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Re: Wireless Radiation is an Environmental Justice Issue That Needs to be Addressed by the Department of Homeland Security

The scientific evidence[1] is adequate to support strong public health policies to reduce wireless radiation, especially for children and vulnerable populations. Wireless radio frequency (RF) radiation at levels far below FCC limits can cause cancer,[2] increased oxidative stress,[3] genetic damage,[4] structural and functional changes

[1] 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. ; 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; Directorate-General for Parliamentary Research Services (European Parliament), & Belpoggi, F. (2021). Health impact of 5G: Current state of knowledge of 5G related carcinogenic and reproductive/developmental hazards as they emerge from epidemiological studies and in vivo experimental studies. Publications Office of the European Union; 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; 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*.

[2] 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

[3] Yakymenko, I., Sidorik, E., Kyrylenko, 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/.

[4] Falcioni, L., Bua, L., Tibaldi, E., Lauriola, M., De Angelis, L., Gnudi, F., Mandrioli, D., Manservigi, M., Manservisi, 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

of the reproductive system,[5] memory deficit,[6] behavioral problems[7], and neurological impacts.[8]

However, despite these health 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 of radiofrequency radiation, an emerging environmental justice issue.

Research shows that the environmental levels of radiofrequency radiation (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.[9] Studies show a 70x increase[10]. Cell towers are often disproportionately placed in neighborhoods with higher numbers of minorities and students needing free and reduced meals.[11] In Montgomery County, for example, cell towers are overwhelmingly placed in schools with higher numbers of minorities, english as a second language students, and those who subscribe to free and reduced lunch rates.[12] Parents in schools with a higher white and more affluent population have organized and successfully fought off the towers.[13]

Cell antennas are being put up in front of apartments and renters are not being informed nor are they a part of

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[5] 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

[6] 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>.

[7] 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.

[8] 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

[9] 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

[10] 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.

[11] MCPS places controversial cellular towers at predominantly high-poverty schools, stats show states, "according to MCPS' own data, 81 percent of its cell phone towers are at schools where at least one-third of students are eligible for the free and reduced price meals (FARMs).

[12] MCPS places controversial cellular towers at predominantly high-poverty schools, stats show According to MCPS' own data, 81 percent of its cell phone towers are at schools where at least one-third of students are eligible for the free and reduced price meals (FARMs).

[13] Wootton Principal: School 'Will Not Move Forward' With Cell Tower | Montgomery Community Media; Prince George's the latest school system to face debate over planned cellphone towers - The Washington Post

the decision making process. Low income families and renters have less ability to move or mitigate exposures. Health care inequalities will further exacerbate health inequities as people in under-resourced communities will receive unequal care for the damages from exposure to RFR.

**U.S. Government Regulations are Inadequate**

FCC limits are inadequate to address long term health effects from daily exposure to wireless radiation. As stated by the EPA, FDA, and Department of Interior, current FCC guidelines address heating effects of short term exposures only.[14] Current FCC human exposure guidelines are unchanged since 1996 and 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 radiation documented in the scientific literature.[15] Current guidelines also do not consider the documented effects of modulations and pulsation on living cells. As the DC Circuit recognized, these antiquated studies are a far cry from properly assessing the health and environmental impacts of modern technology and ubiquitous wireless devices.

A study by U.S. Army and Air Force Research Laboratories found that high powered pulsed microwave exposures could reach the same threshold pressures of explosive blast brain and football head impact injuries even at levels considered "safe" and compliant with current FCC RF limits.[16]

[14] 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 from 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 (nonthermal), longterm (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."

[15] 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.

[16] A. M. Dagro, J. W. Wilkerson, T. P. Thomas, B. T. Kalinosky, and J. A. Payne, "Computational modeling investigation of pulsed high peak power microwaves and the potential for traumatic brain injury," Sci. Adv., vol. 7, no. 44, pp. 1–10, Oct. 2021, doi: 10.1126/sciadv. abd8405. "Nevertheless, the simulations here have shown that exceptionally intense HPM exposures with incident power densities greater than 1.5 × 106 mW/cm2 (at short pulse durations) may generate intracranial stresses that are similar (±~20 to 200 kPa) in comparison to typical TBI events (sports, vehicle accidents, ballistic impact, etc.). For sufficiently short microwave pulse durations (<τc), large tensile stresses are created in the

No federal agency with health or science expertise has evaluated the comprehensive body of scientific research on the human health and environmental impacts of wireless radiation. Yet an ever growing body of scientific evidence documents adverse effects from RF radiation at exposure levels well below FCC limits[17] with research findings that include cancer, the induction of oxidative stress, epigenetic effects, impacts to neurotransmitters, memory, brain development and damage to the immune, endocrine, hematological and reproductive system. Further, studies have found impacts to tree canopy, plant growth, pollinator health and the orientation, migration and breeding of wildlife.[18] The science clearly indicates that wireless networks create harmful interference in humans as well as flora and fauna. Attachments 2 and Attachment 3 below document the significant body of scientific evidence indicating adverse effects to humans and the environment from radiofrequency exposure.

Neither FCC, nor the Food and Drug Administration (FDA), have yet to address their responsibilities to ensure public health and environmental protection. The FCC has not responded to the August 13, 2021, U.S. Court of Appeals for the District of Columbia Circuit *ORDER* in *Environmental Health Trust et al. v. FCC, 2021* wherein the court ordered the FCC to "address the impacts of RF radiation on children, the health implications of long-term exposure to RF radiation, the ubiquity of wireless devices, and other technological developments that have occurred since the Commission last updated its guidelines, and…the impacts of RF radiation on the environment." The Court also ordered the FCC to "provide a reasoned explanation for its decision to retain its testing procedures for determining whether cell phones and other portable electronic devices comply with its guidelines."

Further, as documented in Attachment 1 on Regulatory Gaps, there are no federal agencies with health and science expertise engaged in activities related to reviewing the science on health effects of rising environmental RF levels from network infrastructure.

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deep regions of the brain…While the peak power densities used within this simulation study are large, they are achievable with known microwave hardware. For example, to produce a power density of 1 × 106 mW/cm2 at 25 m away from a 40-dBi antenna, a microwave source would require approximately 8 MW of power per pulse. This is within the capabilities of some commercial and military systems, and we therefore consider this as a relevant approximation for the simulations here. However, we also consider some more extreme conditions in the final analysis summary for scaling purposes against known mechanical TBI thresholds." See also Lin, J. C. (2023). A Paradigm Shift? IEEE Microw. https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=10314707

[17] 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.

[18] 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

**Recommendations to the Department of Homeland Security**

**Recommendation 1. DHS must address RF wireless radiation just as they are addressing other environmental justice issues.**
Wireless radio frequency (RF) radiation is a civil rights issue and an environmental justice issue. Exposures must be considered and addressed with every action by the Department. Pointing to the federal regulations as providing safety is no longer acceptable as the federal government has failed to protect the public by not updating its 1996 RF limits. See **ATTACHMENT 1: Today's Regulatory Gap Regarding Radiofrequency Bioeffects**

**Recommendation 2. Individuals such as those with EMF related disabilities and vulnerable populations like children, pregnant women, the sick and elderly should have equal access to safe wired (wireless radiation free) technology in homes, schools, the workplace and community buildings. They also should have a choice of a low EMF homes without a cell tower in close proximity.**

There is a segment of the population that has developed or will develop microwave sickness, a debilitating reaction to electromagnetic fields including RFR. Microwave sickness is well documented in the medical literature. [19] [20] Electromagnetic related disability is recognized by the US government and multiple other entities.[21] In addition, certain segments of the population are more vulnerable to radiofrequency impacts, including children, pregnant women, the sick and the elderly.[22]

Wired internet connections can safely and more effectively provide internet connectivity without the risks to individuals especially those with electromagnetic disabilities and vulnerable populations.

People need safe low EMF homes. They should not be forced to live with a cell tower beaming into their window. Yet many people have no choice. This has to change.

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

[20] 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.

[21] Resources on Electromagnetic Sensitivity and Accommodations - Environmental Health Trust

[22] 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*.

***Recommendation 3:*** **The Department can share information on the impacts of RF exposure to humans, especially children, pregnant people, the sick and the elderly and ways to mitigate these impacts.**[23]

Environmental Health Trust has developed public health fact sheets and educational resources to communicate all the ways to reduce everyday wireless exposures.[24] More outreach needs to be done with the American public so they understand this issue. We recommend a multimedia educational campaign.

***Recommendation 4***: **We recommend that wired networks be installed instead of wireless access points for internet connectivity. In addition, wired computers and associated equipment, along with training should be provided to communities so they can learn how to use wired computers and technology.**

We recommend against installing Wi-Fi access points in buildings and instead wired networks should be installed whenever possible. For example, in a library each desk can be equipped with an ethernet connection and adapters. If Wi-Fi or wireless systems are to be installed then proper RFR measurements should be taken and publicly posted on the map so the RF radiation measurements may be accessed by all individuals concerned with wireless radiation exposure, especially those with electromagnetic sensitivity. We also recommend that proper signage be posted on all locations with Wi-fi hotspots, visible at least 9 feet away, so that individuals with electromagnetic sensitivities may be alerted prior to high exposure. Full transparency is needed regarding RF exposures.

**Expert Recommendations 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."[25] The Commission released its Final Report on Commission to Study the Environmental and Health Effects of Evolving 5G Technology[26] 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:

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[23] 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.

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

[25] https://www.gencourt.state.nh.us/bill_status/legacy/bs2016/

[26] https://www.gencourt.state.nh.us/statstudcomm/committees/1474/reports/5G%20final%20report.pdf

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 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 [27]stating 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."

In response to the National Toxicology Program animal study findings of cancer and DNA damage[28] from cell

[27] 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
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
[28] Cell Phone Radio Frequency Radiation

phone radiation, the AAP also issued the cell phone safety tips specifically for families[29] 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 American Academy of Pediatrics states of cell towers[30] 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"

***The California Department of Health***

The California Department of Health released an advisory on how to reduce cell phone radiation[31] 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.[32]

***The North Carolina Public Health Department***

The North Carolina Public Health Department lists the full cancer findings of the NTP study[33], 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.[34]

***The Santa Clara Medical Association***

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[29] Cell Phone Radiation & Children's Health: What Parents Need to Know - HealthyChildren.org
[30] Electromagnetic Fields: A Hazard to Your Health? - HealthyChildren.org
[31] California Department of Public Health, Cell phone advisory (2017)
[32] Connecticut Department of Public Health,Cell Phone Factsheet 2015
[33] North Carolina Department of Health and Human Services,Cell Phones 2020 .
[34] 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"

The Santa Clara Medical Association Best Practices for Technology in schools[35] 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 exposure[36]. 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 Nations[37] 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 health risks, particularly risk to children and fetal development."

**ATTACHMENT 1: Today's Regulatory Gap Regarding Radiofrequency Bioeffects**
**ATTACHMENT 2: Radio-frequency Radiation Impacts on the Environment**
**ATTACHMENT 3: Radio-frequency Radiation Impacts on Human Health**
**ATTACHMENT 4: Legal and Liability Issues of Wireless**

## ATTACHMENT 1: Today's Regulatory Gap Regarding Radiofrequency Bioeffects

[35] Santa Clara County Medical Association Best Practices for Safe Technology in Schools

[36] Reykjavik Iceland Appeal on Wireless in School; Scientist 5G Appeal to the EU(2017) Nicosia Declaration (2017);m 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.

[37]https://ehtrust.org/wp-content/uploads/European_Journal_on_Oncology_December_2015.International_EMF_Scientist_Appeal-2.pdf and EMF Scientist

Although the public and elected officials assume that federal agencies are engaged in RF activities to ensure public health and environmental protection, this is inaccurate. FCC RF exposure limits are guidelines only, as they are not federally developed safety standards[38] whereby agencies reviewed the totality of scientific evidence, performed risk analysis and identified a level of adverse effect to base an exposure limit on that would ensure adequate public protection. A review of federal agency involvement indicates minimal research and oversight activities along with serious regulatory gaps including but not limited to:

Issues related to the FCC's 1996 limits.

- 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 transparency, monitoring, data gathering and oversight.

- There is no federal registry for all wireless facility sites, macro cell towers, and 5G/4G " small cell" wireless facilities.
- There is no measuring, monitoring or mapping program for environmental RF levels.
- There is no post market surveillance program nor public/industry reporting system to gather data on health and environmental impacts.

Issues related to compliance

- There is no oversight and enforcement program in place to ensure RF emissions from network antennas and devices are compliant.
- Current industry-generated or commissioned pre-construction reports and post-construction testing are largely inadequate, if not inaccurate, in large part because the modeling protocols and programs have not been validated for real world accuracy.
- There are no up-to-date, minimum standards for preparing RF compliance reports, studies and evaluations nor quality control.
- As of June 2023, FCC has not issued updated guidance on how to comply with RF rules, which includes newly licensed frequencies and services, since 1997. The existing guidance, *Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields* (FCC OET 65 (1997),[39] which provides assistance in determining whether proposed or existing transmitting facilities, operations or devices comply with limits for human exposure to

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

[39] https://transition.fcc.gov/Bureaus/Engineering_Technology/Documents/bulletins/oet65/oet65.pdf

radiofrequency (RF) adopted by the Federal Communications Commission (FCC) rules, is outdated. Independent inspectors, informed by up-to-date guidance, should be required to carry out on-the-ground measurements post antenna deployments to verify compliance with human exposure limits.

- Field compliance reports taking actual measurements can reach different conclusions depending on, for example, the number of measurements, location of measurements in relation to the antennas and the length of measurement in each location. Furthermore, reports are inconsistent regarding the inclusion of peak measurements versus averaged measurements, and the inclusion of actual values versus percentage of FCC limits.

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 (as compared to cell phones of which the FDA has shared authority and has shown only limited activities).
- 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 ongoing animal study by the National Toxicology Program.
- There is no agency carrying out pre-or post-market studies 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.).

**RF Guideline Background**

FCC RF exposure limits are guidelines only, as they are not federally developed safety standards[40] 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.

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

Decades ago, the EPA was actively engaged in monitoring and research[41] to develop RF limits[42] that would protect humans from both thermal and non thermal impacts. The agency had long been tasked to lead on radiation protection activities by several federal agencies.[43]

However, just as the EPA was poised to release its RF human exposure limit recommendations[44] the EPA was defunded from all EMF 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 and OSHA specifically recommended[45] that an "updated, comprehensive review of the biological effects be initiated as the IEEE and NCRP recommendations were based on pre-1986 studies.[46] Although both the

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[41] See GAO Report ELECTROMAGNETIC FIELDS Federal Efforts to Determine Health Effects Are Behind Schedule (June 1994); GAO Report Telecommunications: Status of Research on the Safety of Cellular Telephones ( November 1994) "EPA is assessing status of scientific knowledge"; EPA Report: The Radiofrequency Radiation Environment: Environmental Exposure Levels and RF Radiation Emitting Sources 1986, by Hankin, Norbert N., Office of Radiation Programs, Office of Air and Radiation, U.S. Environmental Protection Agency.; KAREN A. MASSEY,, THE CHALLENGE OF NONIONIZING RADIATION: A PROPOSAL FOR LEGISLATION Duke Law Journal 1979 states "By the end of 1976, EPA had completed measurements in more than two hundred locations in Boston, Atlanta, Miami, Philadelphia, New York, Chicago and Washington, D.C, " and "The nonionizing radiation activities of EPA are divided between the Office of Research and Development (ORD) and the Office of Radiation Programs (ORP).'5 6 The former office conducts bioeffects research at the Health Effects Research Laboratory in North Carolina" ; See also 1978: GAO Report Efforts by the EPA to Protect the Public From Environmental Non-ionizing EMF

[42] June 19, 1995 Letter from the E. Ramona Tomato EPA Office of Radiation and Air to Richard M Smith Chief Office of Engineering and Technology FCC states, "The guidelines are substantially complete and beginning to enter the review phase… issuance of thermal guidelines will be in early 1996."

[43] Norton Nelson Chairman of the Science Advisory Board 9SAB) Letter to Dr. William Ruckelshaus EPA, April 25, 1984 states that the SAB Committee unanimously concluded that after reviewing the EPA's assessment document "Biological Effects of Radiofrequency Radiation" it represents an "adequate statement of the current scientific literature ad can serve as a scientifically defensible basis for the Agency's development of radiation protection guidance for use by federal agencies to limit exposure of the geneal population to radiofrequency radiation." The attachments to the letter references earlier letters by the FCC, Assistant Secretary of Commerce and numerous groups recommending the FCC develop safety limits as soon as possible.

[44] 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 will 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)*

[45] 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."

[46] As the EPA stated 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."https://ehtrust.org/wp-content/uploads/Epa-Letter-to-the-FCC-nov_93.pdf

NCRP and EPA drafted updated reports on biological effects, the drafts were ultimately shelved and never finalized.[47]

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.

Currently, federal agencies are not engaged in researching and evaluating the numerous health effects associated with RF exposure. Biological impacts to the nervous, reproductive and immune systems of humans and animals have not been reviewed by any agency for over forty years[48]. That is why federal agencies such as the EPA, OSHA, NCI and CDC did not submit meaningful input to the FCC in its 2013 Inquiry. They had no conclusions to provide.

Yet, six years later, when the Commission issued its decision not to update its exposure limits, the FCC 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 limits 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."

The DC Circuit did not agree 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."

Documentation on Federal Agencies and Authorities

- Environmental Protection Agency

[47] "The Environmental Protection Agency (EPA) has indefinitely delayed the release of its already long-awaited report assessing the cancer risk of electro- magnetic fields (EMFs)"..."An earlier draft of the EPA report, obtained by Microwave News in 1994, concluded that the EMF–cancer link "is a real association that cannot be explained by improper epidemiologic methodology" … "EPA's cancer assessment is said to be in essential agreement with the conclusions of another report, prepared for the National Council on Radia- tion Protection and Measurements (NCRP), which calls for strong action to curtail exposure of the U.S. population (see pp.2-3 and *MWN,* J/A95), ac- cording to a source who has read both reports." Microwave News EPA Shelves EMF–Cancer Report, January/February 1996

[48] The last U.S. government report on all effects is the U.S. Environmental Protection Agency, 1984 Report Biological Effects of Electromagnetic Radiation https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=300065H1.TXT

- The Federal Communications Commission
- The Food and Drug Administration
- The FDA's Technical Electronic Product Radiation Safety Standards Committee
- National Toxicology Program
- National Cancer Institute
- Centers for Disease Control
- National Institute for Occupational Safety and Health
- Department of Labor, Occupational Safety and Health Administration
- The World Health Organization

**Environmental Protection Agency (EPA)**

The EPA has no current research activities related to non ionizing EMFs. When asked about the EPA's EMF related activities in 2020 and 2023, Lee Ann B. Veal, Director of the EPA Radiation Protection Division Office of Radiation and Indoor Air wrote[49] Theodora Scarato, EHT Executive Director that "Up through the mid-1990s, EPA did study non-ionizing radiation…EPA does not have a funded mandate for radiofrequency matters, nor do we have a dedicated subject matter expert in radiofrequency exposure. The EPA defers to other agencies possessing a defined role regarding RF," and in regards to the EPA's review of research the EPA responded that, "EPA's last review was in the 1984 document Biological Effects of Radiofrequency Radiation. The EPA does not currently have a funded mandate for radiofrequency matters."

**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, measure a certain percentage of sites for compliance every year, penalize operators for non compliance, and transparently post RF levels for the public.[50] Not in the USA.

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[49] *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* *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, (March 7, 2023)* *https://ehtrust.org/wp-content/uploads/EPA-letters-2023-and-2020-Radiofrequency-Radiation-EPA-Scarato-1-1.pdf*

[50] 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

Environmental Health Trust gave a brief presentation on the policies of other countries at the National Spectrum Managers Association 2023 Annual Spectrum Management Conference.[51]

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."[52] 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."[53] 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."[54] A 2014 investigation by the Wall Street Journal "Cellphone Boom Spurs Antenna-Safety Worries[55] found "one in 10 sites violates the rules, according to six engineers who examined more than 5,000

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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.

[51] See Conference site at https://www.nsma.org/conferences/nsma-presentations-2023/ Video of Theodora Scarato at https://youtu.be/NNJUT-ZQcqE?si=GtL9k_IEezuEmiUK&t=1597

[52] FCC RF Safety FAQ https://www.fcc.gov/engineering-technology/electromagnetic-compatibility-division/radio-frequency-safety/faq/rf-safety

[53] FCC RF Safety FAQ https://www.fcc.gov/engineering-technology/electromagnetic-compatibility-division/radio-frequency-safety/faq/rf-safety

[54] FCC RF Safety FAQ https://www.fcc.gov/engineering-technology/electromagnetic-compatibility-division/radio-frequency-safety/faq/rf-safety

[55] *"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

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.[56] 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.[57]

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.[58]

The FCC relies on licensees to measure exposure 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

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[56] 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., & Röösli, M. (2014). Temporal trends of radio-frequency electromagnetic field (RF-EMF) exposure in everyday environments across European cities. *Environmental Research*, *134*, 134–142.

[57] 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.

[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

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. The FDA has repeatedly clarified[60] this. As FDA's engineer David Kassiday stated, "We don't have jurisdiction over cellphone towers since those are environmental emitters."

Further, even 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.[61] 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 FDA[62]

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[60] See email communications between a mother with a 5G tower near her home and the FDA and FCC. The mother requested safety data from the FCC. The FCC lawyer initially directed her to the FDA and to the WHO. However when the mother requested the research reports, the FDA said cell tower and 5G tower radiation was not their area or authority. Laurie Lenkel FDA Ombudsman wrote the mother that the "FDA is responsible for protecting the public health from hazardous or unnecessary radiation from radiation emitting electronic products." and "The Federal Communication Commission (FCC) has jurisdiction over all radiofrequency transmitting structures in the United States. Therefore, the 5G tower you inquired about is under the authority of the FCC, not the FDA." The FCC lawyer could not find any WHO report on the science of cell tower radiation or 5G. It could not find any reports on long term effects of wireless and cell tower radiation to children. On Oct 27, 2021 the FCC lawyer stated, "If anyone has "studied what might happen to children if a cell tower is placed in front of their bedroom window," it's not here or anywhere else I'm aware of." https://ehtrust.org/wp-content/uploads/FCC-Lawyer-and-FDA-Communications-with-Mother-on-Cell-Tower-G-Radiation-Safety-2.pdf

[61] FDA, Review of Published Literature between 2008 and 2018 of Relevance to Radiofrequency Radiation and Cancer

[62] 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

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 Report on Strategic Priorities has nothing on the issue of RF radiation.[63] 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

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

[63] https://www.fda.gov/media/155888/download

The Environmental Health Trust issued a "Report on FDA Activities on Cell Phones and Radiofrequency"[64] 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.

**The FDA's Technical Electronic Product Radiation Safety Standards Committee (TEPRSSC)**

The TEPRSSC has not met since October 2016[65] and has not evaluated the issue of health effects of cell phone or RF emitting devices.

**National Toxicology Program (NTP)**

In 1999, the FDA requested the NTP perform large scale animal studies on cell phone radiation stating,[66] "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."

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,[67] with the NTP's highest level of evidence.[68] 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).

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

65 The TEPRSSC website shows 11 vacancies with its the last meeting dates were on Oct. 25, and Oct. 26 of 2016 and previous to that was a 2003 meeting. https://www.fda.gov/advisory-committees/technical-electronic-product-radiation-safety-standards-committee/past-meeting-materials-technical-electronic-product-radiation-safety-standards-committee; Archived meetings going back to 1999 can be found at https://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfAdvisory/results.cfm?panel=27&searchtype=1&month=0&year=&maxrows=10

66 FDA CDRH nomination of NTP to Study RFR_Nomination Background: Wireless Communication Devices

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

68 https://ntp.niehs.nih.gov/whatwestudy/testpgm/cartox/criteria

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 findings[69]. The DC Circuit rejected FDA's statement, saying "we find them to be of the conclusory variety that we have previously rejected as insufficient."[70]

**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 5G[71], 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 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.

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[69] 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

[70] EHT et al.v FCC, supra

[71] 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

In 2020 the GAO Report on 5G[72] references NCI's reference to the lack of safety data on *long term exposure* to 5G high band frequencies stating, "According to an NCI scientist, even after high-band 5G technology has been put into use in the coming years, the long term health effects on people, if any, may not be known for many years later because some health outcomes could take decades to develop. The high-band frequencies used in 5G will only be available for observational studies once 5G technology has been deployed widely. A National Institutes of Health scientist noted that the 5G frequencies are still not clearly defined, making it difficult to understand the impact on human exposure" and "An NCI scientist we interviewed reiterated these unknown long-term health effects for pre-5G technology and with respect to 5G. Further research was also needed for non-cancer outcomes, such as developmental and behavioral outcomes, according to the committee proceedings and the NCI scientist. Observational studies may be used to study health outcomes that take years and decades to develop, such as developmental, behavioral, and cancer outcomes. However, as mentioned above, there have been no observational studies on the long-term health effects of high-band 5G frequencies because the technology is still new."

## Centers for Disease Control (CDC)

There are no scientific reports of research reviews or evaluations by the CDC on wireless safety, nor does the agency have staff with expertise monitoring the science and evaluating risk. The current web pages are outdated and EHT's FOIAs have found that an industry consultant helped draft several of the CDC's website pages of wireless radiation.[73] Furthermore, EHT's FOIAs have also found the CDC has engaged two well-known industry consultants to draft text for updated CDC website pages.

## 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 exposure[74] and developed

[72] Page 42 and 43 https://www.gao.gov/assets/gao-21-26sp.pdf
[73] The CDC Hired An Industry Consultant to Draft Website Information For the Public - Environmental Health Trust
Kenneth Foster, a consultant for wireless companies and researcher funded by wireless companies for his publications, was hired by the CDC to be the subject matter expert for four CDC webpages.
[74] 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."

recommendations to reduce extremely low frequency EMF,[75] 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 according to the FCC document 13-39 [76] which addresses radiofrequency human exposure limits and policies "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."

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 90s[77] that was never implemented. An OSHA representative also participated in the now defunct RF Interagency workgroup.

It is notable that in March 1994, OSHA wrote the FCC highlighting the need for an up to date research review. OSHA stated of the NCRP 1986 Report and IEEE/ANSI 1991 Standard, both of which were used by the FCC to develop its 1996 exposure guidelines that, "Both criteria are based on biological-effects literature reviews conducted over seven years ago and need to be updated." OSHA also recommended labeling by manufacturers such as a " user's manual which describes the safest use of the device and objectively describes health concerns for its use, and 3) affix a warning label to the device to direct the users to the manual."

**The World Health Organization (WHO)**

There are two entities within the WHO, the WHO International Agency for Research on Cancer (IARC) and the WHO EMF Project and neither of them have reviewed the up to date science for well over a decade.

[75] 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
[76] https://docs.fcc.gov/public/attachments/FCC-13-39A1.pdf
[77] 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

The WHO/IARC determined RF radiation to be a Class 2 B "possible" carcinogen in 2011. Many WHO EMF working group scientists who participated in the WHO/IARC review in 2011[78] now state the current evidence indicating an association with cancer has significantly increased, and if the evidence were evaluated today, they conclude RF would be considered a probable, if not fully confirmed human carcinogen.[79] The

[78] IARC Working Group on the Evaluation of Carcinogenic Risks to Humans. (2013). Non-ionizing radiation, Part 2: Radiofrequency electromagnetic fields. *IARC Monographs on the Evaluation of Carcinogenic Risks to Humans*, *102*(Pt 2), 1–460. See also the WHO/IARC 2011 Press Release http://www.iarc.fr/en/media-centre/pr/2011/pdfs/pr208_E.pdf

[79] WHO/IARC scientists concluding the evidence has significantly increased include Lennart Hardell who published Carlberg, M., & Hardell, L. (2017). Evaluation of Mobile Phone and Cordless Phone Use and Glioma Risk Using the Bradford Hill Viewpoints from 1965 on Association or Causation. BioMed Research International, 2017, 9218486 and Hardell, L., & Carlberg, M. (2019). Comments on the US National Toxicology Program technical reports on toxicology and carcinogenesis study in rats exposed to whole-body radiofrequency radiation at 900 MHz and in mice exposed to whole-body radiofrequency radiation at 1,900 MHz. International Journal of Oncology, 54(1), 111–127;

James Lin in James C. Lin. (2022) Carcinogenesis from chronic exposure to radio-frequency radiation. Front. Public Health, Sec. Radiation and Health. 31 October and Lin J. C. (2023). Incongruities in recently revised radiofrequency exposure guidelines and standards. Environmental research, 222, 115369.

In 2021, Chris Portier PhD, former Director of the U.S. National Center for Environmental Health at the Centres for Disease Control and Prevention in Atlanta and the Director of the Agency for Toxic Substances and Disease Registry submitted a comprehensive review of the scientific research in a major cell phone/brain cancer lawsuit where he concludes that "The evidence on an association between cellular phone use and the risk of glioma in adults is quite strong" and "In my opinion, RF exposure probably causes gliomas and neuromas and, given the human, animal and experimental evidence, I assert that, to a reasonable degree of scientific certainty, the probability that RF exposure causes gliomas and neuromas is high."
https://ehtrust.org/wp-content/uploads/Expert-report-Christopher-J-Portier-Murray-v-Motorola-3-1-2021-1.pdf

Dariusz Leszczynski PhD stated in his 2015 lecture to officials in Serbia, "In my opinion, the currently available scientific evidence is sufficient to upgrade the carcinogenicity of cell phone radiation from the possible carcinogen (Group 2B) to the probable carcinogen (Group 2A)"
https://betweenrockandhardplace.files.wordpress.com/2015/10/wireless-communication-and-health-future-of-the-research.pdf

Igor Belyaev PhD states, "The NTP findings along with recent replicated animal studies from Germany [47], supplemented other studies and provided sufficient evidence for carcinogenicity of mobile phone exposure in animals. Studies with chronic exposures have also provided evidence for possible mechanisms of MW effects, which involve production of reactive oxygen/nitrogene species. Taking into account the evidence from human epidemiological studies, MW exposure from mobile phones was suggested to be classified as human carcinogen according to the generally accepted Bradford Hill criteria" in Belyaev, I. (2019). Main Regularities and Health Risks from Exposure to Non-Thermal Microwaves of Mobile Communication. 2019 14th International Conference on Advanced Technologies, Systems and Services in Telecommunications (TELSIKS), 111–116.
Ronald Melnick PhD states "The NTP studies show that the assumption that RF radiation is incapable of causing cancer or other adverse health effects other than by tissue heating is wrong." Melnick, R. (2020). Regarding ICNIRP'S

WHO/IARC has not convened an expert group of scientists to review the scientific evidence since 2011 but the WHO/IARC advisory committee has recommended[80] the science on RF radiation be re-evaluated by a scientific working group as "high priority" due to the new research.

The other WHO entity called the WHO EMF Project has not reviewed the science since 1993[81] despite its short webpages on cell phones and cell towers that inaccurately offer safety assurances. The statements on the WHO EMF Project website pages are not based on any current WHO research review (as there has been no review since 1993). An industry funded scientist, now wireless industry consultant[82] claimed authorship of these webpages.[83]

**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

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Evaluation of the National Toxicology Program's Carcinogenicity Studies on Radiofrequency Electromagnetic Fields. Health Physics, 118(6), 678–682.

Anthony Miller MD was a reviewer to the WHO/IARC monograph and co-authored 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.

[80] WHO Report of the Advisory Group to Recommend Priorities for the IARC Monographs https://monographs.iarc.who.int/wp-content/uploads/2019/10/IARCMonographs-AGReport-Priorities_2020-2024.pdf

[81] WHO lists its reports including Environmental Health Criteria 137 (1993): Electromagnetic Fields (300 Hz - 300 GHz) which addresses RF

[82] Michael Repacholi stated that he wrote the WHO web pages . Repacholi also arranged for large part of the WHO EMF project to be financed by the telecommunication industry's lobbying organisations" ;"Repacholi acted like a representative for the telecom industry while responsible for the EMF health effects department at the WHO (http://microwavenews.com/news/time-stop-who-charade). Since he left WHO in 2006 he has been involved in industry propaganda video interviews with GSM Association and Hydro Quebec (https://www.youtube.com/watch?v=fDZx7MphDjQ; https://www.youtube.com/watch?v=1MI_fa5YsgY) where he clearly speaks in favor of the telecommunications and the power industries, respectively."

[83]Michael Repacholi stated he wrote some of WHO online webpage factsheets in his speech in a meeting in India, hosted by the Cellular Operators of India stating, "WHO came out with a factsheet stating very clearly mobile phones do not cause cancer, it has not been established…" https://youtu.be/YGbibsFL1dA?si=Rkrw1OkOj4RN3mXF&t=18; He then later says in the Q and A how "I worked for 12 years…getting these uh fact sheets is clear as we could make them and as accurate as we could make them from the science and this they've been accurate now for 10 years" https://www.youtube.com/watch?v=v_KOKMF9Vyg&t=118s

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[84] 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 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 2: Radiofrequency Radiation Impacts on the Environment

No U.S. agency or international authority has ever acted to review research on wireless radiation effects on

[84] https://ehtrust.org/wp-content/uploads/Representative-Doris-Matsui-Letter-on-5G-December-20-2023.pdf

the environment nor set exposure limits to ensure protections for birds, bees, trees and wildlife.[85,86] 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."[87]

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*),[88] 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."[89] 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[90] 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 wildlife from RF-induced biological effects because the relationships among RF-EMF exposure, dosage, and outcome are

[85] 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*.
[86] 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
[87] https://www.ntia.doc.gov/files/ntia/us_doi_comments.pdf
[88] Final Court Decision EHT et. al v. the FCC 8/13/2021 https://www.cadc.uscourts.gov/internet/opinions.nsf/FB976465BF00F8BD85258730004EFDF7/$file/20-1025-1910111.pdf
[89] https://www.cadc.uscourts.gov/internet/opinions.nsf/FB976465BF00F8BD85258730004EFDF7/$file/20-1025-1910111.pdf
[90] Jérémy S. P. Froidevaux, Laura Recuero Virto, Marek Czerwiński, Arno Thielens, and Kirsty J. Park Addressing Wildlife Exposure to Radiofrequency Electromagnetic Fields: Time for ActionEnvironmental Science & Technology Letters

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.[91] [92] [93]

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.[94] Biologists caution that non ionizing electromagnetic radiation is a critical factor in the decline of pollinator and insect populations.[95]

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. [96]

Individual studies investigating 5G have found adverse effects including:

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[91] 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*.

[92] 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.

[93] 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.

[94] 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.

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

[96] 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.[97]

> "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.[98] Researchers have released subsequent reports documenting continued impacts to tree canopy from cell tower antennas.[99,100] Other RF effects include impacts to leaf, shoot, seedlings of Aspen trees. [101]

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

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

[98] 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.

[99] Breunig, Helmut. "Tree Damage Caused By Mobile Phone Base Stations An Observation Guide." (2017).

[100] 2021 Report "Tree damage caused by mobile phone base stations"

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

## ATTACHMENT 3: 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,[102] increased oxidative stress,[103] genetic damage,[104] structural and functional changes of the reproductive system,[105] memory deficit,[106] behavioral problems[107], and neurological impacts.[108]

*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 states[109] 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 report[110] in 2020 with 15 recommendations including: requiring setbacks

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[102] 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

[103] Yakymenko, I., Sidorik, E., Kyrylenko, 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/.

[104] Falcioni, L., Bua, L., Tibaldi, E., Lauriola, M., De Angelis, L., Gnudi, F., Mandrioli, D., Manservigi, M., Manservisi, 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

[105] 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

[106] 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>.

[107] 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.

[108] 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

[109] 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

[110] https://www.gencourt.state.nh.us/statstudcomm/committees/1474/reports/5G%20final%20report.pdf

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 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 [111] 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.[112] 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.[113]

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.[114] Additionally, the NTP found heart damage and DNA damage, despite the fact that the animals were carefully exposed to

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

[112] 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

[113] Zothansiama, Zosangzuali, M., Lalramdinpuii, 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.

[114] National Toxicology Program Radiofrequency Radiation https://ntp.niehs.nih.gov/whatwestudy/topics/cellphones/index.html

non-heating RFR levels long assumed to be safe. The Ramazzini Institute animal studies[115] 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 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.[116]

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.

## ATTACHMENT 4: 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.[117]

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

[115] 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

[116] 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.

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

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.[118]

Insurers rank 5G and electromagnetic radiation as a "high" risk,[119] comparing the issue to lead and asbestos.[120] A 2019 Report[121] 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.[122] As an example, Portland Oregon Public School Insurance states,[123] "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 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 risk[124] but not the communities impacted by the

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

[119] https://ehtrust.org/key-issues/reports-white-papers-insurance-industry/

[120] 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

[121] 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

[122] Electromagnetic Field Insurance Policy Exclusions Cell Phone Radiation and EMFs - Environmental Health Trust

[123] page 30 https://ehtrust.org/wp-content/uploads/Portland-Public-School-2017-18-Excess-Liability0D0A-policy-1.pdf

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

infrastructure.[125] 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 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."*

[125] https://ehtrust.org/key-issues/corporate-company-investor-warnings-annual-reports-10k-filings-cell-phone-radiation-risks/