision is pending. The Republican majority of the Federal Communications Commission **supports the deal**, though the agency has yet to vote.

T-Mobile and Sprint have argued that they need to bulk up to upgrade to a fast, powerful "5G" mobile network that competes with Verizon and AT&T. The companies are

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> appealing to President Donald Trump's **desire for the U.S. to "win"** a global 5G race.
>
> Consumer advocates, labor unions and **many Democratic lawmakers** worry that the deal could mean job cuts, higher wireless prices and a hit to the rural cellphone market.
>
> Amanda Wait, an antitrust lawyer and former Federal Trade Commission lawyer, said states are acting because they disagree with what they have seen the federal government doing.
>
> "They see the FCC accepting certain remedies and concessions that don't, in their minds, solve the problem," she said.

Activist Post continues to regularly cover **FCC** and telecom shenanigans – especially the insane and insidious "Race for 5G." Please **see our archives** for more details.

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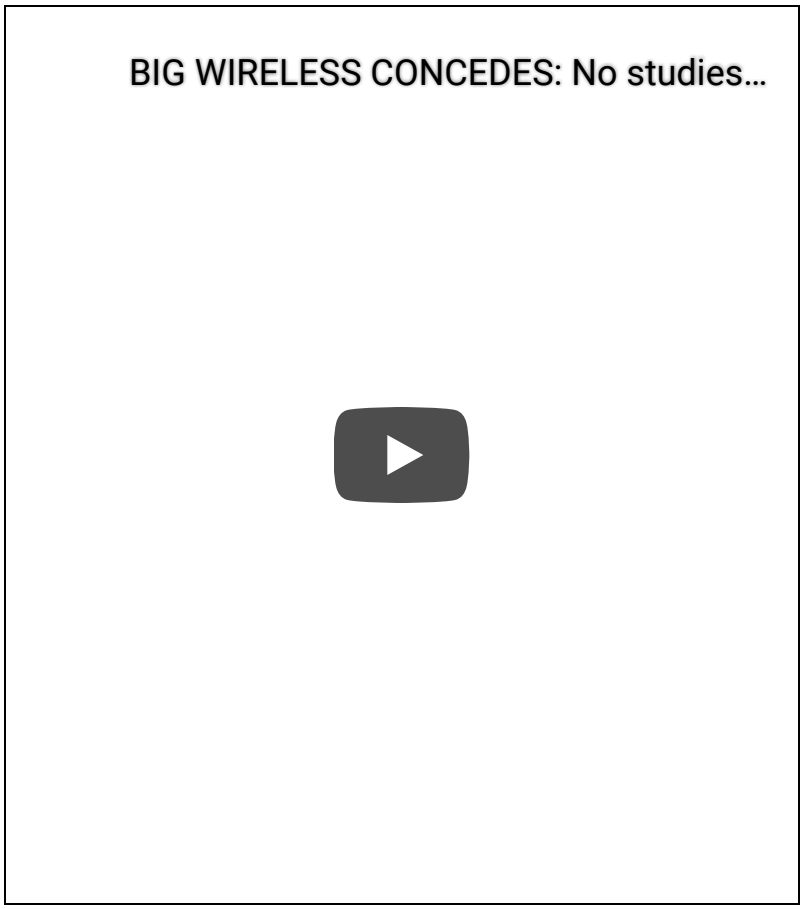

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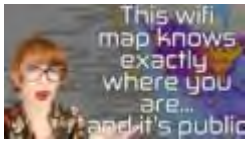

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Texas Joins Multi-State Lawsuit Against Sprint/T-Mobile Merger

TOPICS: 5G BN Frank Free Market Telecom Texas

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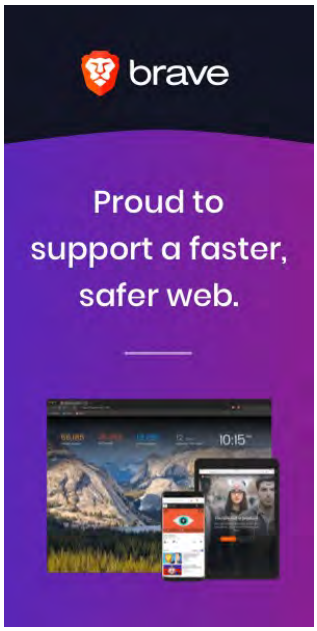

DAILY NEWSLETTER

Email address:

By **B.N. Frank**

Activist Post has already reported about states filing lawsuits against the proposed Sprint/T-Mobile merger (see **1**, **2**). Now Texas is joining them.

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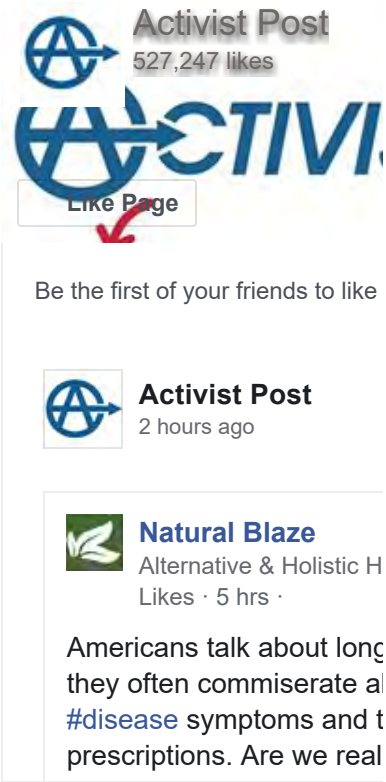

Hillary's Entire "Hit List" Just Went Public. You'll Never Guess Who's #1

Today, Texas Attorney General Ken Paxton announced that Texas intends to join a coalition of 13 other states, and the District of Columbia, in challenging the proposed merger of Sprint and T-Mobile, the 3rd and 4th largest providers of mobile wireless telecommunications services in the United States. The merger, if consummated, would result in a substantial harm to competition in the market for mobile wireless telecommunications services, both nationwide, and specifically within the State of Texas.

"While we appreciate the time and effort that went into the agreement between the parties and the U.S. Dept. of Justice, the Texas Attorney General has an independent obligation to protect Texas consumers. After careful evaluation of the proposed merger and the settlement, we do not anticipate that the proposed new entrant will replace the competitive role of Sprint anytime soon," Attorney General Paxton said. "It is the Attorney General's responsibility to preserve free market competition, which has proven to result in lower prices and better quality for consumers. The bargain struck by the U.S. Dept. of Justice is not in the best interest of working Texans, who need affordable mobile wireless telecommunication services that are fit to match the speed and technological innovation demands of Texas' growing economy."

The New York and California co-led lawsuit was originally filed on June 11 and includes the attorneys general of Colorado, Connecticut,

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> Hawaii, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Nevada, Virginia, Wisconsin, and the District of Columbia. Today, at a hearing in the U.S. District court for the Southern District of New York, counsel for New York advised the court that they will be seeking leave for Texas and possibly other states to join the lawsuit next week.

T-Mobile and Sprint want to merge so they can better compete with Verizon and AT&T to win the insidious "**Race for 5G**." In February, telecom executives gave **congressional testimony** that they had NO scientific evidence that exposure isn't harmful. **Opposition to 5G** includes:

- Doctors and scientists (see **1**, **2**, **3**)
- Environmentalists (see **1**, **2**, **3**)
- Engineers (see **1**, **2**)
- **Meteorologists, NASA, NOAA, the U.S. Navy**
- **Security experts**
- **Utility companies**

Lawsuits have also been filed against the Federal Communications Commission (FCC) for **promoting and forcing 5G installation** throughout American communities (see **1**, **2**, **3**, **4**, **5**).

5G is already operating in some communities and adults, kids, and **pets** are suffering from exposure (see **1**, **2**, **3**). The **American Academy of Pediatrics** and other health experts warn that children are more vulnerable to illness and injury from exposure to **all sources of wireless** radiation including 5G.

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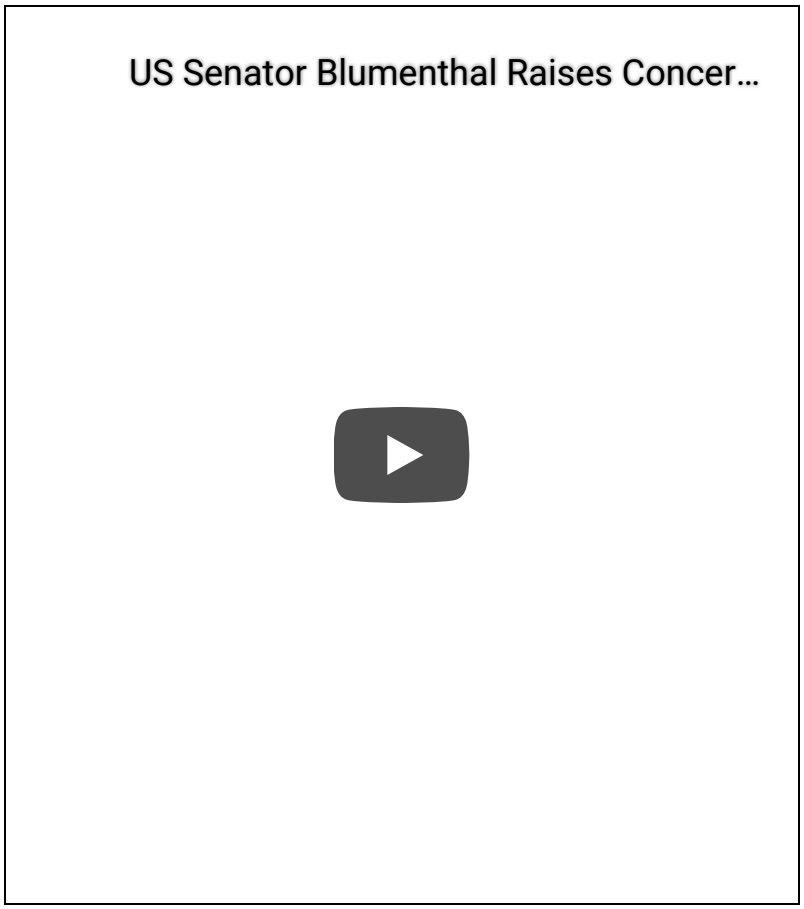

Activist Post reports regularly about 5G risks, research and opposition. For more information **visit our archives** and the following websites:

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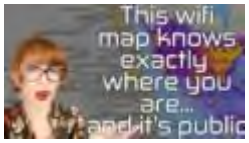

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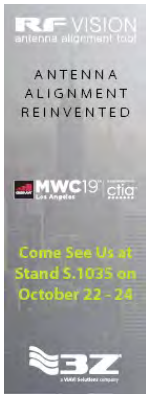

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T-Mobile cancels 5G upgrades and new builds nationwide, possibly crippling some contractors

In Featured News (http://wirelessestimator.com/articles/category/industry-news/featured-news/) by Wireless Estimator / August 28, 2019

Beginning last Friday, contractors started getting calls from T-Mobile's contracted managers informing them that most purchase orders they had for new builds and 5G upgrades were going to be put on hold until 2020 unless materials for the project were sitting in a warehouse.

The news came as a shock to many wireless contracting companies that had been counting on fourth quarter builds to maintain their increased staffing required for T-Mobile's ambitious buildout of the past eight months.

One contractor informed Wireless Estimator that the canceled POs represented approximately $700,000 for his mid-sized company and he had no way of supplementing additional income.

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"T-Mobile and all of the other carriers promise a continued pipeline of work if you can provide the crews and then cut you off at the knees with a phone call when it's in their best interest," he said.

T-Mobile sells it to Wall Street as it shaves contractors' balance sheet

A spokesperson for T-Mobile said that it isn't a nationwide shutdown, simply a Capex adjustment.

In a statement to Wireless Estimator, he said, "We are managing capital expenditures as we do every year, and we continue to invest billions to build out our network aggressively, expanding LTE coverage and performance while simultaneously laying the foundation for broad, nationwide 5G in 2020. That hasn't and won't change."

However, seven contractors interviewed by Wireless Estimator said that in the years that they had worked for them the carrier never stopped their build program due to Capex budget constraints in September.

"There have been times where it was just the opposite where they had to invoice projects scheduled for the following year in December," a Midwest contractor said.

It is anticipated that T-Mobile will be in line with their network expansion goals and fiscal commitments with their 2019 cash Capex guidance expected to be at the very high end of $5.8 to $6.1 billion, so why did contractors get this sudden September surprise?

According to a T-Mobile construction manager that requested anonymity, T-Mobile had no intention of curtailing growth in Q4 but expected that by June or July the merger with Sprint would have been a done deal, allowing for $1 Billion or more to become available to continue to expand the carrier's 5G network.

The blame, he believes, should be directly attributed to the 15 state attorneys general plus the District of Columbia who filed a lawsuit in hopes of stopping the T-Mobile $26 billion merger with Sprint because they thought it would not be in the best interest of the American consumer.

Although the U.S. Justice Department greenlit the marriage and the FCC has given its blessing, the AGs are requesting the case to be heard no earlier than December 9.

T-Mobile thought that the merger would have been approved months ago and that's why they were charging hard to roll out 5G and be able to rely upon additional Capex funding to continue that drive, the T-Mobile manager said.

Texas Attorney General Ken Paxton is the only Republican who joined the lawsuit that is being seen by many contractors to be a political stand against President Trump and the Republican-led FCC, and not what's best for the country.

"Let's not let T-Mobile shoulder the blame of having to put in place a nationwide halt to most builds, place it where it belongs on the Democrat AGs," said one contracting firm's owner.

A West Coast contractor said the delay is hurting consumers, contractors, and the carriers.

He believes the AGs are casting aside the benefits of the deal to "get cheap ink."

One contractor informed Wireless Estimator that he was advised that he could take on additional work if he were to delay billing for 120 days, essentially financing T-Mobile's 5G build since it might be another 60 days before payment was made following his invoicing.

He said he notified them that he would accept those terms, but his pricing would have to be increased.

T-Mobile hasn't replied to his request.

Smaller subcontractors who barely keep afloat as a result of thin margins and delayed payment terms will be especially hit hard by T-Mobile's actions.

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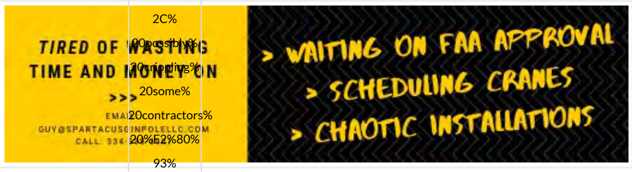

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FCC to hold big 5G auction, spend $20B for rural internet

By DARLENE SUPERVILLE and TALI ARBEL April 12, 2019

WASHINGTON (AP) — The U.S. government will hold a massive auction later this year to bolster 5G service , the next generation of mobile networks. President Donald Trump showcased the announcement Friday, declaring that the race to stand up these faster, more powerful networks is a competition "America must win."

"We cannot allow any other country to outcompete the United States in this powerful industry of the future," Trump said at the White House. "We are leading by so much in so many different industries of that type, and we just can't let that happen."

Trump also announced a $20 billion plan to expand broadband access to rural areas currently without it, a decadelong extension of an existing program.

5G will mean faster wireless speeds and has implications for technologies like self-driving cars and augmented reality. Trump said it will transform the way people work, learn, communicate and travel, making farms more productive, manufacturers more competitive and health care better and more accessible. But experts say it's hard to know now how much life will actually change because of the much-hyped network upgrade.

It will take years to roll out, and the highest data speeds and capacities may not reach rural areas at all.

The rollout started last week in the U.S. and South Korea but will take years.

The Federal Communications Commission said Friday that it would hold the largest auction in U.S. history to boost wireless companies' networks. The auction is set for Dec. 10, and will be the agency's third for 5G, said FCC Chairman Ajit Pai, who joined Trump for the announcement.

AP NEWS

"We want Americans to be the first to benefit from this new digital revolution," Pai said.

The U.S. is jockeying for position with China over 5G. It has effectively banned Chinese telecom equipment maker Huawei from most U.S. networks due to concerns that it might enable Chinese government spying, which Huawei denies. The U.S. has pushed its allies to do the same, with mixed results . Huawei is the world's largest maker of such equipment.

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FCC Commissioner Jessica Rosenworcel, a Democrat, criticized the agency's approach to 5G Friday. She said the U.S. has not auctioned off "midband" spectrum that is better suited to serve rural areas because of how far it can carry signals, and that the Trump administration's actions on 5G have "set us back." She cited tariffs on telecom equipment that have raised costs and said the administration has been "alienating allies" on the 5G security issue.

The FCC also said Friday that it will be renewing an existing $2 billion broadband subsidy program, for 10 years. It will provide about $20.4 billion over a decade to providers, with the goal of connecting up to 4 million rural homes and small businesses to high-speed internet.

The agency spent $34.5 billion on rural-broadband network subsidy programs from 2010 to 2017, according to the Government Accountability Office.

It's more expensive for telecom companies to serve spread-out rural areas than cities and suburbs, so the government provides grants to encourage them to build internet networks in rural parts of the country. Some 24 million Americans lacked access to high-speed internet as of the end of 2016, by the FCC's count.

—

Arbel reported from New York. Associated Press writer Kevin Freking in Washington contributed to this report.

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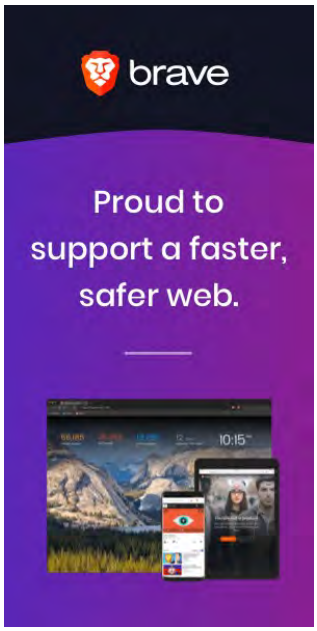

Judge Overturns 5G Deregulation Court Case – FCC Still Wants to Install It Everywhere Despite Increasing Opposition and No Proof It's Safe

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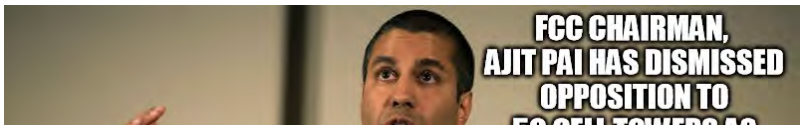

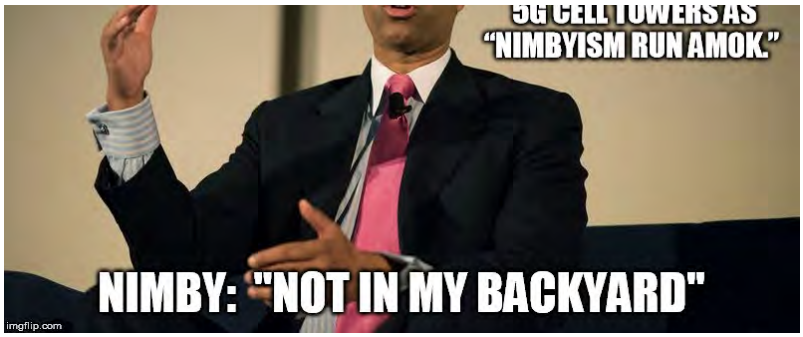

By **B.N. Frank**

The Federal Communications Commission is not a health or environmental agency. Its role is to protect the public by regulating the Telecom Industry but it's been doing the exact opposite for many years and has been identified as a **"Captured Agency"**. Staff has primarily included **former Telecom employees** who **return to the industry** as soon as they stop working for the government.

The agency's blind loyalty to the Telecoms has only become more obvious and more dangerous via the "**Race for 5G**" which is being opposed by a growing list of credible agencies, individuals and organizations (see **1**, **2**), in addition to hundreds of doctors and scientists (see **1**, **2**, **3**).

The good news is that they've lost another court case on 5G deregulation. The bad news is these folks don't ever seem to give up, **5G is already running** in some U.S. cities, **people are sick**, and more cities are scheduled to start operating it this year.

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One of Ajit Pai's attempts to eliminate regulation of 5G deployment has been overturned by federal judges.

The Federal Communications Commission last year **approved** an order that "exempted most small cell construction from two kinds of previously required review: historic-preservation review under the National Historic Preservation Act (NHPA) and environmental review under the National Environmental Policy Act (NEPA)," federal judges said in their decision partially overturning the order.

The FCC claimed its deregulation of small cells was necessary to spur deployment of 5G wireless networks. But the commission was sued by the United Keetoowah Band of Cherokee Indians in Oklahoma, the Blackfeet Tribe, and the Natural Resources Defense Council (NRDC). The FCC order was of particular interest to tribal groups because it affected construction on "sites of religious and cultural importance to federally recognized Indian Tribes," the judges noted. "The Order also effectively reduced Tribes' role in reviewing proposed construction of macrocell towers and other wireless facilities that remain subject to cultural and environmental review."

The FCC's opponents argued that the elimination of historic-preservation and environmental review was arbitrary and capricious, that it violated both the NHPA and NEPA, and that the changes to tribes' role in reviewing construction was arbitrary and

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> capricious. A three-judge panel of the US Court of Appeals for the District of Columbia Circuit **issued its unanimous ruling** today.
>
> Judges wrote that Pai's order "does not justify the Commission's determination that it was not in the public interest to require review of small cell deployments. In particular, the Commission failed to justify its confidence that small cell deployments pose little to no cognizable religious, cultural, or environmental risk, particularly given the vast number of proposed deployments and the reality that the Order will principally affect small cells that require new construction.
>
> The FCC also failed to "adequately address possible harms of deregulation and benefits of environmental and historic-preservation review," which means the commission's "deregulation of small cells is thus arbitrary and capricious," judges concluded.

Register Now for The 5G Crisis: Awareness & Accountability Summit. Online and FREE from August 26 – September 1, 2019.

The Telecom Industry gave congressional testimony in February that they have no scientific evidence that exposure to 5G is safe. The **FCC** continues to champion widespread installation anyway – **by any means necessary**. This includes allowing companies to send **satellites into space to blast it** from there, and trying to loosen regulations so **homeowners can be paid** to put 5G antennas on their roofs.

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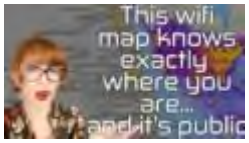

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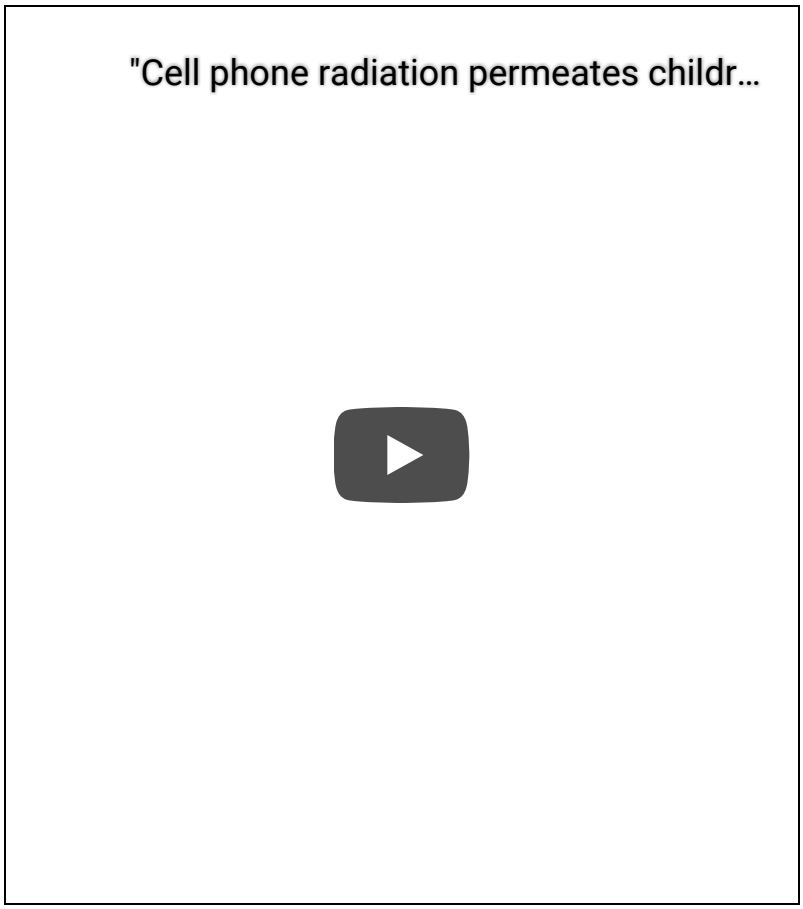

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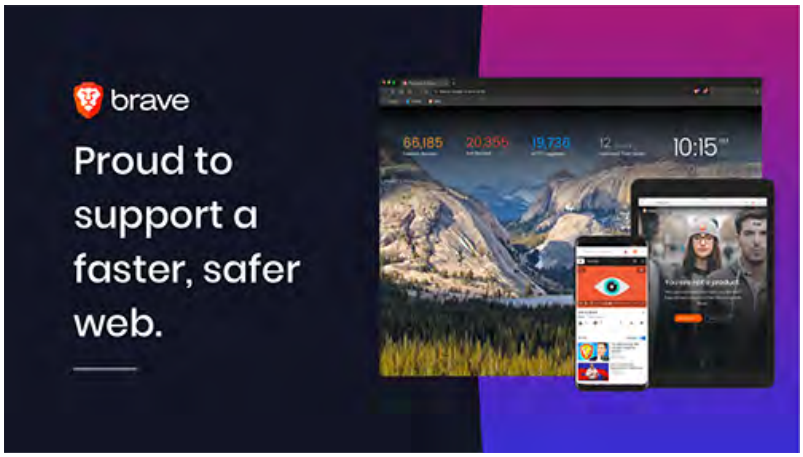

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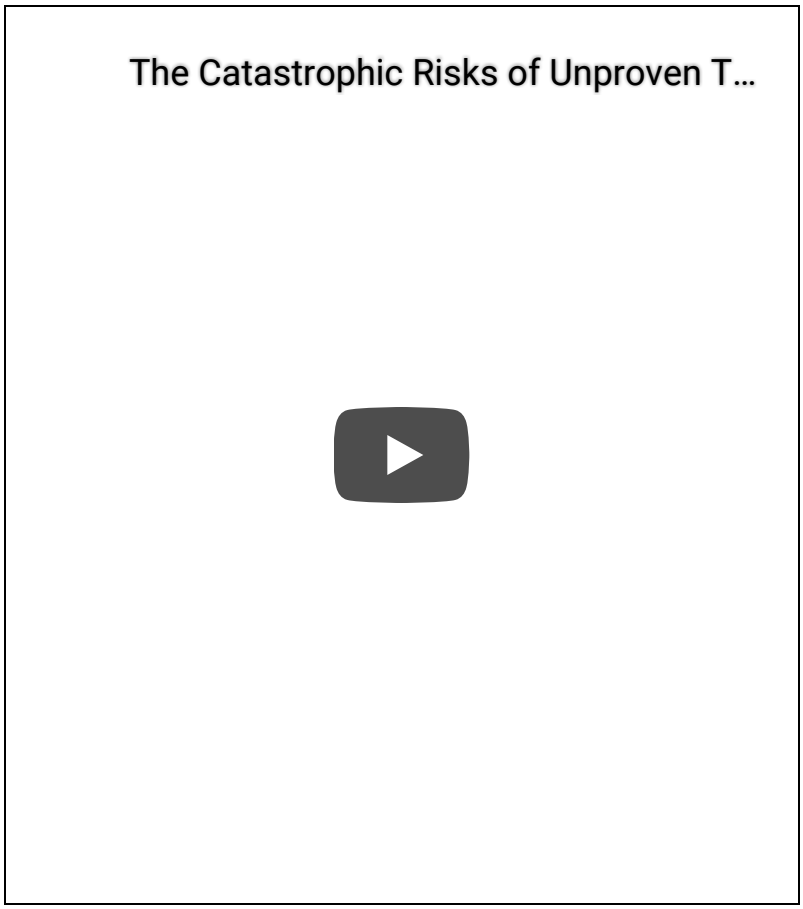

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Research has indicated that exposure to all sources of wireless radiation is harmful – not just 5G – and children are more vulnerable to it than adults.

Activist Post regularly reports about the ne'er-do-wells at the FCC and growing opposition to 5G. For more information, visit our archives and the following websites.

- **Wireless Information Network**
- **Americans for Responsible Technology**
- **5GCrisis**
- **5GExposed**
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- **Center For Safer Wireless**
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Bruce Kushnick and The IRREGULATORS Win First Round Against The FCC. Exposing the $500B Rip-Off Continues.

TOPICS: 5G BN Frank Corruption FCC Telecom

JUNE 24, 2019

By **B.N. Frank**

Hooray for **Bruce Kushnick** and **The IRREGULATORS**! *Activist Post* and many others have reported about **their most recent efforts** against telecom corruption.

From Counterpunch:

> On May 20th, a group known as the Irregulators submitted legal briefs to the U.S. District Court in Washington, DC, seeking standing to appeal a Federal Communications Commission (FCC) decision that, in effect, has facilitated one of the largest accounting scandals in American history. The petitioners are accusing the FCC of allowing the nation's telecommunications companies – the telecom trust – to engage in a bookkeeping slight-of-hand scam that cost telecom users, states and tax payers across the country an estimated $50-$60 billion a year over the last decade.

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And now some **good news** from Bruce:

> On June 3rd, 2019, the FCC decided to not attempt to challenge or block our standing request and we are moving to the next round, the "merits" phase: the presentation of briefs and the identification of supporting evidence.

Ay carumba. Do they have supporting evidence!

There are plenty of reasons to be concerned about this long-time corruption other than being ripped off. It has led Americans to a very dangerous time in history – the "Race for 5G."

Warnings about widespread 5G deployment have come from:

1. **Security experts**,
2. **Meteorologists, NASA, NOAA and the U.S. Navy**
3. Doctors and scientists (see **1**, **2**, **3**)
4. **Utility companies**

Even the **Telecom Industry** won't say they have evidence that 5G is safe.

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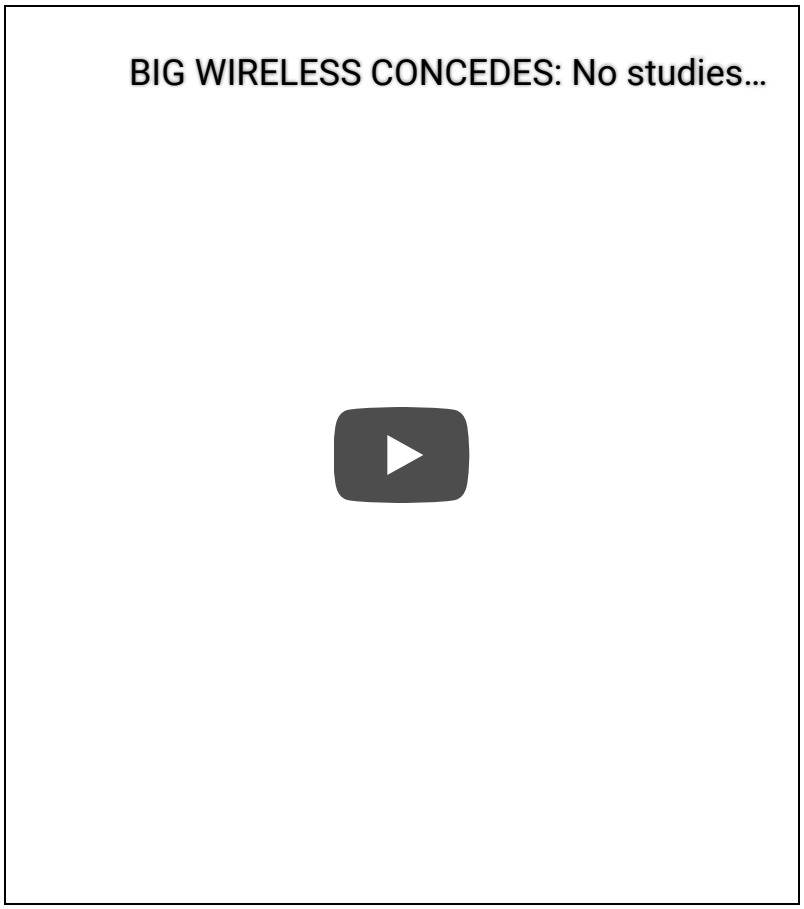

Activist Post regularly reports about 5G issues, warnings, and opposition as well as the FCC's role in all of this (see 1, 2, 3, 4, 5, 6). Increasing numbers of people in the U.S. and around the world are fighting its installation.

Warning From God Discovered In Human DNA

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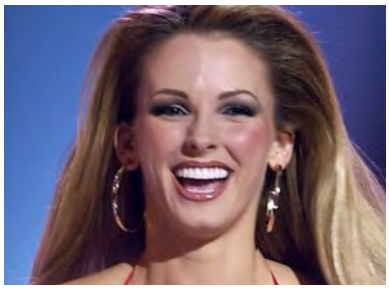

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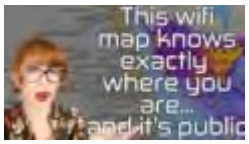

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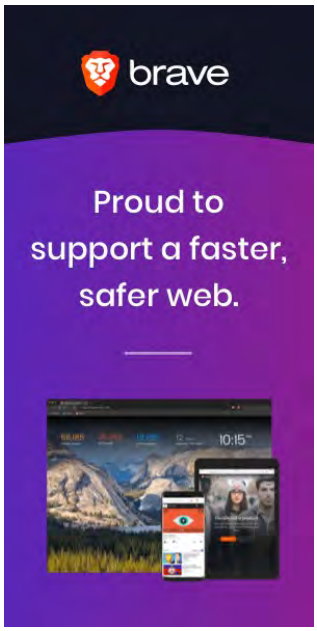

NRDC and American Tribal Groups' Update on Cell Tower Lawsuits, The FCC, and Why You Should Care About 5G

TOPICS: 5G BN Frank Consumer Rights Corruption FCC Indigenous Telecom

AUGUST 18, 2019

DAILY NEWSLETTER

Email address:

By **B.N. Frank**

The Federal Communications Commission (FCC) is supposed to protect the public by regulating the Telecom Industry. Instead they have a long history of **protecting the telecom industry** at the public's expense (see **1**, **2**). This has become way scarier due to the "*Race for 5G*" which involves installing hundreds of thousands (maybe millions) of **small cells** in front of homes and everywhere else.

The Telecom Industry gave congressional testimony in February that they have no scientific evidence that exposure to 5G is safe. That hasn't deterred the FCC or various elected officials who are still promoting widespread installation. The FCC is also allowing companies to send **satellites into space to blast 5G** from there AND trying to loosen regulations so **homeowners can be paid** to put antennas on their roofs.

Opposition and warnings have been publicized by a growing list of credible sources (see 1, 2, 3, 4, 5) including Natural Resources Defense Council (NRDC) and 19 American tribal groups. Unfortunately, **5G is already operating** in many American cities, **people are sick**, so are **their pets**, and telecoms are planning to "unleash it" in more cities before the end of the year.

Last week **The FCC lost another court case** on 5G deregulation and one **tribal group** weighed in:

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Hillary's Entire "Hit List" Just Went Public. You'll Never Guess Who's #1

Warning From God Discovered In Human DNA

> The United States Court of Appeals for the District of Columbia Circuit concluded that a Federal Communications Commission (FCC) deregulation order was arbitrary and capricious because it eliminated historic preservation review under the National Historic Preservation Act (NHPA), including tribal consultation and environmental review under the National Environmental Policy Act (NEPA), for construction of small wireless facilities or small cell radio towers transmitting a cellular signal in an effort to expedite the rollout of the next generation of wireless service known as 5G. The Court of Appeals concluded that the FCC failed to justify its determination that the public interest did not require review of the deployment of hundreds of thousands of small cells. The Court said, "In particular, the Commission failed to justify its confidence that small cell deployments pose little to no cognizable religious, cultural, or environmental risk, particularly given the vast number of proposed deployments and the reality that the Order will principally affect small cells that require new construction."

Register Now for The 5G Crisis: Awareness & Accountability Summit. Online and FREE from August 26 – September 1, 2019.

In June, NRDC posted an article, **"5G and the FCC: 10 Reasons Why You Should Care."**

12x More Efficient Than Solar Panels? Scientists Screaming In Disbelief

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10. While the FCC has limited the review by others, the Commission at the same time has **refused to update its own health and environmental guidelines**. The Commission's guidelines date from the 1990's. In 2012, the **General Accountability Office** found that the existing guidelines may not reflect current knowledge and recommended that the FCC formally reassess its guidelines. The FCC's guidelines address only one aspect of potential harm from electromagnetic radiation—heat. The current guidelines do not address other ways in which exposure to increasing electromagnetic radiation from wireless communications can harm human health, as well as the natural systems around us on which all life depends.

Do you care yet? **Research has also indicated that exposure to all sources of wireless radiation is harmful – not just 5G – and children are more vulnerable to it than adults.**

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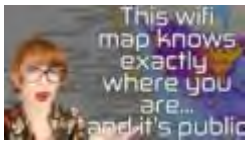

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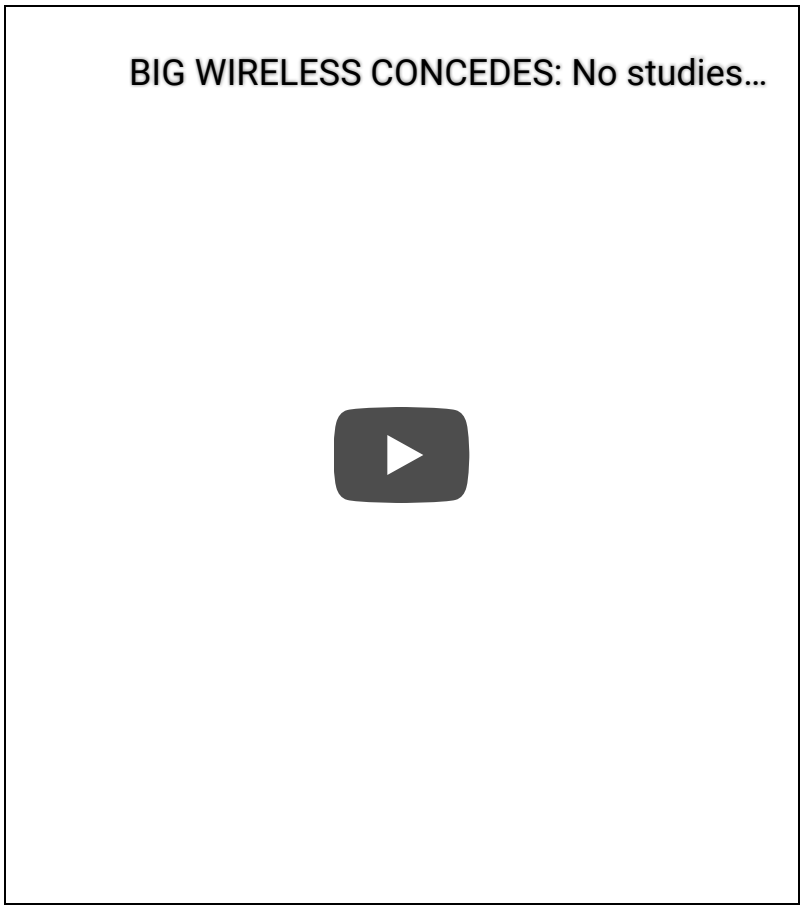

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This being said, if you want any say in **whether or not this is unleashed** in your community, or maybe **removed**, the time to act is now.

American Natural Superfood - Free Sample

Also see: NRDC v. Federal Communications Commission

Activist Post reports regularly about the insidious "Race for 5G." For more information **visit our archives** and the following websites:

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SMARTCITIESDIVE

BRIEF

Cities and counties sue FCC over 5G vote

By Jason Plautz

Published Oct. 30, 2018

Dive Brief:

- Two dozen cities and counties have filed lawsuits against the Federal Communications Commission (FCC) over newly-passed rules that limit the amount local governments can charge telecom companies to install infrastructure for 5G. Bloomberg BNA reports that three separate lawsuits filed in the U.S. Court of Appeals for the Ninth Circuit seek a reversal of the FCC rule.
- The FCC in September passed a controversial set of rules to streamline 5G infrastructure installation, including capping fees to only cover the government's costs for installing small cells. Access fees would be limited to $270 per year per cell site, a reduction that could save wireless companies millions as they build out the network.
- San Jose, CA; Seattle and Huntington Beach, CA are leading the three lawsuits.

Dive Insight:

The FCC proposal was controversial from the start, as cities and counties said the federal government was stepping on their authority, potentially risking public safety, aesthetics and revenue opportunities (in addition to capping fees, the FCC plan also set deadlines for reviewing small cell sites). Some cities warned that digital inclusion efforts backed by 5G fees could be imperiled;

Commissioner Jessica Rosenworcel pointed to San Jose, which signed a deal with three telecom providers to install small cells and used the money raised to increase internet access across the city.

The U.S. Conference of Mayors (USCM), which had already opposed the FCC plan, said in a statement that it backed the attempt to get a federal court to "review and rectify such unlawful actions."

"Instead of working with local governments to win the global race to 5G, the FCC is forcing cities to race to the courthouse to defend the most basic of local government rights — the authority to manage and seek fair compensation from private users that seek to employ public assets, owned and paid for by local taxpayers, for their personal profit without any obligation to serve all of the community whose assets are occupied," USCM CEO and Executive Director Tom Cochran said.

Politico also reports that the FCC is facing opposition from carriers, with AT&T and Sprint both filing lawsuits saying the commission should have done more to automatically approve applications for small cells if local governments did not act quickly enough.

Although companies are racing ahead to get 5G in major cities by the end of the year, the controversy over the streamlining rules shows how federal policy can still lag and present a possible barrier. Industry has called for more streamlining to get infrastructure on the ground faster — especially as they eye China's success in installing 5G — but that can't happen without the cooperation of cities and governments.

Recommended Reading:

WASHINGTON POST

More than a dozen cities are challenging the FCC over how to deploy 5G cell sites

BLOOMBERG BNA

Cities, Counties Challenge FCC on 5G Network Deployment

SMART CITIES DIVE

FCC's 5G ruling could hurt city tech initiatives, opponents warn

JPDV1uV2KuGuR0_QuiG_HtZS0VsYS4aPeV0DDykOurVBFwi75EMH4sN4N2p-B2yLv-KiK0gdX86jE8SQn5VS0bkLnSeDAXGqy6IY%3D)

The American Academy Of Pediatrics Recommendations On Cell Phones, Cell Towers And Wireless Radiation

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The American Academy Of Pediatrics

Medical recommendations on Cell Phones, Cell Towers and Wireless Radiation

The American Academy of Pediatrics (AAP), the largest US medical association of pediatricians and pediatric specialists, recommends that the US government *tighten* wireless exposure limits and that the public *reduce* children's exposure to cell phones and other devices that emit wireless radiation. The AAP also cautions that cell tower radiation is linked to headaches, sleep problems and depression in scientific research studies.

The AAP issued the following cell phone safety tips on their webpage Healthy Children Webpage on Cell Phones. (https://www.healthychildren.org/English/safety-prevention/all-around/Pages/Cell-Phone-Radiation-Childrens-Health.aspx)They specifically recommend to reduce exposure to wireless radiation:

AAP Cell phone tips for families:

- Use text messaging when possible, and use cell phones in speaker mode or with the use of hands-free kits.

(https://ehtrust.org/key-issues/fine-print-warnings/)

(https://ehtrust.org/take-action/educate-yourself/cell-phones-and-wireless-radiation-faqs/)

(https://ehtrust.org/key-issues/wifi-in-schools/)

(https://ehtrust.org/key-issues/cell-phones-and-breast-cancer/)

- When talking on the cell phone, try holding it an inch or more away from your head.
- Make only short or essential calls on cell phones.
- Avoid carrying your phone against the body like in a pocket, sock, or bra. Cell phone manufacturers can't guarantee that the amount of radiation you're absorbing will be at a safe level.
- Do not talk on the phone or text while driving (https://www.healthychildren.org/English/ages-stages/teen/safety/Pages/Sample-Driving-Rules-Teens-Must-Follow.aspx). This increases the risk of automobile crashes.
- Exercise caution when using a phone or texting while walking or performing other activities. "Distracted walking" injuries are also on the rise.
- If you plan to watch a movie on your device, download it first, then switch to airplane mode while you watch in order to avoid unnecessary radiation exposure.
- Keep an eye on your signal strength (i.e. how many bars you have). The weaker your cell signal, the harder your phone has to work and the more radiation it gives off. It's better to wait until you have a stronger signal before using your device.
- Avoid making calls in cars, elevators, trains, and buses. The cell phone works harder to get a signal through metal, so the power level increases.
- Remember that cell phones are not toys or teething items.

"They're not toys. They have radiation that is emitted from them and the more we can keep it off the body and use (the phone) in other ways, it will be safer," said Jennifer A. Lowry, M.D., FAACT, FAAP, chair of the AAP Council on Environmental Health Executive Committee in the AAPs press release on the NTP Study Results (http://www.aappublications.org/news/2016/05/27/Cancer052716).

(https://www.healthychildren.org/English/safety-prevention/all-around/Pages/Cell-Phone-Radiation-Childrens-Health.aspx)
HealthyChild.org Website Page on Cell Phone Radiation

"The findings of brain tumors (gliomas) and malignant schwann cell tumors of the heart in the NTP study, as well as DNA damage in brain cells, present a major public health concern because these occurred in the same types of cells that have been reported to develop into tumors in epidemiological studies of adult cell phone users," stated Ronald L. Melnick, PhD, the National Institutes of Health toxicologist who lead the NTP study design and senior advisor to the Environmental Health Trust. "For children the cancer risks may be greater than that for adults because of greater penetration and absorption of cell phone radiation in the brains of children and because the developing nervous system of children is more susceptible to tissue-damaging agents. Based on this new information, regulatory agencies need to make strong recommendations for consumers to take precautionary measures and avoid close contact with their cell phones, and especially limit or avoid use of cell phones by children."

In 2012, the American Academy of Pediatrics (AAP) strongly supported (http://healthland.time.com/2012/07/20/pediatricians-call-on-the-fcc-to-reconsider-cell-phone-radiation-standards/) the Cell Phone Right to Know Act H.R. 6358 (https://www.govtrack.us/congress/bills/112/hr6358/text), federal legislation that would have informed the American public that wireless devices expose consumers to radiofrequency microwave radiation exposures. This

legislation would have authorized the US government to review the scientific research on biological effects, initiate research on electromagnetic fields and develop safety standards by the Environmental Protection Agency.

American Academy Of Pediatrics Webpage on Cell Towers and Electromagnetic Fields

"An Egyptian study confirmed concerns that living nearby mobile phone base stations increased the risk for developing:

- Headaches
- Memory problems
- Dizziness
- Depression
- Sleep problems

Short-term exposure to these fields in experimental studies have not always shown negative effects, but this does not rule out cumulative damage from these fields, so larger studies over longer periods are needed to help understand who is at risk. In large studies, an association has been observed between symptoms and exposure to these fields in the everyday environment."

Click here to go to the American Academy Of Pediatrics Webpage on Cell Towers and Electromagnetic Fields (https://www.healthychildren.org/English/safety-prevention/all-around/Pages/Electromagnetic-Fields-A-Hazard-to-Your-Health.aspx)

The official position of the AAP is documented in three letters they sent to government officials. The letters describe children's unique vulnerability to wireless radiation and call on the federal government to review and tighten radiation standards for wireless devices in order to protect pregnant women and children's health. In 2012, the AAP sent a letter (https://ehtrust.org/wp-content/uploads/2015/12/aap_support_letter_cell_phone_right_to_know_act.pdf) in support of the newly proposed federal legislation referred to as the Cell Phone Right to Know Act. In 2012, the AAP wrote a letter (https://ehtrust.org/wp-content/uploads/American-Academy-of-Pediatrics-letter-to-the-FCC-July-12-2012.pdf) to the Federal Communications Commission calling for it to open up a review of radiofrequency limits. In 2013, after the FCC opened up "Reassessment of Exposure to Radiofrequency Electromagnetic Fields Limits and Policies (https://www.federalregister.gov/documents/2013/06/04/2013-12713/reassessment-of-exposure-to-radiofrequency-electromagnetic-fields-limits-and-policies)" the AAP submitted a letter with their official comment (https://ehtrust.org/wp-content/uploads/7520941318.pdf).

In 2012, the AAP published Pediatric Environmental Health, the AAP Textbook of Children's Environmental Health and Chapter 41 is about Electromagnetic Fields (https://books.google.com/books?id=5dhBAgAAQBAJ&printsec=frontcover&dq=electromagnetic+fields++Philip+J.+Landrigan,+Ruth+A.+Etzel&hl=en&sa=X&ved=0ahUKEwjnc
20fields%20%20Philip%20J.%20Landrigan%2C%20Ruth%20A.%20Etzel&f=false). The AAP website HealthyChild.org informs the public about cell phone and wireless radiation (https://www.healthychildren.org/English/safety-prevention/all-around/Pages/Cell-Phone-Radiation-Childrens-Health.aspx) and cell tower radiation (https://www.healthychildren.org/English/safety-prevention/all-around/Pages/Electromagnetic-Fields-A-Hazard-to-Your-Health.aspx). In 2016, the AAP issued a press release (http://www.aappublications.org/news/2016/05/27/Cancer052716) about the carcinogenic findings from the NIH National Toxicology Program Studies and

issued new recommendations (https://www.healthychildren.org/English/safety-prevention/all-around/Pages/Cell-Phone-Radiation-Childrens-Health.aspx) with 10 ways to reduce children's exposure to wireless radiation.

American Academy of Pediatrics Documents

AAP Healthy Children.org Cell Phone Radiation & Children's Health: What Parents Need to Know (https://www.healthychildren.org/English/safety-prevention/all-around/Pages/Cell-Phone-Radiation-Childrens-Health.aspx)

AAP Healthy Children Website on Cell Tower Radiation and Health Effects (https://www.healthychildren.org/English/safety-prevention/all-around/Pages/Electromagnetic-Fields-A-Hazard-to-Your-Health.aspx)

"AAP responds to study showing link between cell phone radiation, tumors in rats" AAP Press Release May 27, 2016 (http://www.aappublications.org/news/2016/05/27/Cancer052716)

Pediatric Environmental Health, Textbook of Children's Environmental Health 3rd Edition edited by Philip J. Landrigan, Ruth A. Etzel. Chapter 41 , Electromagnetic Fields (https://books.google.com/books?id=5dhBAgAAQBAJ&printsec=frontcover&dq=electromagnetic+fields++Philip+J.+Landrigan,+Ruth+A.+Etzel&hl=en&sa=X&ved=0ahUKEwjnc
20fields%20%20Philip%20J.%20Landrigan%2C%20Ruth%20A.%20Etzel&f=false)
Oxford Medicine Chapter 41 (http://oxfordmedicine.com/view/10.1093/med/9780199929573.001.0001/med-9780199929573-chapter-41)

"More study needed on risk of brain tumors from cell phone use" AAP Press Release, September 25, 2011: (http://www.aappublications.org/content/32/10/28?sso=1&sso_redirect_count=1&nfstatus=401&nftoken=00000000-0000-0000-0000-000000000000&nfstatusdescription=ERROR%3a+No+local+token)

American Academy of Pediatrics Official Letters on Cell Phones and Wireless Radiation

2013 AAP Letter to FCC Commissioner Mignon Clyburn and FDA Commissioner Margaret Hamburg calling for a review of RF guidelines (https://ehtrust.org/wp-content/uploads/7520941318.pdf)

2012 AAP Letter to US Representative Dennis Kucinich in Support of the Cell Phone Right to Know Act (https://ehtrust.org/wp-content/uploads/2015/12/aap_support_letter_cell_phone_right_to_know_act.pdf)

2012 AAP Letter to the FCC Chairman calling for the FCC to open up a review of RF guidelines (https://ehtrust.org/wp-content/uploads/American-Academy-of-Pediatrics-letter-to-the-FCC-July-12-2012.pdf)

News Reports

WMKY Public Radio: AAP Recommends Putting Cellphone Use on Hold for Children's Health (http://wmky.org/post/aap-recommends-putting-cellphone-use-hold-childrens-health#stream/0)

WebMed: Children Face Higher Health Risk From Cell Phones (http://www.webmd.com/children/news/20140819/children-cell-phones#3)

Baltimore Sun: Pediatric researchers suggest potential dangers for children from cellphone exposure (http://www.baltimoresun.com/health/blog/bal-cell-phones-child-brain-story.html)

National Center for Health Research: Children and cell phones: is phone radiation risky for kids? (http://center4research.org/child-teen-health/children-and-cell-phones-is-phone-radiation-risky-for-kids/)

Time Magazine (2012): Pediatricians Say Cell Phone Radiation Standards Need Another Look (http://healthland.time.com/2012/07/20/pediatricians-call-on-the-fcc-to-reconsider-cell-phone-radiation-standards/)

CNN Sanjay Gupta: Children and Cell Phones Report (https://www.youtube.com/watch?time_continue=3&v=kL2ncKs9K8o)

Click here for a PDF of a Powerpoint of the American Academy of Recommendations (https://ehtrust.org/wp-content/uploads/7520941318.pdf)

American Academy of Pediatrics Issues New Recommendations to "Reduce Exposure to Cell Phones" Nation's largest group of children's doctors responds to new government study linking cell phone radiation to cancer. Press Release September 2016 (http://www.releasewire.com/press-releases/american-academy-of-pediatrics-issues-new-recommendations-to-reduce-exposure-to-cell-phones-726805.htm)

The American Academy of Pediatrics recommendations are highlighted in this Factsheet (https://ehtrust.org/wp-content/uploads/Parents_SafeTech_Flyer_V5.pdf)and Postcard (https://ehtrust.org/wp-content/uploads/BabySafe_Postcard_PRESS.pdf) on children and wireless radiation.

(https://ehtrust.org/resources-to-share/printable-resources/?mgi_139=10722/Protect%20the%20ones%20you%20love%20postcards)

Click to download the 'protect the ones you love' safety cards

(https://ehtrust.org/resources-to-share/printable-resources/?mgi_139=10722/Protect%20the%20ones%20you%20love%20postcards)

(https://ehtrust.org/resources-to-share/printable-resources/?mgi_139=10674/American%20Academy%20of%20Pediatrics%20Recommendations%20Safety%

20Cards)

Click to download the 'protect the ones you love' safety cards (https://ehtrust.org/resources-to-share/printable-resources/?mgi_139=10674/American%20Academy%20of%20Pediatrics%20Recommendations%20Safety%20Cards)

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CLEAR LIGHT VENTURES

HOME BLOG ABOUT

Wireless Safety: Sources and Solutions

Wireless Safety

Sources	Solutions
Baby Monitor	● Turn off ○ Move far away from child
Wi-Fi Router	● Replace with wired Ethernet ○ Turn on only when needed ○ Turn off at night
Cordless Phone	● Replace with corded phone ○ Turn off main base station at night (unplug or timer)
Cell Phone	● Turn Off ○ Use airplane mode ○ Carry and use away from body and head
Laptop	● Use Ethernet cable and turn off Wi-Fi and Bluetooth ○ Move off lap to table top
iPad/Tablet	● Use Ethernet cable and turn off Wi-Fi and Bluetooth ○ Move off lap to table top
Smart Meter	● Opt-out, use analog meter ○ Shield from wireless signal

● Safe ● Reduced Exposure

Wireless Health Effects

- Sperm Damage
- Insomnia
- Ringing in Ears
- Anxiety
- Headaches
- Attention Problems
- Memory Problems
- And more...

References

1. Wireless/RF: WHO Group 2B carcinogen (2011)
2. Bibliography of Reported Biological Phenomena ('Effects') and Clinical Manifestations Attributed to Microwave and Radio-Frequency Radiation – US Navy (1972)
3. Pall, Martin L. "Microwave frequency electromagnetic fields (EMFs) produce widespread neuropsychiatric effects including depression." Journal of chemical neuroanatomy (2015).
4. Sepehrimanesh, Masood, and Devra Lee Davis. "Proteomic impacts of electromagnetic fields on the male reproductive system." Comparative Clinical Pathology (2016): 1-5.
5. Overpowered: The Dangers of Electromagnetic Radiation (EMF) and What You Can Do about It, Martin Blank, Ph.D (2014)

For more details:
clearlightventures.com/wirelesscard

CLEAR LIGHT VENTURES

This article is written as supplemental support for the Wireless Safety Card (front/back) designed and distributed by Clear Light Ventures.

This article will cover the most common sources of wireless radiation and offer a range of choices to reduce or eliminate exposure. On the card, the choices that are completely safe and which will fully eliminate exposure are highlighted by a green dot. The solutions that help to reduce exposure are highlighted by a yellow dot. For all of these sources of exposure, moving the device farther away or moving yourself farther from the device will rapidly reduce exposure. Every time you double the distance, exposure is reduced by 75%. Also, additional common sources of exposure that could not fit on the card are listed below.

Additional details on the most commonly reported symptoms and references are also included (topics covered on the back of the Wireless Safety Card).

Baby Monitor

Safe

- Turn off and do not use.
- Use a wired baby monitor, camera, or microphone that does not emit any wireless radiation. Keep wires and cords far away from the crib.

Reduce Exposure

- Move far away from child, ideally to the other side of the room.
- Use a wireless baby monitor with analog signals and lower frequency, like the Safety 1st Crystal Clear Baby Monitor.
- Use a wireless baby monitor with reduced radiation and digital pulses like the SmartNova Baby Monitor.
- Place shielding products or material between the baby monitor and the child to reduce or eliminate exposure in the crib area. Use a meter to confirm the reduction in exposure.

Wireless Baby Monitors (Video)

Wi-Fi Router

Safe

- Turn off Wi-Fi and use a wired Ethernet connection.

Reduce Exposure

- Reduce power level. Some Wi-Fi units allow the power level to be adjusted in the administration software. Set the power level as low as it can be set while the network still functions reasonably well.
- Replace your router with an Eco Wi-Fi router. This specially configured router allows the beaconing signal to be set to be as low as once a second (1 Hz), instead of the default of 10 Hz, which reduces radiation exposure by about 90%. It also allows the power level to be adjusted.
- Turn off at night or minimally during sleep hours. Some Wi-Fi routers will have a software setting that can be used to turn the Wi-Fi signal on a regular schedule. If your Wi-Fi doesn't have that, you can try using an electric power timer or a wireless power remote (not a constant signal).
- Turn Wi-Fi on only when needed. Some Wi-Fi models have a button that allows immediate activation and de-activation of the Wi-Fi signal without turning the unit on or off (this NetGear model). Some light timers can be used to turn on lights for 2 or 4 hours and then will automatically turn off after that period has elapsed.
- Turn off 5Ghz. If your router has a 5 Ghz band, turn it off.
- Use a shielded box or shielding material to reduce the signal strength (see LessEMF.com).
- Add shielding material to reduce or eliminate the signal strength near bedrooms. Use a meter to confirm the reduction. (see LessEMF.com)
- Relocate the Wi-Fi router far away from bedrooms.

Constant Wireless Exposure: Wi-Fi (Video)

Cordless Phone

Safe

- Replace with a corded phone.

Reduce Exposure

- Turn off main base station at night (unplug or use timer).
- Relocate the base station unit far away from bedrooms.

- Add shielding material to reduce or eliminate the signal strength near bedrooms. Use a meter to confirm the reduction.
- Use an Eco-DECT phone, which lowers or turns off the constant signal when the phone is in the handset.

Constant Wireless Exposure: Cordless Phone Base Stations (Video)

Cell Phone

Safe

- Turn phone off.

Reduce Exposure

- Use the phone far away from body and head (use speakerphone or air-tube headset).
- Carry the phone away from the body in a purse or backpack.
- Make sure you have read the warning on your phone and know the minimum distance the phone needs to be away from your body to comply with FCC safety standards. Touching the phone to the ear or directly against the head can expose you to wireless levels that are 3-4 times the FCC limit, which is already well above levels of exposure that have been shown to cause biological harm.
- Use airplane mode to reduce exposure. Airplane mode used to turn off all wireless signals, but now Wi-Fi and Bluetooth can still be on as well as near field communications and signals to track the location of the phone.
- Keep phone in a shielded cover or pouch, ideally still as far as possible from the body.
- Turn off LTE and allow the phone to use the 3G and 2G networks. On an iPhone, Setting->Cellular->Cellular Data->LTE Enable to Off.
- Minimize use when the phone has a weak signal (1 or 2 bars). This is when the phone will use higher power levels to try to reach the cell tower. You will also see reduced signals when you are surrounded by metal, as is the case when you are inside of a car, train, airplane, or elevator.
- Turn off background app data updates (Settings->General->Background App Refresh->Off)

- Keep your cell phone away from your bed and bedroom and ideally off or in airplane mode at night (with Wi-Fi and Bluetooth off).

Cell Phone Safety Tips (Video)

Laptop

Safe

- Use Ethernet cable and turn off Wi-Fi and Bluetooth.

Reduce Exposure

- Move off lap to table top.
- Use a shielded pad, like a HaraPad or DefenderShield.

Laptop Safety Tips (Video)

iPad/Tablet

Safe

- Use Ethernet cable and turn off Wi-Fi and Bluetooth. See this video for iPad instructions.

Reduce Exposure

- Move off lap to table top.
- Use a shielded pad, like a HaraPad or DefenderShield.

iPad Safety Tips (Video)

Smart Meter

Safe

- Opt-out, use analog meter.

Reduce Exposure

- Shield from wireless signal.

The remaining sources were not listed on the wireless card due to space constraints, but are still very common and should be reviewed to reduce wireless exposure.

Cell Tower

Safe

- Live at least ¼ mile away (see antennasearch.com). This is an approximate guideline. It is always best to measure the exposure, especially in your sleep environment. Building biology guidelines for wireless (Microwave/RF) exposure are based on average peak levels of exposure.

Reduce Exposure

- Shield from wireless signal. Confirm the wireless levels are reduced by measuring with a wireless/RF meter or hiring an EMF expert like a building biologist to measure your exposure.

Video Games

Safe

- Use a wired Ethernet connection for Internet access.
- Use wired remotes.
- Disable Wi-Fi, Bluetooth and other wireless signals, if possible.

Reduce Exposure

- Minimize use, limit interactive screen time.

Wireless Weather Stations

Safe

- Turn off.
- Use a thermometer that doesn't transmit wirelessly.
- Use a wired weather stations.

Reduce Exposure

- Shield from wireless signal.

Wireless Alarm Systems

Safe

- Use a wired alarm system or camera.

Reduce Exposure

- Shield from wireless signal.

Wireless Thermostats

Safe

- Turn off wireless network connection.

Wireless Smoke and CO Alarms

Safe

- Turn off wireless network connection.
- Replace with smoke alarms and CO alarms that do not constantly emit wireless signals.

Wireless Symptoms

The back of the Wireless Safety Card highlights some of the most common symptoms reported by wireless exposure.

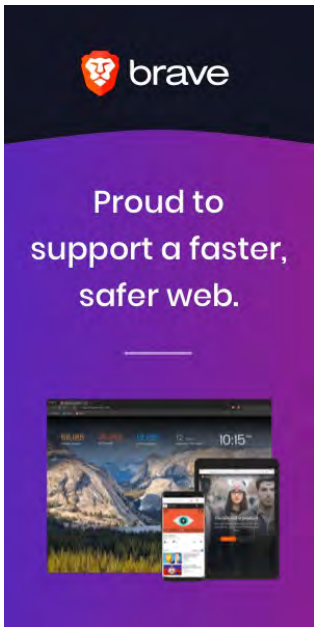
- Sperm Damage
- Insomnia
- Ringing in Ears
- Anxiety
- Headaches
- Attention Problems

- Memory Problems
- And More...

References

1. Wireless/RF: WHO Class 2B carcinogen (2011)
2. Bibliography of Reported Biological Phenomena ('Effects') and Clinical Manifestations Attributed to Microwave and Radio-Frequency Radiation – US Navy (1972)
3. Pall, Martin L. "Microwave frequency electromagnetic fields (EMFs) produce widespread neuropsychiatric effects including depression." Journal of chemical neuroanatomy (2015).
4. Sepehrimanesh, Masood, and Devra Lee Davis. "Proteomic impacts of electromagnetic fields on the male reproductive system." Comparative Clinical Pathology (2016): 1-5.
5. Overpowered: The Dangers of Electromagnetic Radiation (EMF) and What You Can Do about It, Martin Blank, Ph.D 2014

Don’t Know What to Believe About 5G Technology? Dr. Joel Moskowitz of SaferEMR.com Provides Summary and Commentary of NPR Segment “The Future Of 5G”



DAILY NEWSLETTER

Email address:

TOPICS: 5G BN Frank EMF Joel Moskowitz WiFi

APRIL 24, 2019

By **B.N. Frank**

If you're looking for research on how cell phone and wireless WiFi radiation exposure is harmful, you definitely want to check out Dr. **Joel M. Moskowitz's** website **SaferEMR** as well as sign-up for his newsletter. Recently, he sent out a summary and commentary on the April 19, 2019 NPR Science Friday segment, **"The Future of 5G."**

For those not familiar with 5G technology and the ridiculous and highly risky "**Race for 5G**," please see ***Activist Post* archives** as well as Dr. Moskowitz's recommended research links (**1**, **2**).

Save Independent Media for as Little as $1 Per Month

From Dr. Moskowitz: ***"The Future Of 5G" (PBS Science Friday): My Summary and Comments.***

Brian Fung – *Washington Post*

5G should be available in most US cities by 2020; many years later for complete nationwide coverage.
Race to 5G: role out quickly so US can dominate development of new technologies (e.g., self-driving cars).
U.S has security concerns re: Chinese manufacturers of 5G equipment.

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Americans talk about long
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#disease symptoms and t
prescriptions. Are we real

The Incredible Kidney Restoration Results - Watch Video!

NASA and NOAA’s concerns re: interference with weather monitoring and forecasting; “bureaucratic tussle.”

Harold Feld – Public Knowledge

5G may increase digital divide because this technology requires “densification” (i.e., many cell antennas); this will be 10 times more expensive to build out than current cellular technology; rural areas and poor urban areas may not get 5G due to high cost to install the infrastructure.

Trump recently announced $20 billion program over 10 years to provide broadband access to rural areas; but this is the same old Obama program of $2 billion per year; we need a more aggressive program.

Many states adopted laws which remove all regulations on deployment. California is considering such a law. This will increase the digital divide.

Ira Flatow (IP)

IF: Senator Blumenthal & Rep. Eshoo – asked FCC for proof that 5G is safe.

Devra Davis (taped, not live): Wants moratorium on deployment of 5G due to concerns about health effects.

[My comments: Instead of relying on a single sound byte from a pre-taped interview with Dr. Devra Davis, she should have been on the program to address the problematic assertions made by Drs. Bucher and Samet.]

Hilary Clinton Video Is So Shocking Trump Won't Mention It

12x More Efficient Than Solar Panels? Scientists Screaming In Disbelief

MUST SEE VIDEOS

OCTOBER 24, 2019

Special-Ed Students Are Secretly Being Restrained And Labeled “High-Level Threats”

OCTOBER 24, 2019

People Worldwide Are Getting Sick From Utility “Smart” Meters — Californians Took

[Christie Taylor, the associate producer for Science Friday, scheduled a phone interview with me yesterday and then failed to follow up. I was available to provide an alternative perspective on the show re: the science and implications for public health if Devra was not available to do this. So read on if you are interested in what I might have said.]

IF: National Toxicology Program (NTP) found tumor increase in male rats exposed to 2G & 3G

John Bucher (JB) & Jonathan Samet (JS)

JB: NTP looked at whether non-ionizing cell phone radiation via safety assessment studies; described study design; whole body exposures; largely negative findings in mice and female rats; NTP found increased tumors in glial cells in heart and brains of male rats; 2G & 3G radiation; NTP used 1,000-fold higher exposure than typical cell phone exposure.

[My comments: The increased incidence of heart cancers in the male rats were Schwann cells, not glial cells. The Schwann cells are similar to glial cells, but the former are in the peripheral nervous system, and the latter, in the central nervous system; both cell types produce myelin, a fatty sheath which insulates the nerves. NTP found "clear evidence" of increased heart schwannoma and "some evidence" of increased (brain) glioma in male rats. Several case-control studies with humans have found increased incidence of glioma and acoustic neuroma (aka vestibular schwannoma) in the head of heavy cell phone users. I doubt this is coincidental with the findings in the NTP study.]

[JB claimed that typical cell phone exposures are 1,000 times less than those used in the NTP study.

PG&E to Court

OCTOBER 23, 2019

The Deep State Is Assassinating Julian Assange

OCTOBER 23, 2019

CNBC Reports Amazon Is Regularly Selling Expired Baby Food, Beef Jerky, Coffee Primers and More via 3rd Party Vendors

OCTOBER 23, 2019

Although technically this may be accurate, it seems like a specious argument. The NTP study employed full body exposures. In the rats these exposures were 1.5 watts per kilogram, 3.0 watts per kilogram, or 6.0 watts per kilogram. In contrast, cell phones in the U.S. can legally expose the user to a maximum of 1.6 watts per kilogram, but this is a partial body exposure, not a full body exposure. Nonetheless, the NTP study was designed to emulate realistic levels of cell phone partial body exposures even though it used a full body exposure system because it is not practical to partially expose rats to cellular radiation over a long period of time. I suppose if one is comparing the full body exposure from a cell phone to the full body exposures of the rats in the NTP study, JB's statement may be accurate, but making this distinction now is revisionist history in terms of the justification for the design of the NTP study. JB should have mentioned that a similar study conducted by the Ramazzini Institute found increased incidence of heart schwannoma in male rats with a full body exposure of only 0.1 watts per kilogram.]

For more information about the NTP study see:

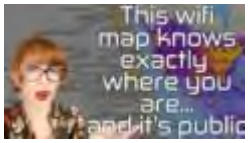
NTP Cell Phone Radiation Study: Final Reports
National Toxicology Program (NTP) Finds Cell Phone Radiation Causes Cancer
National Toxicology Program: Peer & public review of cell phone radiation study reports

Also see:

Ramazzini Institute Cell Phone Radiation Study Replicates NTP Study
NTP: Not the First Govt. Study to Find Wireless Radiation Can Cause Cancer in Lab Rats]

Democrat's Proposed Law Would Make This Offensive Word ILLEGAL

MOST VIEWED ARTICLES OF THE WEEK



Snowden Says Don't Use WiFi — Here's Why

OCTOBER 17, 2019

Civil Unrest Is Erupting All Over The World, But...

OCTOBER 20, 2019

Ready to Pay $30,000 for Sharing a Photo

JS: We need more research to apply the NTP findings to people.

[My comments: Numerous EMF scientists believe we have adequate data to adopt stronger RF guidelines and do not need to wait for more research. See the **International EMF Scientist Appeal** signed by 247 scientists from 42 nations. All have published peer-reviewed research on EMF and biology or health totaling more than 2,000 papers in professional journals.]

[Since the IARC review of RF radiation conducted in 2011 which was chaired by JS, more than 1,000 experimental and epidemologic studies on RF have been published. The preponderance of these studies have found bioeffects or health effects — most studies employed low intensity (non-thermal exposure) exposure to RF.]

JB: NTP is assembling a new exposure system and will look at molecular changes in organs; NTP hopes to extend the research to 4G and possibly 5G.

[My comments: Does the NTP have the funding to conduct this research? What is the timeline for completion of these studies? Wouldn't it be prudent to wait until this research is completed before allowing the deployment of 5G?]

JS: Often with animal studies there are inconsistencies; effects were in male rats, not female rats, but that doesn't change the fact that effects were found.

IF: Are we conducting a population study with billions of people by deploying 5G?

Online? The...

OCTOBER 21, 2019

The Deep State Is Assassinating Julian Assange

OCTOBER 23, 2019

L3 Technologies and the Early New Manhattan Project...

OCTOBER 20, 2019

[My comments: Yes, we should not experiment on the population by deploying 5G which uses millimeter waves in addition to new microwave frequencies ("low bands" and "mid bands"). Over two hundred scientists (including about 100 EMF scientists) and medical doctors have signed a petition, **The 5G Appeal**, calling for a moratorium on 5G. Also see: **Scientists and Doctors Demand Moratorium on 5G.]**

[The FCC has been gathering input from scientists and the public since 2003 regarding its cell phone exposure limits which were adopted in 1996 and protect the public only from short-term heating risks. Although the Commission has received thousands of submissions that call into question the adequacy of the guidelines including hundreds of research studies, the FCC has yet to review their exposure limits. The NTP study and the Ramazzini Institute study provide "clear evidence" that long-term exposure to non-thermal levels of cell phone radiation can cause cancer. Isn't it time for the FCC to strengthen its exposure guidelines?]

JS: Tumor registries monitor cancer rates but we don't want to wait to see if cancer incidence has increased; we need the right studies to look at health risks: animal studies that look at mechanisms; perhaps some creative epidemiologic studies too.

[My comments: With the exception of the NTP cell phone radiation study, the Federal government has barely funded any research on the bioeffects or health effects of EMF exposure since the 1990s.]

IF: Why no explosion in human cancers so far?

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American Natural Superfood - Free Sample

JS: Many cancers develop over long period of time; 30-40 year lag from nuclear radiation exposure for some cancers so we can't be certain that cell phone use is safe.

JB: Mechanisms: Heat is one possible mechanism, but current regulations protect against heating effects. Otherpossible mechanisms include oxidative stress inhibits repair mechanisms; diminished immune response; permeabliity of blood-brain barrier. We don't really know the mechanism.

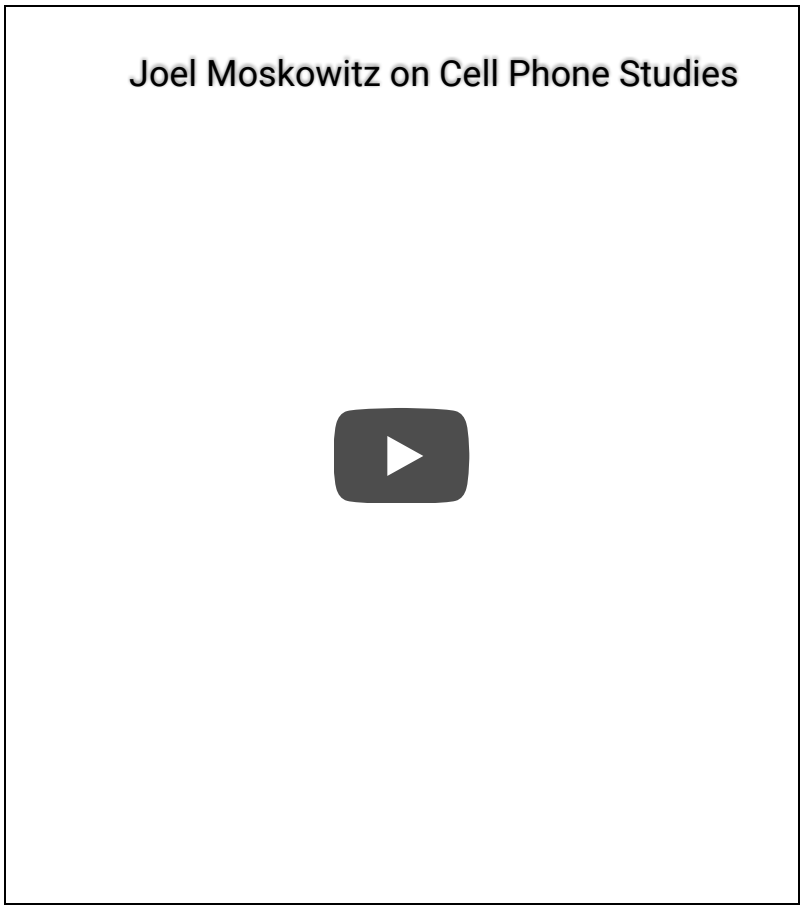
[My comments: EMF causes health effects via multiple mechanisms. See my list of mechanistic studies at **Key Cell Phone Radiation Research Studies**. Moreover, medicine and public health generally does not wait for a complete understanding of the mechanisms to prevent or treat diseases.]

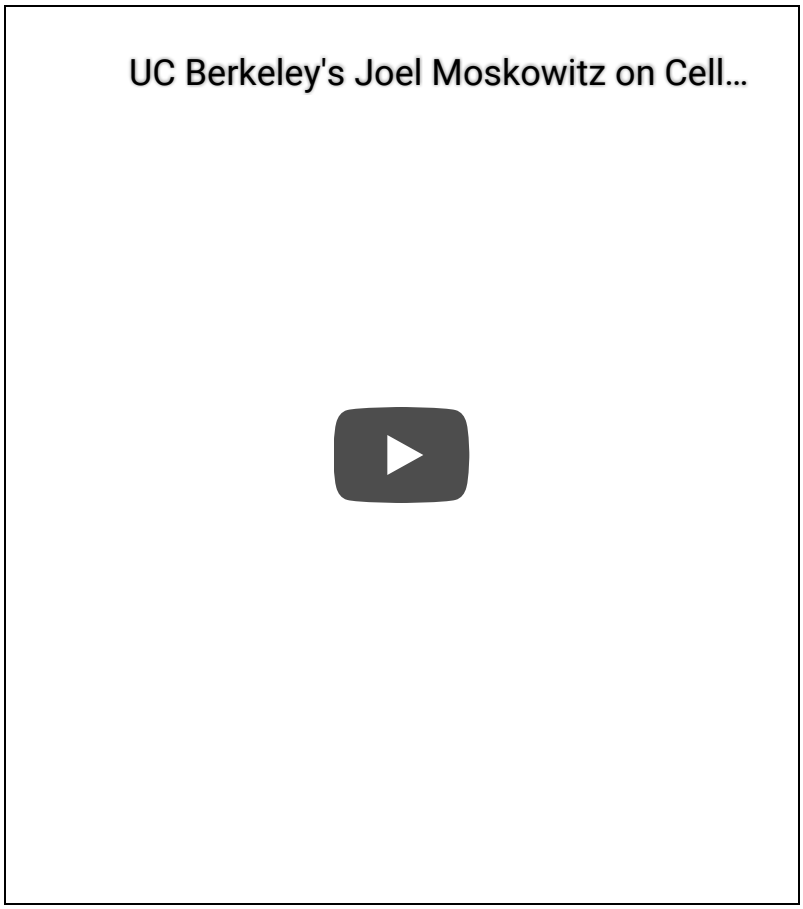
JB: NTP wants to establish biological markers and use them to test different frequencies; 5G won't penetrate beyond the skin unlike 2G and 3G; male rats in NTP absorbed more radiation perhaps because they were larger.

[My comments: This is inaccurate. 5G includes microwaves (low band and mid band) in addition to millimeter waves; microwaves can penetrate the entire body.]

[The research on millimeter waves indicates that it will have direct effects on the skin, sweat glands, peripheral nervous system, the eyes and the testes. Many organs and systems within the body will be adversely impacted.

Thanks to Dr. Moskowitz for his tireless efforts to inform the public which also includes co-producing the **2014 documentary, *Mobilize***.

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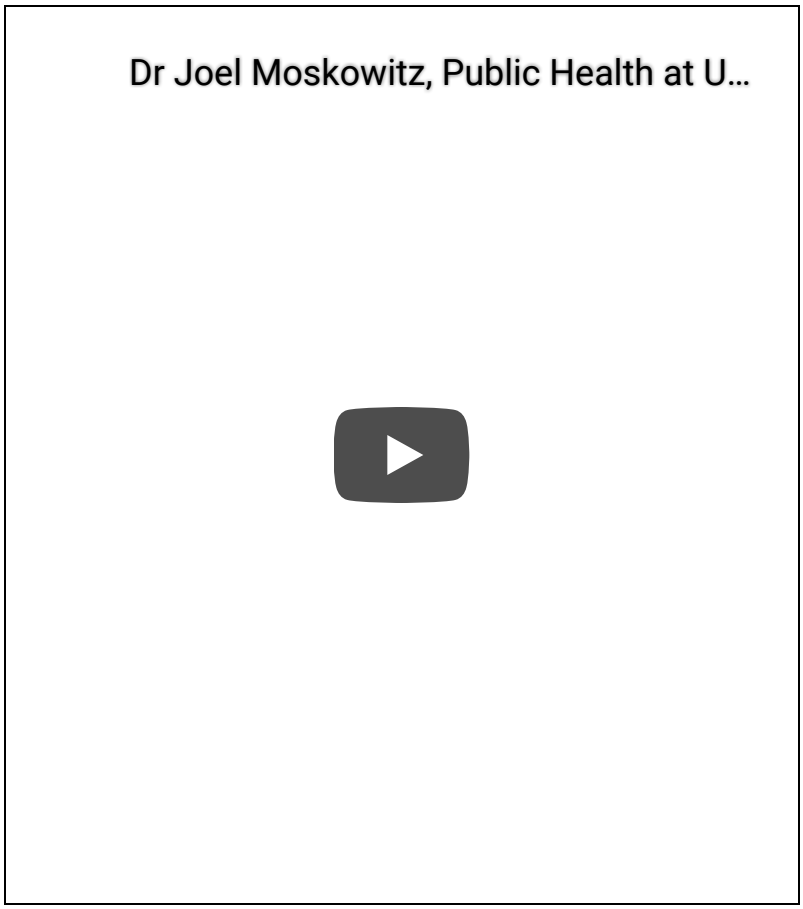
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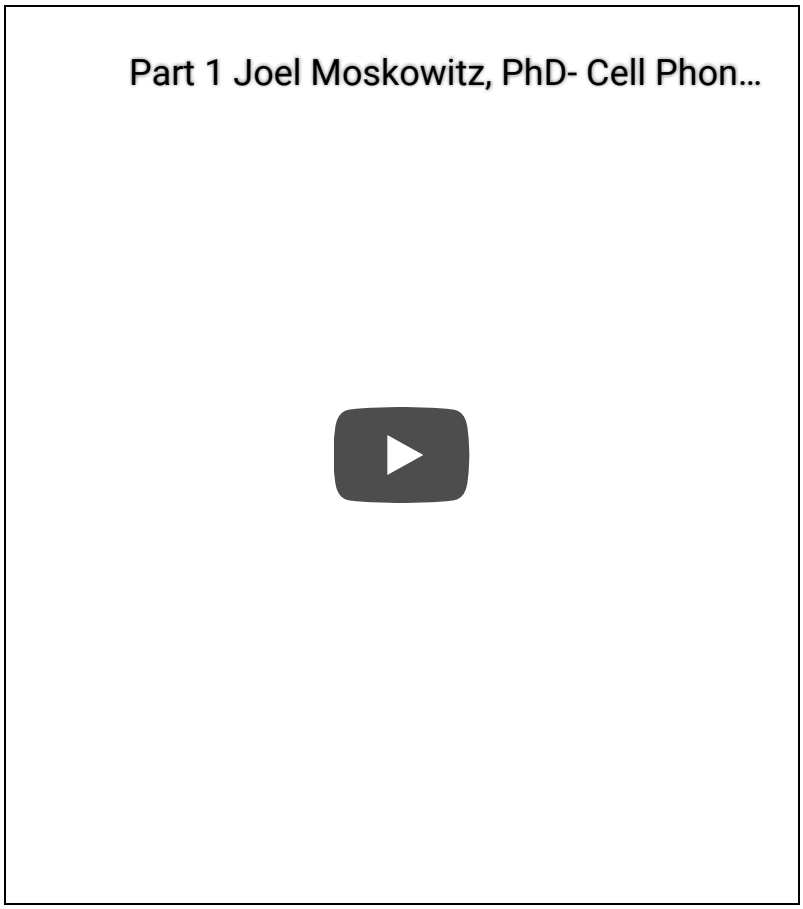
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Scientific Research On 5G, 4G Small Cells, Wireless Radiation And Health

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Published Scientific Research on 5G, Small Cells Wireless and Health

Published peer reviewed science already indicates that the current wireless technologies of 2G, 3G and 4G – in use today with our cell phones, computers and wearable tech – creates (create) radiofrequency exposures which poses (pose) a serious health risk to humans, animals and the environment. Scientists are cautioning that before rolling out 5G, research on human health effects urgently needs to be done first to ensure the public and environment are protected.

"Small cells" are microwave antennas (basically shorter cell towers) rapidly being installed in public areas on utility poles and street lights in front of homes, parks and schools. Just like cell towers, these wireless antennas generate and emit microwave radiofrequency (RF) radiation to transmit 2G, 3G and 4G network signals. Companies soon plan to add a new technology called 5G which will use current 4G technology plus even higher frequencies. The higher frequencies include millimeter-wave emissions that were not previously released into public areas.

Companies state that these 4G (https://www.gsma.com/publicpolicy/arbitrary-radio-frequency-exposure-limits-impact-on-4g-network-deployment-2) and 5G (https://ehtrust.org/itu-report-emf-limits-on-5g/) antennas will increase (https://ehtrust.org/itu-report-emf-limits-on-5g/) the wireless radiation levels in the area so much that they are working to loosen several governments' radiation limits in order to roll it out. More than 240 scientists published (https://www.researchgate.net/publication/298533689_International_Appeal_Scientists_call_for_protection_from_non-ionizing_electromagnetic_field_exposure) an appeal to the United Nations to

CELL PHONE FINE PRINT WARNINGS
(https://ehtrust.org/key-issues/fine-print-warnings/)

CELL PHONE RADIATION FAQ'S
(https://ehtrust.org/take-action/educate-yourself/cell-phones-and-wireless-radiation-faqs/)

WIFI IN SCHOOLS
(https://ehtrust.org/key-issues/wifi-in-schools/)

CELL PHONES AND BREAST CANCER
(https://ehtrust.org/key-issues/cell-phones-and-breast-cancer/)

reduce public exposure and called for a moratorium on 5G (https://www.emfcall.org/the-emf-call/) citing "established" adverse biological effects of RF radiation.

5G will utilize not only the frequencies currently in use, but also higher millimeter wave and sub-millimeter wave frequencies. Small cells being installed in cities are usually 4G technology with a wide variety of frequencies. Thus, when we consider the health impacts of 5G and small cells we are looking at research on current technologies and frequencies in use in addition to research on sub-millimeter and millimeter waves. The 5G standard is new there are no studies that have looked at long term human exposure to 5G. However the current body of research finding effects from current wireless technology provides enough data for scientists to call for a moratorium.

This page lists important research on 5G, millimeter waves, cellular antennas, the environment and human health.

- Learn more about 5G on EHT's (https://ehtrust.org/key-issues/cell-phoneswireless/5g-internet-everything/)database of resources here. (https://ehtrust.org/key-issues/cell-phoneswireless/5g-internet-everything/)
- Click here for EHT's list of Scientists letters on Health Impacts of 5G (https://ehtrust.org/small-cells-mini-cell-towers-health-letters-scientists-health-risk-5g/)
- Click here to read research in cell tower radiation linked to health effects (https://ehtrust.org/science/cell-towers-and-cell-antennae/compilation-of-research-studies-on-cell-tower-radiation-and-health/)
- Click here to get the EHT factsheet on 5G (https://ehtrust.org/wp-content/uploads/5G_What-You-Need-to-Know.pdf)
- Dr. Martin Pal, "5G: Great risk for EU, U.S. and International Health! Compelling Evidence for Eight Distinct Types of Great Harm Caused by Electromagnetic Field(EMF) Exposures and the Mechanism that Causes Them" (https://ehtrust.org/wp-content/uploads/5g-emf-hazards-dr-martin-l.-pall-eu-emf2018-6-11us3.pdf)
- Published article on the EMF Scientist Appeal in the European Journal of Oncology. (https://www.researchgate.net/publication/298533689_International_Appeal_Scientists_call_for_protection_from_non-ionizing_electromagnetic_field_exposure)

Published Research Documents Adverse Effects of RF Exposure

Published peer reviewed science associating exposure with biological effects already indicates that the current wireless technologies of 2G, 3G and 4G – in use today with our cell phones, computers and wearable tech poses serious risks to humans, animals and the environment. More than 240 scientists published (https://www.researchgate.net/publication/298533689_International_Appeal_Scientists_call_for_protection_from_non-ionizing_electromagnetic_field_exposure) an appeal to the United Nations to reduce public exposure and are calling for a moratorium on 5G (https://www.emfcall.org/the-emf-call/) citing "established" adverse biological effects of RF radiation.

Companies state that these 4G (https://www.gsma.com/publicpolicy/arbitrary-radio-frequency-exposure-limits-impact-on-4g-network-deployment-2) and 5G (https://ehtrust.org/itu-report-emf-limits-on-5g/) antennas will increase (https://ehtrust.org/itu-report-emf-limits-on-5g/) the wireless radiation levels in the area so much that they are working to loosen several governments' radiation limits in order to roll it out.

5G will utilize not only the frequencies currently in use, but also higher millimeter wave and sub-millimeter wave frequencies. Small cells (wireless antenna installations) being installed in cities are usually 4G technology with the capacity for 5G installations at a later date. Cell phones and wireless devices in use today and the near future have multiple antennas with a range of frequencies and modulations. Thus, when we consider the health impacts of 5G and "small cells" we need to consider research on current technologies already in use (2G, 3G and 4G) in addition to research on sub-millimeter and millimeter waves. The 5G standard is new and there are no studies that have looked at long term human exposure to 5G specifically.

Published Research Documents Adverse Effects of RF Exposure

Publications on 5G

"5G Wireless Expansion: Public Health and Environmental Implications (https://doi.org/10.1016/j.envres.2018.01.016)" is a research review that documents the range of reported adverse effects of RF and millimeter waves—effects range from cancer to bacteria growth changes to DNA damage. The study concludes that "a moratorium on the deployment of 5G is warranted" and "the addition of this added high frequency 5G radiation to an already complex mix of lower frequencies, will contribute to a negative public health outcome … from both physical and mental health perspectives" (Russell 2018 (https://doi.org/10.1016/j.envres.2018.01.016)).

"Towards 5G communication systems: Are there health implications? (https://www.ncbi.nlm.nih.gov/pubmed/29402696)" is a research review detailing research findings that millimeter waves can alter gene expression, promote cellular proliferation and synthesis of proteins linked with oxidative stress, inflammatory and metabolic processes." The researchers conclude, "available findings seem sufficient to demonstrate the existence of biomedical effects, to invoke the precautionary principle" (Di Ciaula 2018 (https://www.ncbi.nlm.nih.gov/pubmed/29402696)).

"Systematic Derivation of Safety Limits for Time-Varying 5G Radiofrequency Exposure Based on Analytical Models and Thermal (https://www.ncbi.nlm.nih.gov/pubmed/30247338)Dose" documents how significant tissue heating can be generated by 5G technology's rapid short bursts of energy. "The results also show that the peak-to-average ratio of 1,000 tolerated by the International Council on Non-Ionizing Radiation Protection guidelines may lead to permanent tissue damage after even short exposures, highlighting the importance of revisiting existing exposure guidelines." (Neufeld and Kuster 2018)

"The Human Skin as a Sub-THz Receiver – Does 5G Pose a Danger to It or Not? (https://www.ncbi.nlm.nih.gov/pubmed/29459303)" and "The Modeling of the Absorbance of Sub-THz Radiation by Human Skin (http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=8016593&isnumber=5741778)" are two papers by physicists presenting research that found higher 5G frequencies are intensely absorbed into human sweat ducts (in skin), at much higher absorption levels than other parts of our skin's tissues (Betzalel 2017 (http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=8016593&isnumber=5741778), Betzalel 2018 (https://www.ncbi.nlm.nih.gov/pubmed/29459303)). The researchers conclude

(https://www.ncbi.nlm.nih.gov/pubmed/29459303), "we are raising a warning flag against the unrestricted use of sub-THz technologies for communication, before the possible consequences for public health are explored."

"Exposure of Insects to Radio-Frequency Electromagnetic Fields from 2 to 120 GHz (https://www.nature.com/articles/s41598-018-22271-3)" published in Scientific Reports is the first study to investigate how insects (including the Western honeybee) absorb the higher frequencies (2 GHz to 120 GHz) to be used in the 4G/5G rollout. The scientific simulations showed increases in absorbed power between 3% to 370% when the insects were exposed to the frequencies. Researchers concluded, "This could lead to changes in insect behaviour, physiology, and morphology over time…." (Thielens 2018 (https://www.nature.com/articles/s41598-018-22271-3))

Review Publications on Electromagnetic Radiation and RF

A 2019 literature review "Oxidative mechanisms of biological activity of low-intensity radiofrequency radiation (https://www.ncbi.nlm.nih.gov/pubmed/26151230)" found that 93 of the 100 peer-reviewed studies dealing with oxidative effects of low-intensity RFR, confirmed that RFR induces oxidative effects in biological systems.

"Planetary Electromagnetic Pollution: It Is Time to Assess Its Impact (https://www.sciencedirect.com/science/article/pii/S2542519618302213?via%3Dihub)" published in The Lancet documents the significant increase in environmental levels of radio-frequency (RF) electromagnetic wireless radiation over the last two decades. The study cites an evaluation that found 68.2% of 2266 studies in humans, animals, and plants demonstrated significant biological or health effects associated with exposure to electromagnetic fields. 89% of experimental studies that investigated oxidative stress endpoints showed significant effects and "radiofrequency electromagnetic radiation causes DNA damage apparently through oxidative stress. The paper also highlights research that has associated RF exposure with altered neurodevelopment and behavioural disorders, structural and functional changes in the brain and the sensitivity of pollinators. "These findings deserve urgent attention.This weight of scientific evidence refutes the prominent claim that the deployment of wireless technologies poses no health risks at the currently permitted non-thermal radiofrequency exposure levels." (Bandara and Carpenter 2018 (https://www.sciencedirect.com/science/article/pii/S2542519618302213?via%3Dihub))

The review "Thermal and non-thermal health effects of low intensity non-ionizing radiation: An international perspective (https://www.ncbi.nlm.nih.gov/pubmed/30025338)" published by researchers of the European Cancer Environment Research Institute in Brussels, Belgium and the Institute for Health and the Environment, University at Albany, NY, USA reviews current research findings and states that, "the mechanism(s) responsible include induction of reactive oxygen species, gene expression alteration and DNA damage through both epigenetic and genetic processes." The paper states that "exposure to low frequency and radiofrequency electromagnetic fields at low intensities poses a significant health hazard that has not been adequately addressed by national and international organizations such as the World Health Organization."

The literature review "Effect of radiofrequency radiation on reproductive health" (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6469375/)published by the Division of Reproductive Biology & Maternal Health, Child Health, Indian Council of Medical Research documents research that has found a link between radiofrequency radiation and oxidative stress and changes to the reproductive system including sperm count, motility, normal morphology and viability. The review concludes that the "available data indicate that exposure to EMF can cause adverse health effects. It is also reported that biological effects may occur at very low levels of exposure."

A 2010 landmark review study (https://www.nrcresearchpress.com/doi/pdfplus/10.1139/A10-018) on 56 studies that reported biological effects found at very low intensities, including impacts on reproduction, permeability of the blood-brain barrier, behavior, cellular and metabolic changes, and increases in cancer risk (Lai and Levitt 2010 (https://www.nrcresearchpress.com/doi/pdfplus/10.1139/A10-018)).

Cancer

Cancer epidemiology update, following the 2011 IARC evaluation of radiofrequency electromagnetic fields (https://doi.org/10.1016/j.envres.2018.06.043) is a comprehensive research review of RF effects in human and animal research. The review concludes that scientific evidence is now adequate to conclude radiofrequency radiation is carcinogenic to humans (Miller 2018 (https://doi.org/10.1016/j.envres.2018.06.043)). Several previously published studies also concluded that RF can "cause" cancer, for example, Hardell 2017 (https://www.hindawi.com/journals/bmri/2017/9218486/), Atzman 2016 (https://clinmedjournals.org/articles/ijccr/international-journal-of-cancer-and-clinical-research-ijccr-3-040.php?jid=ijccr) and Peleg 2018 (https://www.ncbi.nlm.nih.gov/pubmed/29433020).

The US National Toxicology Program (NTP) Study on Cell Phone Radiation (https://ntp.niehs.nih.gov/results/areas/cellphones/index.html) found "clear evidence" of cancer, heart damage and DNA damage in a $30-million study designed to test the basis for federal safety limits (NIEHS (https://ntp.niehs.nih.gov/results/areas/cellphones/index.html) 2018). The heart and brain cancers found in the NTP rats are the same cell type as tumors that researchers have found to be increased (https://www.hindawi.com/journals/bmri/2017/9218486/) in humans who have used cell phones for over 10 years. Thus, researchers say (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6254861/) this animal evidence confirms the human evidence associating the exposure to cancer(Hardell 2019 (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6254861/).)

The Ramazzini Institute (RI) Study on Base Station RF (https://www.ncbi.nlm.nih.gov/pubmed/29530389) was another large scale rat study that also found increases in the same heart cancers that the NTP study found—yet the Ramazzini rats were exposed to much lower levels of RF than the NTP rats. In fact, all the RI Ramazzini radiation exposures were below FCC limits, as the study was specifically designed to test the safety of RF limits for cell tower/base stations (Falconi 2018

(https://www.ncbi.nlm.nih.gov/pubmed/29530389).) Thus the Ramazzini study corroborates the NTP findings (https://ntp.niehs.nih.gov/results/areas/cellphones/index.html).

Tumor promotion by exposure to radiofrequency electromagnetic fields below exposure limits for humans" (https://www.sciencedirect.com/science/article/pii/S0006291X15003988) is a replication study that used very, very low RF exposures (lower than the Ramazzini and NTP study) and combined the RF with a known carcinogen. Researchers found elevated lymphoma and significantly higher numbers of tumors in the lungs and livers in the animals exposed to both RF and the carcinogen, leading researchers to state that previous research (Tillman 2010 (https://www.ncbi.nlm.nih.gov/pubmed/20545575)) was confirmed and that "our results show that electromagnetic fields obviously enhance the growth of tumors" (Lerchl 2015 (https://www.sciencedirect.com/science/article/pii/S0006291X15003988)).

Environment

"A review of the ecological effects of RF-EMF (https://www.sciencedirect.com/science/article/pii/S0160412012002334)" reviewed 113 studies finding RF-EMF had a significant effect on birds, insects, other vertebrates, other organisms and plants in 70% of the studies (Cucurachi 2013) (https://www.sciencedirect.com/science/article/pii/S0160412012002334). Development and reproduction in birds and insects were the most strongly affected. As an example of the several studies on wildlife impacts, a study focusing on RF from antennas found increased sperm abnormalities in mice exposed to RF from GSM antennas (Otitoloju 2010) (https://www.ncbi.nlm.nih.gov/pubmed/19816647).

Studies on bees have found behavioral effects (Kumar 2011 (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3052591/), Favre 2011) (https://link.springer.com/article/10.1007%2Fs13592-011-0016-x#page-1), disrupted navigation Goldsworthy 2009 (https://ecfsapi.fcc.gov/file/7520958012.pdf), Sainudeen 2011 (http://ipublishing.co.in/jesvol1no12010/EIJES2044.pdf), Kimmel et al. 2007 (http://www.partecipiamo.it/cultura/renzo_barbattini/api_e_frequenze_elettromagnetiche_002.pdf)) decreasing egg laying rate (Sharma and Kumar, 2010 (http://www.gammel.felo.no/2010_Bier%20Sharma-Kumar-%7Cfelo%7Ccontent%7Cdownload%7C3923%7C33892%7Cfile%7C2010_Bier%20Sharma-Kumar.pdf.pdf)) and reduced colony strength (Sharma and Kumar, 2010 (http://www.gammel.felo.no/2010_Bier%20Sharma-Kumar-%7Cfelo%7Ccontent%7Cdownload%7C3923%7C33892%7Cfile%7C2010_Bier%20Sharma-Kumar.pdf.pdf), Harst et al. 2006 (http://www.next-up.org/pdf/ICRW_Kuhn_Landau_study.pdf)).

Research has also found a high level of damage to trees from antenna radiation. For example, a field monitoring study —-spanning 9 years involving over 100 trees (Waldmann-Selsam 2016) (https://www.sciencedirect.com/science/article/pii/S0048969716317375#!) found trees sustained more damage on the side of the tree facing the antenna.

5G and the Internet of Things will increase overall use of all types of wireless frequencies.

A published review of effects of Wi-Fi radiation entitled, "Wi-Fi is an important threat to human health (https://www.sciencedirect.com/science/article/pii/S0013935118300355)" found that "repeated Wi-Fi studies show that Wi-Fi causes oxidative stress, sperm/testicular damage, neuropsychiatric effects including EEG changes, apoptosis, cellular DNA damage, endocrine changes, and calcium overload.

"The Impact of radiofrequency radiation on DNA damage and antioxidants in peripheral blood lymphocytes of humans residing in the vicinity of mobile phone base station" (https://www.researchgate.net/publication/318916428_Impact_of_radiofrequency_radiation_on_DNA_damage_and_antioxidants_ir is a research study that compared people living close (within 80 meters) and far (more than 300 meters away) from cellular antennas and found that the people living closer had several significant changes in their blood predictive of cancer development (Zothansiama 2017 (https://www.researchgate.net/scientific-contributions/2131399242_Zothansiama)). An earlier 2016 study (https://www.ncbi.nlm.nih.gov/pubmed/26238667) looking at 116 persons exposed to radiation from mobile towers and 106 control subjects found DNA damage in peripheral blood lymphocytes (Gulati 2016 (https://www.ncbi.nlm.nih.gov/pubmed/26238667)).

"Mortality by neoplasia and cellular telephone base stations (https://www.sciencedirect.com/science/article/pii/S0048969711005754)" is a 10 year study by the Belo Horizonte Brazil Health Department and several universities in Brazil that found an elevated relative risk of cancer mortality at residential distances of 500 meters or less from cell installations (Dode 2011 (https://www.sciencedirect.com/science/article/pii/S0048969711005754)). Shortly after this study was published, the city prosecutor sued several cell phone companies and requested that almost half of the city's antennas be removed. Many antennas were dismantled.

A 2019 study (https://www.ncbi.nlm.nih.gov/pubmed/?term=Mobile+Phone+Base+Station+Tower+Settings+Adjacent+to+School+Buildings%3A+Impact+on+Students%E2%80%99+Cognitive+Health) of students in schools near cell towers found their higher RF exposure was associated with impacts on motor skills, memory and attention (Meo 2019 (https://www.ncbi.nlm.nih.gov/pubmed/?term=Mobile+Phone+Base+Station+Tower+Settings+Adjacent+to+School+Buildings%3A+Impact+on+Students%E2%80%99+Cognitive+Health)). Examples of other effects linked to cell towers in research studies include neuropsychiatric problems (https://www.ncbi.nlm.nih.gov/pubmed/16962663), elevated diabetes (https://www.researchgate.net/publication/283726472_Association_of_Exposure_to_Radio-Frequency_Electromagnetic_Field_Radiation_RF-EMFR_Generated_by_Mobile_Phone_Base_Stations_with_Glycated_Hemoglobin_HbA1c_and_Risk_of_Type_2_Diabetes_Mellitus), headaches (https://www.ncbi.nlm.nih.gov/pubmed/16621850), sleep problems (https://www.ncbi.nlm.nih.gov/pubmed/12168254) and genetic damage (https://www.ncbi.nlm.nih.gov/pubmed/25006864).

A published study entitled, "Effect of Mobile Tower Radiation on Microbial Diversity in Soil and Antibiotic Resistance" (https://ieeexplore.ieee.org/document/8665432) took soil samples from four different base stations located in Dausa city, and control samples from soil far from stations and then isolated and evaluated the microorganisms in the soil. The researchers found greater antibiotic resistance in microbes present in soil near base stations compared to the control. The study concludes, "our

findings suggest that mobile tower radiation can significantly alter the vital systems in microbes and turn them multidrug resistant (MDR) which is most important current threat to public health."

Research on 3G and 4G

3G and 4G technology is still very much in use around the world. In addition, 5G devices will also have 4G emissions and 5G will use the frequencies currently used in 2G, 3G and 4G.

A 2019 study on human blood found microwave 3G MT EMF/radiation – within the current exposure limits – had significant genotoxic action on human cells (Panagopoulos 2019) (https://www.ncbi.nlm.nih.gov/pubmed/31516130). A series of landmark papers found that effects from microwaves on human lymphocytes can be dependant on carrier frequency (Belyaev 2005 (https://www.ncbi.nlm.nih.gov/pubmed/16140623)), that UMTS (3G) microwaves can affect chromatin and inhibit formation of DNA double-strand breaks (Belyaev 2009) (https://www.ncbi.nlm.nih.gov/pubmed/?term=Microwaves+from+UMTS%2FGSM+mobile+phones+induce+long%E2%80%90lasting+inhibition+of+53BP1%2F%CE%B3%E2%80%90H2AX+DNA+repair+foci+in+human+lymphocytes) and that stem cells are most sensitive to microwave exposure (Belyaev 2010 (https://www.ncbi.nlm.nih.gov/pubmed/20064781)). Children have more active stem cells.

4G or the fourth generation of cellular technology called Long Term Evolution or LTE was launched without premarket safety testing for long term exposure. Published research has found behavioral changes in mice (Broom 2019 (https://www.ncbi.nlm.nih.gov/pubmed/31522469)); damage to the testes and reproductive potential in mice (Yu 2019 (https://www.ncbi.nlm.nih.gov/pubmed/31514029)); reduction to EEG alpha power (Vecsei 2018 (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6301959/)); modulation to resting state EEG on alpha and beta bands (Yang 2017) (https://1.usa.gov/2475GM3); alteration of spontaneous low frequency fluctuations induced by the acute LTE RF-EMF exposure (Lv 2014 (https://1.usa.gov/1gTqxVr)).

A 2018 double-blind, crossover, randomized, and counterbalanced design study Modulation of brain functional connectivity by exposure to LTE (4G) cell phone radiation (https://onlinelibrary.wiley.com/doi/full/10.1002/bem.22165) found that acute LTE-EMF exposure did modulate connectivity in some brain regions and the authors conclude that "Our results may indicate that approaches relying on network-level inferences can provide deeper insights into the acute effects of LTE -EMF exposure with intensities below the current safety limits on human functional connectivity. In the future, we need to investigate the evolution of the effect over time." (Wei 2018 (https://onlinelibrary.wiley.com/doi/full/10.1002/bem.22165)).

The Building Industry

The paper "Building science and radiofrequency radiation: What makes smart and healthy buildings (https://www.sciencedirect.com/science/article/pii/S0360132319305347)" with a long list of authors including former Microsoft Canada President Frank Clegg as well as Anthony Miller MD former Director of the Epidemiology Unit of the National Cancer Institute of Canada reviews research finding adverse health effects below regulatory limits and recommends reducing radiofrequency radiation in buildings by installing wired rather than wired internet connections and corded rather than cordless phones (Clegg 2019 (https://www.sciencedirect.com/science/article/pii/S0360132319305347)).

The Collaborative for High Performance Schools has developed Best Practices for LOW EMF classrooms that details how schools can replace wireless networks with wired networks. See CHPS Low EMF Criteria (https://ehtrust.org/wp-content/uploads/US-CHPS__Criteria_2014_Low-EMF-Low-ELF-Criteria102314_VA-1-copy-2.pdf)

Cell Towers and Health

A 2014 publication (https://www.academia.edu/24818673/Mobile_phone_infrastructure_regulation_in_Europe_Scientific_challenges_and_human_rights_protec in Environmental Science & Policy by human rights experts argue that cell tower placement is a human rights issue for children because "the protection of children is a high threshold norm in Human Right law and the binding language of the Convention on the Rights of the Child obliges States Parties to provide a higher standard of protection for children than adults" and "any widespread or systematic form of environmental pollution that poses a long-term threat to a child's rights to life, development or health may constitute an international human rights violation." The article concludes that the "dearth of legislation to regulate the installation of base stations (cell towers) in close proximity to children's facilities and schools clearly constitutes a human rights concern…" (Roda and Perry 2014 (https://www.academia.edu/24818673/Mobile_phone_infrastructure_regulation_in_Europe_Scientific_challenges_and_human_rights_protec

"Safety Zone Determination for Wireless Cellular Tower – A Case Study from Tanzania (http://esatjournals.net/ijret/2013v02/i09/IJRET20130209029.pdf)" *published in the International Journal of Research in Engineering and Technology* evaluated the radiation levels and concluded that "respective authorities should ensure that people reside far from the tower by 120m or more depending on the power transmitted to avoid severe health effect."

"Long-term exposure to microwave radiation provokes cancer growth: evidences from radars and mobile communication systems (https://www.ncbi.nlm.nih.gov/pubmed/21716201)" published in Experimental Oncology reviews research findings on RF-EMF and states that it is "becoming increasingly evident that assessment of biological effects of non-ionizing radiation based on physical (thermal) approach used in recommendations of current regulatory bodies, including the International Commission on Non-Ionizing Radiation Protection (ICNIRP) Guidelines, requires urgent reevaluation." The paper concluded that "everyday exposure of both occupational and general public to MW radiation should be regulated based on a precautionary principles which imply maximum restriction of excessive exposure" (Yakymenko 2011 (https://www.ncbi.nlm.nih.gov/pubmed/21716201))

A cross-sectional case control study on genetic damage in individuals living near cell towers found genetic damage parameters of DNA were significantly elevated (Gandhi 2015 (https://www.ncbi.nlm.nih.gov/pubmed/25006864)).

"Neurobehavioral effects among inhabitants around mobile phone base stations (https://www.ncbi.nlm.nih.gov/pubmed/16962663)*" published in Neurotoxicology* concluded that "Inhabitants living nearby mobile phone base stations are at risk for developing neuropsychiatric problems and some changes in the performance of neurobehavioral functions either by facilitation or inhibition" and called for the revision of standard guidelines for public exposure to RER from mobile phone base station antennas" (Abdel-Rassoul, 2006 (https://www.ncbi.nlm.nih.gov/pubmed/16962663)).

"Epidemiological Evidence for a Health Risk from Mobile Phone Base Stations (https://www.researchgate.net/publication/45387389_Epidemiological_evidence_for_a_health_risk_from_mobile_phone_base_stations)*" published in the International Journal of Occupational Environmental Health* reviewed 10 epidemiological studies that assessed for health effects of mobile phone base stations and found that eight of the 10 studies reported increased prevalence of adverse neurobehavioral symptoms or cancer in populations living at distances < 500 meters from base stations. The review concludes that" current guidelines may be inadequate in protecting the health of human populations" (Khurana 2010 (https://www.researchgate.net/publication/45387389_Epidemiological_Evidence_for_a_Health_Risk_from_Mobile_Phone_Base_Stations)).

"How does long term exposure to base stations and mobile phones affect human hormone profiles? (https://www.ncbi.nlm.nih.gov/pubmed/22138021)" published in Clinical Biochemistry followed volunteers for six years and found that high radio frequency radiation had effects on pituitary–adrenal axis represented in the reduction of ACTH, cortisol, thyroid hormones, prolactin in young females, and testosterone levels (Eskander 2012 (https://www.sciencedirect.com/science/article/pii/S0009912011027330?via%3Dihub)).

A study of 530 people living near mobile phone masts reported more symptoms of headache, sleep disturbance, discomfort, irritability, depression, memory loss and concentration problems the closer they lived to the cellular antennas (Santini 2002 (https://www.ncbi.nlm.nih.gov/pubmed/12168254)).

A study from Spain "The Microwave Syndrome: A preliminary Study (http://www.emf-portal.de/viewer.php?aid=13498&l=e)" published in *Electromagnetic Biology and Medicine found* statistically significant associations between field intensity and the symptoms of fatigue, irritability, headaches, nausea, loss of appetite, sleeping disorder, depressive tendency, feeling of discomfort, difficulty in concentration, loss of memory, visual disorder, dizziness and cardiovascular problems (Navarro 2003) (https://www.emf-portal.org/en/article/13498). "Subjective symptoms, sleeping problems, and cognitive performance in subjects living near mobile phone base stations. (https://www.ncbi.nlm.nih.gov/pubmed/?term=Hutter%20HP%5BAuthor%5D&cauthor=true&cauthor_uid=16621850)" published in Occupational Environmental Medicine found a significant correlation between measured power density and headaches, fatigue, and difficulty in concentration in 365 subject (Hutter 2006 (https://www.ncbi.nlm.nih.gov/pubmed/16621850)). Abdel-Rassoul 2007 (https://www.ncbi.nlm.nih.gov/pubmed/16962663)found residents living

beneath and opposite a long established mobile phone mast reported significantly higher occurrences of headaches, memory changes, dizziness, tremors, depressive symptoms and sleep disturbance than a control group.

"Increased Incidence of Cancer Near a Cell-Phone Transmitter Station" published in the *International Journal of Cancer Prevention* (http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.652.9315&rep=rep1&type=pdf)found a four-fold increase in the incidence of cancer among residents living within 300m radius of a mobile phone mast after three and seven years of exposure (Wolf 2004) (http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.652.9315&rep=rep1&type=pdf).

"The Influence of Being Physically Near to a Cell Phone Transmission Mast on the Incidence of Cancer (http://avaate.org/IMG/pdf/20041118_naila.pdf)" found a three-fold increase in the incidence of malignant tumours after five years' exposure in people living within 400m radius of a mobile phone mast (Eger 2004 (http://avaate.org/IMG/pdf/20041118_naila.pdf)).

Cell Antennas Increase Exposures in Communities

A 2019 study (https://link.springer.com/article/10.1007%2Fs12243-018-0680-1) found increased RF-EMF exposure from small cell LTE networks in two urban cities in France and the Netherlands. Researchers measured the RF-EMF from LTE (Long-Term Evolution) MC (macro cells meaning large cell towers) and SC networks (low-powered small cell base stations) and found that the small cell networks increased the radio emissions from base stations (called downlink) a factor of 7–46 while decreasing the radio emissions from user equipment exposure (called) a factor of 5–17. So while the devices themselves could emit less radiation, the cell antennas will increase the levels from cell antennas (Mazloum 2019 (https://link.springer.com/article/10.1007%2Fs12243-018-0680-1)). This study shows the increased exposures would be involuntary. We can turn our phone off, but we cannot turn off the antennas in the neighborhood.

An Australian study (https://www.ncbi.nlm.nih.gov/pubmed/27759027) also found that children in kindergartens with nearby antenna installations had nearly three-and-a-half times higher RF exposures than children with installations further away (more than 300 meters (Bhatt 2016 (https://www.ncbi.nlm.nih.gov/pubmed/27759027)).

A 2018 multi-country study (https://www.sciencedirect.com/science/article/pii/S016041201731485X) that measured RF in several countries found that cell phone tower radiation is the dominant contributor to RF exposure in most outdoor areas exposure in urban areas was higher and that exposure has drastically increased. As an example, the measurements the researchers took in Los Angeles, USA were 70 times higher than the US EPA estimate 40 years ago (Sagar 2018 (https://www.sciencedirect.com/science/article/pii/S016041201731485X)).

As an example of how rapidly RF is increasing from wireless antennas, a 2014 published study (https://www.sciencedirect.com/science/article/pii/S0013935114002254) looked at RF in three European cities and found in just one year (between April 2011 and March 2012) that the total RF-EMF exposure levels in all outdoor areas in combination increased by 57.1% in Basel by 20.1% in Ghent and by 38.2% in

Brussels (Urbinello 2014) (https://www.sciencedirect.com/science/article/pii/S0013935114002254). "Exposure increase was most consistently observed in outdoor areas due to emissions from mobile phone base stations."

Another study, Birks 2018 (https://www.ncbi.nlm.nih.gov/pubmed/29754001), looked at 529 children in Denmark, the Netherlands, Slovenia, Switzerland and Spain who wore meters around the waist or carried in a backpack during the day and placed close to the bed at night. Researchers found "the largest contributors to total personal environmental RF-EMF exposure were downlink (meaning from cell tower base stations) and broadcast."

Cell tower radiation is a significant contribution to our daily dose of RF. A study on Australian adults where participants carried a measuring device in a small hip bag for approximately 24 consecutive hours also found "downlink and broadcast are the main contributors to total RF-EMF personal exposure." Downlink (RF from mobile phone base station) contributed 40.4% of the total RF-EMF exposure (Zeleke 2018) (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6211035/). Another published study (Choi 2018 (https://www.ncbi.nlm.nih.gov/pubmed/30857115)) that gave 50 Korean adult child pairs a special radiation measuring device for 48 hours evaluated the types of radiation the participants were exposed to and found that "the contribution of base-station exposure to total RF-EMF exposure was the highest both in parents and children."

The Bioeffects of Millimeter Waves Documented Years Ago

A Russian Review on Millimeter Waves declassified by the CIA in 2015 "Biological Effect of Millimeter Waves (https://ehtrust.org/wp-content/uploads/Zalyubovskaya-Declassif-by-CIA-1977-biol-eff-mm-waves-1.pdf)" reported multiple research findings and concluded that "Morphological, functional and biochemical studies conducted in humans and animals revealed that millimeter wave caused changes in the body manifested in structural alterations in the skin and internal organs, qualitative and quantitative changes of the blood and bone marrow composition and changes of the conditioned reflex activity, tissue respiration, activity of enzymes participating in the process of tissue respiration and nucleic metabolism." (Zalyubovskaya)

"Current state and implications of research on biological effects of millimeter waves: a review of the literature **(https://www.ncbi.nlm.nih.gov/pubmed/9771583#)**" published in Bioelectromagnetics reviewed dozens of research findings on low-intensity millimeter waves and concluded that the reported "MMW effects could not be readily explained by temperature changes during irradiation." The review concludes by questioning the adequacy of regulatory limits stating that, "Safety limits for these types of exposure are based solely on predictions of energy deposition and MMW heating, but in view of recent studies this approach is not necessarily adequate." (Pakhomov)

The evidence supports the International EMF Scientist Appeal (http://www.emfscientist.org/) by 244 scientists from 41 countries who have published on the subject in peer-reviewed literature and collectively petitioned the WHO and the UN for immediate measures to reduce public exposure to artificial electromagnetic fields and radiation.

Attenuation by a Human Body and Trees as well as Material Penetration Loss in 26 and 39 GHz Millimeter Wave Bands, (https://www.hindawi.com/journals/ijap/2017/2961090/) International Journal of Antennas and Propagation

- "In this paper, attenuation by human body and trees and penetration loss of different materials at 26 and 39 GHz are investigated for 5G wireless communications.."
- "The results show that the upper bound of the KE model is better to predict the attenuation by a human body compared with UTD one-cylinder and two-cylinder models at both 26 and 39 GHz. ITU model overestimates the attenuation by willow trees, and a modified attenuation model by trees is proposed based on our measurements at 26 GHz."
- "It is found that the penetration loss for wood is smaller than that of transparent glass in the same thickness, and the penetration loss of frosted glass is slightly larger than that of transparent glass."
- "The measurement and modeling results in this paper are significant and necessary for simulation and planning of fifth-generation (5G) mm-wave radio systems in ITU recommended frequency bands at 26 and 39 GHz."

Skin Heating and Injury by Prolonged Millimeter-Wave Exposure: Theory Based on a Skin Model Coupled to a Whole Body Model and Local Biochemical Release From Cells at Supraphysiologic Temperatures, IEEE TRANSACTIONS ON PLASMA SCIENCE, VOL. 34, NO. 4, AUGUST 2006 (http://epore.mit.edu/papers/2006_7.pdf)

- "Second, the biophysical mechanism of biochemical release through cell membranes within the tissue regions that reach supraphysiologic temperatures is also considered. The released molecules are delivered to other skin regions by diffusion and into the bloodstream by perfusion, where according to our hypothesis, the molecules interact with susceptible cells. This raises the possibility of additional indirect injury at nearby deeper skin regions that experience insignificant heating. Biochemical release may also lead to injury at distant sites within the body by perfusion clearance that transfers molecules into the systemic circulation to reach other susceptible cells."

"Numerical Model of Heat Transfer in the Rabbit EyeExposed to 60-GHz Millimeter Wave Radiation" 2011 (https://www.academia.edu/12014751/Numerical_Model_of_Heat_Transfer_in_the_Rabbit_Eye_Exposed_to_60-GHz_Millimeter_Wave_Radiation)

- "We have presented a new model of the anterior part of the rabbit eye, which takes into account the fluid dynamics of the aqueous humor, with realistic boundary conditions implemented at the interface between the cornea and the environment. "
- This paper is not about health effects but rather about howhow to model the eye for research on exposures.

This page has just a sampling of research that has found effects from radiofrequency radiation exposure. For more studies please see

The Bioinitiative Report (http://www.bioinitiative.org/)

Annotated Bibliography of Scientific Papers Finding Evidence of Harm from Cell Phone Radiation Exposure (https://bit.ly/cellphoneharm0816-0718) Published between August, 2016 and July, 2018 Joel M. Moskowitz, Ph.D. School of Public Health University of California, Berkeley which contains 92 papers published in scientific journals during the last two years that report evidence of harm from cell phone radiation exposure.

PowerWatch: 1,670 Peer-Reviewed Scientific Papers on Electromagnetic Fields and Biology or Health
(https://drive.google.com/file/d/19CbWmdGTnnW1iZ9pxlxq1ssAdYl3Eur3/view)

Panagopoulos, D. J., Johansson, O., & Carlo, G. L. (2015). Polarization: A Key Difference between Man-made and Natural Electromagnetic Fields, in regard to Biological Activity (https://www.ncbi.nlm.nih.gov/pubmed/26456585). *Scientific reports*, *5*, 14914. doi:10.1038/srep14914

Panagopoulos, D. J., Johansson, O., & Carlo, G. L. (2015). Real versus Simulated Mobile Phone Exposures in Experimental Studies (https://www.ncbi.nlm.nih.gov/pubmed/26346766). *BioMed research international*, *2015*, 607053. doi:10.1155/2015/607053

Hardell, L., & Carlberg, M. (2018). Comments on the US National Toxicology Program technical reports on toxicology and carcinogenesis study in rats exposed to whole-body radiofrequency radiation at 900 MHz and in mice exposed to whole-body radiofrequency radiation at 1,900 MHz (https://www.ncbi.nlm.nih.gov/pubmed/30365129). *International journal of oncology*, *54*(1), 111–127. doi:10.3892/ijo.2018.4606

Michael Carlberg and Lennart Hardell, "Evaluation of Mobile Phone and Cordless Phone Use and Glioma Risk Using the Bradford Hill Viewpoints from 1965 on Association or Causation (https://www.hindawi.com/journals/bmri/2017/9218486/)," *BioMed Research International*, vol. 2017, Article ID 9218486, 17 pages, 2017. https://doi.org/10.1155/2017/9218486 (https://doi.org/10.1155/2017/9218486).

Belyaev, I., Dean, A., Eger, H., et al. (2016). EUROPAEM EMF Guideline 2016 for the prevention, diagnosis and treatment of EMF-related health problems and illnesses (https://www.ncbi.nlm.nih.gov/pubmed/27454111). *Reviews on Environmental Health*, 31(3), pp. 363-397. Retrieved 14 May. 2019, from doi:10.1515/reveh-2016-0011

Dominique Belpomme, Lennart Hardell, Igor Belyaev, Ernesto Burgio, David O. Carpenter, Thermal and non-thermal health effects of low intensity non-ionizing radiation: An international perspective (https://www.ncbi.nlm.nih.gov/pubmed/30025338), *Environmental Pollution*, Volume 242, Part A, 2018, Pages 643-658, ISSN 0269-7491,

https://doi.org/10.1016/j.envpol.2018.07.019.

Research on People Near Cell Towers Links Exposure to Adverse Effects

" *The Impact of radiofrequency radiation on DNA damage and antioxidants in peripheral blood lymphocytes of humans residing in the vicinity of mobile phone base station"* (https://www.researchgate.net/publication/318916428_Impact_of_radiofrequency_radiation_on_DNA_damage_and_antioxidants_in is a research study that compared people living close (within 80 meters) and far (more than 300 meters away) from cellular antennas and found that the people living closer had several significant changes in their blood predictive of cancer development (Zothansiama 2017 (https://www.researchgate.net/scientific-contributions/2131399242_Zothansiama)). Researchers controlled for various demographics, including the use of microwaves and wireless in the homes.

"Mortality by neoplasia and cellular telephone base stations (https://www.sciencedirect.com/science/article/pii/S0048969711005754)" is a 10 year study by the Belo Horizonte Brazil Health Department and several universities in Brazil that found an elevated relative risk of cancer mortality at residential distances of 500 meters or less from cell installations (Dode 2011 (https://www.sciencedirect.com/science/article/pii/S0048969711005754)). Shortly after this study was published, the city prosecutor sued several cell phone companies and requested that almost half of the city's antennas be removed. Many antennas were dismantled.

A 2019 study (https://www.ncbi.nlm.nih.gov/pubmed/?term=Mobile+Phone+Base+Station+Tower+Settings+Adjacent+to+School+Buildings%3A+Impact+on+Students%E2%80%99+Cognitive+Health) of students in schools

near cell towers found their higher RF exposure was associated with impacts on motor skills, memory and attention (Meo 2019 (https://www.ncbi.nlm.nih.gov/pubmed/?term=Mobile+Phone+Base+Station+Tower+Settings+Adjacent+to+School+Buildings%3A+Impact+on+Students%E2%80%99+Cognitive+Health)). Examples of other effects linked to cell towers in research studies include neuropsychiatric problems (https://www.ncbi.nlm.nih.gov/pubmed/16962663), elevated diabetes (https://www.researchgate.net/publication/283726472_Association_of_Exposure_to_Radio-Frequency_Electromagnetic_Field_Radiation_RF-EMFR_Generated_by_Mobile_Phone_Base_Stations_with_Glycated_Hemoglobin_HbA1c_and_Risk_of_Type_2_Diabetes_Mellitus), headaches (https://www.ncbi.nlm.nih.gov/pubmed/16621850), sleep problems (https://www.ncbi.nlm.nih.gov/pubmed/12168254) and genetic damage (https://www.ncbi.nlm.nih.gov/pubmed/25006864). Such research continues to accumulate after the 2010 landmark review study (https://www.nrcresearchpress.com/doi/pdfplus/10.1139/A10-018) on 56 studies that reported biological effects found at very low intensities, including impacts on reproduction, permeability of the blood-brain barrier, behavior, cellular and metabolic changes, and increases in cancer risk (Lai and Levitt 2010 (https://www.nrcresearchpress.com/doi/pdfplus/10.1139/A10-018)).

A published study entitled, "Effect of Mobile Tower Radiation on Microbial Diversity in Soil and Antibiotic Resistance" (https://ieeexplore.ieee.org/document/8665432) took soil samples from four different base stations located in Dausa city, and control samples from soil far from stations and then isolated and evaluated the microorganisms in the soil. The researchers found greater antibiotic resistance in microbes present in soil near base stations compared to the control and a statistical significant difference in pattern of antibiotic resistance was found with Nalidixic acid, and cefixime when used as antimicrobial agents. The study concludes, "our findings suggest that mobile tower radiations can significantly alter the vital systems in microbes and turn them multidrug resistant (MDR) which is most important current threat to public health."

Cellular Antennas Create Measurable Increases in Radiation in the Area

A 2018 article (https://www.sciencedirect.com/science/article/pii/S2542519618302213?via%3Dihub) published in The Lancet Planetary Health points to unprecedented increasing RF exposures (Bandara and Carpenter 2018 (https://www.sciencedirect.com/science/article/pii/S2542519618302213?via%3Dihub)). Another key finding from Zothansiama 2017 (https://www.researchgate.net/scientific-contributions/2131399242_Zothansiama) was that homes closer to antennas had measurably higher radiation levels—adding to the documentation that antennas increase RF levels. An Australian study (https://www.ncbi.nlm.nih.gov/pubmed/27759027) also found that children in kindergartens with nearby antenna installations had nearly three-and-a-half times higher RF exposures than children with installations further away (more than 300 meters (Bhatt 2016 (https://www.ncbi.nlm.nih.gov/pubmed/27759027)).

Research Finds that Cell Tower Base Station Radiation is the Dominant Contributor to Overall Environmental Radiation Exposures

A 2018 multi-country study (https://www.sciencedirect.com/science/article/pii/S016041201731485X) that measured RF in several countries found that cell phone tower radiation is the dominant contributor to RF exposure in most outdoor areas exposure in urban areas was higher and that exposure has drastically increased. As an example, the

measurements the researchers took in Los Angeles, USA were 70 times higher than the US EPA estimate 40 years ago (Sagar 2018 (https://www.sciencedirect.com/science/article/pii/S016041201731485X)).

As an example of how rapidly RF is increasing from wireless antennas, a 2014 published study (https://www.sciencedirect.com/science/article/pii/S0013935114002254) looked at RF in three European cities and found in just one year (between April 2011 and March 2012) that the total RF-EMF exposure levels in all outdoor areas in combination increased by 57.1% in Basel by 20.1% in Ghent and by 38.2% in Brussels (Urbinello 2014) (https://www.sciencedirect.com/science/article/pii/S0013935114002254). "Exposure increase was most consistently observed in outdoor areas due to emissions from mobile phone base stations."

Another study, Birks 2018 (https://www.ncbi.nlm.nih.gov/pubmed/29754001), looked at 529 children in Denmark, the Netherlands, Slovenia, Switzerland and Spain who wore meters around the waist or carried in a backpack during the day and placed close to the bed at night. Researchers found "the largest contributors to total personal environmental RF-EMF exposure were downlink (meaning from cell tower base stations) and broadcast."

A study on Australian adults where participants carried a measuring device in a small hip bag for approximately 24 consecutive hours also found "downlink and broadcast are the main contributors to total RF-EMF personal exposure." Downlink (RF from mobile phone base station) contributed 40.4% of the total RF-EMF exposure (Zeleke 2018) (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6211035/).

Another published study (Choi 2018 (https://www.ncbi.nlm.nih.gov/pubmed/30857115)) that gave 50 Korean adult child pairs a special radiation measuring device for 48 hours evaluated the types of radiation the participants were exposed to and found that "the contribution of base-station exposure to total RF-EMF exposure was the highest both in parents and children." These two studies are an important example of the research that shows that radiation from base stations is the dominant contributor to a person's cumulative exposure. Therefore we cannot only focus on a persons cell phone use as the way people are exposed to this radiation. People are exposed to wireless radiation even when they are not using a mobile device due to cell towers, antennas and hotspots and they have no control over this.

Russell CL. 5G wireless telecommunications expansion: (https://doi.org/10.1016/j.envres.2018.01.016) Public health and environmental implications. (https://doi.org/10.1016/j.envres.2018.01.016)**Environmental Research. Available online 11 April 2018. in press.**

- "On the horizon, a new generation of even shorter high frequency 5G wavelengths is being proposed to power the Internet of Things (IoT)."
- "It is argued that the addition of this added high frequency 5G radiation to an already complex mix of lower frequencies, will contribute to a negative public health outcome both from both physical and mental health perspectives."
- "Like other common toxic exposures, the effects of radiofrequency electromagnetic radiation (RF EMR) will be problematic if not impossible to sort out epidemiologically as there no longer remains an unexposed control group. This is especially important considering these effects are likely magnified by synergistic toxic exposures and other common health risk behaviors. Effects can also be non-linear. Because this is the first generation to have cradle-to-grave lifespan exposure to this level of man-made microwave (RF EMR) radiofrequencies, it will be years or decades before the

true health consequences are known. Precaution in the roll out of this new technology is strongly indicated."

- "Current radiofrequency radiation wavelengths we are exposed to appear to act as a toxin to biological systems. A moratorium on the deployment of 5G is warranted, along with development of independent health and environmental advisory boards that include independent scientists who research biological effects and exposure levels of radiofrequency radiation. Sound regulatory policy regarding current and future telecommunications initiative will require more careful assessment of risks to human health, environmental health, public safety, privacy, security and social consequences. Public health regulations need to be updated to match appropriate independent science with the adoption of biologically based exposure standards prior to further deployment of 4G or 5G technology."

Betzalel N, Ben Ishai P, Feldman Y., The human skin as a sub-THz receiver – Does 5G pose a danger to it or not?
(https://www.ncbi.nlm.nih.gov/pubmed/29459303) **Environ Res. 2018 May;163:208-216. doi: 10.1016/j.envres.2018.01.032. Epub 2018 Feb 22.**

- Experimentally we showed that the reflectance of the human skin in the sub-THz region depends on the intensity of perspiration, i.e. sweat duct's conductivity, and correlates with levels of human stress (physical, mental and emotional). Later on, we detected circular dichroism in the reflectance from the skin, a signature of the axial mode of a helical antenna. The full ramifications of what these findings represent in the human condition are still unclear. We also revealed correlation of electrocardiography (ECG) parameters to the sub-THz reflection coefficient of human skin. In a recent work, we developed a unique simulation tool of human skin, taking into account the skin multi-layer structure together with the helical segment of the sweat duct embedded in it. The presence of the sweat duct led to a high specific absorption rate (SAR) of the skin in extremely high frequency band.
- In this paper, we summarize the physical evidence for this phenomenon and consider its implication for the future exploitation of the electromagnetic spectrum by wireless communication. Starting from July 2016 the US Federal Communications Commission (FCC) has adopted new rules for wireless broadband operations above 24 GHz (5 G). This trend of exploitation is predicted to expand to higher frequencies in the sub-THz region. One must consider the implications of human immersion in the electromagnetic noise, caused by devices working at the very same frequencies as those, to which the sweat duct (as a helical antenna) is most attuned.
- We are raising a warning flag against the unrestricted use of sub-THz technologies for communication, before the possible consequences for public health are explored.

Thielens **et al., "Exposure of Insects to Radio-Frequency Electromagnetic Fields from 2 to 120 GHz (https://www.nature.com/articles/s41598-018-22271-3)" Scientific Reports volume 8, Article number: 3924 (2018)**

- Excerpts from abstract: "Insects are continually exposed to Radio-Frequency (RF) electromagnetic fields at different frequencies. This paper is the first to report the absorbed RF electromagnetic power in four different types of insects as a function of frequency from 2 GHz to 120 GHz. A set of insect models was obtained using novel Micro-CT (computer tomography) imaging. These models were used for the first time in finite-difference time-domain electromagnetic simulations. All insects showed a dependence of the absorbed power on the frequency. All insects showed a general increase in absorbed RF power at and above 6 GHz, in comparison to the absorbed RF power below 6 GHz. Our simulations showed that a shift of 10% of the incident power density to frequencies above 6 GHz would lead to an increase in absorbed power between 3–370%."

- "This could lead to changes in insect behaviour, physiology, and morphology over time due to an increase in body temperatures, from dielectric heating. The studied insects that are smaller than 1 cm show a peak in absorption at frequencies (above 6GHz), which are currently not often used for telecommunication, but are planned to be used in the next generation of wireless telecommunication systems."

Miller AB, Morgan LL, Udasin I, Davis DL. Cancer epidemiology update, following the 2011 IARC evaluation of radiofrequency electromagnetic fields (Monograph 102) (https://doi.org/10.1016/j.envres.2018.06.043). Available online Sep 6, 2018. https://doi.org/10.1016/j.envres.2018.06.043 (https://doi.org/10.1016/j.envres.2018.06.043)

• Increased risk of brain, vestibular nerve and salivary gland tumors are associated with mobile phone use.
• Nine studies (2011–2017) report increased risk of brain cancer from mobile phone use.
• Four case-control studies (3 in 2013, 1 in 2014) report increased risk of vestibular nerve tumors.
• Concern for other cancers: breast (male & female), testis, leukemia, and thyroid.
• Based on the evidence reviewed it is our opinion that IARC's current categorization of RFR as a possible human carcinogen (Group 2B) should be upgraded to Carcinogenic to Humans (Group 1).

Betzalel, Y. Feldman, and P. Ben Ishai, "The Modeling of the Absorbance of Sub-THz Radiation by Human Skin," (http://ieeexplore.ieee.org/document/8016593/) **IEEE Trans. THz Sci. Tech. (Paris) 7(5), 521–528 (2017).**

- In 2008, we demonstrated that the coiled portion of the sweat duct in upper skin layer could be regarded as a helical antenna in the sub-THz band. The full ramifications of what these findings represent in the human condition are still very unclear, **but it is obvious that the absorption of electromagnetic energy is governed by the topology for the skin and its organelles, especially the sweat duct.**

Di Ciaula, Towards 5G communication systems: Are there health implications? (https://www.ncbi.nlm.nih.gov/pubmed/29402696), Int J Hyg Environ Health. 2018 Feb 2.

- "Preliminary observations showed that MMW increase skin temperature, alter gene expression, promote cellular proliferation and synthesis of proteins linked with oxidative stress, inflammatory and metabolic processes, could generate ocular damages, affect neuro-muscular dynamics."
- "Further studies are needed to better and independently explore the health effects of RF-EMF in general and of MMW in particular. However, available findings seem sufficient to demonstrate the existence of biomedical effects, to invoke the precautionary principle, to define exposed subjects as potentially vulnerable and to revise existing limits.

Nasim I, Kim S. Human Exposure to RF Fields in 5G Downlink (https://arxiv.org/abs/1711.03683)**. Submitted on 10 Nov 2017 to IEEE International Communications Conference.**

- "Prior research on human exposure to radio frequency (RF) fields in a cellular communications system has been focused on uplink only due to the closer physical contact of a transmitter to a human body. However, this paper claims the necessity of thorough investigation on human exposure to downlink RF fields, as cellular systems deployed in mmW bands will entail (i) deployment of more transmitters due to smaller cell size and (ii) higher concentration of RF energy using a highly directional antenna.
- In this paper, we present human RF exposure levels in downlink of a Fifth Generation Wireless Systems (5G). Our results show that 5G downlink RF

fields generate significantly higher power density (PD) and specific absorption rate (SAR) than a current cellular system. This paper also shows that SAR should also be taken into account for determining human RF exposure in the mmW downlink."

Pogam et al., Untargeted metabolomics unveil alterations of biomembranes permeability in human HaCaT keratinocytes upon 60 GHz millimeter-wave exposure, (https://www.nature.com/articles/s41598-019-45662-6) Scientific Reports volume 9, Article number: 9343 (2019)

- "this report represents the first metabolomic investigation focusing on the effects of MMW."
- "it is reasonable to assume that the vast amount of dysregulations reported in these sequences do not stem from alterations of gene expression but rather from alterations in membrane permeability, consistently with previous reports on acellular phospholipidic systems. "
- "further studies will be necessary to assess MMW bioeffects on animal models and to investigate potential dysregulations induced by lower IPD values prior to the wide-scale deployment of technologies based on these specific frequencies."
- "This unexpected extent of modifications can hardly stem from the mild changes that could be reported throughout transcriptomics studies, leading us to hypothesize that MMW might alter the permeability of cell membranes, as reported elsewhere."

Soubere Mahamoud Y, Aite M, Martin C, Zhadobov M, Sauleau R, Le Dréan Y, et al. (2016) Additive Effects of Millimeter Waves and 2-Deoxyglucose Co-Exposure on the Human Keratinocyte Transcriptome. (https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0160810) PLoS ONE 11(8): e0160810.

- Millimeter Waves (MMW) will be used in the next-generation of high-speed wireless technologies, especially in future Ultra-Broadband small cells in 5G cellular networks. Therefore, their biocompatibilities must be evaluated prior to their massive deployment. Using a microarray-based approach, we analyzed modifications to the whole genome of a human keratinocyte model that was exposed at 60.4 GHz-MMW at an incident power density (IPD) of 20 mW/cm^2 for 3 hours in athermic conditions. No keratinocyte transcriptome modifications were observed. We tested the effects of MMWs on cell metabolism by co-treating MMW-exposed cells with a glycolysis inhibitor, 2-deoxyglucose (2dG, 20 mM for 3 hours), and whole genome expression was evaluated along with the ATP content. We found that the 2dG treatment decreased the cellular ATP content and induced a high modification in the transcriptome (632 coding genes). The affected genes were associated with transcriptional repression, cellular communication and endoplasmic reticulum homeostasis. The MMW/2dG co-treatment did not alter the keratinocyte ATP content, but it did slightly alter the transcriptome, which reflected the capacity of MMW to interfere with the bioenergetic stress response. The RT-PCR-based validation confirmed 6 MMW-sensitive genes (*SOCS3*, *SPRY2*, *TRIB1*, *FAM46A*, *CSRNP1* and *PPP1R15A*) during the 2dG treatment. These 6 genes encoded transcription factors or inhibitors of cytokine pathways, which raised questions regarding the potential impact of long-term or chronic MMW exposure on metabolically stressed cells.

Mandl P, Pezzei P, Leitgeb E. Selected Health and Law Issues Regarding Mobile Communications with Respect to 5G. Presented at 2018 International Conference on Broadband Communications for Next Generation Networks and Multimedia Applications (CoBCom). (https://ieeexplore.ieee.org/xpl/mostRecentIssue.jsp?punumber=8423924) Graz, Austria. July 11-13, 2018.

- Abstract: Over the next years the demand of wireless communication will increase tremendously. More and more mobile end devices require a high data rate connection e.g. to a smart home (Internet of Things, IoT) or to the internet. The radiation power pattern of base stations and mobile end devices will completely change for the 5G Next Generation Mobile Network technology which will use frequency bands up to 100 GHz. Therefore the electromagnetic exposure especially to human body will increase in the future, because most of the wireless connections are realized in RF technology. In this contribution two different measurement setups are presented. The first shows the electromagnetic radiation regarding a base station powered by a mobile phone provider over a timespan of a number of days. The second figures out the electromagnetic radiation of a handheld mobile end device to a human head in an area with very poor reception values. The results of those measurements where compared with legal and health limits. All measured and calculated results regarding the base stations were within the legal exposure limits. The calculated legal exposure limits of mobile devices were exceeded twice in areas within very poor reception values. Regarding the expected higher bandwidth and corresponding higher electromagnetic exposure to human bodies in future there have to be periodic measurements to comply with radiation limits.
- Excerpts: "Regarding the above mentioned circumstances it will be necessary to measure the radiation exposure of base stations in the future on a regular basis in order to ensure the legal limits and to reduce possible health hazards. It also will be necessary to develop new measurement strategies and/or technologies regarding the large frequency spectrum 5G will use up to 100 GHz. …When measuring directly on a mobile phone (simulating the use of an end device directly on the human head), it was found that the calculated SAR of 3.834 *W/kg* exceeds the legal limit of 2 W*/ kg*. This shows clearly that the legal limit values can be exceeded significantly in areas with very poor reception values …Increasing the distance between a mobile end device and the head, e.g. by using a hands-free set or a headset can significantly reduce the human exposure to electromagnetic radiation when such a device is used in badly supplied areas and transmits with maximum power."

Neufeld E, Kuster N. Systematic Derivation of Safety Limits for Time-Varying 5G Radiofrequency Exposure Based on Analytical Models and Thermal Dose (https://www.ncbi.nlm.nih.gov/pubmed/30247338). Health Phys. 2018 Sep 21.

Extreme broadband wireless devices operating above 10 GHz may transmit data in bursts of a few milliseconds to seconds. Even though the time- and area-averaged power density values remain within the acceptable safety limits for continuous exposure, **these bursts may lead to short temperature spikes in the skin of exposed people.**

- In this paper, a novel analytical approach to pulsed heating is developed and applied to assess the peak-to-average temperature ratio as a function of the pulse fraction α (relative to the averaging time [INCREMENT]T; it corresponds to the inverse of the peak-to-average ratio).
- To stay consistent with the current safety guidelines, safety factors of 10 for occupational exposure and 50 for the general public were applied.
- The results demonstrate that the maximum averaging time, based on the assumption of a thermal time constant of 100 s, is 240 s if the maximum local temperature increase for continuous-wave exposure is limited to 1 K and α ≥ 0.1. For a very low peak-to-average ratio of 100 (α ≥ 0.01), it decreases to only 30 s.
- **The results also show that the peak-to-average ratio of 1,000 tolerated by the International Council on Non-Ionizing Radiation Protection guidelines may lead to permanent tissue damage after even short exposures,** highlighting the importance of revisiting existing exposure guidelines.

TRIPATHI et al., Frequency of the resonance of the human sweat duct in a normal mode of operation (https://www.osapublishing.org/DirectPDFAccess/D9A2E695-D15D-19E6-03A77C91ED8C556F_382113/boe-9-3-1301.pdf?da=1&id=382113&seq=0&mobile=no)**, BIOMEDICAL OPTICS EXPRESS 130, Vol. 9, No. 3 | 1 March 2018**

- This result indicates that careful consideration should be given while designing electronic and photonic devices operating in the sub-terahertz frequency region in order to avoid various effects on human health due to these waves.

Declassified by CIA in 2015: Russian Review on Millimeter Waves Biological Effect of Millimeter Waves (https://ehtrust.org/wp-content/uploads/Zalyubovskaya-Declassif-by-CIA-1977-biol-eff-mm-waves-1.pdf) by Zalyubovskaya

- "Morphological, functional and biochemical studies conducted in humans and animals revealed that millimeterwave caused changes in the body manifested in structural alterations in the skin and internal organs, qualitative and quantitative changes of the blood and bone marrow composition and changes of the conditioned reflex activity, tissue respiration, activity of enzymes participating in the process of tissue respiration and nucleic metabolism. The degree of unfavorable effect of millimeterwave depended on the duration of the radiation and individual characteristics of the organism."

Pakhomov et. al., Current state and implications of research on biological effects of millimeter waves: a review of the literature (https://www.ncbi.nlm.nih.gov/pubmed/9771583#). Bioelectromagnetics. 1998;19(7):393-413.

- "This paper analyzes general trends in the area and briefly reviews the most significant publications, proceeding from cell-free systems, dosimetry, and spectroscopy issues through cultured cells and isolated organs to animals and humans.
- The studies reviewed demonstrate effects of low-intensity MMW (10 mW/cm2 and less) on cell growth and proliferation, activity of enzymes, state of cell genetic apparatus, function of excitable membranes, peripheral receptors, and other biological systems. In animals and humans, local MMW exposure stimulated tissue repair and regeneration, alleviated stress reactions, and facilitated recovery in a wide range of diseases (MMW therapy). Many reported MMW effects could not be readily explained by temperature changes during irradiation."
- Full paper in draft form is online as **CURRENT STATE AND IMPLICATIONS OF RESEARCH ON BIOLOGICAL EFFECTS OF MILLIMETER WAVES: A REVIEW OF LITERATURE** (https://www.rife.org/otherresearch/millimeterwaves.html) **CURRENT STATE AND IMPLICATIONS OF RESEARCH ON BIOLOGICAL EFFECTS OF MILLIMETER WAVES: A REVIEW OF LITERATURE** Andrei G. Pakhomov, Yahya Akyel, Olga N. Pakhomova, Bruce E. Stuck, and Michael R. Murphy McKesson BioServices (A.G.P., Y.A., O.N.P.), U. S. Army Medical Research Detachment of the Walter Reed Army Institute of Research (B.E.S.), and Directed Energy Bioeffects Division, Human Effectiveness Directorate, Air Force Research Laboratory (M.R.M.), Brooks Air Force Base, San Antonio, TX
- "It is important to note that, even with the variety of bioeffects reported, no studies have provided evidence that a low-intensity MMW radiation represents a health hazard for human beings. Actually, none of the reviewed studies with low-intensity MMW even pursued the evaluation of health risks, though in view of numerous bioeffects and growing usage of MMW technologies this research objective appears very reasonable. Such MMW

effects as alterations of cell growth rate and UV light sensitivity, biochemical and antibiotic resistivity changes in pathogenic bacteria, as well as many others are of potential significance for safety standards. MMW therapy in many cases employs field intensities comparable to or lower than allowed by current safety standards; still, even local and short-term exposures were reported to produce marked effects. It should also be realized that biological effects of a prolonged or chronic MMW exposure of the whole body or a large body area have never been investigated. Safety limits for these types of exposure are based solely on predictions of energy deposition and MMW heating, but in view of recent studies this approach is not necessarily adequate."

Wu T, Rappaport TS, Collins CM, "The Human Body and Millimeter-Wave Wireless Communication Systems: Interactions and Implications," (https://arxiv.org/pdf/1503.05944.pdf) (2015). Accepted in 2015 IEEE International Conference on Communications (ICC), NYU WIRELESS. 2015

- This paper gives examples of today's regulatory requirements, and provides an example for a 60 GHz transceiver. Also, the propagation characteristics of millimeter-waves in the presence of the human body are studied, and four models representing different body parts are considered to evaluate thermal effects of millimeter-wave radiation on the body. Simulation results show that about 34% to 42% of the incident power is reflected at the skin surface at 60 GHz. This paper shows that power density is not suitable to determine exposure compliance when millimeter wave devices are used very close to the body. A temperature-based technique for the evaluation of safety compliance is proposed in this paper.

Wu T et al., Safe for Generations to Come. (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4629874/) IEEE Microw Mag. 16(2): 65–84. 2015

"A literature survey representing the most recent available results related to the biological effects of mmWave exposure, from the well-understood and well-accepted effects of thermal heating to recent reports of nonthermal effects and the attempt to motivate further discussion and research for appropriate emission standards."

- "We highlighted the findings of mmWave radiation studies on the eyes and skin since, in communication applications, these tissues would receive the most radiation, with other tissues receiving, by comparison, a negligible amount. Ocular injury can be induced by short-term high-intensity exposure (e.g., 2,000 mW/cm2, 1.5–5 s) far beyond the anticipated future communication device levels, but the eyes do not appear to suffer damage from longer low-intensity exposure (e.g., 10 mW/cm2, 8 h), which might be experienced from mmWave communication technologies in the far field.
- More work may be required to determine the possible effects from exposure above 10 mW/cm2 that might be experienced in the near field from specific communication devices with adaptive antennas as well as to ensure that mechanisms are in place to ensure that no hazardous levels of energy are transmitted into the eyes. We also showed that using typical power levels, there would be no unsafe temperature increase caused by exposure of skin to mmWave communication technologies in the far field.
- As with the eyes, however, more work is required to determine temperature increases from higher exposure levels that might be experienced in the near field from specific communication devices with high-gain antennas and to develop and demonstrate reliable mechanisms to ensure that no hazardous levels of energy are transmitted to the skin."

Ramundo-Orlando A., Effects of millimeter waves radiation on cell membrane – A brief review. (https://link.springer.com/article/10.1007%2Fs10762-010-9731-z) (2010) Journal of Infrared, Millimeter, and Terahertz Waves. 2010; 31 (12):1400–1411.

- The millimeter waves (MMW) region of the electromagnetic spectrum, extending from 30 to 300 GHz in terms of frequency (corresponding to wavelengths from 10 mm to 1 mm), is officially used in non-invasive complementary medicine in many Eastern European countries against a variety of diseases such gastro duodenal ulcers, cardiovascular disorders, traumatism and tumor. On the other hand, besides technological applications in traffic and military systems, in the near future MMW will also find applications in high resolution and high-speed wireless communication technology. This has led to restoring interest in research on MMW induced biological effects. In this review emphasis has been given to the MMW-induced effects on cell membranes that are considered the major target for the interaction between MMW and biological systems.

Scientific Citations from the published study "Potential Risks to Human Health Originating from Future Sub-MM Communication Systems" by Paul Ben-Ishai, PhD and Yuri Feldman, PhD

- Feldman, Yuri and Paul Ben-Ishai. "Potential Risks to Human Health Originating from Future Sub-MM Communication Systems." (https://ehtrust.org/wp-content/uploads/Yuri-Feldman-and-Paul-Ben-Ishai-Abstract.pdf) Abstract, 2017.
- Feldman, Yuri, et al. "Human skin as arrays of helical antennas in the millimeter and submillimeter wave range." (https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.100.128102) *Physical Review Letters*, vol. 100, no. 12, 2008.
- Hayut, Itai, et al. "Circular polarization induced by the three-dimensional chiral structure of human sweat ducts." (https://journals.aps.org/pre/abstract/10.1103/PhysRevE.89.042715) *Physical Review*, vol. 89, no. 4, 2014.
- Hayut, Itai, et al. "The Helical Structure of Sweat Ducts: Their Influence on the Electromagnetic Reflection Spectrum of the Skin." (http://ieeexplore.ieee.org/abstract/document/6395794/) *IEEE Transactions on Terahertz Science and Technology*, vol. 3, no. 2, 2013, pp. 207-15.
- Professor Yuri Feldman – Research Study Summaries, The Hebrew University of Jerusalem Department of Applied Physics, Dielectric Spectroscopy Laboratory (http://aph.huji.ac.il/people/feldman/research.htm#Human%20Skin%20as%20Arrays%20of%20Helical%20Antennas%20in%20the%20Millimeter%20and%20Submillimeter%20Wave%20Range)

RESEARCH ON MILLIMETER WAVES

Gandhi OP, Riazi A. Absorption of millimeter waves by human beings and its biological implications. (https://drive.google.com/file/d/0B14R6QNkmaXuZ1JqNHpYNWRWdjg/view) *IEEE Transactions on Microwave Theory and Techniques*, vol. 34, no. 2, 1986, pp. 228-235.

Protein changes in macrophages induced by plasma from rats exposed to 35 GHz millimeter waves. (https://www.ncbi.nlm.nih.gov/pubmed/20683908) (2010) Sypniewska RK et al. Bioelectromagnetics. 2010 Dec;31(8):656-63.

The Active Denial System: A Revolutionary, Non-lethal Weapon for Today's Battlefield. (http://ndupress.ndu.edu/Media/News/Article/1229000/dtp-065-the-active-denial-system-a-revolutionary-non-lethal-weapon-for-todays-b/) (2009). Levine S. Center for Technology and National Security Policy National Defense University. National Defense University Press.

The response of giant phospholipid vesicles to millimeter waves radiation. (https://www.sciencedirect.com/science/article/pii/S0005273609001175) (2009) Ramundo-Orlando et al. Biochimica et Biophysica Acta (BBA) – Biomembranes (https://www.sciencedirect.com/science/journal/00052736). 1788 (7):1497–1507.

[Effects of millimeter wave on gene expression in human keratinocytes] (https://www.ncbi.nlm.nih.gov/pubmed/18275115). (2008) Chen et al. Zhejiang Da Xue Xue Bao Yi Xue Ban. 37(1):23-8.

Human skin as arrays of helical antennas in the millimeter and submillimeter wave range. (https://www.ncbi.nlm.nih.gov/pubmed/18517913) (2008) Feldman et al. Phys Rev Lett. 100(12):128102

Gene expression changes in the skin of rats induced by prolonged 35 GHz millimeter-wave exposure. (2008) Millenbaugh NJ et al. Radiat Res. 2008 Mar;169 (3):288-300.

[Thermoelastic excitation of acoustic waves in biological models under the effect of the high peak-power pulsed electromagnetic radiation of extremely high frequency]. ((https://www.ncbi.nlm.nih.gov/pubmed/18225661)2007) Gapeev AB et al. Biofizika. 2007 Nov-Dec;52(6):1087-92.

Comparison of blood pressure and thermal responses in rats exposed to millimeter wave energy or environmental heat. (https://www.ncbi.nlm.nih.gov/pubmed/16721271) (2006) Millenbaugh et al., Shock. 25(6):625-32.

Low-Intensity Electromagnetic Millimeter Waves for Pain Therapy (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1475937/).(2006) Taras et al. Evid Based Complement Alternat Med. 3(2): 201–207.

[The study of the mechanisms of formation of reactive oxygen species in aqueous solutions on exposure to high peak-power pulsed electromagnetic radiation of extremely high frequencies] (https://www.ncbi.nlm.nih.gov/pubmed/16248149). (2005) Gugkova OIu. Biofizika. 2005 Sep-Oct;50(5):773-9.

[Indirect and repeated electromagnetic irradiation of extremely high freguency of bacteria Escherichia coli]. (https://www.ncbi.nlm.nih.gov/pubmed/16212062) (2005) Isakhanian and Trchunian Biofizika. 50(4):689-92.

Effect of millimeter waves on natural killer cell activation. (https://www.ncbi.nlm.nih.gov/pubmed/15605409) (2005) Makar et al., Bioelectromagnetics. 26(1):10-9.

Effects of low-intensity ultrahigh frequency electromagnetic radiation on inflammatory processes. (https://www.ncbi.nlm.nih.gov/pubmed/15452603) (2004) Lushnikov et al., Bull Exp Biol Med. 137(4):364-6.

[A comparison of the effects of millimeter and centimeter waves on tumor necrosis factor production in mouse cells]. (https://www.ncbi.nlm.nih.gov/pubmed/15327216) (2004) Sinotova OA (https://www.ncbi.nlm.nih.gov/pubmed/?term=Sinotova%20OA%5BAuthor%5D&cauthor=true&cauthor_uid=15327216) et al. Biofizika. 2004 May-Jun;49 (3):545-50.

[Effects of low-intensity extremely high frequency electromagnetic radiation on chromatin structure of lymphoid cells in vivo and in vitro] (https://www.ncbi.nlm.nih.gov/pubmed/12677665). (2003) Gapeev et al. Radiats Biol Radioecol. (1):87-92.

[Decrease in the intensity of the cellular immune response and nonspecific inflammation upon exposure to extremely high frequency electromagnetic radiation]. (https://www.ncbi.nlm.nih.gov/pubmed/14582420) (2003) Lushnikov et al. Biofizika. 48(5):918-25.

[Effects of extremely high-frequency electromagnetic radiation on the immune system and systemic regulation of homeostasis] (https://www.ncbi.nlm.nih.gov/pubmed/12449822). (2002) Lushnikov Radiats Biol Radioecol. 42(5):533-45.

[Effect of millimeter waves on the immune system in mice with experimental tumors]. (https://www.ncbi.nlm.nih.gov/pubmed/12397969) (2002) Novoselova EG et al. Biofizika. 2002 Sep-Oct;47(5):933-42.

Reactions of keratinocytes to in vitro millimeter wave exposure. (2001) Szabo et al. Bioelectromagnetics. 22(5):358-64. (http://ieeexplore.ieee.org/document/884211/)

https://www.ncbi.nlm.nih.gov/pubmed/11424160 (https://www.ncbi.nlm.nih.gov/pubmed/11424160)Nonthermal effects of extremely high-frequency microwaves on chromatin conformation in cells in vitro—Dependence on physical, physiological, and genetic factors. (http://ieeexplore.ieee.org/document/884211/) (2000) Belyaev (http://ieeexplore.ieee.org/search/searchresult.jsp?searchWithin=%22Authors%22:.QT.I.Y.%20Belyaev.QT.&newsearch=true)IY et al. IEEE Transactions on Microwave Theory and Techniques. 2000; 48(11):2172-2179.

Effects of Microwave and Millimeter Wave Radiation on the Eye. (https://link.springer.com/chapter/10.1007/978-94-011-4191-8_43) (2000) In: Klauenberg B.J., Miklavčič D. (eds) Radio Frequency Radiation Dosimetry and Its Relationship to the Biological Effects of Electromagnetic Fields. D'Andrea and Chalfin. NATO Science Series (Series 3: High Technology), vol 82. Springer, Dordrecht.

Skin heating effects of millimeter- wave irradiation-Thermal modeling results. (http://ieeexplore.ieee.org/document/884202/) (2000) Nelson et al. IEEE Transactions on Microwave Theory and Techniques 48:2111-2120..

Heating and pain sensation produced in human skin by millimeter waves: comparison to a simple thermal model (. https://www.ncbi.nlm.nih.gov/pubmed/10688448). (2000) Walters et al., Health Physics 78:259- 267

Haas AJ, et al. "Effect of acute millimeter wave exposure on dopamine metabolism of NGF-treated PC12 cells (https://www.ncbi.nlm.nih.gov/pubmed/28339776)." *Journal of Radiation Research*, 2017.

Haas AJ, et al. "Effects of 60-GHz millimeter waves on neurite outgrowth in PC12 cells using high-content screening." (https://www.ncbi.nlm.nih.gov/pubmedhttps://www.osapublishing.org/boe/abstract.cfm?uri=boe-8-1-273/26921450?dopt=Abstract) *Neuroscience Letters*, vol. 618, 2016, pp. 58-65.

Le Dréan Y, et al. "State of knowledge on biological effects at 40–60 GHz." (https://www.sciencedirect.com/science/article/pii/S1631070513000480) *Comptes Rendus Physique*, vol. 14, no. 5, 2013, pp. 402-411.

Sivachenko IB, et al. "Effects of Millimeter-Wave Electromagnetic Radiation on the Experimental Model of Migraine (https://www.ncbi.nlm.nih.gov/pubmed/26899844?dopt=Abstract)." *Bulletin of Experimental Biology and Medicine*, vol. 160, no. 4, 2016, pp. 425-8.

Soghomonyan D, K. Trchounian and A. Trchounian. "Millimeter waves or extremely high frequency electromagnetic fields in the environment: what are their effects on bacteria?" (https://www.ncbi.nlm.nih.gov/pubmed/27087527?dopt=Abstract) *Applied Microbiology and Biotechnology*, vol. 100, no. 11, 2016, pp. 4761-71.

Ramundo-Orlando A. Effects of millimeter waves radiation on cell membrane – A brief review. (https://link.springer.com/article/10.1007%2Fs10762-010-9731-z) *Journal of Infrared Millimeter Terahertz Waves*, vol. 30, no. 12, 2010, pp. 1400-1411.

References on Millimeter waves in Military Non Lethal Weapon Program

- US Department of Defense Non-Lethal Weapons Program FAQS (http://jnlwp.defense.gov/About/Frequently-Asked-Questions/Active-Denial-System-FAQs/)
- A Narrative Summary and Independent Assessment of the Active Denial System by the The Human Effects Advisory Panel: (http://jnlwp.defense.gov/Portals/50/Documents/Future_Non-Lethal_Weapons/HEAP.pdf)
- The Active Denial System A Revolutionary, Non-lethal Weapon for Today's Battlefield Susan LeVine Center for Technology and National Security Policy National Defense University, June 2018: (https://pdfs.semanticscholar.org/9e45/be0c2d3398efa5988c5b131099f4c7644171.pdf)
- June 2012 Powerpoint on Active Denial Defense: Active Denial Technology (ADT) Non-Lethal Weapons Research and Technology Development Industry Day 22 June 2012 David Law Technology Division Chief (https://static.dvidshub.net/media/pubs/pdf_10566.pdf)

American Academy of Pediatrics Website

"Electromagnetic Fields: A Hazard to Your Health?" on Cell Tower Radiation

"In recent years, concern has increased about exposure to radio frequency electromagnetic radiation emitted from cell phones and phone station antennae. An Egyptian study confirmed concerns that living nearby mobile phone base stations increased the risk for developing:

- Headaches
- Memory problems
- Dizziness
- Depression
- Sleep problems

Short-term exposure to these fields in experimental studies have not always shown negative effects, but this does not rule out cumulative damage from these fields, so larger studies over longer periods are needed to help understand who is at risk. In large studies, an association has been observed between symptoms and exposure to these fields in the everyday environment."

–American Academy of Pediatrics (https://www.healthychildren.org/English/safety-prevention/all-around/Pages/Electromagnetic-Fields-A-Hazard-to-Your-Health.aspx)

Compilation of Research Studies on Cell Tower Radiation and Health

Zothansiama, et al. "Impact of radiofrequency radiation on DNA damage and antioxidants in peripheral blood lymphocytes of humans residing in the vicinity of mobile phone base stations." (http://www.tandfonline.com/doi/abs/10.1080/15368378.2017.1350584) Electromagnetic Biology and Medicine 36.3 (2017): 295-305.

- This study evaluated effects in the human blood of individuals living near mobile phone base stations (within 80 meters) compared with healthy controls (over 300 meters). The study found higher radiofrequency radiation exposures and statistically significant differences in the blood of people living closer to the cellular antennas. The group living closer to the antennas had for example, statistically significant higher frequency of micronuclei and a rise in lipid peroxidation in their blood. These changes are considered biomarkers predictive of cancer.

Neurobehavioral effects among inhabitants around mobile phone base stations (https://www.ncbi.nlm.nih.gov/pubmed/16962663) Abdel-Rassoul et al, Neurotoxicology, 2007

- This study found that living nearby mobile phone base stations (cell antennas) increased the risk for neuropsychiatric problems such as headaches, memory problems, dizziness, tremors,depression, sleep problems and some changes in the performance of neurobehavioral functions.

Biological Effects from Exposure to Electromagnetic Radiation Emitted by Cell Tower Base Stations and Other Antenna Arrays (https://www.researchgate.net/publication/233593841_Biological_effects_from_exposure_to_electromagnetic_radiation_emitted_by_cell_tc Levitt & Lai, Environmental Reviews, 2010

- This review of 100 studies found approximately 80% showed biological effects near towers. "Both anecdotal reports and some epidemiology studies have found headaches, skin rashes, sleep disturbances, depression, decreased libido, increased rates of suicide, concentration problems, dizziness, memory changes, increased risk of cancer, tremors, and other neurophysiological effects in populations near base stations."

Mortality by neoplasia and cellular telephone base stations. (https://www.sciencedirect.com/science/article/pii/S0048969711005754) Dode et al. (Brazil), Science of the Total Environment, Volume 409, Issue 19, 1 September 2011, Pages 3649–3665

- This 10 year study on cell phone antennas by the Municipal Health Department in Belo Horizonte and several universities in Brazil found a clearly elevated relative risk of cancer mortality at residential distances of 500 meters or less from cell phone transmission towers. Shortly after this study was published, the city prosecutor sued several cell phone companies and requested that almost half of the cities antennas be removed. Many antennas were dismantled.

Epidemiological Evidence for a Health Risk from Mobile Phone Base Stations (https://www.researchgate.net/publication/45387389_Epidemiological_evidence_for_a_health_risk_from_mobile_phone_base_stations) Khurana, Hardell et al., International Journal of Occupational Environmental Health, Vol 16(3):263-267, 2010

- A review of 10 epidemiological studies that assessed for negative health effects of mobile phone base stations (4 studies were from Germany, and 1 each from Austria, Egypt, France, Israel, Poland, Spain) found that seven showed altered neurobehavioral effects near cell tower and three showed increased cancer incidence. The review also found that eight of the 10 studies reported increased prevalence of adverse neurobehavioral symptoms or cancer in populations living at distances < 500 meters from base stations. Lower cognitive performance was found in individuals living ≤ 10 meters from base stations. None of the studies reported exposure above accepted international guidelines, suggesting that current guidelines may be inadequate in protecting the health of human populations.

Health effects of living near mobile phone base transceiver station (BTS) antennae: a report from Isfahan, Iran (https://www.ncbi.nlm.nih.gov/pubmed/23781985). Shahbazi-Gahrouei et al, Electromagnetic Biology Medicine, 2013.

- This cross-sectional study found the symptoms of nausea, headache, dizziness, irritability, discomfort, nervousness, depression, sleep disturbance, memory loss and lowering of libido were statistically increased in people living closer than 300 m from cell antennas as compared to those living farther away. The study concludes that "antennas should not be sited closer than 300 m to people to minimize exposure."

Long-term exposure to microwave radiation provokes cancer growth: evidences from radars and mobile communication systems. (https://www.ncbi.nlm.nih.gov/pubmed/21716201) Yakymenko (https://www.ncbi.nlm.nih.gov/pubmed?term=Yakymenko%20I%5BAuthor%5D&cauthor=true&cauthor_uid=21716201) (2011) Exp Oncology, 33(2):62-70.

- Even a year of operation of a powerful base transmitting station for mobile communication reportedly resulted in a dramatic increase of cancer incidence among population living nearby.

Association of Exposure to Radio-Frequency Electromagnetic Field Radiation (RF-EMFR) Generated by Mobile Phone Base Stations (MPBS)with Glycated Hemoglobin (HbA1c) and Risk of Type 2 Diabetes Mellitus (https://www.researchgate.net/publication/283726472_Association_of_Exposure_to_Radio-Frequency_Electromagnetic_Field_Radiation_RF-EMFR_Generated_by_Mobile_Phone_Base_Stations_with_Glycated_Hemoglobin_HbA1c_and_Risk_of_Type_2_Diabetes_Mellitus) , Sultan Ayoub Meo et al, International Journal of Environmental Research and Public Health, 2015

- Elementary school students who were exposed to high RF-EMFR generated by MPBS had a significantly higher risk of type 2 diabetes mellitus relative to their counterparts who were exposed to lower RF-EMFR.

How does long term exposure to base stations and mobile phones affect human hormone profiles? (https://www.ncbi.nlm.nih.gov/pubmed/22138021) Eskander EF et al, (2011), Clin Biochem

- RFR exposures significantly impacted ACTH, cortisol, thyroid hormones, prolactin for females, and testosterone levels for males.

Investigation on the health of people living near mobile telephone relay stations: Incidence according to distance and sex (https://www.ncbi.nlm.nih.gov/pubmed/12168254) Santini et al, 2002 , Pathol Bio

- People living near mobile phone masts reported more symptoms of headache, sleep disturbance, discomfort, irritability, depression, memory loss and concentration problems the closer they lived to the installation. Study authors recommend that the minimal distance of people from cellular phone base stations should not be < 300 m.

Navarro EA, Segura J, Portoles M, Gomez-Perretta C, The Microwave Syndrome: A preliminary Study (http://www.emrpolicy.org/science/research/docs/navarro_ebm_2003.pdf). 2003 (Spain) Electromagnetic Biology and Medicine, Volume 22, Issue 2, (2003): 161 – 169

- Statistically significant positive exposure-response associations between RFR intensity and fatigue, irritability, headaches, nausea, loss of appetite, sleeping disorder, depressive tendency, feeling of discomfort, difficulty in concentration, loss of memory, visual disorder, dizziness and cardiovascular problems.

Two Important Animal Studies on Radiofrequency Radiation

These studies indicate that government limits are non protective. Government limits are based on the assumption that radiofrequency radiation is only harmful at thermal levels. However, the cancers developed in animals in these studies at radiation levels that were non thermal.

Belpoggi et al. 2018, "Report of final results regarding brain and heart tumors in Sprague-Dawley rats exposed from prenatal life until natural death to mobile phone radiofrequency field representative of a 1.8 GHz base station environmental emission (https://ehtrust.org/wp-content/uploads/Belpoggi-Heart-and-Brain-Tumors-Base-Station-2018-First-page-.pdf)" Environmental Research Journal

- Researchers with the renowned Ramazzini Institute (RI) in Italy performed a large-scale lifetime study (https://www.sciencedirect.com/science/article/pii/S0013935118300367?via%3Dihub) of lab animals exposed to environmental levels (comparable to allowable limits from cell towers) of RFR radiation and found the rats developed increased cancers- schwannoma of the heart in male rats. This study confirms the $25 million US National Toxicology Program (https://ntp.niehs.nih.gov/about/org/sep/trpanel/meetings/docs/2018/march/index.html) study which used much higher levels of cell phone radiofrequency (RF) radiation, but also reported finding the same unusual cancers as the Ramazzini- schwannoma of the heart in male rats. In addition, the RI study of cell tower radiation also found increases in malignant brain (glial) tumors in female rats and precancerous conditions including Schwann cells hyperplasia in both male and female rats.
- "Our findings of cancerous tumors in rats exposed to environmental levels of RF are consistent with and reinforce the results of the US NTP studies on cell phone radiation, as both reported increases in the same types of tumors of the brain and heart in Sprague-Dawley rats. Together, these studies provide sufficient evidence to call for the International Agency for Research on Cancer (IARC) to re-evaluate and re-classify their conclusions regarding the carcinogenic potential of RFR in humans," said Fiorella Belpoggi PhD, study author and RI Director of Research.
- The Ramazzini study exposed 2448 Sprague-Dawley rats from prenatal life until their natural death to "environmental" cell tower radiation for 19 hours per day (1.8 GHz GSM radiofrequency radiation (RFR) of 5, 25 and 50 V/m). RI exposures mimicked base station emissions like those from cell tower

antennas, and exposure levels were far less than those used in the NTP studies of cell phone radiation.
- Watch Press Conference (https://ehtrust.org/worlds-largest-animal-study-on-cell-tower-radiation-confirms-cancer-link/)

Wyde, Michael, et al. "National Toxicology Program Carcinogenesis Studies of Cell Phone Radiofrequency Radiation in Hsd: Sprague Dawley® SD rats (Whole Body Exposure).Statement on conclusions of the peer review meeting by NIEHS, released after external peer review meeting (https://ntp.niehs.nih.gov/ntp/about_ntp/trpanel/2018/march/actions20180328_508.pdf) and the DNA damage presentation (https://ehtrust.org/wp-content/uploads/Evaluation-of-Genotoxicity-of-Cell-Phone-Radiofrequency-Radiation-in-Male-and-f-the-Genot-d-Female-notoxicity-e-Rats-and-y-Ce-d-Mice-ell-Ra-e-Following-g-Subchronic-ncy-c-Exposure-Poster-.pdf).

- This 25 million dollar study is the most complex study completed by the NTP and the world's largest rodent study on radiofrequency radiation exposure to date which found long term exposure at non thermal levels associated with brain cancer and schwannomas of the heart in male rats. In addition damage to heart was found in all exposure levels. The full report is expected to be released in Fall 2018.

More Important Studies on Cell Tower Radiation

Cindy L. Russell, 5 G wireless telecommunications expansion: Public health and environmental implications (https://www.sciencedirect.com/science/article/pii/S0013935118300161), Environmental Research, 2018, ISSN 0013-9351

- Radiofrequency radiation (RF) is increasingly being recognized as a new form of environmental pollution (https://www.sciencedirect.com/topics/earth-and-planetary-sciences/environmental-pollution). This article reviews relevant electromagnetic (https://www.sciencedirect.com/topics/earth-and-planetary-sciences/electromagnetism) frequencies, exposure standards and current scientific literature on the health implications of 2G, 3G, 4G and 5G.
- Effects can also be non-linear. Because this is the first generation to have cradle-to-grave lifespan exposure to this level of man-made microwave (RF EMR) radiofrequencies, it will be years or decades before the true health consequences are known. Precaution in the roll out of this new technology is strongly indicated.

Noa Betzalel, Paul Ben Ishai, Yuri Feldman, The human skin as a sub-THz receiver – Does 5G pose a danger to it or not? (https://www.sciencedirect.com/science/article/pii/S0013935118300331), Environmental Research, Volume 163, 2018, Pages 208-216, ISSN 0013-9351,

- Researchers have developed a unique simulation tool of human skin, taking into account the skin multi-layer structure (https://www.sciencedirect.com/topics/earth-and-planetary-sciences/laminates) together with the helical segment of the sweat duct embedded in it. They found that the presence of the sweat duct led to a high specific absorption rate (SAR) of the skin in extremely high frequency (https://www.sciencedirect.com/topics/earth-and-planetary-sciences/extremely-high-frequencies) band that will be used in 5G. "One must consider the implications of human immersion in the electromagnetic noise, caused by devices working at the very same frequencies as those, to

which the sweat duct (as a helical antenna) is most attuned. We are raising a warning flag against the unrestricted use of sub-THz technologies for communication, before the possible consequences for public health are explored."

Mobile phone infrastructure regulation in Europe: Scientific challenges and human rights protection (https://www.sciencedirect.com/science/article/pii/S146290111300186X) Claudia Roda, Susan Perry, Environmental Science & Policy, Volume 37, March 2014, Pages 204-214.

- This article was published in Environmental Science & Policy by human rights experts. It argues that cell tower placement is a human rights issue for children.
- "We argue that (1) because protection of children is a high threshold norm in Human Right law and (2) the binding language of the Convention on the Rights of the Child obliges States Parties to provide a higher standard of protection for children than adults, any widespread or systematic form of environmental pollution that poses a long-term threat to a child's rights to life, development or health may constitute an international human rights violation.
- In particular we have explained how the dearth of legislation to regulate the installation of base stations (cell towers) in close proximity to children's facilities and schools clearly constitutes a human rights concern according to the language of the Convention on the Rights of the Child, a treaty that has been ratified by all European States.

SAFETY ZONE DETERMINATION FOR WIRELESS CELLULAR TOWER (http://ijret.org/Volumes/V02/I09/IJRET_110209029.pdf) Nyakyi et al, Tanzania (2013)

- This research looked at the radiation that cell towers emit and states a safety zone is needed around the towers to ensure safe sleeping areas. The authors state that "respective authorities should ensure that people reside far from the tower by 120m or more depending on the power transmitted to avoid severe health effect."

A cross-sectional case control study on genetic damage in individuals residing in the vicinity of a mobile phone base station. (https://www.ncbi.nlm.nih.gov/pubmed/25006864) Ghandi et al, 2014 (India):

- This cross-sectional case control study on genetic damage in individuals living near cell towers found genetic damage parameters of DNA were significantly elevated. The authors state," The genetic damage evident in the participants of this study needs to be addressed against future disease-risk, which in addition to neurodegenerative disorders, may lead to cancer."

Human disease resulting from exposure to electromagnetic fields (https://www.ncbi.nlm.nih.gov/pubmed/24280284), Carpenter, D. O. Reviews on Environmental Health, Volume 28, Issue 4, Pages 159172.

- This review summarizes the evidence stating that excessive exposure to magnetic fields from power lines and other sources of electric current increases the risk of development of some cancers and neurodegenerative diseases, and that excessive exposure to RF radiation increases risk of cancer, male infertility, and neurobehavioral abnormalities.

Signifikanter Rückgang klinischer Symptome nach Senderabbau – eine Interventionsstudie. (English-Significant Decrease of Clinical Symptoms after Mobile Phone Base Station Removal – An Intervention Study) (http://nebula.wsimg.com/d1e65ba8eb587c44cba6164dfef44ed2?AccessKeyId=045114F8E0676B9465FB&disposition=0&alloworigin=1)Tetsuharu Shinjyo and Akemi Shinjyo, 2014 Umwelt-Medizin-Gesellschaft, 27(4), S. 294-301.

- Japanese study Showed Statistically Significant Adverse Health Effects from electromagnetic radiation from mobile phone base stations. Residents of a condominium building that had cell tower antennas on the rooftop were examined before and after cell tower antennas were removed. In 1998, 800MHz cell antennas were installed, then later in 2008 a second set of antennas (2GHz) were installed. Medical exams and interviews were conducted before and after the antennas were removed in 2009 on 107 residents of the building who had no prior knowledge about possible. These results lead researchers to question the construction of mobile phone base stations on top of buildings such as condominiums or houses.

Effect of GSTM1 and GSTT1 Polymorphisms on Genetic Damage in Humans Populations Exposed to Radiation From Mobile Towers. (https://1.usa.gov/1hlQmoj)Gulati S, Yadav A, Kumar N, Kanupriya, Aggarwal NK, Kumar R, Gupta R., Arch Environ Contam Toxicol. 2015 Aug 5. [Epub ahead of print]

- In our study, 116 persons exposed to radiation from mobile towers and 106 control subjects were genotyped for polymorphisms in the GSTM1 and GSTT1 genes by multiplex polymerase chain reaction method. DNA damage in peripheral blood lymphocytes was determined using alkaline comet assay in terms of tail moment (TM) value and micronucleus assay in buccal cells (BMN). Our results indicated that TM value and BMN frequency were higher in an exposed population compared with a control group and the difference is significant. In our study, we found that different health symptoms, such as depression, memory status, insomnia, and hair loss, were significantly associated with exposure to EMR. Damaging effects of nonionizing radiation result from the generation of reactive oxygen species (ROS) and subsequent radical formation and from direct damage to cellular macromolecules including DNA.

Subjective symptoms, sleeping problems, and cognitive performance in subjects living near mobile phone base stations (https://www.ncbi.nlm.nih.gov/pubmed/16621850), Hutter HP et al, (May 2006), Occup Environ Med. 2006 May;63(5):307-13

- Found a significant relationship between some cognitive symptoms and measured power density in 365 subjects; highest for headaches. Perceptual speed increased, while accuracy decreased insignificantly with increasing exposure levels.

Oberfeld, A.E. Navarro, M. Portoles, C. Maestu, C. Gomez-Perretta, The microwave syndrome: further aspects of a Spanish study (http://www.powerwatch.org.uk/pdfs/20040809_kos.pdf),

- A health survey was carried out in La Ñora, Murcia, Spain, in the vicinity of two GSM 900/1800 MHz cellular phone base stations. The adjusted (sex, age, distance) logistic regression model showed statistically significant positive exposure-response associations between the E-field and the following variables: fatigue, irritability, headaches, nausea, loss of appetite, sleeping disorder, depressive tendency, feeling of discomfort, difficulty in

concentration, loss of memory, visual disorder, dizziness and cardiovascular problems.

Bortkiewicz et al, 2004 (Poland), Subjective symptoms reported by people living in the vicinity of cellular phone base stations: review, (https://www.ncbi.nlm.nih.gov/pubmed/15620045)Med Pr. (https://www.ncbi.nlm.nih.gov/pubmed/15620045#)2004;55(4):345-51. (https://www.ncbi.nlm.nih.gov/pubmed/15620045)

- Residents close to mobile phone masts reported: more incidences of circulatory problems, sleep disturbances, irritability, depression, blurred vision and concentration difficulties the nearer they lived to the mast.
- The performed studies showed the relationship between the incidence of individual symptoms, the level of exposure, and the distance between a residential area and a base station.

Wolf R and Wolf D, Increased Incidence of Cancer Near a Cell-phone Transmitter Station (http://www.powerwatch.org.uk/news/20050207_israel.pdf), International Journal of Cancer Prevention, (Israel) VOLUME 1, NUMBER 2, APRIL 2004

- A significant higher rate of cancer (300% increase) among all residents living within 300m radius of a mobile phone mast for between three and seven years was detected.
- 900% cancer increase among women alone
- In the area of exposure (area A) eight cases of different kinds of cancer were diagnosed in a period of only one year. This rate of cancers was compared both with the rate of 31 cases per 10,000 per year in the general population and the 2/1222 rate recorded in the nearby clinic (area B). The study indicates an association between increased incidence of cancer and living in proximity to a cell-phone transmitter station.

Changes of Neurochemically Important Transmitters under the influence of modulated RF fields – A Long Term Study under Real Life Conditions (http://apps.fcc.gov/ecfs/document/view?id=7521095891)(Germany), Bucher and Eger, 2011

- German study showing elevated levels of stress hormones (adrenaline, noradrenaline), and lowered dopamine and PEA levels in urine in area residents during 1st 6 months of cell tower installation. Even after 1.5 years, the levels did not return to normal.

The Influence of Being Physically Near to a Cell Phone Transmission Mast on the Incidence of Cancer (http://www.tetrawatch.net/papers/naila.pdf) (Umwelt·Medizin·Gesellschaft 17,4 2004) Eger et al, 2004 (Germany) (http://apps.who.int/peh-emf/research/database/emfstudies/viewstudy.cfm?ID=1226)

- 200% increase in the incidence of malignant tumors was found after five years' exposure in people living within 400m radius of a mobile phone mast. The proportion of newly developing cancer cases is significantly higher among patients who live within 400 meters of a cell phone transmitter. Early age of cancer diagnosis.

Microwave electromagnetic fields act by activating voltage-gated calcium channels: why the current international safety standards do not predict biological hazard. (https://bit.ly/1nQjboA) Martin L. Pall. Recent Res. Devel. Mol. Cell Biol. 7 (2014).

- "It can be seen from the above that 10 different well-documented microwave EMF effects can be easily explained as being a consequence of EMF VGCC activation: oxidative stress, elevated single and double strand breaks in DNA, therapeutic responses to such EMFs, breakdown of the blood-brain barrier, cancer, melatonin loss, sleep dysfunction, male infertility and female infertility."

Pall ML. 2015. Microwave frequency electromagnetic fields (EMFs) produce widespread neuropsychiatric effects including depression. (http://electromagnetichealth.org/wp-content/uploads/2015/05/reveh-2015.pdf)J. Chem. Neuroanat. 2015 Aug 20.

- Non-thermal microwave/lower frequency electromagnetic fields (EMFs) act via voltage-gated calcium channel (VGCC) activation.
- Two U.S. government reports from the 1970s to 1980s provide evidence for many neuropsychiatric effects of non-thermal microwave EMFs, based on occupational exposure studies. 18 more recent epidemiological studies, provide substantial evidence that microwave EMFs from cell/mobile phone base stations, excessive cell/mobile phone usage and from wireless smart meters can each produce similar patterns of neuropsychiatric effects, with several of these studies showing clear dose–response relationships.
- Lesser evidence from 6 additional studies suggests that short wave, radio station, occupational and digital TV antenna exposures may produce similar neuropsychiatric effects. Among the more commonly reported changes are sleep disturbance/insomnia, headache, depression/depressive symptoms, fatigue/tiredness, dysesthesia, concentration/attention dysfunction, memory changes, dizziness, irritability, loss of appetite/body weight, restlessness/anxiety, nausea, skin burning/tingling/dermographism and EEG changes. In summary, then, the mechanism of action of microwave EMFs, the role of the VGCCs in the brain, the impact of non-thermal EMFs on the brain, extensive epidemiological studies performed over the past 50 years, and five criteria testing for causality, all collectively show that various non-thermal microwave EMF exposures produce diverse neuropsychiatric effects.

This webpage only has a sampling of research on this issue. There is research going back decades on this issue. More can be found here. (https://ehtrust.org/science/research-on-wireless-health-effects/)

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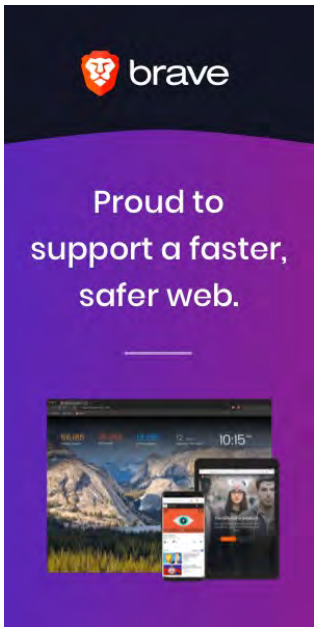

Canadian Doctors and Former Microsoft Canada President Warn About Grave Health Risks of 5G

TOPICS: 5G BN Frank Canada Telecom

JULY 5, 2019

DAILY NEWSLETTER

Email address:

By **B.N. Frank**

The telecom industry has provided **no scientific evidence** that 5G is safe and there is research that already proves it isn't (see **1**, **2**). Because of this, some government leaders have already declared moratoriums on installation (see **1**, **2**, **3**).

Additional **warnings about 5G** have come from a variety of sources including:

1. **Meteorologists** who fear that 5G frequencies will greatly reduce their ability to accurately predict the weather.
2. **Utility companies** fear that 5G will interfere with their already problematic **Smart Grids** and **Smart Meters**.
3. Security experts fear cyberattacks on the easily hacked 5G and **Internet of Things (IoT)** technologies could lead to catastrophic consequences (see **1**, **2**).

Unfortunately, this hasn't stopped 5G installation everywhere – including in Canada – despite publicized opposition from doctors, scientists, and former Microsoft Canada president, **Frank Clegg**.

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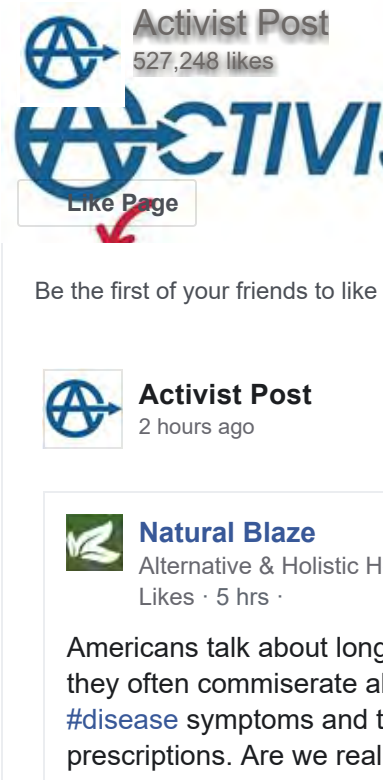

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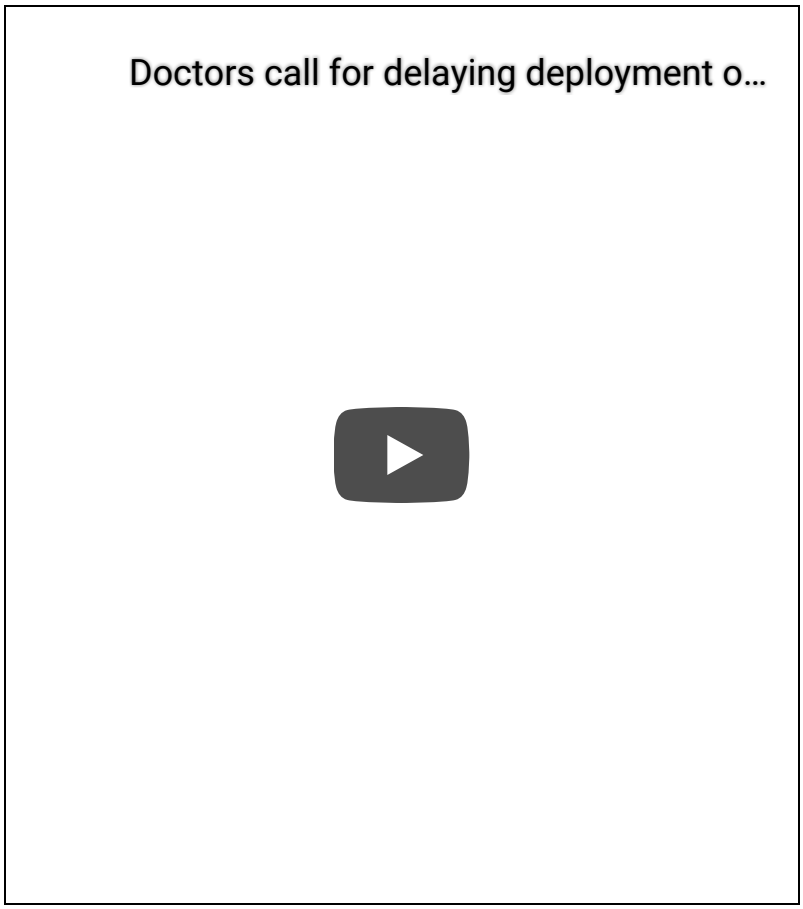

If the telecom industry won't even defend 5G, shouldn't we be concerned about anyone who does?

For more information, visit the following websites:

- **Canadians for Safe Technology**
- **Dr. Madga Havas**
- **Environmental Health Trust**
- **SaferEMR**
- **Scientists for Wired Tech**
- **Whatis5G.Info**
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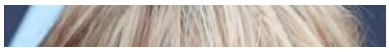

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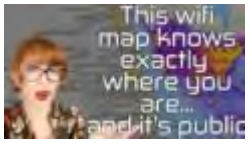

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TIME Magazine Reports How 5G Will Increase Our Already High Levels of E-Waste and Why This Isn't Green

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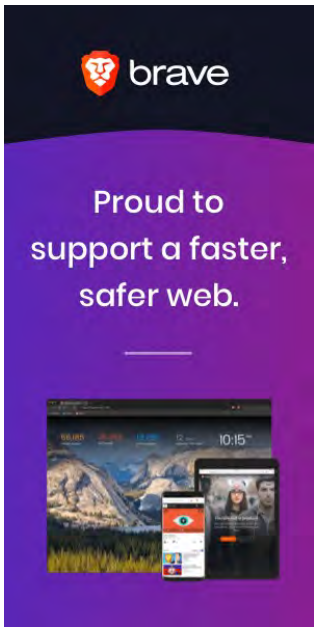

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By **B.N. Frank**

Activist Post has reported before about how digital, electronic, and wireless technology has created an already **huge and increasing environmental E-Waste problem** due to short life-spans and planned obsolesce. Unfortunately, some self-proclaimed environmentalists continue to turn a blind eye to this (see **1**, **2**, **3**) and still promote problematic technology as "green" despite E-Waste and other ways it is **harmful biologically and environmentally** (see **1**, **2**, **3**, **4**, **5**, **6**).

A recent article from ***Time Magazine*** confirms the seriousness of E-Waste worldwide and emphasizes how **5G** will make this **MUCH WORSE**:

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> "That stream (of E-Waste) is expected to turn into a torrent as the world upgrades to 5G, the next big step in wireless technology."
>
> "…50 million tons of e-waste generated globally last year–a number that stands to skyrocket as consumers replace their old devices with the newest 5G-ready gadgets money can buy."
>
> "But less than a quarter of all U.S. electronic waste is recycled….The rest is incinerated or ends up in landfills. That's bad news, as e-waste can contain harmful materials like mercury and beryllium that pose environmental risks."
>
> "…technology companies are speeding the pace of obsolescence…."
>
> "Our products today don't last as long as they used to, and it's a strategy by manufacturers to force us into shorter and shorter upgrade cycles…"

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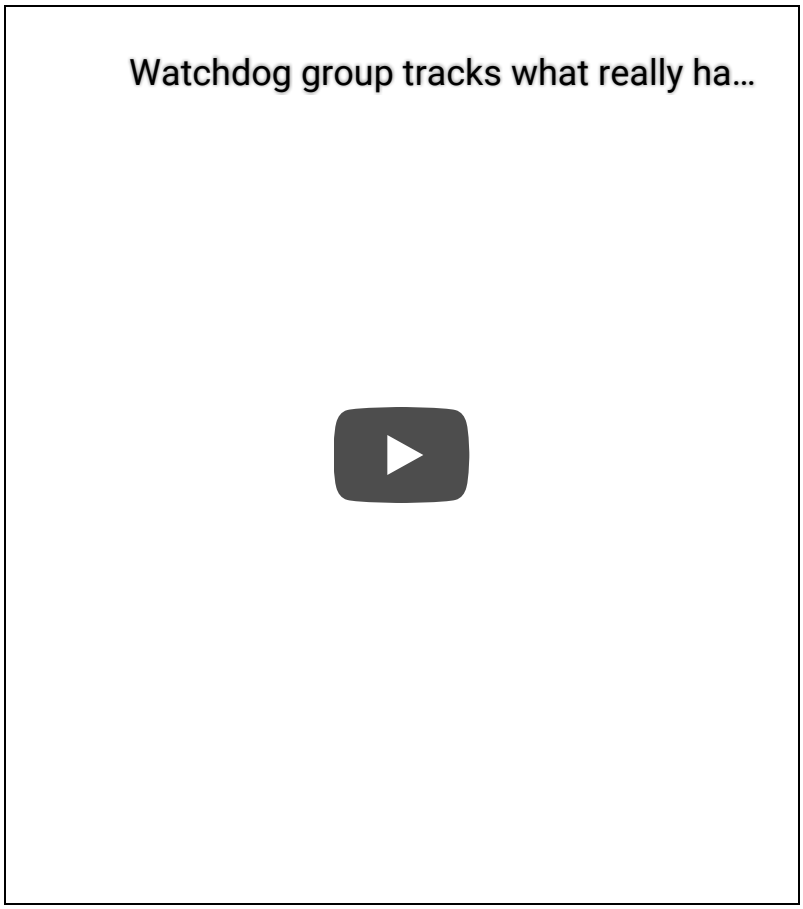

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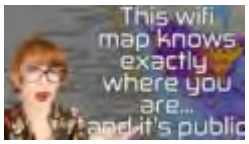

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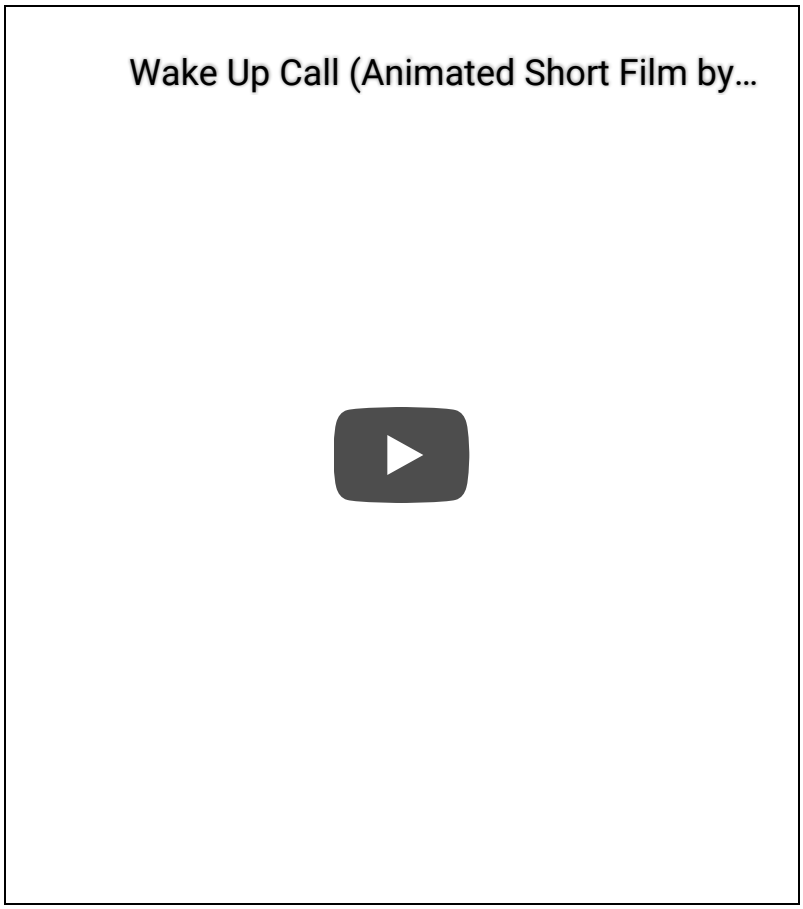

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Activist Post has reported on the many ways that 5G is awful as well as its increasing worldwide opposition.

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- **5GCrisis**
- **5GExposed**
- **5G Information**
- **Center For Electrosmog Prevention**
- **EMF Safety Network**
- **Environmental Health Trust**
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- **My Street, My Choice**
- **Our Town Our Choice**

- Parents for Safe Technology
- Physicians for Safe Technology
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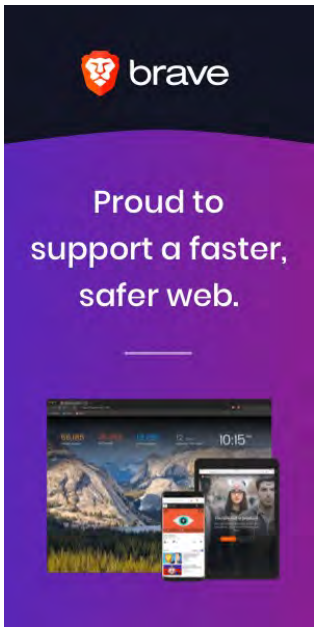
New Flyer and Website All About The Bees Being Harmed by 5G

TOPICS: 5G Bees BN Frank EMF Nature Radiation

JUNE 26, 2019



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Email address:

By **B.N. Frank**

In February, **telecom industry** representatives gave congressional testimony that they have no scientific evidence that 5G is safe. Many studies say it's not. Regardless, 5G is being installed everywhere despite worldwide **opposition** and warnings from **doctors, scientists**, **environmentalists** and many other **credible sources**. (see also **1**, **2**, **3**, **4**, **5**). Where 5G has already been installed, few **seem interested** in subscribing to it.

Recently *Activist Post* published two articles about how bees and other insects are harmed by all sources of Electromagnetic Radiation (EMR) (see **1, 2**).

Thanks to EMF Safety Network for posting this fantastic new flyer and take-action instructions to help fight widespread 5G installation in American communities:

Peer-reviewed studies show that wireless radiation harms bees, birds, and humans. In 2018 ***Newsweek*** reported *"Technology is quite literally destroying nature"* and 5G could make it even worse. Click on the flyer below to learn more, and then *TAKE ACTION!* What is 5G? See this **fact sheet.**

TAKE ACTION!

1. **Contact your local, state and federal representatives**. *See letter template and how to find your representatives below.*
2. **Reduce your wireless use**. *See this*

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Americans talk about long
they often commiserate a
#disease symptoms and t
prescriptions. Are we real

12x More Efficient Than Solar Panels? Scientists Screaming In Disbelief

3. **Download and share** the **Stop 5G bee flyer**, and use this **flyer** (best when printed on bright yellow paper) to post on telephone and light poles in your neighborhood where 5G could be installed.

Suggested letter template

Dear _____,

The science is in: EMFs are harmful to nature. I am calling on you to stop 5G to protect bees, birds and humans! 5G requires significantly more cell towers which will increase *involuntary exposure* to wireless radiation in our communities. There is no scientific

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People Worldwide Are Getting Sick From Utility "Smart" Meters — Californians Took

evidence to support any claim of 5G safety! **(1)** Scientists and public health experts from around the world are calling for a moratorium on 5G.**(2)**

In 2018 Newsweek reported: *"Technology is quite literally destroying nature, with a new report further confirming that electromagnetic radiation from power lines and cell towers can disorientate birds and insects and destroy plant health. The paper warns that as nations switch to 5G this threat could increase."* **(3)**

Peer-reviewed studies show worker bees did not return to their hives because of wireless radiation, which led to a colony collapse. **(4)** Radiation impacts on wild birds documented nest abandonment, plumage deterioration and death. Lab studies of chick embryos documented heart attacks and death. **(5)** In 2019 the Swiss environmental group Pro Natura reported 5G increases the body temperature of insects. **(6)**

The 30 million dollar, ten year US National Toxicology Program study found clear evidence of cancer from exposure to wireless radiation. **(7)**

The telecommunication industry's unbounded profit motive should never outweigh safety. Communications are safer using wired and corded connections. **Stop 5G!**

Sincerely, [your name and address]

How to find your representatives

- **Local**: search online for: "contact information for city and county officials in (your zip code)"
- **State**: **https://openstates.org**

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- **US Senators**: **https://www.senate.gov/senators/contact/senators_cfm.cfm**
- **US Representatives**: **https://www.house.gov/htbin/findrep**
- **US President:** phone 202-456-1111 (TTY/TTD 202-456-6213); The White House 1600 Pennsylvania Avenue NW Washington, DC 20500 **https://www.whitehouse.gov/contact/**

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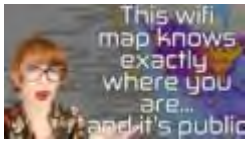

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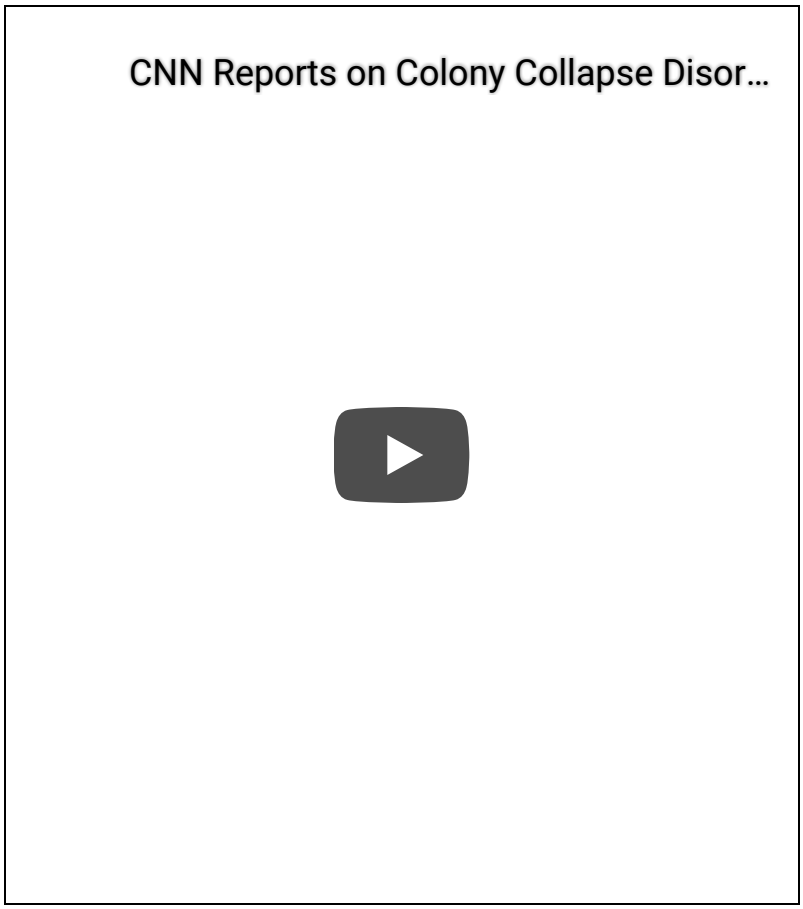

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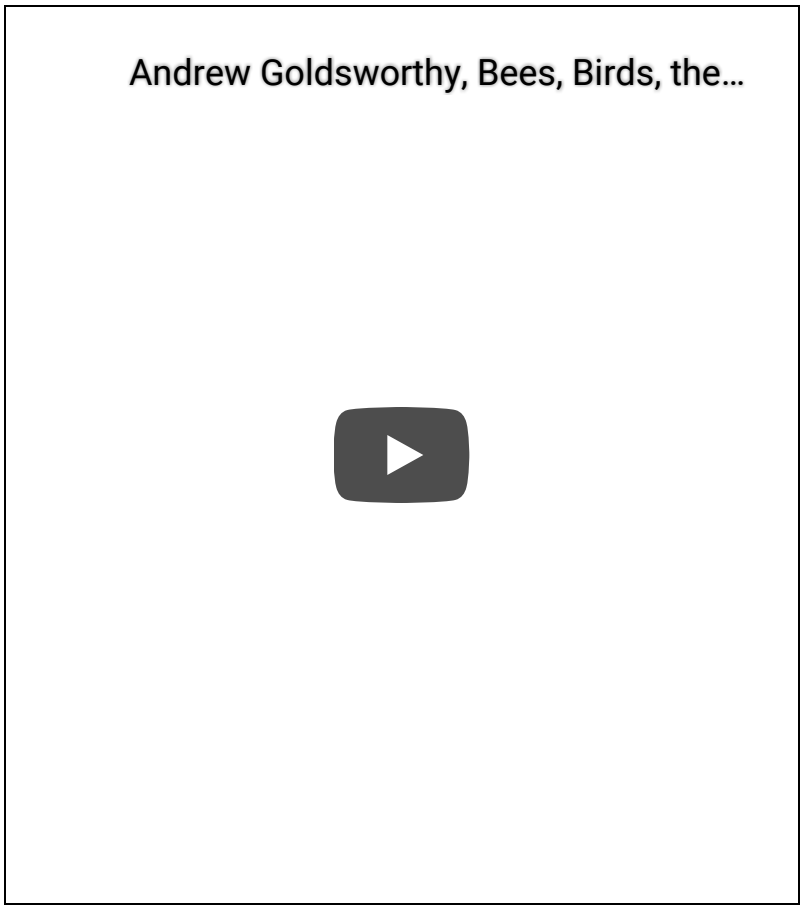

For more information on what you can do to stop 5G installation in your community, visit the following websites:

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- 5G Information
- Environmental Health Trust
- In Power Movement
- Last Tree Laws
- My Street, My Choice
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New Questions Arise About 5G Energy Efficiency as Experts Report Overheating of Base Stations and Phones

TOPICS: 5G BN Frank Consumer Rights Energy

AUGUST 8, 2019

By **B.N. Frank**

The case against **5G** keeps growing **environmentally** and **otherwise**. Now engineers are reporting that 5G **base stations** are overheating. They aren't the only ones. Reports indicate that operating 5G on **phones and modems** overheats them too.

Research indicates that exposure to 5G causes the body temperature to increase in **people** and **insects**. Of course, using additional energy to cool everything and everybody down can resolve overheating. Of course, suggesting this should have many environmentalists soiling their pants.

From ***Semiconductor Engineering***:

> Inefficient conversion of RF to digital and continuous connectivity issues are causing thermal problems, threatening signal integrity and reliability.
>
> Before 5G can be deployed commercially on a large scale, engineers have to solve some stubborn problems—including how to make a hot technology a whole lot cooler.

Unfortunately, 5G is already being deployed across the U.S. and around the world despite these issues and MANY OTHERS.

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Stop the 5G Rollout

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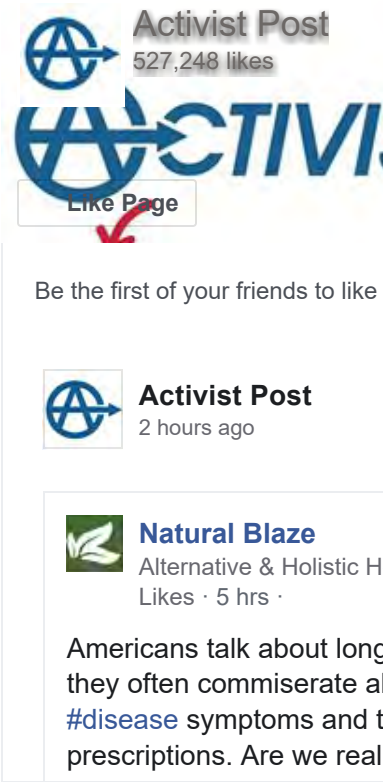

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Activist Post reports regularly about 5G research, risks, opposition and warnings. For more information **visit our archives** and the following websites:

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- **5GCrisis**
- **5GExposed**
- **5G Information**
- **Center For Safer Wireless**
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U.S. Military Seeks A.I. "Quarterback" to Call Plays for The Internet of Battlefield Things

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IBTimes Publishes "The Dangerous Push for More Technology in Schools.

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The Real Reason No One Wants to Date Taylor Swift

Serena Williams Is Speaking Out About Her Sister's Murder

How Camille Grammer Found Out About Kelsey's Cheating

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" Silicon Valley Parents Still Sending Their Kids to Low-Tech or No-Tech Schools

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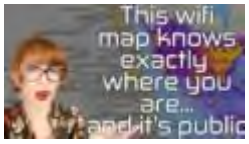

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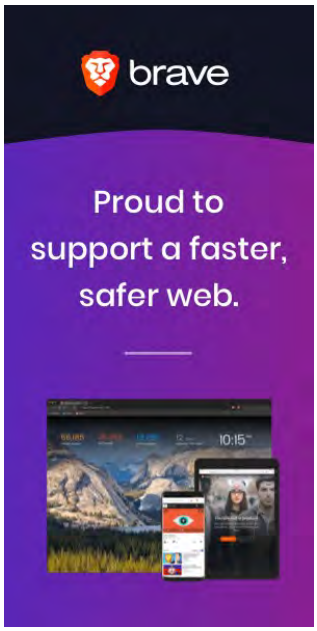

IEEE: 5G Base Stations Expected to Use Roughly 3X as Much Power As 4G Base Stations and More Are Needed to Cover Same Area. That Ain't Eco-Friendly!

TOPICS: 5G BN Frank

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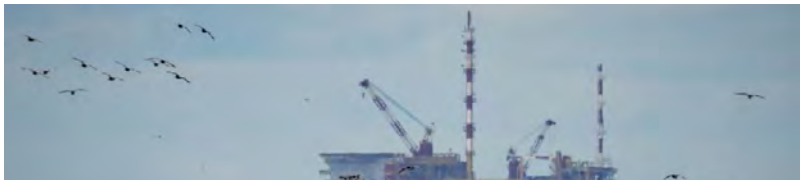

By **B.N. Frank**

Concerned about your carbon footprint and everybody else's?

Research has proven that exposure to **5G** can cause **excessive sweating** and excessively sweating people are surely going to crank up the A/C which means increased energy usage. Research has also proven that 5G makes phones and modems overheat and **users are being encouraged to crank up their A/C** to remedy this which also means increased energy usage.

Now **IEEE** has announced that a 5G base station is generally expected to consume roughly 3X times as much power as a **4G base station**:

> A 5G base station is generally expected to consume roughly three times as much power as a 4G base station. And more 5G base stations are needed to cover the same area.

So there's that too.

As for the **bees** and other insects, they're just plain screwed if 5G continues to be installed worldwide. Of course, in the long run, we all will be no matter

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how consistently and earnestly we try to reduce our carbon footprints in other ways.

Register Now for The 5G Crisis: Awareness & Accountability Summit. Online and FREE from August 26 – September 1, 2019.

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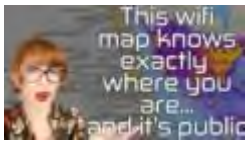

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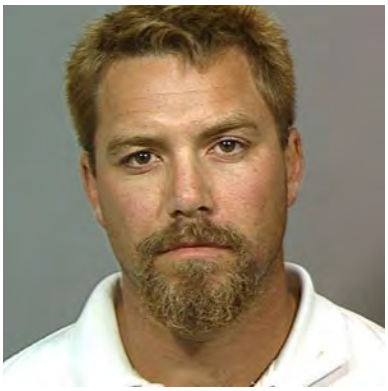
'CSI' Actress Passes Away at 44



Scott Peterson: Then & Now

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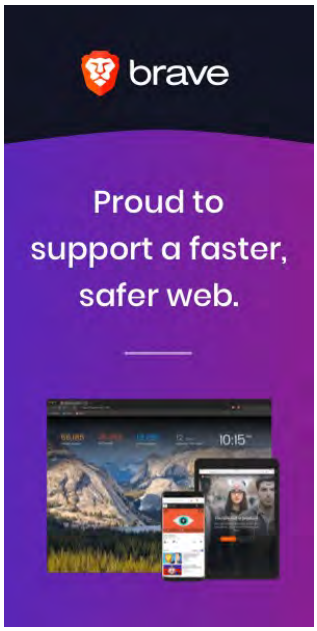

FCC Blows Off Warnings AGAIN from Meteorologists, NASA, NOAA and Navy About 5G Interfering with Weather Forecasting

TOPICS: 5G BN Frank FCC Military Weather

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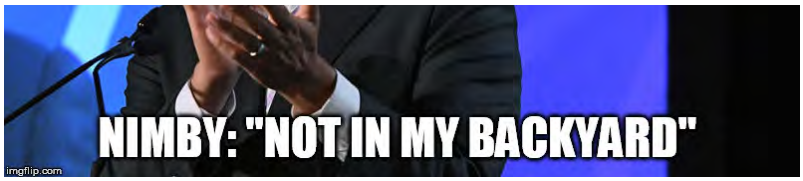

By **B.N. Frank**

Activist Post **reported about this** last month too. Many media sources did and continue to do so. The Federal Communications Commission (FCC) blows off everybody's concerns about 5G– even **security experts** who say

> 5G is not just for refrigerators," Spalding said. "It's farm implements, it's airplanes, it's all kinds of different things that can actually kill people or that allow someone to reach into the network and direct those things to do what they want them to do. It's a completely different threat that we've never experienced before.

Killing people is not what the FCC is supposed to do. They are not a health, environmental, or weather-forecasting agency. However, they are supposed to protect the public by **regulating the Telecom Industry**.

Now back to the FCC blowing off **meteorologists, NASA, NOAA and Navy:**

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WASHINGTON — The chairman of the Federal Communications Commission defended the use of spectrum for 5G wireless services while a key senator called for a hearing on potential interference such services could have with space-based weather observations.

At a hearing of the Senate Commerce Committee June 12, FCC Chairman Ajit Pai dismissed claims that 5G services operating at the 24 gigahertz band could interfere with weather observations and thus degrade the accuracy of forecasts, saying studies that made those claims were flawed.

"Over the last two and a half years we have patiently waited for a validated study to suggest that our proposed limit is inappropriate. We've never gotten such a validated study," he said on one of several occasions during the two-and-a-half-hour hearing when the subject came up.

He said the commission did receive a study that made such claims. Once the FCC's staff obtained the source code for the modeling that estimated the potential interference, "the assumptions that clearly underlaid were so flawed as to make the study, in our view at least, meaningless."

Pai's comments were the latest salvo that has pitted the FCC against the Department of Commerce and NASA regarding use of the 24 gigahertz band for 5G services. Commerce, which is the parent department of the National Oceanic and Atmospheric Administration, and

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NASA have argued that allowing use of that band for 5G services could create interference with satellite observations of water vapor used in weather forecasting.

Asked about potential interference at the hearing by Sen. John Thune (R-S.D.), former chairman of the committee, Pai referred to "one of our federal partners" who offered that study but only in the last month provided the source code. "In our view, the assumptions that undergird that study are fundamentally flawed," he said. That included not taking into account that 5G services will use beam-forming technologies rather than wider broadcasts to limit potential interference.

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> "We believe, ultimately, that we can have the best of both worlds. We can allocate the 24 gigahertz band for 5G and we can protect those very important passive weather sensors and other functionalities that other agencies and other parts of the government work on," he said.

Best of both worlds? The **Telecom Industry** won't even say that 5G is biologically or environmentally safe.

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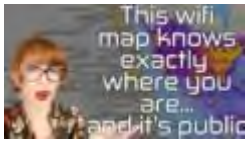

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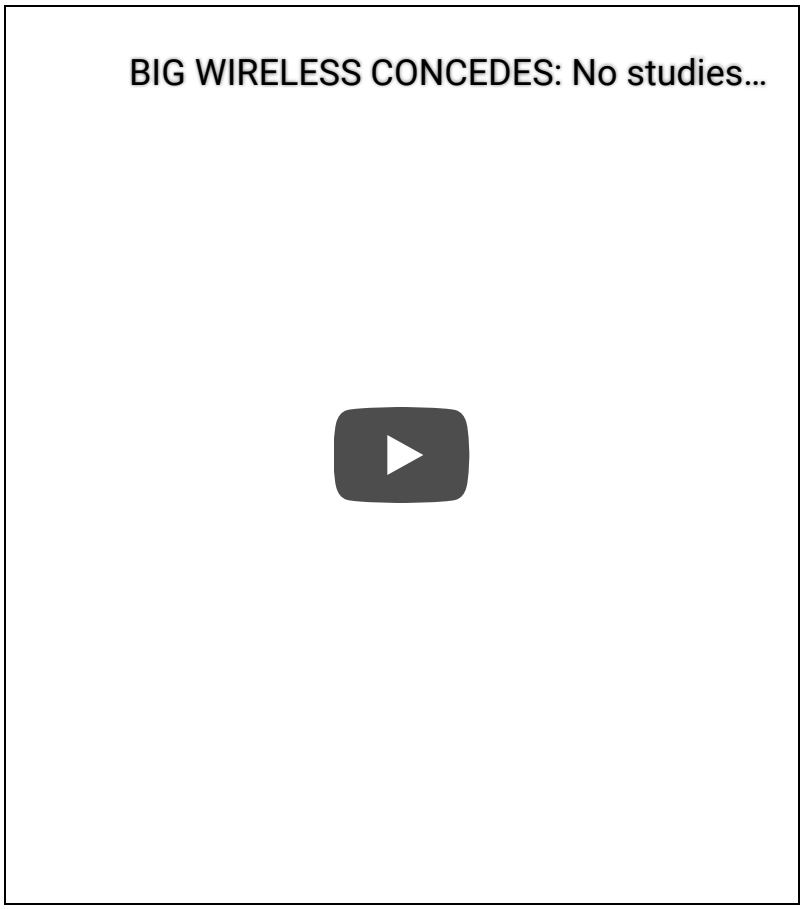

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Now back to the weather…

> Earlier in the hearing, Sen. Maria Cantwell (D-Wash.),
> the committee, brought up the interference issue. "Pe
> research has concluded that, without key vapor data t
> to actions on where spectrum has been allocated, this
> weather forecasting," she said in her opening remarks
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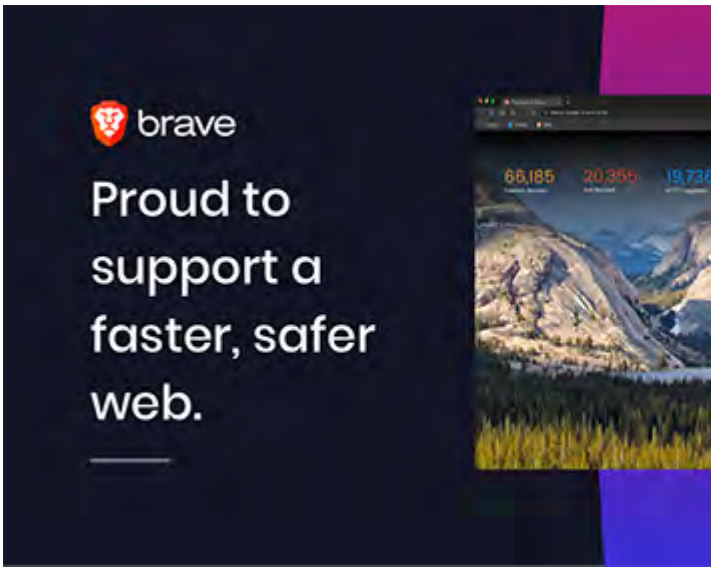
> 
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>
> Cantwell also discussed the potential 24 gigahertz int
> a May 14 hearing of the committee's space subcommi
> Administrator Jim Bridenstine and Kevin O'Connell, d
> of Space Commerce, about interference. Bridenstine a
> Secretary Wilbur Ross **had previously warned about**
> **letter to the FCC in February**.

Maybe certain FCC employees are willing to die to win the "Race for 5G" but an increasing number of Americans are not.

Activist Post regularly reports about 5G issues, warnings, and opposition as well as FCC lunacy (see **1**, **2**, **3**, **4**, **5**, **6**, **7**). Please **see our archives**.

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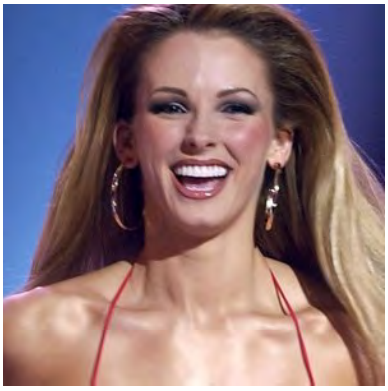

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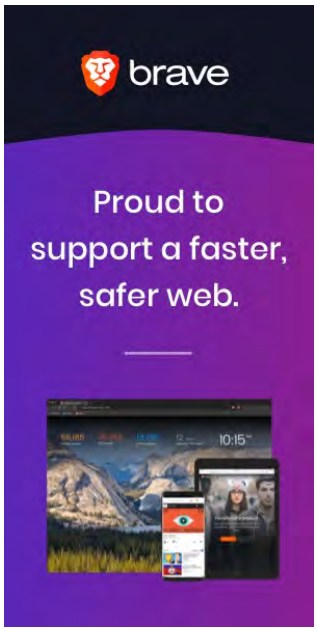

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By **B.N. Frank**

The New Yorker published an article yesterday – **"The Terrifying Potential of the 5G Network."**

In 2018, Robert Spalding's job as senior director for strategic planning at the National Security Council included studying ways to insure that 5G can be made secure from cyberattacks. He seemed more than qualified for the job. In his interview with *The New Yorker*, he provides intricate details of why we should all be freaking out over 5G regardless of who installs it. His warnings also go beyond cybersecurity risks:

> "What is existential to democracy is allowing totalitarian regimes—or any government—full knowledge of everything you do at all times," he said. "Because the tendency is always going to be to want to regulate how you think, how you act, what you do."

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More from Spalding:

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> "I wasn't looking at this from a policy perspective," he said. "It was about the physics, about what was possible."
>
> Even before the introduction of 5G networks, hackers have breached the control center of a municipal dam system, stopped an Internet-connected car as it travelled down an interstate, and sabotaged home appliances. Ransomware, malware, crypto-jacking, identity theft, and data breaches have become so common that more Americans are **afraid of cybercrime** than they are of becoming a victim of violent crime.

Uh-huh. This has been **reported many times** before by many sources.

> Adding more devices to the online universe is destined to create more opportunities for disruption. "5G is not just for refrigerators," Spalding said. "It's farm implements, it's airplanes, it's all kinds of different things that can actually kill people or that allow someone to reach into the network and direct those things to do what they want them to do. It's a completely different threat that we've never experienced before."

So the "Race for 5G" is for "*all kinds of different things that can actually kill people*" and Spalding isn't the only one to say so. Fabulous.

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> "It was meant to be a nationwide network," Spalding told me, not a nationalized one. "They could build this network and then sell bandwidth to their retail customers. That was one idea, but it was never that the government would own the network. It was always about, How do we get industry to actually secure the system?"

Many other articles and at least **one book** have been written about how the American government and **telecom regulators** seem to have no right to ask the Telecom Industry to do much of anything. Telecom expert, **Bruce Kushnick** has written A LOT about that.

Even before Spalding began working on his report, the telecom companies were rolling out what they were calling their new 5G services in test markets around the country.

Activist Post has reported about **5G "rollouts"** before. Many Americans have been **fighting this** in their communities. (See also **1**, **2, 3, 4, 5**, **6**, **7**, **8**, **9**, **10**)

Last summer, **New Yorkers** reported becoming sick after 5G was installed. Their pets were sick too. Some were putting their homes up for sale. Last year, the **first 5G court case was won** in England but not after it had been installed, people became sick, and some women delivered stillborn babies.

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> As the Clemson University professor Thomas Hazlett told me, "This is just the transitional part. You have various experiments, you do trial in the market, and various deployments take place that lay a pathway to something that will be truly distinguishable from the old systems."

It sounds like Professor Hazlett is saying that telecom companies are allowed to perform various experiments on the American people – regardless of the risks. Unfortunately, experiments on the American people aren't new and **the apologies** always seem to be too little, too late.

> In the meantime, the carriers jockeyed for position. A lawsuit brought by Sprint and T-Mobile, which was **settled** on Monday, claimed that A.T. & T.'s 5GE service, where "E" stands for "evolution," was just 4G by another name.

Just part of the experiment…

Spalding describes more greed-driven behavior by the Telecom Industry and Federal Communications Commission (FCC) chairman Ajit Pai, which seems to have led to Spalding being canned from his job. The "Race for 5G" then continued without his interference.

Huawei, a Chinese manufacturer, is currently the global leader in 5G technology and has been accused

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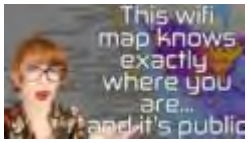

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