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September 10, 2024

**RE: Draft Proposed BEAD [Broadband Equity Access and Deployment]
Alternative Broadband Technology Guidance**

Submitted via email to: BEAD@NTIA.gov

Dear National Telecommunications and Information Administration,

On behalf of the Environmental Health Trust (EHT) these comments address the *Draft Proposed BEAD Alternative Broadband Technology Guidance* which seeks input on “*A BEAD Alternative Broadband Technology Policy Notice to provide Eligible Entities with additional guidance regarding the use of alternative technologies to serve unserved and underserved locations within their jurisdiction.*”¹ EHT will also apply to Appendix A.

The Environmental Health Trust (EHT) is a not-for-profit scientific think tank that promotes a healthier environment through research, education and policy. We work directly with policymakers, communities, and health and education professionals to bring awareness of environmental hazards and how to mitigate them.²

Summary

EHT shares the goal of the NTIA to ensure that every resident in the U.S. has access to robust, efficient, and sustainable broadband. As stated in the summary of the Draft Proposed BEAD Alternative Broadband Technology Guidance: “*The Infrastructure Act includes the Broadband Equity, Access, and Deployment (BEAD) Program, which provides \$42.45 billion of funding to achieve **reliable, affordable, and high-speed** Internet coverage throughout the United States.*” EHT submits that investments into low-earth-orbit (LEO)

¹ NTIA seeks comment from the public on this proposed guidance as well as the issues noted in Appendix A <https://www.ntia.gov/other-publication/2024/proposed-bead-alternative-broadband-technology-guidance>

Draft Proposed BEAD Alternative Broadband Technology Guidance

<https://www.ntia.gov/sites/default/files/publications/bead-alternative-broadband-technology-policy-notice-for-public-comment-final.pdf>

² www.EHTrust.org

satellite broadband service and unlicensed fixed wireless (ULFW) service is neither “reliable”, “affordable” nor “high-speed” and would be a huge waste of taxpayer dollars especially as user capacity and needs are increasing exponentially. These investments will perpetuate the digital divide, as LEO satellites and ULFW already do not keep up with average household and business broadband usage demands. Furthermore, it would be irresponsible for the government to continue to fund expansion of wireless networks when it has not done its due-diligence in addressing environmental and health impacts from cumulative exposure to radiofrequency (RF) radiation emitting from all wireless infrastructure.

In calculating Extremely High Cost per Location Thresholds (EHCPLT), NTIA and States must also add the following costs that are inherent in LEO satellites and ULFW technologies:

1. Costs to residents and businesses due to slow speeds, unreliable service, privacy and cybersecurity issues inherent in LEO satellite and ULFW technologies.
2. Costs due to impacts of addressing radiofrequency exposure to humans and the environment.
3. Costs due to satellite environmental impacts and governmental liability due to those impacts.

Outdated RF Regulations

The Federal Communications Commission (FCC) set human exposure limits for RFR in 1996 and has failed to update them. As stated, by the EPA, FDA, and Department of Interior, current FCC guidelines address heating effects of short-term exposures only,³ not from all biological impacts.⁴ Current FCC human exposure guidelines were based on now antiquated limits developed by [ANSI/IEEE C95.1-1992](#) and [NCRP’s 1986 Report](#). These limits identified the level of adverse effects [based on studies](#) which exposed a few monkeys and rats to RF radiation for less than one hour, more than 40 years ago. They do not consider the biological effects of non-thermal or long-term low-level exposures of radiofrequency

³ Guidelines of the FCC, ICNIRP and IEEE are based on protection for short term heating, not for long term exposures. In 1999, the FDA stated in its [Nomination](#) to the National Toxicology Program to study wireless radiation that, “As noted above, the existing exposure guidelines are based entirely on protection from acute injury from thermal effects of RF exposure, and may not be protective against any non-thermal effects of chronic exposures.” FDA Nomination from FDA’s Center for Device and Radiological Health Radio Frequency Radiation Emissions of Wireless Communication Devices (CDRH) May 19, 1999 https://ntp.niehs.nih.gov/sites/default/files/ntp/htdocs/chem_background/exsumpdf/wireless051999_508.pdf; EPA’s Norbert Hankin [clarified that the FCC’s 1996 RF limits do not protect against all effects](#) stating that, “federal health and safety agencies have not yet developed policies concerning possible risk from long-term, nonthermal exposures” in a 2002 letter <https://ehtrust.org/wp-content/uploads/4c0f61dc30c3d6bb27d90f53a57c616e.pdf> [George Brozowski Regional Health Physicist of the EPA’s 2014](#) letter stated, “The standards are intended to prevent adverse health effects that may be associated with tissue heating, but are not intended to address low intensity (non-thermal), long-term (chronic) exposures. Investigation as to whether there may be effects from exposures too low to cause heating is continuing.” The [US Department of the Interior](#) stated in a 2014 letter to the NTIA 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.”

⁴ Lin, J. C. (2023). [Incongruities in recently revised radiofrequency exposure guidelines and standards](#). Environmental Research, 222, 115369; International Commission on the Biological Effects of Electromagnetic Fields (ICBE-EMF), (2022). [Scientific evidence invalidates health assumptions underlying the FCC and ICNIRP exposure limit determinations for radiofrequency radiation: implications for 5G](#). Environ Health. Oct 18;21(1):92; Lopez I, Rivera M, Feliz N, Maestu C. (2022) [It is mandatory to review environmental radiofrequency electromagnetic field measurement protocols and exposure regulations: An opinion article](#). Front. Public Health, 24 October; Davis, D., Birnbaum, L., Ben-Ishai, P., Taylor, H., Sears, M., Butler, T., & Scarato, T. (2023). [Wireless technologies, non-ionizing electromagnetic fields and children: Identifying and reducing health risks](#). Current Problems in Pediatric and Adolescent Health Care, 53(2), 101374.

radiation documented in the scientific literature.⁵ Current guidelines also do not consider the documented effects of radiofrequency modulations and pulsation on living cells.⁶

In 2019, the FCC decided its 1996 limits did not need to be changed.⁷ EHT challenged the FCC's decision by bringing suit in the U.S. Circuit Court of Appeals for the District of Columbia in *Environmental Health Trust et al. v. FCC, 2021*.⁸ The court found that the FCC had failed to take into account scientific findings documenting impacts of radiofrequency radiation on children and on wildlife that had been submitted to the record, and *remanded* further action to the FCC. In addition, the Court noted that the FCC had **not** shown consideration of record evidence regarding long-term impacts on public health, testimony of those injured, the environment nor the ubiquity of wireless devices and other major technological changes since the 1996 RFR exposure guidelines (in use today) were first promulgated. **To date, the FCC has not taken action on the 2021 court order.**

Satellites Lack of Government Oversight

In 1986, FCC determined that, “based upon the Commission’s experience,” its authorizations and licensing of satellites were categorically excluded under the National Environmental Policy Act,⁹ although the FCC has provided no justification for maintaining this exclusion despite evidence of significant environmental effects of individual and cumulative satellite deployments.¹⁰ In 2022, GAO recommended that FCC justify its NEPA categorical exclusion; **to this date the FCC has not yet complied.**¹¹

Cell Phone and Device RF Regulations are Inadequate in the U.S.

Currently, the public is largely unaware that there are warnings buried in every cell phone and most devices to keep them at a specific minimum distance away from the user’s body. Wireless networks and devices are not properly measured to ascertain if existing exposure levels are being violated. On April 22, 2024, EHT published results from a Freedom of Information Act (FOIA) request revealing FCC’s own Human RF Exposure guidelines were exceeded for certain cell phones when they were within 2 mm of the user’s

⁵ International Commission on the Biological Effects of Electromagnetic Fields (ICBE-EMF), (2022), [Scientific evidence invalidates health assumptions underlying the FCC and ICNIRP exposure limit determinations for radiofrequency radiation: implications for 5G](#), Environ Health. Oct 18;21(1):92.

⁶ Lai, H., & Levitt, B. B. (2022). [The roles of intensity, exposure duration, and modulation on the biological effects of radiofrequency radiation and exposure guidelines](#). *Electromagnetic Biology and Medicine*, 41(2), 230–255.

⁷ Federal Communications Commission FCC 19-126 <https://docs.fcc.gov/public/attachments/FCC-19-126A1.pdf>

⁸ [Final Court Decision EHT et. al v. the FCC](#) 8/13/2021

[https://www.cadc.uscourts.gov/internet/opinions.nsf/FB976465BF00F8BD85258730004EFDF7/\\$file/20-1025-1910_111.pdf](https://www.cadc.uscourts.gov/internet/opinions.nsf/FB976465BF00F8BD85258730004EFDF7/$file/20-1025-1910_111.pdf)

⁹ Federal Register at page 14999

<https://www.govinfo.gov/content/pkg/FR-1986-04-22/pdf/FR-1986-04-22.pdf>

¹⁰ *The Balance Group v. FCC* (opening brief, DC Circuit, 2020), page 29 https://www.thebalancegroup.net/uploads/7/0/4/2/7042138/viasat.bg_-_opening_brief.pdf

¹¹ GAO noted that “because large constellations of satellites did not exist [in 1986], FCC’s experience up to that point would not have involved the consideration of this technology.” Satellite Licensing: FCC Should Reexamine Its Environmental Review Process for Large Constellations of Satellites (November 2022) <https://www.gao.gov/products/gao-23-105005>

skin.¹² These **cell phone safety guideline exceedances were never made public by the FCC despite the fact that the majority of the population uses and stores cell phones in body contact positions.**

Several municipalities created ordinances to bring awareness to consumers regarding these fine print warnings but they were sued by the cell phone industry. Instead of supporting municipalities in their public health initiatives the **FCC defends the cell phone industry against these lawsuits.**¹³

Other Regulatory Gaps

At this time the US government does not monitor rising levels nor ensure compliance in any meaningful way related to RF radiation. Research shows that the environmental levels of RFR, that people are exposed to, have increased with the densification of cell tower networks closer to where people live, work and play and levels are highest in urban areas.¹⁴ As an example, a 2018 multi-country study found ambient RF measurements in Los Angeles, California are now 70 times higher than levels measured in the City in the late '70s, as part of a twelve city study by the FCC and EPA.¹⁵

No federal agency with health or science expertise has evaluated the comprehensive body of scientific research on the human health and environmental impacts of long-term exposure to wireless radiation. Yet an ever-growing body of scientific evidence documents adverse effects from RFR at exposure levels well below the FCC limits.¹⁶ [Attachment 3](#) and [Attachment 4](#) below document some of this evidence.

Neither FCC, nor the Food and Drug Administration (FDA), have met their responsibilities to ensure public health and environmental protection. As documented in [Attachment 2 on Regulatory Gaps](#), there are no federal agencies, and none with health and science expertise, engaged in activities related to reviewing the

¹² See: [Environmental Health Trust FOIA Project - Environmental Health Trust \(ehtrust.org\)](#)

¹³ **FCC Supports Mobile Industry In RF Emissions Suit:** <https://www.law360.com/retail/articles/1286019/fcc-supports-mobile-industry-in-rf-emissions-suit>

Supes back posting of cell phone emission levels

<https://www.sfgate.com/news/article/Supes-back-posting-of-cell-phone-emission-levels-3185404.php>

¹⁴ Brown, R. (2022). [Assessment of radiofrequency radiation intensity on 35 Main Streets throughout Pennsylvania, USA during the fall of 2021](#). *American Journal of Multidisciplinary Research & Review*, 1(4), 8-20; Mazloum, T., Aerts, S., Joseph, W., & Wiart, J. (2019). [RF-EMF exposure induced by mobile phones operating in LTE small cells in two different urban cities](#). *Annals of Telecommunications*, 74(1), 35–42.; Koppel, T., Ahonen, M., Carlberg, M., Hedendahl, L. K., & Hardell, L. (2019). [Radiofrequency radiation from nearby mobile phone base stations-a case comparison of one low and one high exposure apartment](#). *Oncology Letters*, 18(5), 5383–5391; Koppel, T., & Hardell, L. (2022). [Measurements of radiofrequency electromagnetic fields, including 5G, in the city of Columbia, SC, USA](#). *World Academy of Sciences Journal*, 4(3), 1–12.; El-Hajj, A. M., & Naous, T. (2020). [Radiation Analysis in a Gradual 5G Network Deployment Strategy](#). *2020 IEEE 3rd 5G World Forum (5GWF)*, 448–453.; Boussad Y, Chen XL, Legout A, Chaintreau A, Dabbous W. (2022) [Longitudinal study of exposure to radio frequencies at population scale](#). *Environ Int*.Apr;162:107144

¹⁵ Sagar, S. et al. (2018). [Comparison of radiofrequency electromagnetic field exposure levels in different everyday microenvironments in an international context](#). *Environment International*, Volume 114, 297-306.

¹⁶ Belpomme, D., Hardell, L., Belyaev, I., Burgio, E., & Carpenter, D. O. (2018). [Thermal and non-thermal health effects of low intensity non-ionizing radiation: An international perspective](#). *Environmental Pollution*, 242, 643–658; McCredden, J. E., Cook, N., Weller, S., & Leach, V. (2022). [Wireless technology is an environmental stressor requiring new understanding and approaches in health care](#). *Frontiers in Public Health*, 10; Miller, A. B., Morgan, L. L., Udasin, I., & Davis, D. L. (2018). [Cancer epidemiology update, following the 2011 IARC evaluation of radiofrequency electromagnetic fields \(Monograph 102\)](#). *Environmental Research*, 167, 673–683.

science on health effects of rising environmental RF levels from network infrastructure.

Furthermore, other countries are objectively [measuring](#) RF radiation in their populated areas, and making that real-time information available to the public, regulators and researchers. No such exposure monitoring is being conducted in the United States.

Outline of EHT’s Recommendations

See details and documentation for each recommendation in linked pages.

[Recommendation 1](#): Instead of LEO satellite and ULFW services, NTIA should encourage using existing copper connections to bring broadband access to EHCPLT locations until proper funding is available for fiber or cable to the premises.¹⁷

[Recommendation 2](#): In determining Extremely High Cost per Location Threshold, costs that are inherent in deploying LEO satellite and ULFW services need to be accounted for. These costs include poor performance costs, environmental and health costs, and costs for government liability. NTIA must also consider the macroeconomic costs of lagging behind other countries.

Regulatory gaps that must be addressed prior to government funding of more wireless infrastructure:

[Recommendation 3](#): Ensure that proper NEPA reviews are being conducted on infrastructure emitting radio frequency radiation that considers impacts of RF exposures and structural impacts.

[Recommendation 4](#): Ensure that a comprehensive government registry of all wireless transmitting infrastructure (including commercial, government and private projects) is maintained. This database must include not just macro towers but also 4G and 5G “small cell” facilities, satellite infrastructure, fixed wireless, and rooftop mounted base station network antennas. This database must be transparently posted online and easy to navigate.

[Recommendation 5](#): Ensure the measuring, monitoring and mapping of RF levels throughout the United States.

[Recommendation 6](#): Ensure enforcement of radiofrequency radiation exposure guidelines.

¹⁷ Researchers at Cambridge University's prestigious Cavendish Laboratory, together with a researcher from British Telecom labs, wrote that DSL over copper infrastructure already "can achieve data rates up to 2 Gbps", that an emerging standard can achieve 10 Gbps, and future technologies will exceed 10 Gbps. For comparison, 2 Gbps of 20 Mbps is already 100x faster than the minimum upload speed allowable under BEAD.

Dinc, E., Bukhari, S.S., Rawi, A.A. et al. Investigating the upper bound of high-frequency electromagnetic waves on unshielded twisted copper pairs. Nature Communications 13, 2164 (2022). <https://www.nature.com/articles/s41467-022-29631-8>
<https://ieeexplore.ieee.org/document/8808153>

[Recommendation 7](#): Ensure that the agencies with expertise are engaged in ongoing research and literature monitoring related to biological impacts in real world environmental exposures.

[Recommendation 8](#): Re-establish electromagnetic field programs that ensure health and environmental safety that would motivate the industry to “compete on safety” such as the Environmental Protection Agency Programs that were conducted in the past and similar to programs that are run by dozens of countries around the world.

[Recommendation 9](#): The proper health and environmental agencies should conduct hazard evaluations and risk assessment on FCC RFR exposure limits and update them accordingly.

[Recommendation 10](#): The proper health and environmental agency do health and environmental surveillance to quantify adverse effects on humans and wildlife associated with the cumulative radiofrequency environmental exposures and specifically quantify disproportionate impacts of RFR exposures to communities seeking environmental justice

[Recommendation 11](#): Ensure government accommodates and provides a mechanism for compensation to individuals who are being harmed by RFR exposure

[Recommendation 12](#): Launch government education programs on the impacts of RF exposure to humans, especially children, pregnant women, the sick and the elderly, and ways to mitigate these impacts.

[Recommendation 13](#): EPA should, under Section 112 in the Clean Air Act, specifically include all wireless and cell tower radiofrequency radiation as a pollutant

See the following Attachments for more details:

[ATTACHMENT 1](#): Detail on EHT Recommendations

[ATTACHMENT 2](#): Today’s Regulatory Gap Regarding Radiofrequency Bioeffects

[ATTACHMENT 3](#): Radio-frequency Radiation Impacts on the Environment

[ATTACHMENT 4](#): Radio-frequency Radiation Impacts on Human Health

[ATTACHMENT 5](#): Legal and Liability Issues of Wireless

[ATTACHMENT 6](#): Recommendations from Other Expert Organizations on Technology Safety

[ATTACHMENT 7](#): Satellite Environmental Effects Fact Sheet

We are happy to provide the NTIA with more information and resources.

Sincerely,



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Environmental Health Trust
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cc: Kent Chamberlin, President, EHT
Joseph M. Sandri, General Counsel & VP Legal Affairs

ATTACHMENT 1: Detail on EHT Recommendations

Recommendation 1: Instead of LEO satellite and ULFW technologies, NTIA leverage current copper connections to bring broadband access to EHCPLT locations until proper funding is available for fiber or cable to the premises.

Copper wiring can be used to “surpass present-day demand for broadband speeds in excess of several hundred Mb/s per end user.”¹⁸ NTIA can encourage BEAD recipients to leverage current copper infrastructure to achieve broadband connectivity to EHCPLT locations until proper funding can be allocated for fiber or cable infrastructure to the premise.

Recommendation 2: In determining Extremely High Cost per Location Threshold, costs that are inherent in deploying LEO satellite and ULFW services need to be accounted for. These costs include poor performance costs, environmental and health costs, and costs for government liability. NTIA must also consider the macroeconomic costs of lagging behind other countries.

LEO and ULFW Performance Costs

While wireless infrastructure promises faster and cheaper deployment, it ends up being costlier in the long run to maintain and upgrade.¹⁹ The poor performance metrics²⁰ of wireless infrastructure cost our country billions of dollars when residents and businesses are held up by unreliable service, low speeds, and issues with cybersecurity²¹ and privacy inherent in LEO satellite and ULFW services. Furthermore, wireless infrastructure fails during inclement weather or when the path of the signal is obstructed.²² Costs to residents and businesses when they have poor performing broadband needs to be considered in the metrics of determining EHCPLT.

Competition With Other Countries Costs

Other countries have recognized the importance of fiber optics all the way to the premises and have invested heavily to reach 100% penetration, ensuring that even rural communities with unfavorable terrain have fiber.²³ As of 2019, 92% of China’s internet users had fiber all the way to the home.²⁴ 62%

¹⁸ J. Maes, R. Strobel, A. A. Rawi and M. Ben-Ghorbel, "High-Speed Copper and Coaxial Broadband," in IEEE Communications Magazine, vol. 57, no. 8, pp. 12-12, August 2019, doi: 10.1109/MCOM.2019.8808153.

<https://ieeexplore.ieee.org/document/8808153>

¹⁹ <https://www.benton.org/sites/default/files/FixedWireless.pdf>

²⁰ <https://worldbroadbandassociation.com/greaterbroadbandinvestment/>

²¹ <https://www.sdxcentral.com/articles/news/att-sounds-alarm-on-5g-security/2019/11/>

²² <https://www.benton.org/sites/default/files/FixedWireless.pdf>

²³ Plan to Connect Iceland’s Rural Settlements with Fibre-Optics

<https://www.icelandreview.com/news/plan-to-connect-icelands-rural-settlements-with-fibre-optics/>

Iceland’s fibre optic plans to close rural connectivity gaps by 2026

<https://www.rcinet.ca/eye-on-the-arctic/2024/07/02/icelands-fiber-optic-plans-to-close-rural-connectivity-gaps-by-2026/#:~:text=Iceland's%20Minister%20of%20Universities%2C%20Industry,same%20connectivity%20as%20urban%20centers.>

²⁴ <https://www.pnnewswire.com/news-releases/2020-chinese-ftth-deployments-state-of-the-chinese-fiber-broadband-n>

of homes in the European Union 39 bloc nations have fiber to the premises.²⁵ United Arab Emirates, Qatar, Singapore and Hong Kong all have higher than 90% penetration of fiber all the way to the premises while Iceland, Spain and Portugal are catching up at 76.8%, 73.5% and 71.1% respectively.²⁶ The US, on the other hand, stands at 16.39% penetration of Fiber to the Premises and ranked 30th among Organization for Economic Co-operation and Development countries, as of 2020.²⁷ While the U.S. is making progress in closing this gap through BEAD-fiber-to-the-home funding, U.S. cannot afford to spend more money on infrastructure that is becoming obsolete as it is being rolled out in EHCPLT communities. The cost of not being competitive with other countries needs to be considered in the metrics of determining EHCPLT.

Environmental Costs

Satellite operators plan to launch over one million satellites globally in the coming years.²⁸ By comparison, in 2018, prior to the recent wave of expansion, just over 1,300 satellites were active from all previous history.²⁹ In the US alone, the FCC has received 70,000 applications since 2016 and granted approximately 10,000.³⁰ With a lifespan of only five years per satellite,³¹ the US is on a path to launching 14,000 satellites per year, just to maintain US- licensed networks.

No federal agency has conducted a comprehensive review of the current body of science on the health and environmental impacts of wireless radiofrequency (RF) radiation,³² despite significant evidence of serious biological harm.³³ The US Court of Appeals for the DC Circuit has twice ruled the FCC failed to address environmental effects of its actions.³⁴

Environmental and other impacts include:

- Increases radiofrequency (RF) radiation across the entire planet.³⁵
- Releases chemical and particulate emissions from satellite launches, which may affect climate and the ozone layer.³⁶

[etwork-regional-comparison-competitive-landscape-analysis-of-the-fiber-optical-network-value-chain-301059551.html](#)

²⁵ <https://www.lightwaveonline.com/fttx/ftth-b/article/14292814/ftth-passes-more-than-62-of-eu39-households-ftth-council-europe>

²⁶ <https://www.ftthcouncil.eu/knowledge-centre/all-publications-and-assets/1710/ftth-b-global-ranking-2023>

²⁷ <https://www.statista.com/statistics/604623/share-of-fibre-connections-in-broadband-oecd/#statisticContainer>

²⁸ One million (paper) satellites, *Science* 2023 <https://www.science.org/doi/10.1126/science.adi4639>

²⁹ Union of Concerned Scientists Satellite Database <https://www.ucsusa.org/resources/satellite-database> As of Nov. 7, 2022, only 14,450 satellites had been launched in all of human history, with 6,800 currently active according to the European Space Agency (ESA). <https://www.space.com/spacex-starlink-satellites.html>

³⁰ <https://www.osstp.org/fcc-analysis>

³¹ <https://www.space.com/spacex-starlink-satellites.html>

³² <https://ehtrust.org/wp-content/uploads/5G-and-Cell-Tower-Radiation-Briefing-1.pdf>

³³ <https://ehtrust.org/science/top-experimental-epidemiological-studies/>

³⁴ *Environmental Health Trust v. FCC* (DC Circuit, 2021) [https://www.cadc.uscourts.gov/internet/opinions.nsf/FB976465BF00F8BD85258730004EFDF7/\\$file/20-1025-1910111.pdf](https://www.cadc.uscourts.gov/internet/opinions.nsf/FB976465BF00F8BD85258730004EFDF7/$file/20-1025-1910111.pdf)

Keetoowah Band of Cherokee Indians v. FCC (DC Circuit, 2019) [https://www.cadc.uscourts.gov/internet/opinions.NSF/4001BED4E8A6A29685258451005085C7/\\$file/18-1129-1801375.pdf](https://www.cadc.uscourts.gov/internet/opinions.NSF/4001BED4E8A6A29685258451005085C7/$file/18-1129-1801375.pdf)

³⁵ Global coverage map: <https://orbitalindex.com/feature/starlink-coverage/>

³⁶ Large Constellations of Satellites: Mitigating Environmental and Other Effects (September 2022)

<https://www.gao.gov/products/gao-22-105166>

- Spreads alumina³⁷ and other toxic metals³⁸ upon reentry, as each satellite eventually falls to earth and disintegrates.
- Increases risk of orbital debris, which is a growing threat to space infrastructure, as documented by GAO and others.³⁹
- Increases light and radio pollution from satellites, which adversely impacts astronomy and dark skies.⁴⁰
- Increases RF radiation on farms despite known harms to plants,⁴¹ birds, animals, and insects⁴² (particularly pollinators and bees⁴³), and despite zero assessment of the harms from this radiation to the threat to farm yields.⁴⁴
- Further, studies have found impacts to [tree canopy](#), [plant growth](#), [pollinator health](#) and the [orientation, migration and breeding of wildlife](#).⁴⁵
- Creates liability for US taxpayers under international law, as the FCC has not required satellite companies to bear this liability.⁴⁶

Environmental and liability costs need to be considered for LEO satellite and ULFW services in determining EHCPLT.

Health Costs

Individuals have testified before local and state governments that they are severely limited in their

³⁷ *The Balance Group v. FCC* (opening brief, DC Circuit, 2020), page 29 https://www.thebalancegroup.net/uploads/7/0/4/2/7042138/viasat.bg_-_opening_brief.pdf

³⁸ NOAA scientists link exotic metal particles in the upper atmosphere to rockets, satellites <https://research.noaa.gov/2023/10/16/noaa-scientists-link-exotic-metal-particles-in-the-upper-atmosphere-to-rockets-satellites/>

³⁹ 3 Large Constellations of Satellites: Mitigating Environmental and Other Effects (September 2022)

<https://www.gao.gov/products/gao-22-105166>

<https://www.space.com/starlink-satellite-conjunction-increase-threatens-space-sustainability>; See S. 447, currently pending, which seeks to mitigate orbital debris.

Statement of FCC Chairwoman Jessica Rosenworcel on *Mitigation of Orbital Debris in the New Space Age*, IB Docket No. 18-313 <https://docs.fcc.gov/public/attachments/FCC-24-6A2.pdf>

⁴⁰ *International Dark Sky Association v. FCC* (2022) <https://darksky.org/news/ida-appeals-fcc-approval-of-spacex-gen2-satellite-constellation/>

See also, Astronomer makes prediction on satellite pollution, *CNN*, June 11, 2022

<https://www.cnn.com/videos/world/2022/06/11/satellite-pollution-threatens-night-sky-fisher-pkg-ndwkd-vpx.cnn>

⁴¹ <https://ehtrust.org/electromagnetic-fields-impact-tree-plant-growth/>

⁴² <https://ehtrust.org/environmental-effects-of-wireless-radiation-and-electromagnetic-fields/>

⁴³ <https://ehtrust.org/published-research-adverse-effect-wireless-technology-electromagnetic-radiation-bees/>

⁴⁴ <https://ehtrust.org/radiofrequency-radiation-effects-on-agronomy-agricultural-crops-and-crop-yields>

⁴⁵ Levitt, B. B., Lai, H. C., & Manville, A. M. (2022b). [Effects of non-ionizing electromagnetic fields on flora and fauna, Part 2 impacts: How species interact with natural and man-made EMF](#). *Reviews on Environmental Health*, 37(3), 327–406; Thill A, Cammaerts MC, Balmori A. [Biological effects of electromagnetic fields on insects: a systematic review and meta-analysis](#). *Rev Environ Health*. 2023 Nov 23

⁴⁶ In 2018, the FCC recognized that under international treaties the US government is liable for damages that US satellites cause abroad, including falling debris. See paragraphs 76-80. <https://www.fcc.gov/document/fcc-launches-review-rules-mitigate-orbital-space-debris-0>

In 2020, the FCC decided not to require satellite companies to carry insurance (paragraph 135). FCC has not required satellite companies to indemnify the US government (paragraph 136) for liability (paragraph 177), and acknowledged that: “[T]hose costs would be borne by U.S. taxpayers.” (paragraph 178) <https://www.fcc.gov/document/fcc-updates-orbital-debris-mitigation-rules-new-space-age-0>

participation in society as a result of electromagnetic sensitivity (EMS) or microwave illness.⁴⁷ Electromagnetic sensitivity (EMS) is a condition resulting in a diverse array of adverse health symptoms in some individuals exposed to wireless radiation.⁴⁸ This disability is reported in the medical literature⁴⁹ and sometimes also referred to as electromagnetic hypersensitivity (EHS) or microwave sickness. Symptoms include serious impacts to the neurological, cardiovascular, reproductive and/or immune systems.⁵⁰ Symptoms can generally disappear in the absence of exposure.

⁴⁷ Example of individuals who have testified before government regarding their EMS symptoms:

www.youtube.com/watch?v=OgNLR9fQOX4.

<https://ehtrust.org/wp-content/uploads/Hank-Allen-Idaho-Complaint-as-filed-12-12-23.pdf>

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⁴⁸ Thoradit T, Chabi M, Aguida B, Baouz S, Stierle V, Pooam M, Tousaints S, Akpovi CD, Ahmad M. [Hypersensitivity to man-made electromagnetic fields \(EHS\) correlates with immune responsiveness to oxidative stress: a case report](#). *Commun Integr Biol*. 2024 Aug 4;17(1):2384874. doi: 10.1080/19420889.2024.2384874. PMID: 39108419; PMCID: PMC11302546.

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⁴⁹ Belpomme D, Irigaray P. (2023). [Combined Neurological Syndrome in Electrohypersensitivity and Multiple Chemical Sensitivity: A Clinical Study of 2018 Cases](#). *Journal of Clinical Medicine*, 12(23), 7421.

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⁵⁰ Heuser, G., & Heuser, S. A. (2017). [Functional brain MRI in patients complaining of electrohypersensitivity after long term exposure to electromagnetic fields](#). *Reviews on Environmental Health*, 32(3), 291–299.

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Multiple government entities on the Federal, State and Local levels have recognized EMS as a disability that needs to be accommodated,⁵¹ however no such accommodations are being offered in any broadband infrastructure installation programs, government funded or otherwise.

The draft proposed BEAD guidance would increase ambient levels of environmental radiation in some of the last refuges for EMS disabled persons. The draft guidance makes no provision nor any consideration for their plight or the environmental injustice suffered by this vulnerable population.⁵²

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⁵¹ Many federal agencies have recognized EMS and the need for accommodations

In 2000 the US Architectural and Transportation Barriers Compliance Board recognized the need for special Housing for People Disabled by EMS. [letter](#)

In 2002 the [US Access Board](#) - recognized that EMS can be considered a disability under the ADA

In 2003 and again in 2020 the [Social Security Administration recognized Electromagnetic Sensitivity as a Severe Impairment](#) and awarded benefits

In 2005 the [National Institute of Building Sciences \(NIBS\) Indoor Environmental Quality \(IEQ\) published a Report](#) on how to accommodate EMS disabled individuals IN federally funded buildings

In 2022 [the National Council on Disability: Health Equity Framework](#):

Provided mandatory industry guidance, policies, training and best practices, to address the needs of people with EMS.

The Job Accommodations Network also issued [a list of guidelines](#) to accommodate people disabled by EMS

Just recently in 2024 the Department of Health and Human Services, rules on Nondiscrimination on the Basis of Disability in Programs and Activities Receiving Federal Financial Assistance [45 CFR Part 84](#) recognized EMS can be a disability needing ADA accommodations.

Several states including the states of [Alabama](#), [Colorado](#), [Connecticut](#) and [Florida](#), some Counties and Cities have issued proclamations OR official statements proclaiming the month of May as Electromagnetic Sensitivity Month.

⁵² The Prevalence of People With Restricted Access to Work in Man-Made Electromagnetic Environments

Despite these issues, wireless technologies are often put forward as the solution to bridge the digital divide and connect the unconnected. Thus, vulnerable populations often end up receiving significantly increased exposure to RFR, an emerging environmental justice issue.

Because of FCC wireless infrastructure preemption orders, cell antennas are being put up in front of homes/apartments and residents are not being notified nor are they a part of the decision-making process. Individuals with EMS are given no option but to live in an environment that makes them sick or move out of their homes.⁵³ In vulnerable and lower income communities, moving away from the exposure source is much more challenging.

Most people will not feel the effects of radiofrequency radiation but an ever growing body of scientific evidence documents adverse effects from RFR at exposure levels well below FCC limits⁵⁴ with research findings that include [cancer](#)⁵⁵, the induction of [oxidative stress](#), [epigenetic effects](#), impacts to [neurotransmitters](#), [memory](#), [brain development](#) and damage to the [immune](#), [endocrine](#), [hematological](#) and [reproductive systems](#).⁵⁶ Yet no government agency is monitoring exposure levels and regulating it.

<https://www.omegaonline.org/article-details/The-Prevalence-of-People-With-Restricted-Access-to-Work-in-Man-Made-Electromagnetic-Environments/2402>

⁵³ Hardell L. and Nilsson M. (2023). Case Report: [Summary of seven Swedish case reports on the microwave syndrome associated with 5G radiofrequency radiation](#). *Reviews on Environmental Health*, 2024.

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⁵⁴ Belpomme, D., Hardell, L., Belyaev, I., Burgio, E., & Carpenter, D. O. (2018). Thermal and non-thermal health effects of low intensity non-ionizing radiation: An international perspective. *Environmental Pollution*, 242, 643–658; McCredden, J. E., Cook, N., Weller, S., & Leach, V. (2022). Wireless technology is an environmental stressor requiring new understanding and approaches in health care. *Frontiers in Public Health*, 10; Miller, A. B., Morgan, L. L., Udasin, I., & Davis, D. L. (2018). Cancer epidemiology update, following the 2011 IARC evaluation of radiofrequency electromagnetic fields (Monograph 102). *Environmental Research*, 167, 673–683.

⁵⁵ “Cell Phone Radio Frequency Radiation.” National Institute of Environmental Health Sciences, U.S. Department of Health and Human Services, 13 Feb. 2024, ntp.niehs.nih.gov/whatwestudy/topics/cellphones.

⁵⁶ Panagopoulos, D. J., Karabarbounis, A., Yakymenko, I., & Chrousos, G. P. (2021). Human-made electromagnetic fields: Ion forced-oscillation and voltage-gated ion channel dysfunction, oxidative stress and DNA damage (Review). *International Journal of Oncology*, 59(5), 92; McCredden, J. E., Cook, N., Weller, S., & Leach, V. (2022). Wireless technology is an environmental stressor requiring new understanding and approaches in health care. *Frontiers in Public Health*, 10; Davis, D., Birbaum, L., Ben-Ishai, P., Taylor, H., Sears, M., Butler, T., & Scarato, T. (2023). Wireless technologies, non-ionizing electromagnetic fields and

Choosing wired broadband over wireless can eliminate or greatly reduce RFR exposures to people and the environment. Health costs need to be considered for LEO satellite and ULFW services in determining EHCPLT.

Recommendation 3: Ensure that proper NEPA reviews are being conducted on infrastructure emitting radio frequency radiation that considers impacts of RF exposures and structural impacts.

Studies have found that environmental RF levels generated from RF emissions of cell towers, base station network antennas, satellites and other wireless networks have significantly increased over the last few decades, with higher levels in urban areas and in areas in closer proximity to wireless network antennas, especially in locations within the main beams of the antennas.⁵⁷

Yet, the FCC has never done an environmental impact statement on the individual or cumulative impacts of its spectrum auctions, which have raised \$233 billion to date, nor on the allocation of these proceeds to various programs to deploy wireless networks. The FCC has not considered those funding decisions under NEPA, and so have not considered them to be major federal actions. In 1986, the FCC categorically excluded most of its actions from NEPA review.⁵⁸

The FCC relies on licensees to measure emission levels and prepare environmental assessments (EA) if needed and self-report any exceedances or potential exceedances.⁵⁹ It is indisputable that NEPA is a federal obligation yet the FCC has delegated to the licensees and the carriers the determination of whether a Categorical Exclusion applies. Carriers have a due diligence checklist with different requirements to check off yet this document is never submitted to the FCC if the applicant determines that the facility is categorically excluded; the FCC has no records of carriers doing their due diligence. Only a review finding

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⁵⁷ Brown, R. (2022). [Assessment of radiofrequency radiation intensity on 35 Main Streets throughout Pennsylvania, USA during the fall of 2021](#). *American Journal of Multidisciplinary Research & Review*, 1(4), 8-20; Baltrėnas, P., Buckus, R., & Vasarevičius, S. (2012). [Research and evaluation of the intensity parameters of electromagnetic fields produced by mobile communication antennas](#). *Journal of Environmental Engineering and Landscape Management*, 20(4), 273–284; Bhatt, C. R., Redmayne, M., Billah, B., Abramson, M. J., & Benke, G. (2017). [Radiofrequency-electromagnetic field exposures in kindergarten children](#). *Journal of Exposure Science & Environmental Epidemiology*, 27(5), 497–504; Boussad Y, Chen XL, Legout A, Chaintreau A, Dabbous W. (2022) [Longitudinal study of exposure to radio frequencies at population scale](#). *Environ Int*. Apr;162:107144 ; Mazloum, T., Aerts, S., Joseph, W., & Wiart, J. (2019). [RF-EMF exposure induced by mobile phones operating in LTE small cells in two different urban cities](#). *Annals of Telecommunications*, 74(1), 35–42.; Urbinello, D., Joseph, W., Verloock, L., Martens, L., & Rössli, M. (2014). [Temporal trends of radio-frequency electromagnetic field \(RF-EMF\) exposure in everyday environments across European cities](#). *Environmental Research*, 134, 134–142.

⁵⁸ Federal Register at page 14999

<https://www.govinfo.gov/content/pkg/FR-1986-04-22/pdf/FR-1986-04-22.pdf>

47 CFR 1.1306

<https://www.ecfr.gov/current/title-47/section-1.1306>

⁵⁹ FCC Public Notice – April 27, 2000, Year 2000 Deadline For Compliance With Commission’s Regulations Regarding Human Exposure To Radiofrequency Emissions <https://www.federalregister.gov/documents/2000/05/05/00-11237/year-2000-deadline-for-compliance-with-commissions-regulations-regarding-human-exposure-to>

of a potentially significant environmental effect that triggers an Environmental Assessment (EA) gets submitted to the FCC. If nothing is triggered on the checklist, then the applicant starts building without the public having access to the checklist and measurements, and no ability to refute or comment on the project.

A recent industry report estimated that this new NTIA guidance could result in \$316 million of BEAD funding going to satellite and wireless deployments.⁶⁰ Given the potential for extensive environmental effects as a result of NTIA's funding for LEO satellites and ULFW, NTIA should treat the proposed guidance as a major federal action under NEPA and prepare an environmental impact statement (EIS). The EIS should take into account, without limitation, (a) the radiofrequency impacts to humans, wildlife and flora from cell towers, satellites and the accompanying terrestrial infrastructure that is reasonably likely to result from this guidance, (b) other environmental impacts from terrestrial infrastructure and satellites, many of which are described in this document, including, for example, impacts from rocket fuel during launches and the dispersion of toxic metals across the planet when satellites are decommissioned and reenter the atmosphere. The draft guidance helps enable satellite and/or terrestrial deployment across millions of acres of land in the United States.⁶¹ In addition, the 10-year time horizon for satellite infrastructure contemplated in the draft guidance, means that because each satellite only has a lifespan of 5 years,⁶² at least 2 generations of satellites will be launched and then burned up over the atmosphere.

EPA should work with NTIA and the FCC to ensure that adequate NEPA reviews are being conducted on proposals regarding satellite and other wireless infrastructure buildout with an analysis that includes health and environmental RFR related impacts, cumulative impacts, as well as structural and other impacts mentioned above. We recommend that the NTIA and FCC follow the same NEPA rules that other agencies have to follow in funded government programs. Further, full transparency is needed so that all environmental reviews are publicly posted and easily accessible.

Recommendation 4: Ensure that a comprehensive government registry of all wireless transmitting infrastructure (including commercial, government and private projects) is maintained. This database must include not just macro towers but also 4G and 5G “small cell” facilities, satellite infrastructure and rooftop mounted base station network antennas. This database must be transparently posted online and easy to navigate.

Currently, according to the FCC, “The FCC does not have a comprehensive, transmitter-specific database for all of the services it regulates. ... In some services, licenses are allowed to utilize additional transmitters or to increase power without notifying the FCC. Other services are licensed by geographic area, such that the FCC has no knowledge concerning the actual number or location of transmitters within that geographic

⁶⁰ Satellite broadband joins the party for BEAD: What you need to know. 8/27/24

<https://www.fierce-network.com/broadband/satellite-broadband-joins-party-bead-what-you-need-know>

⁶¹ The proposed guidance meets the definition of an MFA under [40 CFR 1508.1\(w\)](#) for multiple reasons, including without limitation, under subparagraph (1)(ii), by issuing an interpretation of policy, (1)(iv) as part of a concerted action that would implement satellite service, and (1)(vi) by "providing more than a minimal amount of financial assistance.. [for which NTIA] has authority to impose conditions on the receipt of the financial assistance to address environmental effects.”

⁶² <https://www.space.com/spacex-starlink-satellites.html>

area.”⁶³

To better understand exposure to the population, it is imperative that all base station network wireless antenna facilities including commercial, government and private projects, are registered in a comprehensive government database which is transparently posted online and easy to navigate.

Recommendation 5: Ensure the measuring, monitoring and mapping of RF levels throughout the United States.

Numerous countries regularly measure and map RF levels. These countries include [Qatar](#), [France](#), [Spain](#), [Austria](#), [Greece](#), [Turkey](#), [India](#), [Israel](#), [Gibraltar](#), [Brussels](#), [Belgium](#), [Switzerland](#), [Bulgaria](#), [Tunisia](#), [Malta](#), [Brazil](#), [Bahrain](#), [Monaco](#), [French Polynesia](#), [Bhutan](#), [Senegal](#). In contrast, here in the United States, the EPA released the last [report](#) on RFR measurements in 1986 .

According to the FCC, “The FCC does not have the resources or the personnel to routinely monitor the exposure levels at all of the thousands of transmitters that are subject to FCC jurisdiction. ... In addition, the FCC does not routinely perform RF exposure investigations unless there is a reasonable expectation that the FCC exposure limits may be exceeded.”⁶⁴

As stated in a 2020 GAO report⁶⁵, “Measuring RF exposure in observational studies is a challenge, but these types of studies are of interest in making policy relevant recommendations.” In addition to supporting informed policy decisions, measuring, monitoring and mapping RF levels would also benefit researchers to compare health outcomes of individuals with higher versus those with lower exposures. Continuous monitoring would benefit the public, especially sensitive populations like children, pregnant women, the sick, the elderly and those who have been harmed by RFR so they can manage their exposures. RF levels should also be monitored in wilderness, conservation and ecologically sensitive areas to protect wildlife and plants.

We ask that the NTIA to ensure EPA resume adequate data gathering regarding measuring, monitoring and mapping of RF levels nationwide. Information resulting from continuous RFR measurements is essential for the public, policymakers and scientists to study and make informed decisions.

Recommendation 6: Ensure enforcement for radiofrequency radiation exposure guidelines.

With no routine monitoring of RF exposure levels, people and the environment are at risk of exposures to RF levels that exceed current FCC guidelines. Currently, the government relies on the industry to measure

⁶³ FCC RF Safety FAQ <https://www.fcc.gov/engineering-technology/electromagnetic-compatibility-division/radio-frequency-safety/faq/rf-safety>

⁶⁴ FCC RF Safety FAQ <https://www.fcc.gov/engineering-technology/electromagnetic-compatibility-division/radio-frequency-safety/faq/rf-safety>

⁶⁵ United States Government Accountability Office Report on Technology Assessment, 5G Wireless, Capabilities and Challenges for an Evolving Network; November 2020. <https://www.gao.gov/assets/gao-21-26sp.pdf>

and police itself in conducting emission testing on their own wireless facilities. Further, FCC has no program to ensure wireless facilities are compliant regarding signage and other compliance issues.

The FCC has stated that, “There have been a few situations around the country where RF levels in publicly accessible areas have been found to be higher than those recommended in applicable safety standards.”⁶⁶ Yet, the FCC has no meaningful compliance or post market, post deployment surveillance program in place. Thus, current FCC activities are inadequate for towers, rooftop facilities and 4G/5G small cells. Some estimates purport up to 80% of rooftop sites are out of compliance.⁶⁷ 5G antenna systems that create beams of higher power and intensity have exacerbated both the lack of compliance and the risk. As a recent example, an RF study submitted to the FDA⁶⁸ utilizing RF measurements with professional grade calibrated spectrum management tools found RF exceedances. Measurements revealed that according to Crest Factor analysis, the emissions routinely spiked to 132-to-264% beyond the FCC Human RF exposure standard.

RF regulatory limit violations are likely endemic to rooftop installations nationwide as compliance violations have been documented for years, with minimal FCC enforcement.⁶⁹ In 2012, EMR Policy Institute filed 101 documented complaints⁷⁰ with the FCC regarding RF violations, and the FCC took no action, except for one incident against Verizon. A 2014 investigation by the Wall Street Journal “[Cellphone Boom Spurs Antenna-Safety Worries](#)”⁷¹ found “one in 10 sites violates the rules, according to six engineers who examined more than 5,000 sites during safety audits for carriers and local municipalities.”

Since then, FCC rules that have mandated automatic approvals for adding antennas at existing cell sites and “streamlined” placement of new 5G/4G facilities by preempting state and local authority, have resulted in massive antenna proliferation nationwide. Yet, no oversight is required to ensure compliance. As an example, 5G poles are constructed and permitted by local authorities with no requirement for yearly RF checks to ensure FCC compliance. Furthermore, when facilities are determined to be out of compliance and recommendations are made in RF compliance reports, there are no systems in place to verify that required actions were taken to bring a site into compliance.

Cell phone studies by the FCC, as well as Canadian and French governments, have found that cell phone RF levels exceed FCC’s human exposure limits when laboratory-tested in close proximity (in direct body

⁶⁶ FCC RF Safety FAQ <https://www.fcc.gov/engineering-technology/electromagnetic-compatibility-division/radio-frequency-safety/faq/rf-safety>

⁶⁷ Spectrum Cellular Management <https://spectrumcm.com/knowledge/> “SCM estimates that 80% of all cellular roofs are NOT FCC safety compliant. 5G is estimated to be 20X more powerful than 4G. All cellular landlords MUST be better insured, properly indemnified, FCC safety compliant, and accurately compensated for the liability landlords’ burden.”

⁶⁸ [Americans for Responsible Technology Petition for Imminent Hazard Rulemaking](#). Starting at page 225 with statement by Sally Jewell Coxe as well as the ATTACHMENT 1 RF Exposure Analysis: 2701 Connecticut Avenue, NW, Washington, DC Cardinal Communications, a Division of Thought Delivery Systems, Inc. for THE BALANCE GROUP.

⁶⁹ [Marv Wessell’s PPT](#) includes FCC slides used in an April 4, 2005 Enforcement Bureau that were presented at a Las Vegas IWCE trade show; the slide indicates several antennas out of compliance. No enforcement action was taken.

⁷⁰ [Wireless Industry Safety Failure Introduction](#)

⁷¹ “It’s like having a speed limit and no police,” said Marvin Wessel, an engineer who has audited more than 3,000 sites and found one in 10 out of compliance. [Cellphone Boom Spurs Antenna-Safety Worries Many Sites Violate Rules Aimed at Protecting Workers From Excessive Radio-Frequency Radiation](#) https://www.wsj.com/articles/cellphone-boom-spurs-antenna-safety-worries-1412293055?mod=WSJ_hpp_MIDDLE_Video_second

contact and/or with a 2 mm separation as in a tight pocket) usage positions.⁷² Yet the FCC has no post market compliance program in place to enforce RF guidelines for cell phones or personal devices as well as for base station antennas.

We recommend that the NTIA ensure an adequate oversight and enforcement program regarding radiofrequency radiation exposure guideline compliance.

Recommendation 7: Ensure that the proper agencies are engaged in ongoing research and literature monitoring related to biological impacts in real world environmental exposures.

Currently, there is no agency or agencies with funded activities to ensure the totality of research is reviewed to ensure public and environmental safety. Instead, programs are being closed down. As demonstrated in [Attachment 3](#) (Environmental impacts) and [Attachment 4](#) (Human health impacts), biological, health and environmental effects are well documented in the scientific literature. A large-scale [animal study](#) published in Environmental Research found that rats exposed to the same RF levels of cell tower emissions had elevated cancers, the very same cancers that were found in the [US National Toxicology Program \(NTP\) animal study](#) on cell phones that found “clear evidence” of cancer in carefully controlled conditions. Despite these findings, all NTP studies have now ceased⁷³.

Further, current RF exposure guidelines do not protect wildlife, insects, plants and trees, as FCC guidelines were developed for humans, not flora or fauna. A broad range of impacts to plants and animals are documented in an ever-growing base of research studies, yet no environmental agency has activities to review the science. See [Attachment 2 on the Regulatory Gap](#) and lack of federal agency activities.

Recommendation 8: Re-establish electromagnetic field programs that ensure health and environmental safety that would motivate the industry to “compete on safety” such as the Environmental Protection Agency Programs that were conducted in the past and similar to programs that are run by dozens of countries around the world.

In 2019, when the FCC issued its decision not to update its exposure limits, it interpreted the silence of federal agencies to mean agreement with the 1996 guidelines, stating in its [November 9, 2020 brief](#) that,

⁷² France cell phone test program found phones exceed limits that when converted to US test procedures could mean exceedances up to 11 times the FCC limit. See Gandhi, O. P. (2019). [Microwave Emissions From Cell Phones Exceed Safety Limits in Europe and the US When Touching the Body](#). IEEE Access, 7, 47050–47052, See also PhoneGate Alerte documenting the 48 cell phones either software updated or withdrawn from the market due to violations of French RF limit <https://phonegatealert.org/france-liste-portables-dangereux/>; The FCC cell phone SAR test data showing phones tested 2mm separation distance from body exceeded RF human exposure limits was released under FOIA. Details on the FCC tests can be found at <https://ehtrust.org/environmental-health-trust-foia-project/>; [EHT's Appeal Letter to the FCC](#); https://ehtrust.org/wp-content/uploads/EHT-Scarato-Appeal-RE_-_FOIA-Control-Nos.-2023-000281-and-2023-000325_-_FCC-2-mm-Cell-Phone-Radiation-SAR-Tests-December-28-2023-.docx.pdf; [FCC Letter on Cell Phone Radiation Tests Exceeding Limits](#); Canada has a post market surveillance program that found exceedances of the FCC and Health Canada limit of 1.6W/kg for head/body local SAR in some tested phone models tested in close proximity body positions. <https://phonegatealert.org/en/unsafe-canadian-cell-phones/>.

⁷³ [“Follow-Up Research on NTP’s Clear Evidence on RF Causing Malignant Tumors in Rats”](#) IEEE, Microwave Magazine, Vol. 25/6, pp 16-18, June 2024 DOI:10.1109/MMM.2024.3378608

“no other agency advocated tightening the limits” and “the agency reasonably concluded that the weight of the scientific and health evidence, and particularly the judgment of federal agencies expert in health matters, demonstrated that no changes were warranted.” However, *The U.S. Court of Appeals for the D.C. Circuit 2021*, in, *Environmental Health Trust et al. v. FCC*,⁷⁴ rejected such reasoning as “arbitrary and capricious” and in violation of the Administrative Procedures Act. The Court found no indication—no reports, no reviews, no analysis—that the FDA, nor any other agency, had looked at the scientific evidence and submitted an analysis to the official FCC record, stating:

“The silence of other expert agencies, however, does not constitute a reasoned explanation for the Commission’s decision to terminate its notice of inquiry for the same reason that the FDA’s conclusory statements do not constitute a reasoned explanation: silence does not indicate why the expert agencies determined, in light of evidence suggesting to the contrary, that exposure to RF radiation at levels below the Commission’s current limits does not cause negative health effects unrelated to cancer. Silence does not even indicate whether the expert agencies made any such determination, or whether they considered any of the evidence in the record.”

The Court concluded that the FCC had failed to take into account scientific findings relevant to the impacts of radiofrequency radiation (RFR) on children, on long-term impacts and on the ubiquity of wireless devices and other major technological changes since the 1996 RFR exposure guidelines were first promulgated. The court also found that the FCC “completely failed even to acknowledge, let alone respond to, comments concerning the impact of RF radiation on the environment. That utter lack of a response does not meet the Commission’s obligation to provide a reasoned explanation for terminating the notice of inquiry.”⁷⁵ The Court remanded further action to the FCC to address its exposure guidelines as they relate to:

- impacts on children and the environment (wildlife),
- implications of long-term exposures,
- ubiquity of wireless devices,
- major technological changes since 1996 and
- cell phone and wireless device premarket RF compliance tests

Despite the 2021 court order, the FCC has taken no action to justify its refusal to update its 1996 radiofrequency radiation exposure guidelines. Since the FCC admits that they are not a health and environment agency, we ask that NTIA request EPA re-establish electromagnetic field programs that ensure health and environmental safety and provide input on the impacts of this guidance, particularly as we assume NTIA does not have the health and environmental expertise to assess the impact of this draft guidance.

Recommendation 9: The proper health and environmental agency should conduct hazard evaluations and risk assessment on FCC RFR exposure limits and update them accordingly.

⁷⁴ [https://www.cadc.uscourts.gov/internet/opinions.nsf/FB976465BF00F8BD85258730004EFDF7/\\$file/20-1025-1910111.pdf](https://www.cadc.uscourts.gov/internet/opinions.nsf/FB976465BF00F8BD85258730004EFDF7/$file/20-1025-1910111.pdf)

⁷⁵ [https://www.cadc.uscourts.gov/internet/opinions.nsf/FB976465BF00F8BD85258730004EFDF7/\\$file/20-1025-1910111.pdf](https://www.cadc.uscourts.gov/internet/opinions.nsf/FB976465BF00F8BD85258730004EFDF7/$file/20-1025-1910111.pdf)

Currently no government agency is properly assessing FCC guidelines with an up-to-date science-based review and quantitative risk analysis to ensure protection for humans and wildlife.

The American Association of Pediatrics wrote a letter to the FCC requesting the limits be updated with the latest science stating⁷⁶, “Current FCC standards do not account for the unique vulnerability and use patterns specific to pregnant women and children. It is essential that any new standard for cell phones or other wireless devices be based on protecting the youngest and most vulnerable populations to ensure they are safeguarded throughout their lifetimes.” The FCC limits use a 6-foot-tall military man as a model for compliance tests and the RF limits only protect against heating effects of acute short term exposures. The limits are not based on protection for effects from long-term/low-level exposures, children's unique vulnerabilities, the medically vulnerable, the elderly and those who have unique sensitivities to EMF. Yet the majority⁷⁷ of published research has found non-thermal biological effects on humans as well as animals.

Furthermore, a wireless signal is complex and uses varying polarized, modulated and pulsed waveforms, documented in the scientific literature to have impacts on biological systems.⁷⁸ Current guidelines do not consider the studies showing the effects of polarization, modulations and pulsation on living cells. See

⁷⁶ [American Academy of Pediatrics Letters](#)

⁷⁷ Leach, Victor, Weller, Steven and Redmayne, Mary. "[A novel database of bio-effects from non-ionizing radiation](#)" *Reviews on Environmental Health*, vol. 33, no. 3, 2018, pp. 273-280 says that “the clear majority of 2653 papers captured in the database examine outcomes in the 300 MHz–3 GHz range. There are 3 times more biological “Effect” than “No Effect” papers;” and “industry-funded studies more often than not find “No Effect”; McCredden JE, Weller S and Leach V (2023) [The assumption of safety is being used to justify the rollout of 5G technologies](#), *Front. Public Health* 11:1058454 says the majority [of existing epidemiology papers in their database] show effects from mm Wave exposures. In 2024 Dr. Henry Lai released [updated summaries showing the majority of studies show impacts](#): 89% (316 of 354) RFR oxidative effects studies published since 1997 reported significant effects including 95% (82 of 86) studies with a SAR ≤ 0.40 W/kg (which is ten times less than the 4.0 W/kg threshold of harm that the FCC and the ICNIRP use to base their RFR exposure limits). 70% (328 of 466) RFR genetic effects studies published since 1990 reported significant effects including 79% (113 of 144) studies of gene expression; 77% (333 of 435) RFR neurological studies published since 2007; 83% (280 of 335) RFR reproduction and development studies published since 1990; 91% (286 of 316) ELF/static EMF oxidative effects (or free radical) studies published since 1990; 84% (288 of 344) ELF/static EMF genetic effects studies published since 1990 including 95% (168 of 177) of studies of gene expression; 91% (315 of 345) ELF/static EMF neurological studies published since 2007; 75% (65 of 87) ELF/static EMF reproduction and development studies published since 1990. Dr. Lai’s analysis is posted at Dr. Joel Moskowitz of University of California Berkeleys site at <https://www.saferemr.com/2018/02/effects-of-exposure-to-electromagnetic.html>; Cucurachi et al., (2013). [A review of the ecological effects of radiofrequency electromagnetic fields \(RF-EMF\)](#). *Environment International*, 51, 116–140 reviewed 113 studies finding RF-EMF had a significant effect on birds, insects, other vertebrates, other organisms, and plants in 70% of the studies; Thill A, Cammaerts MC, Balmori A. [Biological effects of electromagnetic fields on insects: a systematic review and meta-analysis](#). *Rev Environ Health*. 2023 Nov 23 found “vast majority of studies found effects, generally harmful ones.”; In 2010, the government of India’s Ministry of the Environment and Forest issued a [report](#) on the potential impacts of communication towers on wildlife, citing hundreds of research studies that found adverse effects. The findings were summarized in [“Impacts of Radio-Frequency Electromagnetic Field \(RF-EMF\) from Cell Phone Towers and Wireless Devices on Biosystem and Ecosystem – A Review,”](#) published in *Biology and Medicine* by S. Sivani et al., (2013) concluding that: regarding total effects 593 of the 919 research papers collected on birds, bees, plants, other animals, and humans showed impacts. 180 showed no impacts, and 196 were inconclusive studies.

⁷⁸ 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](#). *Scientific Reports*, 5, 14914; Panagopoulos, D. J. (Ed.). (2022). [Electromagnetic Fields of Wireless Communications: Biological and Health Effects](#) (1st ed.). CRC Press; Panagopoulos, D. J., Karabarbounis, A., Yakymenko, I., & Chrousos, G. P. (2021). [Human-made electromagnetic fields: Ion forced-oscillation and voltage-gated ion channel dysfunction, oxidative stress and DNA damage \(Review\)](#). *International Journal of Oncology*, 59(5), 92; Panagopoulos DJ. [Comparing DNA damage induced by mobile telephony and other types of man-made electromagnetic fields](#). *Mutat Res Rev Mutat Res*. 2019 Jul-Sep;781:53-62.

[Attachment 3](#) for more detailed scientific information on biological effects. Further, FCC limits and compliance regulations do not even consider effects on wildlife, they are not science based with a quantified understanding of how various species are uniquely sensitive to certain frequencies.⁷⁹ As an example, pollinators absorb higher frequencies more intensely.⁸⁰

Since the FCC has always clarified that they are not a health and environmental agency⁸¹ it should not be viewed as the agency with expertise to set RF limits and we request that the EPA investigate the complexities of RF exposure and biological impacts and ensure the development of scientifically based safe levels for all living systems.

Recommendation 10: The proper health and environmental agency do health and environmental surveillance to quantify adverse effects to humans and wildlife associated with the cumulative radiofrequency environmental exposures and specifically quantify disproportionate impacts of RFR exposures to communities seeking environmental justice

Communities who are seeking environmental justice are being targeted for increasing levels of wireless RFR radiation in the name of closing the digital divide. As an example, bridging the digital divide is being used to justify the 5G jumbo poles in New York City.⁸² Although generally in urban areas, affordable service is the key issue, not access, the wireless industry markets their networks as the vehicle to connect communities⁸³ and disregards the fact that wired networks are faster, safer and more secure.

Synergistic effects between chemicals and RFR found in studies will play an important role to further exacerbate health outcomes in communities already dealing with disproportionate pollution and chemical exposures. These cumulative impacts need to be quantified by the proper agencies and alternative technologies like wired cable or fiber optics need to be considered as alternatives to wireless connections.

Cumulative impacts to people and the environment with cost to benefit assessments need to be quantified to assure that the U.S. is moving in the right direction with regards to how broadband is delivered. Wired internet connections can safely and more effectively provide internet connectivity with less risks to individuals and the environment.

⁷⁹ Levitt, B. B., Lai, H. C., & Manville, A. M. (2021b). [Effects of non-ionizing electromagnetic fields on flora and fauna. Part 2 impacts: How species interact with natural and man-made EMF](#). *Reviews on Environmental Health*, 37(3), 327–406.

⁸⁰ Thill A, Cammaerts MC, Balmori A. [Biological effects of electromagnetic fields on insects: a systematic review and meta-analysis](#). *Rev Environ Health*. 2023 Nov 23; Thielens, A., Bell, D., Mortimore, D. B., Greco, M. K., Martens, L., & Joseph, W. (2018). [Exposure of Insects to Radio-Frequency Electromagnetic Fields from 2 to 120 GHz](#). *Scientific Reports*, 8(1), 3924.

⁸¹ page 4 , para 6 <https://docs.fcc.gov/public/attachments/FCC-13-39A1.pdf>

⁸² [32-Foot 5G Towers Proposed for 5 UWS Sites](#),

⁸³ [Wireless in Communities of Color: Bridging the Digital Divide, 5G's Power to Close America's Digital Divide](#)

Recommendation 11: Ensure government accommodates and provides a mechanism for compensation to individuals who are being harmed by RFR exposure

As stated earlier, a segment of the population has developed or will develop EMS or microwave sickness, a debilitating reaction to electromagnetic fields including RFR. EMS is well documented in the medical literature.^{84 85} Electromagnetic related disability is recognized by the US government and multiple other entities.⁸⁶ In addition, certain segments of the population are more vulnerable to radiofrequency impacts, including children, pregnant women, the sick and the elderly.⁸⁷ Government should guarantee accommodations for these individuals. Government should also have funds to compensate those severely injured.

Recommendation 12: Launch Government education programs on the impacts of RF exposure to humans, especially children, pregnant women, the sick and the elderly and ways to mitigate these Impacts.⁸⁸

Buried in each cell phone sold in the United States is a *warning* to keep the call phone at least 5-millimeters away from the user's skin.⁸⁹ That information should be highlighted, especially to parents of small children and to the vulnerable.

Example:

Samsung Galaxy Z Fold 3 5G

"Body-worn SAR testing has been carried out at a separation distance of 1.5 cm. To meet RF exposure guidelines during body-worn operation, the device should be positioned at least this distance away from the body."

⁸⁴ Hocking B. Microwave sickness: a reappraisal. *Occup Med (Lond)*. 2001 Feb;51(1):66-9. doi: 10.1093/occmed/51.1.66. PMID: 11235831.

⁸⁵ Carpenter DO. The microwave syndrome or electro-hypersensitivity: historical background. *Rev Environ Health*. 2015;30(4):217-22. doi: 10.1515/reveh-2015-0016. PMID: 26556835.

⁸⁶ [Resources on Electromagnetic Sensitivity and Accommodations - Environmental Health Trust](#)

⁸⁷ Davis, D., Birnbaum, L., Ben-Ishai, P., Taylor, H., Sears, M., Butler, T., & Scarato, T. (2023). [Wireless technologies, non-ionizing electromagnetic fields and children: Identifying and reducing health risks](#). *Current Problems in Pediatric and Adolescent Health Care*, 53(2), 101374; Miller, A. B., Sears, M. E., Morgan, L. L., Davis, D. L., Hardell, L., Oremus, M., & Soskolne, C. L. (2019). [Risks to Health and Well-Being From Radio-Frequency Radiation Emitted by Cell Phones and Other Wireless Devices](#). *Frontiers in Public Health*, 7; Redmayne, M., & Johansson, O. (2015). [Radiofrequency exposure in young and old: Different sensitivities in light of age-relevant natural differences](#). *Reviews on Environmental Health*, 30(4), 323–335; Sage, C., & Burgio, E. (2018). [Electromagnetic Fields, Pulsed Radiofrequency Radiation, and Epigenetics: How Wireless Technologies May Affect Childhood Development](#). *Child Development*, 89(1), 129–136; McCredden, J. E., Cook, N., Weller, S., & Leach, V. (2022). [Wireless technology is an environmental stressor requiring new understanding and approaches in health care](#). *Frontiers in Public Health*, 10.

⁸⁸ Davis, D., Birnbaum, L., Ben-Ishai, P., Taylor, H., Sears, M., Butler, T., & Scarato, T. (2023). [Wireless technologies, non-ionizing electromagnetic fields and children: Identifying and reducing health risks](#). *Current Problems in Pediatric and Adolescent Health Care*, 53(2), 101374; Clegg, F. M., Sears, M., Friesen, M., Scarato, T., Metzinger, R., Russell, C., Stadtner, A., & Miller, A. B. (2020). [Building science and radiofrequency radiation: What makes smart and healthy buildings](#). *Building and Environment*, 176, 106324.

⁸⁹ <https://ehtrust.org/fine-print-manufacturer-radio-frequency-radiation-warnings/>

Environmental Health Trust has developed [public health fact sheets](#) and [educational resources](#) to communicate all the ways to reduce everyday wireless exposures.⁹⁰ More outreach needs to be done with the American public so they understand this issue. We recommend a multimedia educational campaign.

Recommendation 13: Recommend for EPA to expand Section 112 under the Clean Air Act to specifically include all wireless and cell tower radiofrequency radiation as a pollutant

Wireless electromagnetic radiation is a growing environmental pollutant and yet the EPA is not ensuring public safety in regards to the exposure and has no funded activities in regards to EMF health or environmental effects.⁹¹ Sources include cell towers and 5G/4G networks and other transmitters that are increasingly being erected closer to where people live, work, school and recreate. The EPA's last report on the biological effects of electromagnetic fields was dated 1984.⁹² Prior to that the EPA was regularly measuring levels nationwide and studying the effects of wireless radiation.⁹³

However, the EPA was defunded from researching this issue.⁹⁴ FCC is the agency charged with maintaining exposure guidelines and admits that they are not a health and safety agency and they say that they defer to the EPA, FDA, OSHA and NIOSH for these issues.

However, none of these agencies are researching for health effects, nor conducting hazard evaluations, nor properly re-assessing the guidelines to ensure safety, nor are they monitoring exposures, nor performing health and environmental surveillance to ensure human and environmental safety. No agency is doing such research.

RFR is a silent pollutant in every community and will especially exacerbate the issues in environmental justice communities. RFR needs to be specifically referenced as a pollutant by the EPA Section 112 of the Clean Air Act and appropriate actions must be taken to regulate it. Monitoring, surveillance, cumulative impact research and hazard evaluations need to be reinstated at the EPA to ensure public health and environmental wellbeing, especially with the exponential increase in RFR levels since 1984. Currently the federal government is failing to protect the public. See [ATTACHMENT 2: Today's Regulatory Gap Regarding Radiofrequency Bioeffects](#)

⁹⁰ [Printable Resources - Environmental Health Trust](#) and [Factsheets on Safe Technology - Healthy Tech at Home Project](#) and [Educational Materials for Classrooms - Environmental Health Trust](#)

⁹¹ Letter from Lee Ann B. Veal, Director of the Radiation Protection Division, U.S. Environmental Protection Agency to Theodora Scarato, Executive Director, Environmental Health Trust, (July 8, 2020) <https://ehtrust.org/wp-content/uploads/EPA-Director-Letter-on-EMFs-to-Theodora-Scarato-July-8-2020.pdf>

⁹² <https://nepis.epa.gov/Exe/ZyPDF.cgi/300065H1.PDF?Dockey=300065H1.PDF>

⁹³ <https://ehtrust.org/wp-content/uploads/2015/12/1995-Briefing-for-the-FCC-by-the-EPA-on-the-Development-of-RF-Exposure-Guidelines.pdf>

⁹⁴ https://cfpub.epa.gov/si/si_public_record_Report.cfm?Lab=NHEERL&dirEntryID=47568

ATTACHMENT 2: Today's Regulatory Gap Regarding Radiofrequency Bioeffects

Although the public and elected officials assume that federal agencies are engaged in radiofrequency oversight activities to ensure public health and environmental protection, this is inaccurate. FCC RF exposure limits are guidelines only, not federally developed safety standards.⁹⁵ Such standards are typically promulgated by agencies reviewing the totality of scientific evidence, performing risk analysis, and identifying the levels at which various adverse effects occur, as a basis for toxicant exposure limit that ensures adequate public protection. A review of federal agency involvement indicates scant research and oversight activities along with serious regulatory gaps including but not limited to:

Issues related to the FCC's 1996 human exposure guidelines:

- RF guidelines were designed for humans, not animals or plants, and only for effects of high intensity short term acute exposures. The limits were not designed to protect against effects of long term exposure.
- There is no periodic or ongoing, transparent evaluation of current scientific research to ensure FCC limits are adequate (no hazard evaluation, quantitative risk assessment of the totality of science, including impacts to brain development, reproduction or immune system) by any federal agency with health and safety expertise.

Issues related to agency authority.

- There is no agency with authority regarding impacts of ambient environmental exposures from the RF emissions of cell towers and base station antennas (including 4G, 5G) which is engaged in any scientific activities. In the case of cell phones, FDA has shared authority with FCC, although FDA has shown only limited activity.
- There is no agency with authority nor activities related to impacts of RF exposures to wildlife, animals and the natural environment (plants and trees.)

Issues related to bioeffects research and safety testing.

- There is no regulatory process for premarket safety testing (as currently done with drugs) to ensure new wireless communication frequencies, antenna systems and technologies are safe.
- There is no federal research program on biological impacts, except for a small animal study by the National Toxicology Program.⁹⁶

⁹⁵ The [FCC Website Policy on Human Exposure to Radiofrequency Electromagnetic Fields](https://www.fcc.gov/general/fcc-policy-human-exposure) states, "At the present time there is no federally-mandated radio frequency (RF) exposure standard.<https://www.fcc.gov/general/fcc-policy-human-exposure>

⁹⁶ NTP announced in January 2024 that "No additional RFR studies are planned."

<https://ehtrust.org/statement-by-devra-davis-phd-mph-on-the-u-s-government-national-toxicology-program-ceasing-research-on-cell-phone-radiation/>

- There is no agency carrying out pre-or post-market research activities related to evaluating the health and environmental impacts of new technologies (i.e, new modulations such as 5G, or higher frequencies to be used in future technologies and/or antenna systems such as beamforming etc.).
- There is no agency carrying out activities related to evaluating the health and environmental impacts of 5G modulations nor for new technologies (i.e, that will use higher frequencies as well as new beamforming antenna systems, modulations and pulsation).
- There is no agency with activities related to impacts of RF exposures to wildlife, animals and the natural environment (plants and trees.)

Issues related to cell tower oversight:

- Currently there is no federal registry for all wireless facility sites, cell towers, or small wireless facilities.
- The US has no measuring, monitoring or mapping of environmental RF levels.
- There is no federal oversight and enforcement program in place to ensure wireless facilities emissions are within FCC guidelines.
- There is no agency carrying out activities related to evaluating the health and environmental impacts of 5G modulations nor for new technologies (i.e, that will use higher frequencies as well as new beamforming antenna systems, modulations and pulsation).

The Environmental Protection Agency (EPA) and RF Guideline Background

FCC RF exposure limits are guidelines only, as they are not federally developed safety standards⁹⁷ whereby agencies reviewed the totality of scientific evidence, performed risk analysis and identified a level of adverse effect to base a limit that would ensure adequate public protection. Such a process never happened.

The EPA was actively engaged in research to develop proper federal safety standards for RF that would protect humans from both thermal and non-thermal impacts, as it had been tasked to do by several federal agencies. However, just as the EPA was poised to release its RF limit recommendations in 1995⁹⁸ the EPA

⁹⁷ The [FCC Website Policy on Human Exposure to Radiofrequency Electromagnetic Fields](https://www.fcc.gov/general/fcc-policy-human-exposure) states, “At the present time there is no federally-mandated radio frequency (RF) exposure standard.” <https://www.fcc.gov/general/fcc-policy-human-exposure>

⁹⁸ In 1995 the EPA had briefed both the FCC and the National Telecommunications and Information Administration regarding its two Phases of activities related to the development of RF exposure safety standards. Phase 1 would address only short-term thermal impacts of RF radiation but “does not include modulation, chronic exposure or non thermal [heating] impacts.” Phase 2 would address modulated and nonthermal exposures and result in the final guidelines. See [Memorandum from Robert F. Cleveland, Office of Engineering and Technology to FCC Secretary, Ex Parte Presentation by U.S. Environmental Protection Agency \(March 22, 1995\)](#)

Three months later, EPA informed the FCC that its final RF guidelines “are essentially complete” and entering the review phase which would include a review by the Radiofrequency Interagency Work Group as well as stakeholders. [Letter from E. Ramona Trovata, EPA, Office of Radiation and Indoor Air, to Richard M. Smith, Chief, FCC, Office of Engineering and Technology \(June 19, 1995\)](#)

was defunded from all such activities. The FCC then promulgated limits based on recommendations developed by industry/military connected groups ([ANSI/IEEE C95.1-1992](#) and [NCRP's 1986 Report](#)). At that time, the EPA specifically recommended⁹⁹ that an “updated, comprehensive review of the biological effects” be initiated as the IEEE and NCRP recommendations were based on pre-1986 studies.¹⁰⁰

Although the FCC’s [2013 inquiry stated](#), “Since the Commission is not a health and safety agency, we defer to other organizations and agencies with respect to interpreting the biological research necessary to determine what levels are safe,” there has been no updated federal review since 1996.

Yet, in 2019, when the Commission issued its decision not to update its exposure limits, it stated that it “took into account” views from other expert agencies and standard-setting organizations. The FCC interpreted the silence of federal agencies to mean agreement with the 1996 guidelines, stating in its [11/9/2020 brief](#) that, “no other agency advocated tightening the limits” and “the agency reasonably concluded that the weight of the scientific and health evidence, and particularly the judgment of federal agencies expert in health matters, demonstrated that no changes were warranted.” As mentioned earlier, the DC Circuit, in, *EHT et al. v. FCC*, rejected the FCC’s conclusion as “arbitrary and capricious” and in violation of the Administrative Procedures Act.

In July 8, 2020, Lee Ann B. Veal, Director of the EPA Radiation Protection Division Office of Radiation and Indoor Air wrote¹⁰¹ Theodora Scarato, EHT Executive Director, that “EPA’s last review was in the 1984 document Biological Effects of Radiofrequency Radiation¹⁰². The EPA does not currently have a funded mandate for radiofrequency matters.”

Federal agencies have not shown a review of the totality of the science (including impacts to the nervous, reproductive and immune systems of humans and animals) to issue such a “judgment.” The reality is that federal agencies are not engaged in researching and evaluating the numerous biological effects of RF to humans, flora and fauna. That is why federal agencies such as the EPA did not submit meaningful input to the FCC’s Inquiry. They have not been funded or directed to provide a determination or judgment.

The Federal Communications Commission (FCC)

The FCC has minimal to non-existent regulatory activities to ensure RF compliance for wireless networks. In several other countries, government agencies monitor RF levels regularly, review industry reports,

⁹⁹ [EPA Submission to ET Docket 93-62](#) "Guidelines for Evaluating the Environmental Effects of Radiofrequency Radiation state, “The FCC should consider requesting the NCRP to revise its 1986 report to provide an updated, comprehensive review of the biological effects on RF radiation and recommendations for exposure criteria.”

¹⁰⁰ As the EPA stated to the FCC, “The 1992 ANSI/IEEE standard is based on literature published before 1986, except for a few papers on RF shock and burn. The cut-off date for the literature review supporting the NCRP recommendations is 1982.”

¹⁰¹ *Letter from Lee Ann B. Veal, Director of the Radiation Protection Division, U.S. Environmental Protection Agency to Theodora Scarato, Executive Director, Environmental Health Trust, (July 8, 2020)*<https://ehtrust.org/wp-content/uploads/EPA-Director-Letter-on-EMFs-to-Theodora-Scarato-July-8-2020.pdf>

¹⁰² U.S. Environmental Protection Agency, 1984 Report Biological Effects of Electromagnetic Radiation <https://nepis.epa.gov/Exec/zyPURL.cgi?Dockey=300065H1.TXT>

measure a certain percentage of sites for compliance every year, penalize operators for non compliance, and transparently post RF levels for the public.¹⁰³ Not in the USA.

Environmental Health Trust gave a brief presentation on the policies of other countries at the [National Spectrum Managers Association 2023 Annual Spectrum Management Conference](#).¹⁰⁴

According to the FCC, “The FCC does not have a comprehensive, transmitter-specific database for all of the services it regulates. ... In some services, licenses are allowed to utilize additional transmitters or to increase power without notifying the FCC. Other services are licensed by geographic area, such that the FCC has no knowledge concerning the actual number or location of transmitters within that geographic area.”¹⁰⁵ With no comprehensive transmitter-specific database for all the services regulated by the FCC, and the ability for licenses to utilize additional transmitters and increase power without notifying the FCC, how are radiofrequency exposure levels monitored to remain within FCC guidelines?

Furthermore, according to the FCC, “The FCC does not have the resources or the personnel to routinely monitor the exposure levels at all of the thousands of transmitters that are subject to FCC jurisdiction. ... In addition, the FCC does not routinely perform RF exposure investigations unless there is a reasonable expectation that the FCC exposure limits may be exceeded.”¹⁰⁶ With no routine monitoring of RF exposure levels, people and the environment are at risk of exposures to RF levels that exceed current FCC guidelines.

The FCC is not ensuring that RF exposure levels are compliant as it has no monitoring or oversight program in place. The FCC has stated that, “There have been a few situations around the country where RF levels in publicly accessible areas have been found to be higher than those recommended in applicable safety standards.”¹⁰⁷ A 2014 investigation by the Wall Street Journal “[Cellphone Boom Spurs Antenna-Safety](#)

¹⁰³ Examples of governments with a national program to monitor environmental levels of radiofrequency and/or measure cell tower emissions for compliance with government exposure limits include: [France](#), [Australia](#), [Austria](#), [Brussels Belgium](#), [Switzerland](#), [India](#), [Israel](#), [United Kingdom](#), [Thailand](#), [Croatia](#), [Lithuania](#), [Spain](#), [Hungary](#), [Italy](#), [Netherlands](#), [Greece](#), [Turkey](#), [French Polynesia](#), [Senegal](#), [Monaco](#), [Bhutan](#), [Gibraltar](#), [Bulgaria](#), [Tunisia](#), [China](#), [Bahrain](#), [Norway](#), [Brazil](#), [Malta](#), [Ireland](#), [Romania](#) ([France even has 5G monitoring stations](#), Australia Telco posts RF info at [ACMA EME Checker](#) . Countries such France, Switzerland, Greece, and Belgium now have robust RF monitoring programs with RF measurements posted online in an easy to understand website that members of the general public can easily navigate, such as a map where you simply click on antenna/tower locations to see the latest measurements and how they compare to the country’s limits. Greece’s [National Observatory of Electromagnetic Fields](#) is operated by the Greek Atomic Energy Commission with 500 sensors since 2015. In India, telecommunications companies are to self-certify compliance at: 1. Launch, 2. With any modification/change and 3. On a biennial basis. In addition the country also states they audit 5% to 10% of sites annually on a random basis and all reports are posted on their EMF dedicated website. <https://tarangsanchar.gov.in/EMFPortal/DoT> Penalties are Rs. 10 lakh per BTS per incidence. For the year 2022, they reported 320 of the 11,61,281 base stations they tested had emissions exceeding regulatory limits resulting in penalties for the telecom service providers. India’s RF public exposure limits are set at 10% of ICNIRP levels.

¹⁰⁴ See Conference site at <https://www.nisma.org/conferences/nsma-presentations-2023/> Video of Theodora Scarato at https://youtu.be/NNJUT-ZQcqE?si=GtL9k_IeEzuEmiUK&t=1597

¹⁰⁵ FCC RF Safety FAQ <https://www.fcc.gov/engineering-technology/electromagnetic-compatibility-division/radio-frequency-safety/faq/rf-safety>

¹⁰⁶ FCC RF Safety FAQ <https://www.fcc.gov/engineering-technology/electromagnetic-compatibility-division/radio-frequency-safety/faq/rf-safety>

¹⁰⁷ FCC RF Safety FAQ <https://www.fcc.gov/engineering-technology/electromagnetic-compatibility-division/radio-frequency-safety/faq/rf-safety>

[Worries](#)¹⁰⁸ found “one in 10 sites violates the rules, according to six engineers who examined more than 5,000 sites during safety audits for carriers and local municipalities.” Since then, FCC rules that have mandated automatic approvals for adding antennas at existing cell sites and “streamlined” placement of new 5G/4G facilities by preempting state and local authority, have resulted in massive antenna proliferation nationwide.

Studies have found that environmental RF levels generated from RF emissions of cell towers, base station network antennas, and other wireless systems have significantly increased over the last few decades, with higher levels in urban areas and in areas of closer proximity to wireless network antennas, especially in locations within the main beams of the antennas.¹⁰⁹ As an example, a 2018 multi-country study found ambient RF measurements in Los Angeles, California now 70 times higher than levels measured in the City in the late ‘70s, as part of a twelve-city study by the FCC and EPA.¹¹⁰

The FCC has never done an environmental impact statement on the individual or cumulative impacts of its spectrum auctions, which have raised \$233 billion to date, nor on the allocation of these proceeds to various programs to deploy wireless networks. The FCC has not considered those funding decisions under NEPA, and so have not considered them to be major federal action. In 1986, the FCC categorically excluded most of its actions from NEPA review.¹¹¹

The FCC relies on licensees to measure exposure levels and prepare environmental assessments (EA) if needed and self-report any exceedances or potential exceedances.¹¹² It is indisputable that NEPA is a federal obligation yet the FCC has delegated to the licensees and the carriers the determination of whether a Categorical Exclusion applies. Carriers have a due diligence checklist with different requirements to check

¹⁰⁸ “It’s like having a speed limit and no police,” said Marvin Wessel, an engineer who has audited more than 3,000 sites and found one in 10 out of compliance. Cellphone Boom Spurs Antenna-Safety Worries Many Sites Violate Rules Aimed at Protecting Workers From Excessive Radio-Frequency Radiation https://www.wsj.com/articles/cellphone-boom-spurs-antenna-safety-worries-1412293055?mod=WSJ_hpp_MIDDLE_Video_second

¹⁰⁹ Brown, R. (2022). [Assessment of radiofrequency radiation intensity on 35 Main Streets throughout Pennsylvania, USA during the fall of 2021](#). *American Journal of Multidisciplinary Research & Review*, 1(4), 8-20; Baltrėnas, P., Buckus, R., & Vasarevičius, S. (2012). [Research and evaluation of the intensity parameters of electromagnetic fields produced by mobile communication antennas](#). *Journal of Environmental Engineering and Landscape Management*, 20(4), 273–284; Bhatt, C. R., Redmayne, M., Billah, B., Abramson, M. J., & Benke, G. (2017). [Radiofrequency-electromagnetic field exposures in kindergarten children](#). *Journal of Exposure Science & Environmental Epidemiology*, 27(5), 497–504; Boussad Y, Chen XL, Legout A, Chaintreau A, Dabbous W. (2022) [Longitudinal study of exposure to radio frequencies at population scale](#). *Environ Int*. Apr;162:107144 ; Mazloun, T., Aerts, S., Joseph, W., & Wiart, J. (2019). [RF-EMF exposure induced by mobile phones operating in LTE small cells in two different urban cities](#). *Annals of Telecommunications*, 74(1), 35–42.; Urbinello, D., Joseph, W., Verloock, L., Martens, L., & Rössli, M. (2014). [Temporal trends of radio-frequency electromagnetic field \(RF-EMF\) exposure in everyday environments across European cities](#). *Environmental Research*, 134, 134–142.

¹¹⁰ Sagar, S. et al. (2018). [Comparison of radiofrequency electromagnetic field exposure levels in different everyday microenvironments in an international context](#). *Environment International*, Volume 114, 297-306.

¹¹¹ Federal Register at page 14999
<https://www.govinfo.gov/content/pkg/FR-1986-04-22/pdf/FR-1986-04-22.pdf>
47 CFR 1.1306

<https://www.ecfr.gov/current/title-47/section-1.1306>

¹¹² FCC Public Notice – April 27, 2000, YEAR 2000 DEADLINE FOR COMPLIANCE WITH COMMISSION’S REGULATIONS REGARDING HUMAN EXPOSURE TO RADIOFREQUENCY EMISSIONS
<https://www.federalregister.gov/documents/2000/05/05/00-11237/year-2000-deadline-for-compliance-with-commissions-regulations-regarding-human-exposure-to>

off yet this document is never submitted to the FCC if the applicant determines that the facility is categorically excluded; the FCC has no records of carriers doing their due diligence unless the review finds a potentially significant environmental effect that triggers an EA, which they submit. If nothing is triggered on the checklist, then the applicant starts building without the public having access to the checklist and measurements, and no ability to refute or comment on the project.

The Food and Drug Administration (FDA)

The FDA does not regulate, have activities related to, nor have authority regarding the RF emissions of cell towers, cell tower antennas, network infrastructure, or 5G facilities. Thus, this is a regulatory gap, as no agency is investigating the issue of health effects from ambient RFR or other EMF environmental levels. Further, in regards to cell phones the FDA has not shown an evaluation of the totality of the science. Non cancer issues, such as headaches, oxidative stress, brain development, impacts to wildlife, and any studies on vulnerable populations such as pregnant people, children or the medically vulnerable have not been evaluated by the FDA in any report or evaluation shared with the public.

The FDA's very **limited activities** related to cell phones and cancer include a now outdated literature review (with science ending in 2018) focused solely only on cell phones and cancer.¹¹³ This literature review, done by anonymous individuals (rather than transparently presented experts) is focused only on cancer and omits all non cancer studies such as research on brain development, reproduction, or synergistic effects. The review focused only on cell phones and omitted research on Wi-Fi, 5G, 4G or other RF sources. The review is a literature review and not a systematic review nor is it a hazard or risk analysis nor is it an evaluation of FCC cell tower radiation limits, despite being presented in this way. Several experts sent letters to the FDA¹¹⁴ criticizing the literature review for numerous reasons including the fact that it does not follow any scientifically accepted protocols for risk or hazard assessment.

The [FDA's 2021](#) and [2022](#) Annual reports of the Center for Devices and Radiological Health have zero mention of the issue of cell phones or cell towers or wireless electromagnetic radiation. The [2022 to 2025](#)

¹¹³ FDA, [Review of Published Literature between 2008 and 2018 of Relevance to Radiofrequency Radiation and Cancer](#)

¹¹⁴ 2019/2020 Letters to the FDA Regarding Inaccurate Information on the NTP and FDA Website

[Letter calling for a retraction of FDA signed by several scientists](#) including Ronald Melnick PhD, former National Institutes of Health Scientist, Samuel Milham MD, former Head of the Chronic Disease Epidemiology Section, Washington State Department of Health; David Carpenter MD, Director of the Institute for Health and Environment at University of Albany's School of Public Health, former director of the Wadsworth Laboratory of the New York State Department of Health, Lennart Hardell MD, PhD, Professor Department of Oncology, Faculty of Medicine and Health Dr. Anthony Miller, Professor Emeritus of University of Toronto and World Health Organization Senior Advisor

[Ronald Melnick PhD's individual letter to the FDA on the National Toxicology Program study](#)

[Albert Manville PhD, retired Senior Wildlife Biologist, Division of Migratory Bird Management, U.S. Fish & Wildlife Service, Wash. DC HQ Office \(17 years\); Senior Lecturer, Johns Hopkins University](#)

[Prof. Tom Butler of the University College in Cork, Ireland's letter to the FDA](#)

[Igor Belyaev, PhD, Dr. Sc. Head, Department of Radiobiology of the Cancer Research Institute, Biomedical Research Center of the Slovak Academy of Science letter to the FDA](#)

[Paul Heroux PhD, McGill University](#)

[Alfonso Balmori, BSc statement to the FDA](#)

[Report on Strategic Priorities](#) has nothing on the issue of RF radiation.¹¹⁵ The FDA has not shown any evidence of monitoring RF bioeffects research via new agency reports, meetings or budget allocations on the issue.

The Government Accountability Report on 5G ([GAO 2020](#)) clarified that the FDA and other organizations “only reviewed a subset of the relevant research” and stated in regards to the FDA Literature Review that “The assessment focused on cancer-related animal and human studies of frequencies below 6 GHz.”

FDA Statements:

“The FDA does not regulate cell towers or cell tower radiation. Therefore, the FDA has no studies or information on cell towers to provide in response to your questions.”

[Ellen Flannery, Director, FDA Policy Center for Devices and Radiological Health to a California mother with a cell tower on her street who asked the FDA about safety, July 11, 2022](#)

“Under the law, FDA does not review the safety of radiation-emitting consumer products such as cell phones and similar wireless devices before they can be sold, as it does with new drugs or medical devices.”

[FDA Website until 2019 -](#)

“We don’t have jurisdiction over cellphone towers since those are environmental emitters.”

[Email From FDA’s David Kassiday](#) in 2016

The Environmental Health Trust issued a [“Report on FDA Activities on Cell Phones and Radiofrequency”](#)¹¹⁶ which documents the lack of adequate research review and misleading information put forward by the FDA. While the FDA webpages and cell phone cancer literature review seem to assert that safety is assured, the FDA has not adequately evaluated the totality of the science to reach any such safety or risk conclusion.

National Toxicology Program (NTP)

In 1999, the FDA requested the NTP perform large scale animal studies on cell phone radiation [stating](#),¹¹⁷ “A significant research effort, including well-planned animal experiments, is needed to provide the basis to assess the risk to human health of wireless communications devices.”

¹¹⁵ <https://www.fda.gov/media/155888/download>

¹¹⁶ https://ehtrust.org/wp-content/uploads/EHT-Report_Report-on-FDA-Activities-Related-to-Cell-Phones-and-Radiofrequency-Radiation-2.pdf

¹¹⁷ [FDA CDRH nomination of NTP to Study RFR. Nomination Background: Wireless Communication Devices](#)

The findings of the NTP's \$30 million animal study were released in a 2018 final report which found that long term exposure to RF was associated with two types of cancer in male rats, schwannoma of the heart and glioma of the brain,¹¹⁸ with the NTP's highest level of evidence.¹¹⁹ Further, the NTP notably found significant increases in DNA damage ([Smith-Roe et al., 2020](#)), as well as the induction of cardiomyopathy of the right ventricle in male and female rats. The later Ramazzini Institute studies found elevated incidence of the same tumors the NTP found - heart schwannomas in male rats - despite the Ramazzini Institute use of much lower RF radiation exposures than the NTP which were intended to mimic cell tower base station environmental exposures ([Falcioni et al., 2018](#); [Vornoli et al., 2019](#)).

Analysis of the NTP data according to current risk assessment guidelines concluded that U.S. government FCC limits should be lower by 200 to 400 times to protect children ([Uche & Naidenko, 2021](#)). Several published reviews conclude that the current body of evidence indicates RF radiation is a proven Group 1 human carcinogen ([Miller et al 2018](#), [Peleg et al 2018](#), [Carlberg and Hardell 2017](#), [Belpomme et al 2018](#)).

However, the FDA stated that they “disagreed” with the NTP findings¹²⁰. The DC Circuit rejected FDA's statement, saying “we find them to be of the conclusory variety that we have previously rejected as insufficient.”¹²¹

National Cancer Institute (NCI)

Although the NCI has a lengthy web page on cell phones, the NCI has not performed any type of safety evaluation, nor any formal research review. The NCI has repeatedly stated that “Neither the literature reviews, nor the fact sheets, make safety determinations.” ([Letter from NCI to Scarato](#)).

When directly asked about cell phone safety issues by the New Hampshire Commission on 5G¹²², the National Cancer Institute [responded](#), “As a Federal research agency, the NCI is not involved in the regulation of radiofrequency telecommunications infrastructure and devices, nor do we make recommendations for policies related to this technology... Our sister agencies, the FDA as well as the FCC, retain responsibility for reviewing guidance on safety concerns and informing the public if those circumstances change.”

The NCI signed onto a [one paragraph letter](#) in response to the [FCC Inquiry on RF Human Exposure Rules in 2013](#) simply thanking the FCC for “FCC's interest in continuing to work closely with NIH and other federal agencies with expertise in public health for guidance and expertise on this matter.” However, NCI

¹¹⁸M. Wyde et al., 2018; M. E. Wyde et al., 2018 <https://ntp.niehs.nih.gov/whatwestudy/topics/cellphones>

¹¹⁹ <https://ntp.niehs.nih.gov/whatwestudy/testpgm/cartox/criteria>

¹²⁰ FDA Press [Release, Statement from Jeffrey Shuren, M.D., J.D., Director of the FDA's Center for Devices and Radiological Health on the National Toxicology Program's report on radiofrequency energy exposure](#), November 1, 2018

¹²¹ EHT et al.v FCC, supra

¹²² New Hampshire Commissioner Denise Ricciardi asked the NCI, “What is the NCI opinion on the safety of cell phones? If you have one, please share your scientific documentation. The NCI responded, “The FDA and FCC are the responsible federal agencies with authority to issue opinions on the safety of these exposures. As a Federal research agency, the NCI is not involved in the regulation of radiofrequency telecommunications infrastructure and devices, nor do we make recommendations for policies related to this technology.” page 31 of the New Hampshire Commission Report on 5G <https://www.gencourt.state.nh.us/statstudcomm/committees/1474/reports/5G%20final%20report.pdf>

never submitted a substantive, meaningful comment regarding the adequacy of FCC guidelines, nor a systematic research review or evaluation regarding carcinogenicity or any other health issue as the NCI has not engaged in such activities.

Centers for Disease Control (CDC)

The CDC has no research activities related to EMF bioeffects. There has been no research review or evaluation by CDC experts regarding carcinogenicity or any other health issue. While the CDC does have webpages on cell phone radiation and wireless wearables, FOIAs show several were drafted with the help of an [industry consultant](#).

National Institute for Occupational Safety and Health (NIOSH)

NIOSH has no current activities related to non ionizing EMFs. Although U.S. NIOSH scientists long have recommended precautionary measures to minimize risk from occupational RF exposure¹²³ and developed recommendations to reduce extremely low frequency EMF,¹²⁴ protective policies were never further developed or implemented.

Department of Labor, Occupational Safety and Health Administration (OSHA)

OSHA currently is not engaged in bioeffect activities.

On July 1, 2015 [OSHA wrote the FCC](#) that, “RF emissions are not on OSHA's active regulatory agenda, so we have not conducted a comprehensive literature review or risk assessment on RF hazards” and “OSHA does not appear to have a particularized program in place to ensure worker safety with regard to RF exposure from the wide variety of RF transmitters regulated by the Commission. ... we are not aware that OSHA has adequate resources to ensure compliance with our limits for occupational/controlled exposure among our licensees and grantees.”

¹²³ December 1979 [Radiofrequency \(RF\) Sealers and Heaters \(80-107\) | NIOSH | CDC](#)

“Absorption of RF energy may also result in “nonthermal” effects on cells or tissue, which may occur without a measurable increase in tissue or body temperature. “Nonthermal” effects have been reported to occur at exposure levels lower than those that cause thermal effects. While scientists are not in complete agreement regarding the significance of reports of “nonthermal” effects observed in laboratory animals, NIOSH believes there is sufficient evidence of such effects to cause concern about human exposures. NIOSH and OSHA recommend that precautionary measures be instituted to minimize the risk to workers from unwarranted exposure to RF energy.”

¹²⁴ See “Precautionary Strategies to Reduce Worker Exposures to Extremely Low Frequency (ELF) Magnetic Fields, a Possible Carcinogen” by Joseph D. Bowman, PhD, of the Engineering and Physical Hazards Branch at the National Institute for Occupational Safety (NIOSH) Slide presentation to the [Collaborative on Health and the Environment \(Bowman 2016\)](#). Listen to the presentation at https://www.healthandenvironment.org/partnership_calls/18482

OSHA was actively engaged in RF bioeffect activities in previous decades. The agency had developed elements for a [Comprehensive RF Protection Program](#) in the mid 90s¹²⁵ that was never implemented. An OSHA representative also participated in the now defunct RF Interagency workgroup.

Inaccurate Statements by Elected Officials

There is a lack of appropriate oversight in Congress due to the FDA and FCC’s lack of full transparency regarding RF safety and their regulatory activities. Agencies should transparently state that they have not reviewed the research on health issues such as impacts to memory, epigenetic impacts and impacts to the environment (including pollinators). Agencies should also clearly state that the regulations do not address long term effects. The FDA should clarify that it has no authority nor judgment regarding health impacts from environmental levels of RF exposure from network antennas (including 5G, 4G, small cells, macro cell towers, or unlicensed antennas). The Congressional Committees tasked to provide oversight are not even aware this issue is in need of accountability.

Inaccurate statements by elected officials regarding the involvement of federal agencies on 5G and RF bioeffects.

U.S Senator Schumer’s [February 6, 2023 Letter](#) states “*Rest assured that as additional studies on microwave radiation and RF exposure are published by scientists and reviewed by government agencies...*”*Many other federal agencies, such as the EPA, FDA, NIOSH, OSHA have been actively involved in monitoring and investigating issues related to RF exposure.*” Yet EPA, NIOSH, and OSHA are not actively involved.

[U.S. Representative Scott Fitzgerald](#)’s November 5, 2021 letter states that, “In addition to the FCC, Federal health and safety agencies such as the Environmental Protection Agency (EPA), the Food and Drug Administration (FDA), the National Institute for Occupational Safety and Health (NIOSH) and the Occupational Safety and Health Administration (OSHA) have been actively involved in monitoring and investigating issues related to radio frequency (RF) exposure.” Yet EPA, NIOSH, and OSHA are not actively involved.

Representative Doris Matsui stated in a [December 20, 2023 letter](#)¹²⁶ that “*the monitoring and investigation of RF exposure on public health is a collaborative effort between several federal agencies. Since 1996, the FCC has required all wireless communications devices sold in the United States to meet minimum guidelines for safe human exposure to RF energy. RF exposure standards are developed by subject matter experts such as the Institute of Electrical and Electronics Engineers (IEEE) and the National Council on*

¹²⁵ Presentation on April 12, 1995 by Robert A. Curtis, Director US DOL/OSHA Health Response Team to the National Association of Broadcasters at the Broadcast Engineering Conference Las Vegas, NV <https://www.osha.gov/radiofrequency-and-microwave-radiation/role-of-rf-measurements>

¹²⁶ <https://ehtrust.org/wp-content/uploads/Representative-Doris-Matsui-Letter-on-5G-December-20-2023.pdf>

Radiation Protection and Measurements (NCRP) and are used by federal, state and local governments to regulate the teleservice industry and protect public health. These regulators and experts have not found conclusive, significant or causal evidence to suggest that 5G is harmful to humans.” Yet there is no collaborative effort in regards to bioeffects.

Senator Diane Feinstein, [September 6, 2021](#), stated, without evidence, “Since 1996, it has been the FCC’s policy to cooperate with industry, expert agencies, and health and safety organizations to ensure that guidelines continue to be appropriate and scientifically valid.” Yet expert agencies such as *EPA, NIOSH, and OSHA* with health and science expertise are not working with FCC on this topic.

ATTACHMENT 3: Radiofrequency Radiation Impacts on the Environment

No U.S. agency or international authority has ever acted to review research on wireless radiation effects on the environment nor set exposure limits to ensure protections for birds, bees, trees and wildlife.^{127,128} It is a critical regulatory gap.

In 2014, the U.S. Department of Interior wrote a letter to the NTIA detailing several published studies showing impacts of wireless radiofrequency radiation (RFR) to birds stating that, “There is a growing level of anecdotal evidence linking effects of non-thermal, non-ionizing electromagnetic radiation from communication towers on nesting and roosting wild birds and other wildlife.” It further stated, “However, 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.”¹²⁹

Significant research has accumulated indicating serious environmental effects of RF, yet with no review by federal agencies. On August 13, 2021, the United States Court of Appeals for the District of Columbia Circuit ruled in our case against the FCC (*EHT et al. v FCC*),¹³⁰ stating “we find the Commission’s order arbitrary and capricious in its complete failure to respond to comments concerning environmental harm caused by RF radiation.” The Commission also “completely failed even to acknowledge, let alone respond to, comments concerning the impact of RF radiation on the environment. That utter lack of a response does not meet the Commission’s obligation to provide a reasoned explanation for terminating the notice of inquiry.”¹³¹ Despite the 2021 court order, the FCC has remained silent. It has taken no action to justify its refusal to update its 1996 wireless radiation exposure guidelines .

Wildlife biologists and wireless radiation experts called for a research agenda and protective actions to address wildlife exposures to wireless radiofrequency (RF) radiation in a new article “[Addressing Wildlife Exposure to Radiofrequency Electromagnetic Fields: Time for Action](#)”¹³² published in Environmental Science & Technology Letters. The article highlighted the “unprecedented wildlife exposure to radiofrequency electromagnetic fields” which has “the potential to exert a wide range of biological effects on wildlife, ranging from reduction in bat feeding activity and the alteration of life history characteristics in insects to morphological abnormalities in plants.” The researchers highlight how ICNIRP limits (similar to U.S. FCC limits) are exclusively for humans, not wildlife and “are likely to be inadequate in protecting

¹²⁷ Levitt, B. B., Lai, H. C., & Manville, A. M. (2021). [Effects of non-ionizing electromagnetic fields on flora and fauna, Part 3. Exposure standards, public policy, laws, and future directions.](#) *Reviews on Environmental Health*.

¹²⁸ Levitt BB, Lai HC and Manville AM II (2022) [Low-level EMF effects on wildlife and plants: What research tells us about an ecosystem approach.](#) *Front. Public Health* 10:1000840. doi: 10.3389/fpubh.2022.1000840

¹²⁹ https://www.ntia.doc.gov/files/ntia/us_doi_comments.pdf

¹³⁰ Final Court Decision *EHT et. al v. the FCC* 8/13/2021

[https://www.cadc.uscourts.gov/internet/opinions.nsf/FB976465BF00F8BD85258730004EFDF7/\\$file/20-1025-1910_111.pdf](https://www.cadc.uscourts.gov/internet/opinions.nsf/FB976465BF00F8BD85258730004EFDF7/$file/20-1025-1910_111.pdf)

¹³¹ [https://www.cadc.uscourts.gov/internet/opinions.nsf/FB976465BF00F8BD85258730004EFDF7/\\$file/20-1025-1910111.pdf](https://www.cadc.uscourts.gov/internet/opinions.nsf/FB976465BF00F8BD85258730004EFDF7/$file/20-1025-1910111.pdf)

¹³² Jérémy S. P. Froidevaux, Laura Recuero Virto, Marek Czerwiński, Arno Thielens, and Kirsty J. Park [Addressing Wildlife Exposure to Radiofrequency Electromagnetic Fields: Time for Action](#) *Environmental Science & Technology Letters*

wildlife from RF-induced biological effects because the relationships among RF-EMF exposure, dosage, and outcome are expected to be species-specific; i.e., an RF-EMF exposure that exerts no biological effect in one species could have an effect in another species.”

“We also urge the international community to mandate an independent international organization such as the United Nations Environmental Programme or the International Union for Conservation of Nature to address wildlife exposure to RF-EMFs.”

Pending further evidence they “strongly recommend the implementation of complementary measures aimed at reducing wildlife exposure to RF-EMF, particularly for species of major conservation concern.”

In 2021 and 2022 a three-part landmark research review by U.S experts of over 1,200 studies on the effects of non-ionizing radiation to wildlife entitled “Effects of non-ionizing electromagnetic fields on flora and fauna” found adverse effects in all species studied at even very low intensities. Findings included impacts to orientation, migration, reproduction, mating, nest, den building and survivorship.¹³³
134 135

In a review published in *Environment International* on the ecological effects of RF-EMF, 70% of the studies reviewed found RF had a significant effect on birds, insects, other vertebrates, organisms, and plants, with development and reproduction in birds and insects being the most strongly affected.¹³⁶ Biologists caution that non ionizing electromagnetic radiation is a critical factor in the decline of pollinator and insect populations.¹³⁷

A 2023 [systematic review and meta-analysis of studies](#) on the biological effects on insects of non-ionizing electromagnetic fields, including cell tower and Wi-Fi radiation, was published in the journal *Reviews on Environmental Health*, finding the “vast majority of studies found effects, generally harmful ones” with toxic effects such as impacts to reproduction and immune health occurring at legally allowed exposure levels.¹³⁸

Individual studies investigating 5G have found adverse effects including:

¹³³ Levitt, B. B., Lai, H. C., & Manville, A. M. (2021). [Effects of non-ionizing electromagnetic fields on flora and fauna, Part 3. Exposure standards, public policy, laws, and future directions.](#) *Reviews on Environmental Health*.

¹³⁴ Levitt, B. B., Lai, H. C., & Manville, A. M. (2021). [Effects of non-ionizing electromagnetic fields on flora and fauna, part 1. Rising ambient EMF levels in the environment.](#) *Reviews on Environmental Health*, 37(1), 81–122.

¹³⁵ Levitt, B. B., Lai, H. C., & Manville, A. M. (2021). [Effects of non-ionizing electromagnetic fields on flora and fauna, Part 2 impacts: How species interact with natural and man-made EMF.](#) *Reviews on Environmental Health*, 37(3), 327–406.

¹³⁶ Cucurachi, S., Tamis, W. L. M., Vijver, M. G., Peijnenburg, W. J. G. M., Bolte, J. F. B., & de Snoo, G. R. (2013). [A review of the ecological effects of radiofrequency electromagnetic fields \(RF-EMF\).](#) *Environment International*, 51, 116–140.

¹³⁷ Balmori A. (2021) [Electromagnetic radiation as an emerging driver factor for the decline of insects.](#) *Science of the Total Environment*. 767: 144913

¹³⁸ [Thill A, Cammaerts MC, Balmori A. Biological effects of electromagnetic fields on insects: a systematic review and meta-analysis.](#) *Rev Environ Health*. 2023 Nov 23

- An [Oregon State University study on zebrafish](#) exposed to the 5G frequency of 3.5 GHz found “significant abnormal responses in RFR-exposed fish” which “suggest potential long-term behavioral effects. [Yang et al 2022](#) found 3.5 GHz induced oxidative stress in guinea pigs.
- The study “[Effects of 700 and 3500 MHz 5G radiofrequency exposure on developing zebrafish embryos](#)” published in Science of the Total Environment found “specific organ morphological effects, and behavioral effects in activity, anxiety-like behavior, and habituation that lasted in larvae exposed during the early embryonic period.”
- Male rats exposed to a 5G base station (4 months) that transmitted at 3.6 GHz, 28 GHz, and 36 GHz had moderately increased stress on neuroendocrine system ([Perov et al 2022](#)).
- A study on 3.5 GHz exposure to both diabetic and healthy rats ([Bektas et al 2022](#)) found an increase in degenerated neurons in the hippocampus of the brains, changes in oxidative stress parameters and changes in the energy metabolism and appetite of both healthy and diabetic rats. The researchers conclude that, “5G may not be innocent in terms of its biological effects, especially in the presence of diabetes.”

Pollinators at Risk: Higher Exposures to Insects From 5G and Higher Frequencies

- The study “[Exposure of Insects to Radio-Frequency Electromagnetic Fields from 2 to 120 GHz](#)” by Thielens et al 2018 published in Scientific Reports found that for the 4 insects studied (western honeybee, australian stingless bee, beetle, locust), exposure at and above 6 GHz could lead to an increase in absorbed power between 3–370% (a factor if over 3 times.) The researchers concluded that “this could lead to changes in insect behavior, physiology, and morphology over time...”
- A follow up study on the honeybee entitled “[Radio-Frequency Electromagnetic Field Exposure of Western Honey Bees](#)” published in Scientific Reports by Thielens et al (2020) modeled exposure in various life cycle stages (worker, drone, larva, and queen) and combined the data with in-situ measurements of environmental RF-EMF exposure near beehives in Belgium in order to estimate realistic exposure and absorbed power values. Again, they found even a relatively small shift of 10% of environmental incident power density from frequencies below 3 GHz to higher frequencies will lead to a relative increase in absorbed power of a factor higher than 3.
- In a subsequent study, researchers modeled the exposures of 2.5 to 100 GHz into the honeybee brain and vital organs in [Estimation of the Specific Absorption Rate for a Honey bee Exposed to Radiofrequency Electromagnetic Fields from 2.5 to 100 GHz,](#)” by Jeladze et al (2023) and found relatively higher SAR values are observed at 12, 25, and 40 [GHz] frequencies in the 4.8 - 8 W/Kg range, especially for the brain tissue. The SAR values varied depending on exposure parameters such as the direction of the incident plane wave, polarization, frequency, and body peculiarities. The authors conclude that, “*based on the obtained results, we can conclude that the exposure to high-frequency RF-EMFs on honey bees might have an undesired impact, which can cause an attenuation of the vital functions of this important insect.*”

- [“Radio-frequency exposure of the yellow fever mosquito \(*A. aegypti*\) from 2 to 240 GHz,”](#) published in PLOS Computational Biology, which found that for the given incident RF power, the absorption increases with increasing frequency between 2 and 90 GHz with a maximum between 90 and 240 GHz. Even at the same incident field strength, the power absorption by the mosquito is 16 times higher at 60 GHz than at 6 GHz. For 120 GHz, this increase is even larger compared to 6 GHz, with a factor 21.8. The absorption was highest in the region where the wavelength matches the size of the mosquito. The authors conclude that, “In the future, the carrier frequency of telecommunication systems will also be higher than 6 GHz. This will be paired with higher absorption of EMF by yellow fever mosquitoes, which can cause dielectric heating and have an impact on behavior, development and possibly spread of the insect.”

Impacts on Plants

A 2017 review [“Weak radiofrequency radiation exposure from mobile phone radiation on plants”](#) found physiological and/or morphological effects in 89.9% of studies reviewed.¹³⁹

“Additionally, our analysis of the results from these reported studies demonstrates that the maize, roselle, pea, fenugreek, duckweeds, tomato, onions and mungbean plants seem to be very sensitive to RF-EMFs. Our findings also suggest that plants seem to be more responsive to certain frequencies, especially the frequencies between (i) 800 and 1500 MHz ($p < 0.0001$), (ii) 1500 and 2400 MHz ($p < 0.0001$) and (iii) 3500 and 8000 MHz ($p = 0.0161$).”

Trees are also at risk from wireless. A field monitoring study spanning nine years involving over 100 trees found damage on the side of the trees facing transmitting cell antennas.¹⁴⁰ Researchers have released subsequent reports documenting continued impacts to tree canopy from cell tower antennas.^{141,142} Other RF effects include impacts to leaf, shoot, seedlings of Aspen trees.¹⁴³

Environmental Health Trust has developed a website focused on the science of wildlife and wireless at wildlifeandwireless.org.

¹³⁹ Halgamuge, M. N. (2017). [Review: Weak radiofrequency radiation exposure from mobile phone radiation on plants.](#) *Electromagnetic Biology and Medicine*, 36(2), 213–235

¹⁴⁰ Waldmann-Selsam, C., Balmori-de la Puente, A., Breunig, H., & Balmori, A. (2016). [Radiofrequency radiation injures trees around mobile phone base stations.](#) *Science of The Total Environment*, 572, 554–569.

¹⁴¹ Breunig, Helmut. [“Tree Damage Caused By Mobile Phone Base Stations An Observation Guide.”](#) (2017).

¹⁴² 2021 Report [“Tree damage caused by mobile phone base stations”](#)

¹⁴³ Haggerty, K. (2010). [Adverse Influence of Radio Frequency Background on Trembling Aspen Seedlings: Preliminary Observations.](#) *International Journal of Forestry Research*, 2010, 836278.

ATTACHMENT 4: Radiofrequency Radiation Impacts on Human Health

Extensive published scientific evidence indicates that wireless radiofrequency (RF) radiation at levels far below FCC limits can cause cancer,¹⁴⁴ increased oxidative stress,¹⁴⁵ genetic damage,¹⁴⁶ structural and functional changes of the reproductive system,¹⁴⁷ memory deficit,¹⁴⁸ behavioral problems¹⁴⁹, and neurological impacts.¹⁵⁰

*EHT et al. v. FCC the U.S. Court of Appeals for the D.C. Circuit 2021*¹⁷ also ruled the FCC ignored scientific evidence on negative health effects from long term wireless radiation exposure at current allowable levels, especially in regards to children, whom the American Academy of Pediatrics states¹⁵¹ are more vulnerable to wireless radiation. The court ordered the FCC to examine the record evidence regarding long term exposure to children, health effects unrelated to cancer and environmental impacts. To date, the FCC has not responded. This landmark ruling highlights how no federal health agency has reviewed the full body of current research to ensure current safety standards are protective.

The state of New Hampshire commissioned a study on the Environmental and Health Effects of Evolving 5G Technology and issued a final report¹⁵² in 2020 with 15 recommendations including: requiring setbacks of all wireless transmitters from residences, businesses and schools, adopting a statewide position to encourage fiber optics to the premise, acknowledging the need for further studies to outline clinical symptoms related to RF exposure, developing RF safety limits to protect the environment, among

¹⁴⁴ Miller, A. B., Morgan, L. L., Udasin, I., & Davis, D. L. (2018). Cancer epidemiology update, following the 2011 IARC evaluation of radiofrequency electromagnetic fields (Monograph 102). *Environmental Research*, 167, 673–683. <https://doi.org/10.1016/j.envres.2018.06.043>

¹⁴⁵ Yakymenko, I., Sidorik, E., Kyrlyenko, S., & Chekhun, V. (2011). Long-term exposure to microwave radiation provokes cancer growth: Evidence from radars and mobile communication systems. *Experimental Oncology*, 33(2), 62–70. <https://pubmed.ncbi.nlm.nih.gov/21716201/>.

¹⁴⁶ Falcioni, L., Bua, L., Tibaldi, E., Lauriola, M., De Angelis, L., Gnudi, F., Mandrioli, D., Manservigi, M., Manservigi, F., Manzoli, I., Menghetti, I., Montella, R., Panzacchi, S., Sgargi, D., Strollo, V., Vornoli, A., & Belpoggi, F. (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 GSM base station environmental emission. *Environmental Research*, 165, 496–503. <https://doi.org/10.1016/j.envres.2018.01.037>

¹⁴⁷ Kim S, Han D, Ryu J, Kim K, Kim YH. Effects of mobile phone usage on sperm quality - No time-dependent relationship on usage: A systematic review and updated meta-analysis. *Environ Res*. 2021 Nov;202:111784. doi: 10.1016/j.envres.2021.111784. Epub 2021 Jul 30. PMID: 34333014

¹⁴⁸ Swiss Tropical and Public Health Institute. "Mobile phone radiation may affect memory performance in adolescents, study finds." ScienceDaily. ScienceDaily, 19 July 2018. <www.sciencedaily.com/releases/2018/07/180719121803.htm>.

¹⁴⁹ Divan HA, Kheifets L, Obel C, Olsen J. Cell phone use and behavioral problems in young children. *J Epidemiol Community Health*. 2012 Jun;66(6):524-9. doi: 10.1136/jech.2010.115402. Epub 2010 Dec 7. PMID: 21138897.

¹⁵⁰ Hiie Hinrikus, Jaanus Lass & Maie Bachmann (2021) Threshold of radiofrequency electromagnetic field effect on human brain, *International Journal of Radiation Biology*, 97:11, 1505-1515, DOI: 10.1080/09553002.2021.1969055

¹⁵¹ AAP Letter to the FCC Chairman calling for the FCC to open up a review of RF guidelines (7/12/2012), AAP Letter to US Representative Dennis Kucinich in Support of the Cell Phone Right to Know Act 12/12/2012, AAP to FCC Commissioner Mignon Clyburn and FDA Commissioner Margaret Hamburg calling for a review of RF guidelines 8/29/2013

¹⁵² <https://www.gencourt.state.nh.us/statstudcomm/committees/1474/reports/5G%20final%20report.pdf>

other recommendations.

In 2022, the Pittsfield, Massachusetts Board of Health sent a cease-and-desist order to shut down a Verizon cell tower. The order ¹⁵³ issued to Verizon states “Whereas, soon after the facility was activated and began transmitting, the City started to receive reports of illness and negative health symptoms from residents living nearby the facility,...The negative health symptoms the affected residents have reported include complaints of headaches, sleep problems, heart palpitations, tinnitus (ringing in the ears), dizziness, nausea, skin rashes, and memory and cognitive problems, among other medical complaints. ... Whereas, as further documented below, the neurological and dermatological symptoms experienced by the residents are consistent with those described in the peer-reviewed scientific and medical literature as being associated with exposure to pulsed and modulated Radio Frequency (“RF”) radiation, including RF from cell towers.”

A major 2022 review of the existing scientific literature on cell tower radiation and health found associations with radiofrequency sickness, cancer and changes in biochemical parameters.¹⁵⁴ For example, a study published in *Electromagnetic Biology and Medicine* on people living near cell antennas found significant biochemical changes in the blood. This study evaluated effects in the human blood of individuals living near mobile phone base stations compared with healthy controls living more than 300 meters from a base station. The group living closer to the antennas had statistically significant higher frequency of micronuclei and a rise in lipid peroxidation in their blood; these changes are considered biomarkers predictive of cancer.¹⁵⁵

According to Dr. Linda Birnbaum, Scientist Emeritus and Former Director of the National Institute of Environmental Health Sciences and National Toxicology Program of the National Institutes of Health, “Aware that the FCC’s 1996 limits lacked the underpinning of solid scientific data regarding long term health effects, the FDA requested large-scale studies by the National Toxicology Program (NTP) and in 2018 the NTP studies found clear evidence of an association with cancer in male rats.¹⁵⁶ Additionally, the NTP found heart damage and DNA damage, despite the fact that the animals were carefully exposed to non-heating RFR levels long assumed to be safe. The Ramazzini Institute animal studies¹⁵⁷ used even lower RFR lower exposures to approximate cell tower emissions and also found increases of the same tumor type. The NTP studies were carefully controlled to ensure exposures did not significantly heat the animals. The animal study findings in combination with human studies indicate carcinogenic effects

¹⁵³ <https://ehtrust.org/wp-content/uploads/Pittsfield-Health-Board-Cell-Tower-Order-to-Verizon-April-11-2022-FINAL-REDACTED.pdf>

¹⁵⁴ A. Balmori (2022). Evidence for a health risk by RF on humans living around mobile phone base stations: From radiofrequency sickness to cancer. *Environ. Res.*, 214 (2022), Article 113851 <https://doi.org/10.1016/j.envres.2022.113851>

¹⁵⁵ Zothansiana, Zosangzuali, M., Lalramdinpuui, M., & Jagetia, G. C. (2017). Impact of radiofrequency radiation on DNA damage and antioxidants in peripheral blood lymphocytes of humans residing in the vicinity of mobile phone base stations. *Electromagnetic Biology and Medicine*, 36(3), 295–305. <https://doi.org/10.1080/15368378.2017.1350584>.

¹⁵⁶ National Toxicology Program Radiofrequency Radiation <https://ntp.niehs.nih.gov/whatwestudy/topics/cellphones/index.html>

¹⁵⁷ Falcioni et al., 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 GSM base station environmental emission, *Environmental Research*, Volume 165, 2018, Pages 496-503 DOI: 10.1016/j.envres.2018.01.037

from non heating levels of radiofrequency. Currently, several scientists conclude that the weight of currently available, peer-reviewed evidence supports the conclusion that radiofrequency radiation is a proven human carcinogen.

A review paper on corporate risk entitled “Limiting Liability with Positioning to Minimize Negative Health Effects of Cellular Phone Towers” reviewed the “large and growing body of evidence that human exposure to RFR from cellular phone base stations causes negative health effects.” The authors recommend restricting antennas near homes and within 500 meters of schools and hospitals to protect companies from future liability.¹⁵⁸

European Parliament requested a research report [“Health Impact of 5G”](#) which was released in July 2021 and concluded that commonly used RFR frequencies (450 to 6000 MHz) are probably carcinogenic for humans and clearly affect male fertility with possible adverse effects on the development of embryos, fetuses and newborns.

A [study](#) entitled [The Effect of Continuous Low-Intensity Exposure to Electromagnetic Fields from Radio Base Stations to Cancer Mortality in Brazil](#) published in the International Journal of Environmental Research and Public Health found higher exposure to cell network arrays linked to higher mortality from all cancer and specifically lung and breast cancer.

¹⁵⁸ Pearce, J. M. (2020). Limiting liability with positioning to minimize negative health effects of cellular phone towers. *Environmental Research*, 181, 108845. <https://doi.org/10.1016/j.envres.2019.108845>.

ATTACHMENT 5: Legal and Liability Issues of Wireless

U.S. mobile operators have been [unable to get insurance](#) to cover liabilities related to damages from long term exposure to radiofrequency emissions for well over a decade.¹⁵⁹

It is notable that in 2000, the Ecolog Institute Report on radiofrequency health effects, commissioned by T-Mobile and DeTeMobil Deutsche Telekom MobilNet, recommended an RF exposure limit 1000x lower than the FCC's current power density limit after reviewing the research on biological effects, including impacts to the immune system, central nervous system, hormones, cancer, neurotransmitters and fertility.¹⁶⁰

Insurers [rank](#) 5G and electromagnetic radiation as a “high” risk,¹⁶¹ [comparing the issue](#) to lead and asbestos.¹⁶² A 2019 Report¹⁶³ by [Swiss Re Institute](#), a world leading provider of insurance, classifies 5G mobile networks as a “high”, “off-the-leash” risk stating, “Existing concerns regarding potential negative health effects from electromagnetic fields (EMF) are only likely to increase. An uptick in liability claims could be a potential long-term consequence” and “as the biological effects of EMF in general and 5G in particular are still being debated, potential claims for health impairments may come with a long latency.”

Due to their understanding of the magnitude of this future financial risk [most insurance plans](#) have “electromagnetic field exclusions” applied as the [market standard](#).¹⁶⁴ As an example, [Portland Oregon Public School Insurance](#) states,¹⁶⁵ “Exclusions: This insurance does not apply to: Bodily injury, personal injury, advertising injury, or property damage arising directly or indirectly out of, resulting from, caused or contributed to by electromagnetic radiation, provided that such loss, cost or expense results from or is contributed to by the hazardous properties of electromagnetic radiation.”

Wireless and non-ionizing electromagnetic radiation are defined as a type of “pollution” by wireless companies themselves. According to [pg. 10 of the Verizon Total Mobile Protection Plan](#), “Pollution” is

¹⁵⁹ Roseanne White Geisel, (2007) [Insurers exclude risks associated with electromagnetic radiation](#), Business Insurance

¹⁶⁰ [Review of the Current Scientific Research in view of Precautionary Health Protection](#), Commissioned by T-Mobile DeTeMobil Deutsche Telekom MobilNet GmbH. (2000) Translated into English <https://ehtrust.org/wp-content/uploads/T-mobile-RF-Radiation-Ecolog-2000-Report-.pdf>

¹⁶¹ <https://ehtrust.org/key-issues/reports-white-papers-insurance-industry/>

¹⁶² Lloyd's of London Report on Electromagnetic Fields “Electromagnetic fields from mobile phones: recent developments.” Lloyd's Emerging Risks Team Report, November 2010; 2016 Austrian Accident Insurance Institute (AUVA) ATHEM Report “Investigation of athermal effects of electromagnetic fields in mobile communications.”; Business Insurance (2011) [White paper explores risks that could become 'the next asbestos'](#)

See also Factsheets on Legal Liability of Cell Towers at <https://ehtrust.org/wp-content/uploads/Legal-Liability-Cell-Tower-Radiation-Health-Effects-3.pdf>

¹⁶³ Swiss Re 5G Report “Off the leash – 5G mobile networks”

<https://www.swissre.com/institute/research/sonar/sonar2019/SONAR2019-off-the-leash.html> PDF <https://ehtrust.org/wp-content/uploads/Swiss-Re-SONAR-Publication-2019-excerpt-1.pdf>

¹⁶⁴ [Electromagnetic Field Insurance Policy Exclusions Cell Phone Radiation and EMFs - Environmental Health Trust](#)

¹⁶⁵ page 30 <https://ehtrust.org/wp-content/uploads/Portland-Public-School-2017-18-Excess-Liability0D0A-policy-1.pdf>

defined as “The discharge, dispersal, seepage, migration or escape of pollutants. Pollutants means any solid, liquid, gaseous, or thermal irritant or contaminant including smoke, vapor, soot, fumes, acid, alkalis, chemicals, artificially produced electric fields, magnetic field, electromagnetic field, sound waves, microwaves, and all artificially produced ionizing or nonionizing radiation and/or waste.” Similar definitions for pollution are in the product protection plans for [AT&T](#), [Sprint](#), [Verizon](#), and [T-Mobile](#).

Wireless companies inform shareholders of RF risk¹⁶⁶ but not the communities impacted by the infrastructure.¹⁶⁷ Companies clearly inform shareholders that companies may incur significant financial losses related to non-ionizing electromagnetic fields. Corporate investor [warnings](#) by companies such as [T-Mobile](#), [AT&T](#), [Verizon](#), [Vodafone](#) and [Crown Castle](#) are contained in their Annual Reports, and Form 10-K (or Form 20-F or 40-F for foreign companies) with the Securities and Exchange Commission (SEC). For example, Crown Castle states in their [10-K tax filing](#) that:

If radio frequency emissions from wireless handsets or equipment on our communications infrastructure are demonstrated to cause negative health effects, potential future claims could adversely affect our operations, costs or revenues.

The potential connection between radio frequency emissions and certain negative health effects, including some forms of cancer, has been the subject of substantial study by the scientific community in recent years. We cannot guarantee that claims relating to radio frequency emissions will not arise in the future or that the results of such studies will not be adverse to us.

Public perception of possible health risks associated with cellular or other wireless connectivity services and wireless technologies (such as 5G) may slow or diminish the growth of wireless companies and deployment of new wireless technologies, which may in turn slow or diminish our growth. In particular, negative public perception of, and regulations regarding, these perceived health risks may slow or diminish the market acceptance of wireless services and technologies. If a connection between radio frequency emissions and possible negative health effects were established, our operations, costs, or revenues may be materially and adversely affected. We currently do not maintain any significant insurance with respect to these matters.”

[Verizon stated in its 10-K for 2022](#) under the section “Legal and Regulatory Risks” that:

“We are subject to a substantial amount of litigation, which could require us to pay significant damages or settlements. We are subject to a substantial amount of litigation and claims in arbitration, including, but not limited to, shareholder derivative suits, patent infringement lawsuits, wage and hour class actions, contract and commercial claims, personal injury claims, property claims, environmental claims, and lawsuits relating to our advertising, sales, billing and collection

¹⁶⁶ [Corporate Company Investor Warnings in Annual Reports 10k Filings Cell Phone Radiation Risks - Environmental Health Trust](#)

¹⁶⁷ <https://ehtrust.org/key-issues/corporate-company-investor-warnings-annual-reports-10k-filings-cell-phone-radiation-risks/>

practices. In addition, our wireless business also faces personal injury and wrongful death lawsuits relating to alleged health effects of wireless phones, or radio frequency transmitters. We may incur significant expenses in defending these lawsuits. In addition, we may be required to pay significant awards or settlements.”

ATTACHMENT 6: Recommendations from Other Expert Organizations on Technology Safety

Recommendations of the New Hampshire State Commission on 5G Health and Environment

In 2019 the New Hampshire government passed House Bill 522 “An act establishing a commission to study the environmental and health effects of evolving 5G technology.”¹⁶⁸ The Commission released its [Final Report on Commission to Study the Environmental and Health Effects of Evolving 5G Technology](#)¹⁶⁹ in 2020 with findings that safety assurance for wireless technology “come into question because of the thousands of peer-reviewed studies documenting deleterious health effects associated with cellphone radiation exposure.” In its report the Commission issued 15 recommendations:

1. Support statewide deployment of fiber optic cable connectivity with wired connections inside homes.
2. New Hampshire schools and libraries should replace Wi-Fi with hardwired connections.
3. Require setbacks for new wireless antennas from residences, businesses, and schools.
4. New Hampshire health agencies educate the public on minimizing radiofrequency radiation (RFR) exposure with public service announcements on radio, television, and print. “Warnings concerning the newborn and young as well as pregnant women”
5. Establish RFR free zones in commercial and public buildings
6. New measurement protocols needed to evaluate high data rate, signal characteristics associated with biological effects and summative effects of multiple radiation sources.
7. RFR signal strength measurements for cell sites should be done by independent contractors.
8. NH professional licensure to offer education so home inspectors can include RFR intensity measurements.
9. Warning signs to be posted in commercial and public buildings.
10. State should measure RFR and post maps with measurements for the public.
11. Require 5G structures to be labeled for RFR at eye level and readable from nine feet away.
12. Engage agencies with ecological knowledge to develop RFR safety limits that will protect the trees, plants, birds, insects, and pollinators.
13. Under the National Environmental Policy Act, FCC should do an environmental impact statement as to the effect on New Hampshire and the country as a whole from 5G and the expansion of RF wireless technologies.
14. Cell phones and wireless devices should be equipped with updated software that stops cell phones from radiating when positioned against the body.
15. A resolution to US Congress to require the FCC to commission an independent health study and

¹⁶⁸ https://www.gencourt.state.nh.us/bill_status/legacy/bs2016/

¹⁶⁹ <https://www.gencourt.state.nh.us/statstudcomm/committees/1474/reports/5G%20final%20report.pdf>

review of safety limits.

The American Academy of Pediatrics

The American Academy of Pediatrics (AAP) has written [several letters to the FCC](#) calling on them to update wireless safety limits to protect children ¹⁷⁰stating that, “Current FCC standards do not account for the unique vulnerability and use patterns specific to pregnant women and children. It is essential that any new standard for cell phones or other wireless devices be based on protecting the youngest and most vulnerable populations to ensure they are safeguarded throughout their lifetimes.”

The American Academy of Pediatrics [states of cell towers](#)¹⁷¹ that, “An Egyptian study confirmed concerns that living nearby mobile phone base stations increased the risk for developing: Headaches, Memory problems, Dizziness, Depression, Sleep problems”

In response to the National Toxicology Program [animal study findings of cancer and DNA damage](#)¹⁷² from cell phone radiation, the AAP also issued the cell phone safety tips specifically for families¹⁷³ to reduce exposure to wireless radiation including, “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.”

The California Department of Health

The California Department of Health released [an advisory on how to reduce cell phone radiation](#)¹⁷⁴ stating children may be more at risk and “Although the science is still evolving, some laboratory experiments and human health studies have suggested the possibility that long-term, high use of cell phones may be linked to certain types of cancer and other health effects.” Recommendations include, “Parents should consider reducing the time their children use cell phones and encourage them to turn the devices off at night.”

The Connecticut Department of Public Health

The Connecticut Department of Public Health states in its FAQs on Cell Phones that it is “wise” to reduce cell phone radio frequency to one’s brain.¹⁷⁵

The North Carolina Public Health Department

¹⁷⁰ [The American Academy of Pediatrics Letters to the FCC https://ehtrust.org/wp-content/uploads/American-Academy-of-Pediatrics-Letters-to-FCC-and-Congress-.pdf](https://ehtrust.org/wp-content/uploads/American-Academy-of-Pediatrics-Letters-to-FCC-and-Congress-.pdf)

[AAP Letter to the FCC Chairman calling for the FCC to open up a review of RF guidelines \(7/12/2012\)](#)

[AAP Letter to US Representative Dennis Kucinich in Support of the Cell Phone Right to Know Act 12/12/2012](#)

[AAP to FCC Commissioner Mignon Clyburn and FDA Commissioner Margaret Hamburg calling for a review of RF guidelines 8/29/2013](#)

¹⁷¹ [Electromagnetic Fields: A Hazard to Your Health? - HealthyChildren.org](#)

¹⁷² [Cell Phone Radio Frequency Radiation](#)

¹⁷³ [Cell Phone Radiation & Children’s Health: What Parents Need to Know - HealthyChildren.org](#)

¹⁷⁴ California Department of Public Health, [Cell phone advisory](#) (2017)

¹⁷⁵ [Connecticut Department of Public Health, Cell Phone Factsheet 2015](#)

[The North Carolina Public Health Department](#) lists the full cancer findings of the NTP study¹⁷⁶, the FDA stance and also the American Academy of Pediatrics recommendations to reduce cell phone radiation stating “there is some concern that exposure to non-ionizing radiation, also called radio frequency radiation, that is emitted by cell phones may result in an increased risk of cancer or other health effects”

The Maryland State Children’s Environmental Health And Protection Advisory Council

The [Maryland State Children’s Environmental Health And Protection Advisory Council](#), whose 19 member Commission includes experts in public health, pediatricians, state health and environment agencies and legislators issued a report recommending reducing wireless exposure to children in schools and homes.¹⁷⁷

The Santa Clara Medical Association

The [Santa Clara Medical Association Best Practices for Technology in Schools](#)¹⁷⁸ recommends reducing Wi-Fi exposure and restricting cell towers near schools.

California Medical Association

In 2014, the California Medical Association passed two resolutions regarding wireless standards: 1. To “support efforts to reevaluate microwave safety exposure levels associated with wireless communication devices, including consideration of adverse non-thermal biologic and health effects from non-ionizing electromagnetic radiation used in wireless communications”; and 2. To “support efforts to implement new safety exposure limits for wireless devices to levels that do not cause human or environmental harm based on scientific research.”

Scientists With Expertise in Electromagnetic Radiation

Numerous medical groups have called for policies to reduce children’s exposure¹⁷⁹. For example, the [EMF Scientists](#) are over 259 scientists from 41 countries who have peer-reviewed publications on electromagnetic fields who made a 2015 appeal to the United Nations¹⁸⁰ and all member States in the world to encourage the World Health Organization “to exert strong leadership in fostering the development of more protective EMF guidelines, encouraging precautionary measures, and educating the public about

¹⁷⁶ [North Carolina Department of Health and Human Services, Cell Phones 2020](#) .

¹⁷⁷ The Maryland State Children’s Environmental Health and Protection Advisory Council [Wi-Fi in School Report](#), [Letter to the Federal Communications Commission](#) May 1, 2019 and [“Guidelines to Reduce Electromagnetic Field Radiation”](#)

¹⁷⁸ [Santa Clara County Medical Association Best Practices for Safe Technology in Schools](#)

¹⁷⁹ [Reykjavik Iceland Appeal on Wireless in School](#); [Scientist 5G Appeal to the EU](#)(2017)

[Nicosia Declaration](#) (2017); [the International Society of Doctors for Environment 5G Appeal](#) (2018); [2020 Consensus Statement of UK and International Medical and Scientific Experts and Practitioners on Health Effects of Non-Ionising Radiation](#).

¹⁸⁰https://ehtrust.org/wp-content/uploads/European_Journal_on_Oncology_December_2015.International_EMF_Scientist_Appeal-2.pdf and [EMF Scientist](#)

health risks, particularly risk to children and fetal development.”

INTERNATIONAL RECOMMENDATIONS ON TECHNOLOGY SAFETY

Austrian Medical Chamber, Cyprus Committee on Environment and Children’s Health

- [The 16 Practical Rules to Reduce Cell Phone and Wireless Radiation](#)

Athens Medical Association

- [16 Recommendations to reduce human exposure to wireless radiation \(2017\)](#)

France Agency for Food, Environmental and Occupational Health & Safety (ANSES)

2016 Report “Radiofrequency Exposure and the Health of Children”

[Recommendations of the Agency](#): ANSES recommends to “reconsider the regulatory exposure limits” to ensure “sufficiently large safety margins” to [protect](#) the health of young children and ANSES reiterated its recommendation, as previously stated, to reduce exposure to children: minimize use and prefer a hands-free kit.

Belgium Health Food Environment Agency

“Experts – including those on the Superior Health Council – advise everyone to limit their exposure to mobile phone radiation.” - [Health Food Environment Agency of Belgium](#)

German Government

“Of particular importance is the minimisation of children’s [radiation exposure](#) as they are still developing and could therefore react more sensitively in terms of health. The BfS therefore recommends restricting children’s use of mobile phones as far as possible.”

-German Government [Recommendations from the BfS for making telephone calls on mobile phones](#).

Ireland Department of Health

“Children are thought to be at higher risk of health implications from the use of mobile phones. This is because their skulls and cells are still growing and tend to absorb radiation more easily...It is recommended that children use mobile phones only if absolutely necessary.”

-[Advice from the Chief Medical Officer on Mobile Phone Use, Ireland Department of Health](#)

French Polynesia

“The use of mobile phones by children is not recommended before the age of 15: their brains have not matured and are more sensitive to electromagnetic waves. Parents are advised to advise their children or adolescents to use their phone only for essential calls.”

[Government multimedia campaign to educate the public](#)

Cyprus

In 2017 the Minister of Culture and Education issued a [directive](#) to ban Wi-Fi from kindergartens, remove Wi-Fi from elementary classrooms. The [Cyprus National Committee on Environment and Child Health](#) along with the Ministry of Health launched a public information campaign in 2019 that ran large scale ads on the backs of buses and featured 5 ways to reduce cell phone and Wi-Fi exposure. In 2017 the Cyprus Medical Association issued [Sixteen recommendations](#) to reduce cell phone radiation exposure.

Republic of Korea

“When you are asleep or when you are relaxing, the farther away the phone is from your body, the safer you are.”

The Korea government has a [website](#) with extensive information on what electromagnetic exposures are and how to reduce exposure. The [webpage on children and EMF](#) has graphics that illustrate how to use cell phones in “safer ways” as well as educational videos on how to reduce cell phone radiation exposure for [children](#) and [adults](#).

United Kingdom

“The international guidelines recommended by Public Health England (PHE) provide protection for the population as a whole; however, uncertainties in the science suggest some additional level of precaution is warranted, particularly for sources such as mobile phones where simple measures can be taken to reduce exposure.”

[Radio waves: reducing exposure from mobile phones - GOV.UK](#)

Turkey

[Things to Consider When Using a Mobile Phone](#) by the Electromagnetic Fields Health Effects Assessment Subcommittee on [General Directorate of Public Health](#) website

- It is not recommended for pregnant women to use mobile phones.
- Mobile phones should not be used except in emergencies, and whenever possible, wired landline phones should be used instead of mobile phones.
- Conversations on mobile phones should be kept as short as possible and text messages should be used more.
- When buying a mobile phone, phones with low SAR values should be preferred.
- Mobile phones should be used and kept as far away from the body as possible. It is especially recommended to be away from organs such as the heart, brain and kidney.
- Mobile phones should not be kept in baby rooms, bedrooms and near children.

More government public health recommendations are found at <https://ehtrust.org/reduce-cell-phone-radiation-exposure-list-of-countries-official-recommendations/>

Parliamentary Assembly of the Council of Europe

[Resolution 1815: “The Potential Dangers of Electromagnetic Fields and Their Effect on the](#)

[Environment](#)” which is a call to European governments to “take all reasonable measures” to reduce exposure to electromagnetic fields “particularly the exposure to children and young people who seem to be most at risk from head tumours.”

European Environment Agency

'There are many examples of the failure to use the precautionary principle in the past, which have resulted in serious and often irreversible damage to health and environments. Appropriate, precautionary and proportionate actions taken now to avoid plausible and potentially serious threats to health from EMF are likely to be seen as prudent and wise from future perspectives. We must remember that precaution is one of the principles of EU environmental policy,' says Professor Jacqueline McGlade, Executive Director of the European Environment Agency.

The benefits of mobile telecommunications are many, but, as with other case studies in the Late lessons from early warnings Volume 1 (EEA, 2001) and the present report, such benefits need not to be accompanied by the possibility of widespread harms. Precautionary actions now to reduce head exposures, as pointed out by the EEA in 2007, and many others since, would limit the size and seriousness of any brain tumor risk that may exist. Reducing exposures may also help to reduce the other possible harms that are not considered in this case study.

[-European Environment Agency, Late lessons II Chapter 21 - Mobile phone use and brain tumour risk: early warnings early actions](#)

ATTACHMENT 7:

Satellite Environmental Effects Fact Sheet