ENVIRONMENTAL HEALTH TRUST

ehtrust.org
wildlifeandwireless.org
healthytechhome.org

May 7, 2024

Rola Masri
Director of Government Outreach
Environmental Health Trust
RolaMasri@EHTrust.org

RE: Cell Tower Radiation, a Pollutant and An Environmental Justice Issue; EHT Comments to the National Environmental Justice Advisory Council (NEJAC) April 2024 Public Meeting

Submitted via email to: nejac@epa.gov

Dear National Environmental Justice Advisory Council,

Cell tower radiofrequency radiation (RFR) is an environmental pollutant that requires urgent attention.

We write to the National Environmental Justice Advisory Council (NEJAC) today to urge the EPA:

- to expand Section 112 under the Clean Air Act to include wireless transmitters and cell tower radiofrequency radiation (RFR) as a pollutant
- to monitor radiofrequency exposure levels nationwide
- to quantify adverse effects associated with the cumulative radiofrequency environmental exposures
- to specifically quantify disproportionate impacts of RFR exposures to communities seeking environmental justice

We thank the National Environmental Justice Advisory Council (NEJAC) for the opportunity to submit comments in response to the April 2024 NEJAC Public Meeting. The Environmental Health Trust (EHT) is a not-for-profit scientific think tank that promotes a healthier environment through research, education and policy. We work directly with policymakers, communities, and health and education professionals to bring awareness of environmental hazards and how to mitigate them.[1]

Cell tower RF radiation is emerging as an environmental justice issue. Just as with other types of pollution, cell towers are often disproportionately placed in neighborhoods with higher numbers of minorities and students needing free and reduced meals.[2] In Montgomery County, for example, cell towers are

[1] www.EHTrust.org
[2] MCPS places controversial cellular towers at predominantly high-poverty schools, stats show states, "according to

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.[3] Parents in schools with a higher white and more affluent population have organized and successfully fought off the towers.[4] At this time the US government does not monitor rising levels nor ensure compliance in any meaningful way related to RF radiation.

EHT submits these referenced comments to provide substantive information regarding the decision of the U.S. Circuit Court of Appeals for the District of Columbia in *EHT et al v. FCC, 2021*.[5] In reassessing its radiofrequency exposure guidelines, the court found that the Federal Communications Commission (FCC) had failed to take into account scientific findings relevant to the impacts of radiofrequency radiation (RFR) on children and on wildlife that had been submitted to the record, and *remanded* further action to the FCC. In addition, the Court noted that the FCC had not considered long-term impacts on public health or the environment nor the ubiquity of wireless devices and other major technological changes since the 1996 RFR exposure guidelines (in use today) were first promulgated. To this date the FCC has not taken action on its court order.

The FCC's RF human exposure limits–which have been under federal court *remand* since August 2021–remain almost entirely unchanged since 1996 and are designed only to protect against heating effects of short term exposures, not biological impacts from long term exposure.[6] An ever growing body of scientific evidence documents adverse effects from RFR at exposure levels well below FCC limits[7] with research findings that include cancer, the induction of oxidative stress, epigenetic effects, impacts to neurotransmitters,

---

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).

[3] 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).

[4] 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,
More data is needed to quantify if this example is repeated throughout the country.

[5] 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

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

[7] 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.

memory, brain development and damage to the immune, endocrine, hematological and reproductive systems.[8] Further, studies have found impacts to tree canopy, plant growth, pollinator health and the orientation, migration and breeding of wildlife.[9] The science clearly indicates that wireless networks create harmful interference in humans as well as flora and fauna.

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 to RFR, an emerging environmental justice issue.

Research shows that the environmental levels of RFR, that people are exposed to, have increased with the densification of cell tower networks closer to where people live, work and play and levels are highest in urban areas.[10] As an example, a 2018 multi-country study found ambient RF measurements in Los Angeles,

---

[8] Panagopoulos, D. J., Karabarbounis, A., Yakymenko, I., & Chrousos, G. P. (2021). Human-made electromagnetic fields: Ion forced-oscillation and voltage-gated ion channel dysfunction, oxidative stress and DNA damage (Review). International Journal of Oncology, 59(5), 92; McCredden, J. E., Cook, N., Weller, S., & Leach, V. (2022). Wireless technology is an environmental stressor requiring new understanding and approaches in health care. *Frontiers in Public Health*, *10*; Davis, D., 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; 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.

[9] 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 ;
Jérémy S. P. Froidevaux, Laura Recuero Virto, Marek Czerwiński, Arno Thielens, and Kirsty J. Park Addressing Wildlife Exposure to Radiofrequency Electromagnetic Fields: Time for Action Environmental Science & Technology Letters, 2024, 11, 1, 3–4 ; Balmori A. (2024) Radio-tracking systems emit pulsed waves that could affect the health and alter the orientation of animals, Journal for Nature Conservation Volume 77, January ; Balmori A. (2021) Electromagnetic radiation as an emerging driver factor for the decline of insects. Science of the Total Environment. 767: 144913 ; Balmori, A. (2015). Anthropogenic radiofrequency electromagnetic fields as an emerging threat to wildlife orientation. Science of The Total Environment, 518–519, 58–60; Sivani, S. and D. Sudarsanam. (2012): "Impacts of radio-frequency electromagnetic field (RF-EMF) from cell phone towers and wireless devices on biosystem and ecosystem-a review." Biology and Medicine 4, no. 4 202-216.

[10] 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

California are now 70 times higher than levels measured in the City in the late '70s, as part of a twelve-city study by the FCC and EPA.[11].

Dozens of studies have found that RFR and non-ionizing electromagnetic fields (EMF), in general, act in synergy with chemicals to increase harm on humans and the environment.[12] This is especially important to note in environmental justice neighborhoods that bear a disproportionate burden of chemical exposures that are now additionally facing ubiquitous RFR exposure from wireless networks in the name of closing the digital divide.

Cell antennas are being put up in front of apartments and renters are not being informed nor are they a part of the decision making process. Yet low income families and renters have less ability to move or mitigate exposures.

Furthermore, farmworkers who are already suffering the effects of pesticide exposures will now have a wireless agent, inherent to precision farming, that will act synergistically[13] with the harmful chemicals to

---

[11] 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.

[12] Ansarihadipour, H., & Bayatiani, M. (2016). Influence of Electromagnetic Fields on Lead Toxicity: A Study of Conformational Changes in Human Blood Proteins. Iranian Red Crescent Medical Journal, 18(7), e28050.

Choi, K.-H., Ha, M., Ha, E.-H., Park, H., Kim, Y., Hong, Y.-C., Lee, A.-K., Hwa Kwon, J., Choi, H.-D., Kim, N., Kim, S., & Park, C. (2017). Neurodevelopment for the first three years following prenatal mobile phone use, radio frequency radiation and lead exposure. Environmental Research, 156, 810–817.

Baohong, W., Jiliang, H., Lifen, J., Deqiang, L., Wei, Z., Jianlin, L., & Hongping, D. (2005). Studying the synergistic damage effects induced by 1.8 GHz radiofrequency field radiation (RFR) with four chemical mutagens on human lymphocyte DNA using comet assay in vitro. Mutation Research, 578(1–2), 149–157.

Benavides, R. A. S., Leiro-Vidal, J. M., Rodriguez-Gonzalez, J. A., Ares-Pena, F. J., & López-Martín, E. (2023). The HL-60 human promyelocytic cell line constitutes an effective in vitro model for evaluating toxicity, oxidative stress and necrosis/apoptosis after exposure to black carbon particles and 2.45 GHz radio frequency. The Science of the Total Environment, 867, 161475.

Boga, A., Emre, M., Sertdemir, Y., Akillioglu, K., Binokay, S., & Demirhan, O. (2015). The effect of 900 and 1800 MHz GSM-like radiofrequency irradiation and nicotine sulfate administration on the embryonic development of Xenopus laevis. Ecotoxicology and Environmental Safety, 113, 378–390.

Kostoff, R.N., Lau, C.G.Y. (2017). Modified Health Effects of Non-ionizing Electromagnetic Radiation Combined with Other Agents Reported in the Biomedical Literature. In: Geddes, C. (eds) Microwave Effects on DNA and Proteins. Springer, Cham. https://doi.org/10.1007/978-3-319-50289-2_4

Lerchl, A., Klose, M., Grote, K., Wilhelm, A. F. X., Spathmann, O., Fiedler, T., Streckert, J., Hansen, V., & Clemens, M. (2015). Tumor promotion by exposure to radiofrequency electromagnetic fields below exposure limits for humans. *Biochemical and Biophysical Research Communications*, *459*(4), 585–590; Pall ML. Central Causation of Autism/ASDs via Excessive $[Ca^{2+}]i$ Impacting Six Mechanisms Controlling Synaptogenesis during the Perinatal Period: The Role of Electromagnetic Fields and Chemicals and the NO/ONOO(-) Cycle, as Well as Specific Mutations. *Brain Sciences*. 2024; 14(5):454. doi: 10.3390/brainsci14050454.

[13] Kostoff, R. N., Heroux, P., Aschner, M., & Tsatsakis, A. (2020). Adverse health effects of 5G mobile networking technology under real-life conditions. *Toxicology Letters*, *323*, 35–40.

make matters worse. Yet the EPA has not evaluated the synergistic impacts, nor has any federal agency.

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 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 radiofrequency 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.

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 RFR at exposure levels well below the FCC 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] 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,

Attachment 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. 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.

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

Recommendations to the Environmental Protection Agency (EPA)

EHT RECOMMENDATIONS

Recommendation 1: **EPA expand Section 112 under the Clean Air Act to specifically include all wireless and cell tower radiofrequency radiation as a pollutant**

Wireless electromagnetic radiation is a growing environmental pollutant and yet the EPA is not ensuring public safety in regards to the exposure and has no funded activities in regards to EMF health or environmental effects.[17] Sources include cell towers and 5G/4G networks and other transmitters that are increasingly being erected closer to where people live, work, school and recreate. The EPA's last report on the biological effects of electromagnetic fields was dated 1984.[18] Prior to that the EPA was regularly measuring levels nationwide and studying the effects of wireless radiation.[19]

However, the EPA was defunded from researching this issue.[20] FCC is the agency charged with maintaining exposure guidelines and admits that they are not a health and safety agency and they say that they defer to the EPA, FDA, OSHA and NIOSH for these issues.

However, none of these agencies are researching for health effects, nor conducting hazard evaluations, nor properly re-assessing the guidelines to ensure safety, nor are they monitoring exposures, nor performing

---

I., & Davis, D. L. (2018). Cancer epidemiology update, following the 2011 IARC evaluation of radiofrequency electromagnetic fields (Monograph 102). *Environmental Research*, *167*, 673–683.

[17] 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

[18] https://nepis.epa.gov/Exe/ZyPDF.cgi/300065H1.PDF?Dockey=300065H1.PDF

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

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

health and environmental surveillance to ensure human and environmental safety. No agency is doing such research!

RFR is a silent pollutant in every community and will especially exacerbate the issues in environmental justice communities. RFR needs to be qualified as a pollutant by the EPA Section 112 of the Clean Air Act and appropriate actions must be taken to regulate it. Monitoring, surveillance, cumulative impact research and hazard evaluations need to be reinstated at the EPA to ensure public health and environmental wellbeing, especially with the exponential increase in RFR levels since 1984. Currently the federal government is failing to protect the public. See **ATTACHMENT 1: Today's Regulatory Gap Regarding Radiofrequency Bioeffects**

Recommendation 2: **EPA should monitor radiofrequency levels nationwide as recommended by the Government Accountability Office (GAO) and as other countries are doing.**

As stated in a 2020 GAO report[21], "Measuring RF exposure in observational studies is a challenge, but these types of studies are of interest in making policy relevant recommendations." In addition to making policy decisions, exposure monitoring would also benefit researchers to compare health outcomes of individuals with higher versus those with lower exposures. Continuous monitoring would benefit the public, especially sensitive populations like children, pregnant women, the sick, the elderly and those who have been harmed by RFR and can no longer tolerate exposure to it.

Currently, the government relies on the industry to measure and police itself in conducting emission testing on their own wireless facilities. These FCC procedures have proven inadequate as there have been many situations around the country where exposure limits are being exceeded.

Numerous countries continuously measure RFR levels to insure industry compliance with their exposure guidelines. These countries include Qatar, France , Spain, Austria, Greece, Turkey, India, Israel, Gibraltar, Brussels, Belgium, Switzerland, Bulgaria, Tunisia, Malta, Brazil, Bahrain, Monaco, French Polynesia, Bhuton, Senegal. In contrast, here in the United States, the EPA released the last report on RFR measurements in 1986.

Information resulting from continuous RFR measurements is essential for the public, policymakers and scientists to study and make informed decisions.

Recommendation 3**: The EPA should quantify adverse effects associated with the cumulative radiofrequency environmental exposures.**

Non-ionizing EMFs are a public health issue. Biological and health effects are well documented in the scientific literature. A review study entitled "Evidence for a health risk by RF on humans living around mobile phone base stations: From radiofrequency sickness to cancer" reviewed the existing scientific literature and found increased radiofrequency sickness, cancer and changes in biochemical parameters in

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

people exposed to chronic cell tower radiation.[22] A large-scale animal study published in Environmental Research found that rats exposed to the same RF levels of cell tower emissions had elevated cancers, the very same cancers that were found in the US National Toxicology Program animal study on cell phones that found "clear evidence" of cancer in carefully controlled conditions. See Attachment 3 for more detailed information.

Furthermore, current RF exposure guidelines do not protect wildlife, insects, plants and trees from impacts. Numerous impacts to flora and fauna are documented in research studies. See Attachment 2 for detailed information on environmental impacts of RFR, including impacts to plant growth and tree canopy.

Cumulative impacts to people and the environment with cost to benefit assessments need to be quantified to assure that the U.S. is moving in the right direction with regards to how broadband is delivered. Wired internet connections can safely and more effectively provide internet connectivity without the risks to individuals and the environment.

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. [23] [24] Electromagnetic related disability is recognized by the US government and multiple other entities.[25] In addition, certain segments of the population are more vulnerable to radiofrequency impacts, including children, pregnant women, the sick and the elderly.[26]

Recommendation 4: **The EPA should specifically quantify health and environmental impacts to neighborhoods seeking environmental justice**

As stated above communities who are seeking environmental justice are being targeted for increasing levels of wireless RFR radiation in the name of closing the digital divide.

---

[22] Balmori A. Evidence for a health risk by RF on humans living around mobile phone base stations: From radiofrequency sickness to cancer Environ Res. 2022 Nov; 214

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

[24] 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.

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

[26] 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*.

Synergistic effects between chemicals and RFR found in studies will play an important role to further exacerbate health outcomes in communities already dealing with chemical exposures. These cumulative impacts need to be quantified by the EPA.

Recommendation 5: **The EPA can educate on the impacts of RF exposure to humans, especially children, pregnant people, the sick and the elderly and ways to mitigate these impacts.[27]**

Environmental Health Trust has developed public health fact sheets and educational resources to communicate all the ways to reduce everyday wireless exposures.[28] More outreach needs to be done with the American public so they understand this issue. We recommend a multimedia educational campaign.

RECOMMENDATIONS FROM OTHER EXPERT ORGANIZATIONS ON TECHNOLOGY SAFETY

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

In 2019 the New Hampshire government passed House Bill 522 "An act establishing a commission to study the environmental and health effects of evolving 5G technology."[29] The Commission released its Final Report on Commission to Study the Environmental and Health Effects of Evolving 5G Technology[30] in 2020 with findings that safety assurance for wireless technology "come into question because of the thousands of peer-reviewed studies documenting deleterious health effects associated with cellphone radiation exposure." In its report the Commission issued 15 recommendations:

1. Support statewide deployment of fiber optic cable connectivity with wired connections inside homes.
2. New Hampshire schools and libraries should replace Wi-Fi with hardwired connections.
3. Require setbacks for new wireless antennas from residences, businesses, and schools.
4. New Hampshire health agencies educate the public on minimizing radiofrequency radiation (RFR) exposure with public service announcements on radio, television, and print. "Warnings concerning the newborn and young as well as pregnant women"
5. Establish RFR free zones in commercial and public buildings

[27] 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.

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

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

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

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 [31]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."

The American Academy of Pediatrics states of cell towers[32] that, "An Egyptian study confirmed concerns that living nearby mobile phone base stations increased the risk for developing: Headaches, Memory problems, Dizziness, Depression, Sleep problems"

In response to the National Toxicology Program animal study findings of cancer and DNA damage[33] from cell phone radiation, the AAP also issued the cell phone safety tips specifically for families[34] to reduce exposure

[31] 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
[32] Electromagnetic Fields: A Hazard to Your Health? - HealthyChildren.org
[33] Cell Phone Radio Frequency Radiation
[34] Cell Phone Radiation & Children's Health: What Parents Need to Know - HealthyChildren.org

to wireless radiation including, “If you plan to watch a movie on your device, download it first, then switch to airplane mode while you watch in order to avoid unnecessary radiation exposure.”

The California Department of Health

The California Department of Health released an advisory on how to reduce cell phone radiation[35] 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.[36]

The North Carolina Public Health Department

The North Carolina Public Health Department lists the full cancer findings of the NTP study[37], 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.[38]

The Santa Clara Medical Association

The *Santa Clara Medical Association Best Practices for Technology in Schools*[39] 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

[35] California Department of Public Health, Cell phone advisory (2017)
[36] Connecticut Department of Public Health,Cell Phone Factsheet 2015
[37] North Carolina Department of Health and Human Services,Cell Phones 2020 .
[38] 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”
[39] Santa Clara County Medical Association Best Practices for Safe Technology in Schools

"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[40]. 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[41] 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."

INTERNATIONAL RECOMMENDATIONS ON TECHNOLOGY SAFETY

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

- The 16 Practical Rules to Reduce Cell Phone and Wireless Radiation

Athens Medical Association

- 16 Recommendations to reduce human exposure to wireless radiation (2017)

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

2016 Report "Radiofrequency Exposure and the Health of Children"

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

Belgium Health Food Environment Agency

"Experts – including those on the Superior Health Council – advise everyone to limit their exposure to mobile phone radiation." - Health Food Environment Agency of Belgium

---

[40] 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.

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

German Government

"Of particular importance is the minimisation of children's radiation exposure as they are still developing and could therefore react more sensitively in terms of health. The BfS therefore recommends restricting children's use of mobile phones as far as possible."
-German Government Recommendations from the BfS for making telephone calls on mobile phones.

Ireland Department of Health

"Children are thought to be at higher risk of health implications from the use of mobile phones. This is because their skulls and cells are still growing and tend to absorb radiation more easily…It is recommended that children use mobile phones only if absolutely necessary."
-Advice from the Chief Medical Officer on Mobile Phone Use, Ireland Department of Health

French Polynesia

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

Cyprus

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

Republic of Korea

"When you are asleep or when you are relaxing, the farther away the phone is from your body, the safer you are."
The Korea government has a website with extensive information on what electromagnetic exposures are and how to reduce exposure. The webpage on children and EMF has graphics that illustrate how to use cell phones in "safer ways" as well as educational videos on how to reduce cell phone radiation exposure for children and adults.

United Kingdom

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

Turkey

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

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

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

Parliamentary Assembly of the Council of Europe

> Resolution 1815: "The Potential Dangers of Electromagnetic Fields and Their Effect on the Environment" which is a call to European governments to "take all reasonable measures" to reduce exposure to electromagnetic fields "particularly the exposure to children and young people who seem to be most at risk from head tumours."

European Environment Agency

> 'There are many examples of the failure to use the precautionary principle in the past, which have resulted in serious and often irreversible damage to health and environments. Appropriate, precautionary and proportionate actions taken now to avoid plausible and potentially serious threats to health from EMF are likely to be seen as prudent and wise from future perspectives. We must

remember that precaution is one of the principles of EU environmental policy,' says Professor Jacqueline McGlade, Executive Director of the European Environment Agency.

The benefits of mobile telecommunications are many, but, as with other case studies in the Late lessons from early warnings Volume 1 (EEA, 2001) and the present report, such benefits need not to be accompanied by the possibility of widespread harms. Precautionary actions now to reduce head exposures, as pointed out by the EEA in 2007, and many others since, would limit the size and seriousness of any brain tumor risk that may exist. Reducing exposures may also help to reduce the other possible harms that are not considered in this case study.
-European Environment Agency, Late lessons II Chapter 21 - Mobile phone use and brain tumour risk: early warnings early actions

See below for the following information:
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

We are happy to provide NEJAC with more information and resources.

Sincerely,

Rola Masri
Director of Government Outreach
Environmental Health Trust
RolaMasri@EHTrust.org

Theodora Scarato
Environmental Health Trust
Theodora.Scarato@EHTrust.org

cc: Devra Davis, Founder, EHT
Kent Chamberlin, President, EHT
Joseph M. Sandri, General Counsel & VP Legal Affairs

ATTACHMENT 1: Today's Regulatory Gap Regarding Radiofrequency Bioeffects

Although the public and elected officials assume that federal agencies are engaged in radiofrequency oversight activities to ensure public health and environmental protection, this is inaccurate. FCC RF exposure limits are guidelines only, not federally developed safety standards.[42] Such standards are typically promulgated by agencies reviewing the totality of scientific evidence, performing risk analysis, and identifying the levels at which various adverse effects occur, as a basis for toxicant exposure limit that ensures adequate public protection. A review of federal agency involvement indicates scant research and oversight activities along with serious regulatory gaps including but not limited to:

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

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

Issues related to agency authority.

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

Issues related to bioeffects research and safety testing.

- There is no regulatory process for premarket safety testing (as currently done with drugs) to ensure new wireless communication frequencies, antenna systems and technologies are safe.
- There is no federal research program on biological impacts, except for a small animal study by the National Toxicology Program.[43]

---

[42] 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

[43] NTP announced in January 202424 that "No additional RFR studies are planned." https://ehtrust.org/statement-by-devra-davis-phd-mph-on-the-u-s-government-national-toxicology-program-ceasing-research-on-cell-phone-radiation/

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

Issues related to cell tower oversight:

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

The Environmental Protection Agency (EPA) and RF Guideline Background

FCC RF exposure limits are guidelines only, as they are not federally developed safety standards[44] whereby agencies reviewed the totality of scientific evidence, performed risk analysis and identified a level of adverse effect to base a limit that would ensure adequate public protection. Such a process never happened.

The EPA was actively engaged in research to develop proper federal safety standards for RF that would protect humans from both thermal and non-thermal impacts, as it had been tasked to do by several federal agencies. However, just as the EPA was poised to release its RF limit recommendations in 1995[45] the EPA

[44] 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

[45] In 1995 the EPA had briefed both the FCC and the National Telecommunications and Information Administration regarding its two Phases of activities related to the development of RF exposure safety standards. Phase 1 would address only short-term thermal impacts of RF radiation but "does not include modulation, chronic exposure or non thermal [heating] impacts." Phase 2 would address modulated and nonthermal exposures and result in the final guidelines. See *Memorandum from Robert F. Cleveland, Office of Engineering and Technology to FCC Secretary, Ex Parte Presentation by U.S. Environmental Protection Agency (March 22, 1995)*
Three months later, EPA informed the FCC that its final RF guidelines "are essentially complete" and entering the review phase which would include a review by the Radiofrequency Interagency Work Group as well as stakeholders. *Letter from E. Ramona Trovata, EPA, Office of Radiation and Indoor Air, to Richard M. Smith, Chief, FCC, Office of Engineering and Technology (June 19,1995)*

was defunded from all such activities. The FCC then promulgated limits based on recommendations developed by industry/military connected groups (ANSI/IEEE C95.1-1992 and NCRP's 1986 Report). At that time, the EPA specifically recommended[46] that an "updated, comprehensive review of the biological effects" be initiated as the IEEE and NCRP recommendations were based on pre-1986 studies.[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.

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

In July 8, 2020, Lee Ann B. Veal, Director of the EPA Radiation Protection Division Office of Radiation and Indoor Air wrote[48] Theodora Scarato, EHT Executive Director, that "EPA's last review was in the 1984 document Biological Effects of Radiofrequency Radiation[49]. The EPA does not currently have a funded mandate for radiofrequency matters."

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

The Federal Communications Commission (FCC)

The FCC has minimal to non-existent regulatory activities to ensure RF compliance for wireless networks. In

[46] 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."

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

[48] *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*

[49] U.S. Environmental Protection Agency, 1984 Report Biological Effects of Electromagnetic Radiation https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=300065H1.TXT

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.

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

---

[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 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

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 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

[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

[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

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

The Food and Drug Administration (FDA)

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

The FDA's very **limited activities** related to cell phones and cancer include a now outdated literature review (with science ending in 2018) focused solely only on cell phones and cancer.[60] 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[61]

---

https://www.federalregister.gov/documents/2000/05/05/00-11237/year-2000-deadline-for-compliance-with-commissions-regulations-regarding-human-exposure-to

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

[61] 2019/2020 Letters to the FDA Regarding Inaccurate Information on the NTP and FDA Website
Letter calling for a retraction of FDA signed by several scientists including Ronald Melnick PhD, former National Institutes of Health Scientist, Samuel Milham MD, former Head of the Chronic Disease Epidemiology Section, Washington State Department of Health; David Carpenter MD, Director of the Institute for Health and Environment at University of Albany's School of Public Health, former director of the Wadsworth Laboratory of the New York State Department of Health, Lennart Hardell MD, PhD, Professor Department of Oncology, Faculty of Medicine and Health Dr. Anthony Miller, Professor Emeritus of University of Toronto and World Health Organization Senior Advisor
Ronald Melnick PhD's individual letter to the FDA on the National Toxicology Program study
Albert Manville PhD, retired Senior Wildlife Biologist, Division of Migratory Bird Management, U.S. Fish & Wildlife Service, Wash. DC HQ Office (17 years); Senior Lecturer, Johns Hopkins University
Prof. Tom Butler of the University College in Cork, Ireland's letter to the FDA
Igor Belyaev, PhD, Dr. Sc. Head, Department of Radiobiology of the Cancer Research Institute, Biomedical Research Center of the Slovak Academy of Science letter to the FDA
Paul Heroux PhD, McGill University
Alfonso Balmori, BSc statement to the FDA

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.[62] The FDA has not shown any evidence of monitoring RF bioeffects research via new agency reports, meetings or budget allocations on the issue.

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

FDA Statements

> "The FDA does not regulate cell towers or cell tower radiation. Therefore, the FDA has no studies or information on cell towers to provide in response to your questions."
> Ellen Flannery, Director, FDA Policy Center for Devices and Radiological Health to a California mother with a cell tower on her street who asked the FDA about safety, July 11, 2022
>
> "Under the law, FDA does not review the safety of radiation-emitting consumer products such as cell phones and similar wireless devices before they can be sold, as it does with new drugs or medical devices."
> FDA Website until 2019 -
>
> "We don't have jurisdiction over cellphone towers since those are environmental emitters."
> Email From FDA's David Kassiday in 2016

The Environmental Health Trust issued a "Report on FDA Activities on Cell Phones and Radiofrequency"[63] which documents the lack of adequate research review and misleading information put forward by the FDA. While the FDA webpages and cell phone cancer literature review seem to assert that safety is assured, the FDA has not adequately evaluated the totality of the science to reach any such safety or risk conclusion.

National Toxicology Program (NTP)

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

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

In 1999, the FDA requested the NTP perform large scale animal studies on cell phone radiation stating,[64] "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,[65] with the NTP's highest level of evidence.[66] Further, the NTP notably found significant increases in DNA damage (Smith-Roe et al., 2020), as well as the induction of cardiomyopathy of the right ventricle in male and female rats. The later Ramazzini Institute studies found elevated incidence of the same tumors the NTP found - heart schwannomas in male rats - despite the Ramazzini Institute use of much lower RF radiation exposures than the NTP which were intended to mimic cell tower base station environmental exposures (Falcioni et al., 2018; Vornoli et al., 2019).

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

However, the FDA stated that they "disagreed" with the NTP findings[67]. The DC Circuit rejected FDA's statement, saying "we find them to be of the conclusory variety that we have previously rejected as insufficient."[68]

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[69], 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*

[64] FDA CDRH nomination of NTP to Study RFR_Nomination Background: Wireless Communication Devices
[65] M. Wyde et al., 2018; M. E. Wyde et al., 2018 https://ntp.niehs.nih.gov/whatwestudy/topics/cellphones
[66] https://ntp.niehs.nih.gov/whatwestudy/testpgm/cartox/criteria
[67] 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
[68] EHT et al.v FCC, supra
[69] 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

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.

Centers for Disease Control (CDC)

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

National Institute for Occupational Safety and Health (NIOSH)

NIOSH has no current activities related to non ionizing EMFs. Although U.S. NIOSH scientists long have recommended precautionary measures to minimize risk from occupational RF exposure[70] and developed recommendations to reduce extremely low frequency EMF,[71] protective policies were never further developed or implemented.

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

OSHA currently is not engaged in bioeffect activities.
On July 1, 2015 OSHA wrote the FCC that, "RF emissions are not on OSHA's active regulatory agenda, so we have not conducted a comprehensive literature review or risk assessment on RF hazards" and "OSHA

[70] 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."

[71] 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

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

Inaccurate Statements by Elected Officials

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

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

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

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

[72] 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

Representative Doris Matsui stated in a December 20, 2023 letter[73] 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 the environment nor set exposure limits to ensure protections for birds, bees, trees and wildlife.[74,75] 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."[76]

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

[73] https://ehtrust.org/wp-content/uploads/Representative-Doris-Matsui-Letter-on-5G-December-20-2023.pdf
[74] 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*.
[75] 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
[76] https://www.ntia.doc.gov/files/ntia/us_doi_comments.pdf

Circuit ruled in our case against the FCC (*EHT et al. v FCC*),[77] 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."[78] 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[79] 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 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

[77] 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

[78] https://www.cadc.uscourts.gov/internet/opinions.nsf/FB976465BF00F8BD85258730004EFDF7/$file/20-1025-191011 1.pdf

[79] 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

to orientation, migration, reproduction, mating, nest, den building and survivorship.[80] [81] [82]

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.[83] Biologists caution that non ionizing electromagnetic radiation is a critical factor in the decline of pollinator and insect populations.[84]

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. [85]

Individual studies investigating 5G have found adverse effects including:

- 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

[80] 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*.

[81] 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.

[82] 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.

[83] 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.

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

[85] 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

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.[86]

> "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.[87] Researchers have released subsequent reports documenting continued impacts to tree canopy from cell tower antennas.[88,89] Other RF effects include impacts to leaf, shoot, seedlings of Aspen trees. [90]

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

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,[91] increased oxidative stress,[92] genetic damage,[93] structural and

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

[87] 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.

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

[89] 2021 Report "Tree damage caused by mobile phone base stations"

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

[91] 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

[92] 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/.

[93] 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

functional changes of the reproductive system,[94] memory deficit,[95] behavioral problems[96], and neurological impacts.[97]

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[98] 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[99] in 2020 with 15 recommendations including: requiring setbacks of all wireless transmitters from residences, businesses and schools, adopting a statewide position to encourage fiber optics to the premise, acknowledging the need for further studies to outline clinical symptoms related to RF exposure, developing RF safety limits to protect the environment, among 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 [100] 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

---

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

[94] 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

[95] 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>.

[96] 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.

[97] 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

[98] 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

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

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

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.[101] 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.[102]

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.[103] Additionally, the NTP found heart damage and DNA damage, despite the fact that the animals were carefully exposed to non-heating RFR levels long assumed to be safe. The Ramazzini Institute animal studies[104] 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

[101] 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

[102] 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.

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

[104] 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

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.[105]

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.[106]

It is notable that in 2000, the Ecolog Institute Report on radiofrequency health effects, commissioned by T-Mobile and DeTeMobil Deutsche Telekom MobilNet, recommended an RF exposure limit 1000x lower than the FCC's current power density limit after reviewing the research on biological effects, including impacts to the immune system, central nervous system, hormones, cancer, neurotransmitters and fertility.[107]

Insurers rank 5G and electromagnetic radiation as a "high" risk,[108] comparing the issue to lead and asbestos.[109] A 2019 Report[110] by Swiss Re Institute, a world leading provider of insurance, classifies 5G mobile networks

[105] 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.
[106] Roseanne White Geisel, (2007) Insurers exclude risks associated with electromagnetic radiation, Business Insurance
[107] 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
[108] https://ehtrust.org/key-issues/reports-white-papers-insurance-industry/
[109] 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
[110] Swiss Re 5G Report"Off the leash – 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.[111] As an example, Portland Oregon Public School Insurance states,[112] "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[113] but not the communities impacted by the infrastructure.[114] 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*

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

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

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

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

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

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."