



From: Theodora Scarato, Executive Director of Environmental Health Trust ehtrust.org
To: Gina Armstrong, City of Pittsfield Board of Health

Date: Thu, May 27, 2021 at 9:10 AM

On May 27, 2021 Theodora Scarato sent an email to Gina Armstrong, City of Pittsfield Board of Health with the following attachments as information on the health and environmental effects of wireless radiofrequency radiation.

Letter from Dr. Devra Davis Devra Davis, PhD, MPH, Present of Environmental Health Trust Dr. Paul Ben-Ishai, PhD, Professor, Department of Physics, Ariel University, Israel; Dr. Anthony B. Miller, PhD, Professor Emeritus, University of Toronto, Senior Advisor to Environmental Health Trust; Dr. Alvaro Augusto de Salles, PhD Professor, Federal University of Rio Grande do Sul, P. Alegre, Brazil; Claudio Fernandez Rodriguez, Federal Institute of Technology of Rio Grande do Sul, IFRS, Brazil and Theodora Scarato, Executive Director, Environmental Health Trust

Briefing An Overview of the Health and Environmental Effects of 5G, 4G and Wireless Radiofrequency Radiation which includes studies on RF exposure finding associations with impacts on motor skills, memory, and attention as well as neuropsychiatric problems, elevated diabetes, headaches, sleep problems, and genetic damage.

Belyaev, I. (2019). [Main regularities and health risks from exposure to non-thermal microwaves of mobile communication](#). 14th IEEE International Conference meeting on Advanced Technologies, Systems and Services in Telecommunications – TELSIS 2019 (<http://www.telsiks.org.rs>), Niš, Serbia.

Frank JW. Electromagnetic fields, 5G and health: what about the precautionary principle? J Epidemiol Community Health. 2021 Jan 19; jech-2019-213595. doi: 10.1136/jech-2019-213595. Epub ahead of print. PMID: 33468601.

Priyanka Bandara, David O Carpenter, [Planetary electromagnetic pollution: it is time to assess its impact](#), The Lancet Planetary Health, Volume 2, Issue 12, 2018, Pages e512-e514, ISSN 2542-5196, [https://doi.org/10.1016/S2542-5196\(18\)30221-3](https://doi.org/10.1016/S2542-5196(18)30221-3).

- A recent evaluation of 2266 studies (including in-vitro and in-vivo studies in human, animal, and plant experimental systems and population studies) found that most studies (n=1546, 68.2%) have demonstrated significant biological or health effects associated with exposure to anthropogenic electromagnetic fields.

April 21, 2021

Honorable Joseph R. Biden, President
The White House
1600 Pennsylvania Avenue N.W.
Washington, DC 20500

Dear President Biden,

We write to you as scientists deeply committed to protecting public health and the environment and as authors of several hundred publications, including some prepared for the Intergovernmental Panel on Climate Change. We are writing to urge you to take immediate actions to reduce and restrict the rapid and continuing increase in our schools, workplaces, and homes of a harmful environmental pollutant — wireless microwave radiofrequency radiation (RFR).

Children are [more vulnerable](#) to wireless radiation. They should not be doing homework on cell phones or with wireless hotspots that [catch fire](#). Wireless networks have numerous environmental impacts meriting concerted regulatory control.

We agree that “broadband internet is the new electricity” that enables Americans to do their jobs, to participate equally in school learning and health care, and to create a fairer playing field by eliminating the digital divide. The United States must bridge the digital divide with a “future proof” broadband infrastructure that is affordable, reliable, high-speed, and sustainable.

This infrastructure should be wired, not wireless. We urge that wherever possible the broadband system envisioned in the American Jobs Plan rely on safer, more secure and efficient, wired connections, especially for schools and other institutions where wired connections will save money and eliminate exposures to wireless radiation, found by the National Toxicology Program to cause clear evidence of cancer.

BIOLOGICAL AND ECOLOGICAL IMPACTS OF WIRELESS AND NON-IONIZING RADIATION

A substantial body of [peer-reviewed scientific reports](#) document multiple serious negative impacts on human health from wireless microwave radiation, including [increased brain](#), [breast](#) and [thyroid](#) cancer risk, [cellular stress](#), [genetic damage](#), harm to the [reproductive system](#), [learning](#) and [memory deficits](#), [behavioral problems](#), [neurological effects](#), [damage to brain development](#), [headaches](#), and various [impacts to wellbeing](#).

This letter takes the liberty of providing a detailed appendix with some of the growing and robust independent scientific literature linking wireless radiofrequency radiation to numerous health effects. The literature makes clear the need for a major change in our approach to wireless technology, especially as millions of families increasingly use video conferences for school and work.

Most notable among the science on RFR is the United States' own years-long [National Toxicology Program](#) (NTP) study into the effects of cellphone radiation exposure. The \$30 million, interagency-supported study originally requested and commissioned by the Food and Drug Administration (FDA) exposed animals in their lifetimes to the same levels of cell phone radiation that humans get today. Using standard protocols for testing, the NTP study showed conclusively that low-intensity, modulated radio signals of the form of GSM and CDMA cause cancer and heart damage in animals as well as DNA damage in multiple organs.

Non-ionizing radiation at lower frequencies also can cause biological harm to humans, studies show. As an example, Kaiser Permanente research on prenatal exposures to magnetic field non-ionizing electromagnetic field (EMF) radiation has found increased [miscarriage](#) as well as higher incidences of [ADHD](#), [obesity](#), and [asthma](#). While several countries have strict limits on residential exposures, the United States has no regulatory limits whatsoever on allowable exposures to magnetic field non-ionizing EMF.

Recent reports from the [Swiss government's](#) EMF expert advisory group, the [National Research Foundation of Korea](#), and [Yale Medicine](#), confirm the view that *legal levels* of wireless radiation can damage the health of children, pregnant women, and the medically vulnerable.

Christopher Portier PhD, a longtime U.S. government scientist now retired, recently submitted a [comprehensive review](#) of the scientific research in a major cell phone/brain cancer lawsuit where he concludes that “the evidence on an association between cellular phone use and the risk of glioma in adults is quite strong.”

“In my opinion, RF exposure probably causes gliomas and neuromas and, given the human, animal and experimental evidence, I assert that, to a reasonable degree of scientific certainty, the probability that RF exposure causes gliomas and neuromas is high,” he wrote.

The [176-page expert report](#) with 443 references was prepared for the plaintiffs in a major product liability [lawsuit](#), Murray et al. v Motorola, Inc. et al., filed in the Superior Court for the District of Columbia against the telecommunications industry. Dr. Portier was the Director of the United States National Center for Environmental Health at the Centers for Disease Control and Prevention in Atlanta, and the Director of the Agency for Toxic Substances and Disease Registry. He is one of many US governments scientists and [advisors to the World Health Organization](#) highlighting the ever-growing body of scientific evidence showing harm.

THE ENVIRONMENTAL IMPERATIVE

The unfettered proliferation of new wireless networks including 5G and 4G antenna densification constitutes a major global contributor to greenhouse gases and hazardous e-waste. Rather than advance climate objectives, 5G instead constitutes an unmitigated disaster for our climate because of the vast surge in energy demand that will take place. Further, 5G deployment will increase environmental levels of RFR, which science documents to be harmful not only to human health, but also to wildlife and the environment.

5G requires hundreds of thousands of new so-called “small” cell towers and billions of new wireless devices, which will use massive amounts of energy in their production, operation, and disposal. 5G antennas are referred to as “[hungry, hungry hippos](#)” and “[a battery vampire](#).” [Numerous reports](#) have [documented](#) the exponentially increased use of energy by 5G and 4G densification and the Internet of Things. [Streaming](#) with [wireless](#) results in higher greenhouse gas emissions compared to safer, faster, and more secure corded/wired fiber-optic connections.

While there may be improvements in energy efficiency for new devices individually, these gains are completely lost in the increases in total demand that will take place with the proliferation of games, videos, other streaming services, and the continued generation of highly addictive apps.

Additionally, telecommunications firms contend that 5G network antennas must be sited about every 100 yards, and they have haphazardly started nationwide construction on hundreds of thousands of new “small cell” antennas near our homes and schools.

5G densification to accommodate this wireless infrastructure will inevitably require the removal of countless numbers of trees from urban and rural locales. Not only will this destroy valuable tree canopies, increase greenhouse gases, and damage root systems, but it will cause a dramatic increase in environmental levels of radiofrequency radiation (RFR) known to [damage trees](#). Wireless technology can also impact [insects](#), [bees](#), [plants](#), [animals](#), and [bacteria](#), all of which are vital to the ecosystem, even in the densest urban environment.

U.S. FEDERAL POLICY ON 5G DISREGARDS HEALTH AND ENVIRONMENTAL IMPACTS

The implication of the NTP study, and a [parallel study](#) carried out by the Ramazzini Institute of Bologna, Italy, along with recent reviews on [oxidative stress](#), reproduction and [genetic effects](#), is that current Federal Communications Commission (FCC) human exposure limits for non-ionizing RFR originating from the wireless infrastructure allow for hazardous levels of exposure. In reality, the push for 5G constitutes an unethical experiment with all of us as unwitting subjects.

The FCC has [proposed new rules](#) for a large range of EMF frequencies (lower than are currently used for wireless networks) without adequate safety testing. As scientific comments in FCC [Docket 19-226](#) document, these lower frequencies cannot be considered safe.

It is not widely appreciated that the FCC already ushered in unprecedented and untested commercial expansion of 5G and 4G cellular technology without serious deliberation on the effects of this new technology on humans and the environment. Its lack of serious, systematic deliberation on the science is demonstrated by its unchecked rejection of the need to comply with the National Environmental Policy Act (NEPA), the Administrative Procedures Act (APA), and the Americans With Disabilities Act (ADA).

Our historic legal appeal, [EHT et al. v. FCC](#), documents numerous violations of these federal laws and demonstrates how the FCC did not provide evidence of having undergone a “hard-look” or systematic assessment of the scientific evidence on the [FCC's own record](#) when [deciding in 2019](#) to keep its outdated 1996 wireless radiation limits.

Under NEPA, all major federal regulations must undergo review for their potential impact on the environment. FCC limits are not designed to protect wildlife or the natural environment, yet the FCC refused to conduct an environmental assessment of the 5G network. Although the records were withheld, FOIA investigations by the Environmental Health Trust have found that the FCC [internally discussed](#) the issue of environmental review related to 5G, yet never moved forward to complete one. Studies attached in our appendix show the folly of this unscientific decision.

Unlike other countries that provide robust resources to their people on how to decrease exposure, United States agencies downplay the issue of health effects and provide minimal information on how families can reduce exposures. The Centers for Disease Control (CDC) [hired an industry consultant](#) to draft numerous website pages on the health effects of non-ionizing radiation. The [EPA](#) scrubbed their website of content on potential health risks of wireless radiation.

Further, the FCC and FDA now state that they rely on a self-appointed, self-monitored, private club, to which no American belongs, termed the International Commission of Non-ionizing Radiation Protection (ICNIRP). This small group of around one dozen scientists is closely allied with industry and does not represent the larger expert scientific community. It repeatedly puts forward [unfounded criticisms](#) of U.S. government research yet remains unchecked by oversight or independent external review. [Numerous investigations](#), [published research](#), and a [2020 report](#) released by European Members of Parliament details the ways in which ICNIRP has serious conflicts of interests and remains under the influence of the telecommunications industry. Yet both the FCC and the FDA substantiate their rejection of the US NTP \$30 million animal study with ICNIRP's criticism despite the fact that several retired [scientists](#) of the National Institutes of Health have documented that ICNIRP's criticisms are erroneous.

As a result of the FCC's omissions, the 5G rollout and 4G densification must be halted until environmental evaluations are completed and federally developed safety limits that protect public health and the environment are created.

POLICY RECOMMENDATIONS

As scientists dedicated to public health, we ask that the broadband infrastructure cited in the American Jobs Plan prioritize a wired telecommunication infrastructure, and that the climate, public health, and environmental impacts of future networks be integrated into any assessment of policy options and proposed regulations promulgated by your administration.

We recommend the following:

1. **A sustainable wired (not wireless) infrastructure: The administration should focus on infrastructure that includes wired networks *up to and inside of buildings* and evaluate economic opportunities to ensure environmentally sustainable infrastructure.** In anticipating thousands of miles of new transmission lines to be laid to renew the electrical grid, we stress that much-needed expanded access to broadband need not and should not depend on wireless networks but instead on economical wired fiber-optic cable that goes to and through the premises.
2. **An immediate halt to the 5G rollout and associated 4G densification.** Consistent with concerns expressed by a number of environmental organizations in this nation and expert advice from experts in other nations, we call for a full halt to the more than 1 million new 5G network antennas and associated cell towers — some slated for neighborhoods and areas of pristine wilderness [in our National Parks](#) — and the concomitant destruction of hundreds of thousands of trees and wildlife habitats.
3. **An assessment of the energy consumption and climate impact of 5G and 4G densification.** We urge you to include a full life-cycle assessment of the potential impact of wireless antenna densification on climate policy that takes into account growing evidence of substantially increased greenhouse gas emissions if 5G were to be implemented, as well as emissions and pollution analysis related to the extraction, production, transportation, and disposal of materials in the full life cycle of wireless technologies.
4. **An assessment of the environmental impact of the 5G network.** The U.S. must first do a comprehensive assessment on the environmental impacts of the hundreds of thousands of new 5G/4G wireless facilities which includes impacts to tree canopy, wildlife habitat, and how millimeter waves will impact insects and pollinators and more.
5. **A genuine review of the entire body of scientific research on non-ionizing electromagnetic radiation on human and environmental health.** Independent experts and relevant government authorities must conduct a review of the full body of scientific research so that they may develop biologically based federal safety limits for human and wildlife exposures to radiofrequency and magnetic field non-ionizing electromagnetic

radiation. The review must engage all relevant U.S. health, science, and environmental agencies (such as the Environmental Protection Agency (EPA), National Cancer Institute (NCI), Occupational Safety and Health Administration (OSHA), the National Institutes of Health (NIH) and National Toxicology Program (NTP)) and take into account the ever-growing scientific evidence of immediate and long-term biological impacts as well as the rapidly expanding impacts on climate, wildlife, and our natural world.

6. **The development of science-based safety limits for human and wildlife exposures to RFR and non ionizing EMF.** The allowable exposure limits for RFR were adopted in 1996 and have not changed since then. The EPA should develop safety limits based on scientific research. The United States must also develop exposure limits on magnetic field EMF and other frequencies in the non-ionizing range used in electricity distribution, wireless power transfer and other applications.
7. **Appointment of FCC commissioners who are absent of ties to the wireless Industry.** We call on you to end [the revolving door](#) through which FCC commissioners come from and return to the telecom industry. The FCC is termed a “Captured Agency” in a Safra Center for Ethics, Harvard Law School report. We ask you to ban all telecom industry executives, lobbyists, and representatives from any advisory or official position in your transition team, cabinet, and administration.
8. **Appointment of an interdisciplinary committee at the National Academies of Sciences (NAS) to review the science underlying 5G and wireless networks, to identify major data gaps and uncertainties, and to set priorities for research on health and safety.** This review must systematically consider the full lifetime costs and benefits of 5G and other telecom technologies now on the drawing board and evaluate immediate and long-term climate impacts. The National Academy of Sciences (NAS) Report [“An Assessment of Illness in U.S. Government Employees and Their Families at Overseas Embassies”](#) commissioned by the U.S. State Department cites “directed, pulsed radiofrequency energy” as “the most plausible mechanism” to explain the mystery illness suffered by U.S. Embassy personnel. The NAS must also develop a major interdisciplinary training program for medical and engineering professionals to better understand the impacts of bioelectromagnetics.
9. **A multimedia national public awareness education campaign so that people know why and how to reduce exposure to wireless and other non-ionizing electromagnetic radiation.** We also ask that your administration develop and validate a nationwide educational campaign for parents, teachers, and the public so they understand why and how to reduce daily exposures to wireless radiofrequency and other non-ionizing radiation from laptops, cell phones, and the numerous digital devices in our lives today. This includes an update to the public information posted on the websites of the CDC, EPA, National Cancer Institute, and FCC to include straightforward, unambiguous recommendations to reduce exposure to non-ionizing radiation as well as refer to the full results of the National Toxicology Program study and other independent research on wireless and non-ionizing radiation.

10. **Promotion of policies that reduce wireless exposures in schools.** Strategies are urgently needed to eliminate sources of radiofrequency radiation in the indoor environment, especially in schools and public buildings. Wi-Fi infrastructure should be replaced with wired networks in the classroom where children spent most of their waking hours.
11. **Labor policy that addresses growing occupational exposures.** An investigation by the National Department of Labor and Occupational Safety and Health Administration into current and projected occupational exposures and practical measures to reduce occupational exposures is urgently needed addressing the range of workplace exposure from hospitals, to schools, to delivery drivers, to electricians working on rooftops, to cell tower climbers.
12. **The launch of a task force convened by the Surgeon General on how to minimize health effects of technology on children.** The harmful physical, social, and emotional effects of screens is well documented yet our children's use of screens is ever increasing.

INTERNATIONAL ACTIONS ON WIRELESS INFRASTRUCTURE

While the U.S. should be leading efforts to create and validate safer technology, especially for our schools and workforce, we have fallen far behind other countries in this regard. It is time for change.

Several high-tech nations have surpassed the United States in recognizing not only environmental but also human impacts from wireless radiation exposure. France, Israel, Korea, French Polynesia, and Switzerland, among others, have policies and educational programs to reduce public exposure to wireless and non-ionizing radiation. Numerous countries have far more stringent cell tower radiation exposure limits compared to the United States.

Deeply concerned about growing evidence linking brain cancer to cell phone use, the Korean National Cancer Institute has issued clear recommendations to reduce cell phone radiation to children. Other nations issue notices at points of sale, ban or restrict the use of Wi-Fi and cell phones in schools, and ban the advertising and sale of cell phones to young children.

In economic terms, the American Jobs Plan notes that the United States "has some of the highest broadband prices among OECD countries." Current proposals for wireless 5G are far more costly and wasteful than wired communications. Wired cables create a safer, more secure, faster, and longer-lasting connection. In sum, they are more cost-effective.

Our experts stand ready to provide more detailed information to you on this important issue, including elaborating on materials in the attached appendix and assistance with evaluating the science and impacts on humans, climate, animals, and wilderness.

Yours sincerely,



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Theodora Scarato
Executive Director, Environmental Health Trust

cc: The Honorable Xavier Becerra, Secretary of Health and Human Services
The Honorable John Kerry, Special Presidential Envoy for Climate
Mr. Shawn Benghe, Acting Director of the U.S. National Park Service
The Honorable Nancy Pelosi, CA-12
The Honorable Conor Lamb, PA-17
The Honorable Susie Lee, NV-03
The Honorable Chrissy Houlahan, PA-06
The Honorable Anna Eshoo, CA-18
The Honorable Edward Markey, MA
The Honorable Bernie Sanders, VT
The Honorable Chris Van Hollen, MD

P.O. Box 58
Teton Village, WY 83025



EHTRUST.org

The Honorable Benjamin Cardin, MD

APPENDIX

Reports and White Papers: 5G, Energy Consumption, and Climate

Data Center Forum White Paper, (2020) [Environmentally Sustainable 5G Deployment](https://www.datacenter-forum.com/datacenter-forum/5g-will-prompt-energy-consumption-to-grow-by-staggering-160-in-10-years)
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Vertiv 5G (2019) [Telco Industry Hopes and Fears FROM ENERGY COSTS TO EDGE COMPUTING TRANSFORMATION](#)

https://www.vertiv.com/globalassets/documents/white-papers/451-research-paper/10648_advisory_bw_vertiv_266274_0.pdf

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Letter from the EPA to Environmental Health Trust

----- Forwarded message -----

From: **Veal, Lee**<Veal.Lee@epa.gov>

Date: Wed, Jul 8, 2020 at 11:32 AM

Subject: RE: Letter with specific Questions Related to the FDA review and to the EPA, CDC, NIOSH and FDA Jurisdiction on EMFs

To: Theodora Scarato <Theodora.Scarato@ehtrust.org>

Dear Director Scarato;

Thank you for sending us your questions and references regarding radiofrequency (RF) radiation. Up through the mid-1990s, EPA did study non-ionizing radiation. The Telecommunications Act of 1996 directs the Federal Communications Commission (FCC) to establish rules regarding RF exposure, while the U.S. Food and Drug Administration (FDA) sets standards for electronic devices that emit non-ionizing or ionizing radiation. EPA does not have a funded mandate for radiofrequency matters, nor do we have a dedicated subject matter expert in radiofrequency exposure. The EPA defers to other agencies possessing a defined role regarding RF. Although your questions are outside our current area of responsibilities, we have provided a response to each one as you requested.

1. *What is your response to these scientists' statements regarding the FDA report and the call to retract it?*

EPA Response: The EPA does not have a funded mandate for radiofrequency matters, has not

conducted a review of the FDA report you cited or the scientists' statements, and therefore has no response to it.

2. *To the FDA- What consultants were hired for the FDA review and report on cell phone radiation?*

EPA Response: This is not an EPA matter. Please refer this question to the FDA.

3. *What U.S. agency has reviewed the research on cell phone radiation and brain damage? I ask this because the FDA only has looked at selected studies on cancer. If your agency has not, please simply state you have not.*

EPA Response: EPA's last review was in the 1984 document [Biological Effects of Radiofrequency Radiation \(EPA 600/8-83-026F\)](#). The EPA does not currently have a funded mandate for radiofrequency matters.

4. *What U.S. agency has reviewed the research on damage to memory by cell phone radiation? If so, when and send a link to the review.*

EPA Response: EPA's last review was in the 1984 document [Biological Effects of Radiofrequency Radiation \(EPA 600/8-83-026F\)](#). The EPA does not currently have a funded mandate for radiofrequency matters.

5. *What U.S. agency has reviewed the research on damage to trees from cell phone radiation? If so, when was it issued and send a link to the review. [Note this study showing damage from long term exposure to cell antennas.](#)*

EPA Response: The EPA does not have a funded mandate for radiofrequency matters, and we are not aware of any EPA reviews that have been conducted on this topic. We do not know if any other U.S. agencies have reviewed it.

6. *What U.S. agency has reviewed the research on impacts to birds and bees? If so, when and send a link to the review. I will note the latest research showing [possible impacts to bees](#) from higher frequencies to be used in 5G.*

EPA Response: The EPA does not have a funded mandate for radiofrequency matters, and we are not aware of any EPA reviews that have been conducted on this topic. We do not know if any other US agencies have reviewed it.



An Overview of the Health and Environmental Effects of 5G, 4G and Wireless Radiofrequency Radiation

This review brings to your attention to critical scientific and technical information justifying an immediate moratorium on 5G and wireless network densification as called for by more than [400 scientists](#) and supported by [thousands](#) of medical doctors¹. Independent public health and medical experts worldwide are requesting immediate reductions in both public exposure to microwave wireless radiation and a halt to the densification of wireless infrastructure.

Environmental Health Trust (EHT) is a nonprofit think tank and policy organization, founded in 2007, dedicated to identifying and reducing environmental health hazards. EHT provides independent scientific research and advice on controllable environmental hazards to local, state, and national governments. Today, we write to advise you of the published scientific grounds establishing why and how to avoid major health and environmental impacts from the installation of 5G wireless telecommunications facilities and associated 4G wireless infrastructure in neighborhoods, parks and wilderness.

The transmissions to and from proposed 5G wireless installations are radiofrequency emissions that are an environmental pollutant found to cause cancer (in both experimental animals and humans), DNA damage, neurological damage and other adverse health and environmental effects (e.g., on birds, bees, and trees) according to internationally recognized authoritative research. The prestigious institutions that have conducted these studies include the U.S. National Toxicology Program, the nation's premier testing institute, and the Ramazzini Institute, a foremost testing center in Italy.

The current guidelines put forth by the self-appointed, self-monitored, minority viewpoint of the International Commission on Non-Ionizing Radiation Protection (ICNIRP), upon which some government limits are based, are not protective of health, as they are not based on documentation of safety for long term exposure. Furthermore, none of the limits were developed to ensure safety to flora and fauna. As the [Natural Resources Defense Council](#) has argued in U.S Courts, an environmental impact assessment should be performed before building out these networks.

Distinguished US Government Scientific Directors (recently retired) Document Serious Risks From Current Levels of Wireless Exposures

¹ [“Small Cells, Mini Cell Towers, Wireless Facilities and Health: Letters from Scientists on the Health Risk of 5G.”](#) Environmental Health Trust, last modified September 20, 2017.

Christopher Portier PhD

Christopher Portier PhD, a longtime US government scientist now retired, submitted a [comprehensive review](#) of the scientific research in a major cell phone/brain cancer lawsuit where he concludes that “The evidence on an association between cellular phone use and the risk of glioma in adults is quite strong” and “In my opinion, RF exposure probably causes gliomas and neuromas and, given the human, animal and experimental evidence, I assert that, to a reasonable degree of scientific certainty, the probability that RF exposure causes gliomas and neuromas is high.”

The [176-page expert report](#) with 443 references was prepared for the plaintiffs in a major product liability [lawsuit](#), Murray et al. v Motorola, Inc. et al., filed in the Superior Court for the District of Columbia against the telecommunications industry. The plaintiffs in the case are suing the telecommunications industry for damages because they developed brain cancer after years of using a cell phone by holding it up to their head. Most of the plaintiffs have passed away. Court dates are set for Murray et al. v. Motorola July 12-23, 2021.

Chris Portier PhD was the Director of the United States National Center for Environmental Health at the Centers for Disease Control and Prevention in Atlanta, and the Director of the Agency for Toxic Substances and Disease Registry. Prior to the CDC, Dr. Portier was with the National Institute of Environmental Health Sciences for 32 years where he served as the NIEHS Associate Director, Director of the Environmental Toxicology Program, and Associate Director of the National Toxicology Program. He is one of many US governments scientists issuing expert opinions on the scientific evidence showing harm.

Dr. Linda Birnbaum

Dr. Linda Birnbaum, recently retired as Director of the National Institutes of Environmental Health Sciences of the National Institutes of Health and Director of the National Toxicology Program (NTP).

“The NTP studies tested nonthermal levels of RFR for toxicologic potential including carcinogenic activity and relied on controlled chronic exposures to levels of RFR that do not significantly increase temperature...Overall, the NTP findings demonstrate the potential for RFR to cause cancer in humans.” - Dr. Linda Birnbaum in [Amicus of Joe Sandri August 5, 2020](#)

Dr. Ronald Melnick

Dr. Ronald Melnick, National Institutes of Health Senior Scientist (28 years) who led the design of the National Toxicology Program (NTP) studies on cell phone radiation.

“The NTP studies clearly show that non-ionizing radiation can cause cancers and other adverse health effects. Prior to the start of the NTP studies, it was assumed by the industry and the regulatory agencies that radiofrequency radiation could not cause adverse health effects other than those due to tissue heating. So we designed this study to investigate if non-thermal exposures would cause health effects. In the NTP studies, there was clear evidence of cancer development and other adverse health effects at non thermal exposure levels. In the US, the FCC limits for human exposure to radiofrequency radiation are based on the assumption that only thermal effects can cause harm. The NTP studies prove this assumption

of safety is not valid... All new wireless technologies, including 5G, should be adequately tested before their implementation leads to unacceptable levels of human exposures and increased health risks.” - [Dr. Ronald Melnick](#)

Albert Manville PhD

Albert Manville PhD, U.S. Fish & Wildlife Service Biologist for 17 years.

“There currently are well over 500 scientific, peer-reviewed papers addressing impacts of non-ionizing, non-thermal radiation on laboratory animals — many of the studies directly applicable to human health and safety. I’m coauthoring a detailed scientific paper on these impacts. When I worked as a wildlife biologist for the U.S. Fish & Wildlife Service for 17 years, I collaborated with the late Dr. Ted Litovitz in 2000. Dr. Litovitz and his colleagues studied the impacts of low-level, non-thermal radiation from the standard 915 MHz cell phone frequency on chicken embryos. In their laboratory studies, control/non-treated embryos suffered no effects, but some of the treated/irradiated embryos died — at levels as low as 1/10,000 the normal level of cell phone radiation exposure to humans. This was an eye-opener! The findings were published by DiCarlo and others in 2002 in the Journal of Cellular Biochemistry. Meanwhile, I worked closely with colleagues from Europe, including Balmori, Hallberg, Everaert, and Bauwens on the impacts of cell towers on wild migratory European birds. The results of their field research were equally astounding. Where healthy, breeding bird populations had persisted, once cell towers were installed and operating, nest and site abandonment, plumage deterioration, locomotion problems, reduced survivorship, and death were noted in House Sparrows, White Storks, Rock Doves, Magpies, Collared Doves, and other species. This was documentation in the field of some very troubling consequences of the impacts of cell tower radiation on wildlife.” - [2020 Statement from Dr. Albert Manville on the FDA Report on Cell Phone Radiation](#)

ICNIRP and FCC Limits Do Not Protect People, Wildlife or the Environment

The exposure guidelines developed by ICNIRP, and which many countries rely on to set radiofrequency guidelines, are based on the outdated and proven erroneous assumption that thermal effects are the only harm from radiofrequency radiation. These guidelines do not protect people or wildlife from biological effects of chronic low level non-thermal exposures.

In 2020 Environmental Health Trust filed historic legal action against the FCC calling on the FCC to fully review the record and update its 25-year-old wireless radiation exposure guidelines for radio-frequency radiation (RFR) from cell phones, cell towers, Wi-Fi, 5G and other wireless communication devices². The lawsuit *Environmental Health Trust et al. v. FCC* has been featured in Washington DC Top News and Bloomberg Law^{3,4}.

As our case against the FCC lays out, research on harmful impacts to the developing brain of children was not factored into the standard setting decisions of these groups, nor do these groups consider adverse

² Environmental Health Trust et al. v. Federal Communications Commission
<https://ehtrust.org/eh-takes-the-fcc-to-court/>

³ Bloomberg Law: U.S. [FCC Faces Skeptical Appeals Judges in Radiation Emissions Case](#)

⁴ Washington DC Top News: (WTOP) [“Federal appeals court hears case on FCC’s 5G safety standards“](#)

impacts on male and female reproduction or DNA damage that has been found to occur in published research studies.

The Natural Resources Defense Council filed an [amicus brief](#) in our case on the need for environmental review, signed onto by Mayors and Councilmembers from Maryland, Massachusetts, Michigan, California and Hawaii. Attorney Joe Sandri filed an [Amicus Brief](#) with a statement by Dr. Linda Birnbaum, former Director of the National Institute of Environmental Health Sciences of the National Institutes of Health and former Director of the National Toxicology Program (NTP) who detailed the findings of the NTP and concluded, “Overall, the NTP findings demonstrate the potential for RFR to cause cancer in humans.” The [Building Biology Institute](#) and [Kleiber family](#) also filed critical briefs on injuries sustained from exposures allowed by FCC exposure guidelines.⁵

Numerous Countries Have Much Stronger Limits than ICNIRP

The following is a sampling of countries with cell tower network radiofrequency radiation (RF) limits (maximum permissible limits) far more stringent than ICNIRP limits: Belarus, Bulgaria, China, Russia, Belgium, Chile, Greece, India, Israel, Italy, Liechtenstein and Switzerland^{6,7,8,9,10}.

In 2011 the Parliamentary Assembly of the Council of Europe issued [Resolution 1815: “The Potential Dangers of Electromagnetic Fields and Their Effect on the Environment”](#)^{11,12} 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.” Resolution 1815 specifically states that governments “reconsider the scientific basis for the present standards on exposure to electromagnetic fields set by the International Commission on Non-Ionising Radiation Protection, which have serious limitations, and apply ALARA [as low as reasonably achievable], covering both thermal effects and the athermic or biological effects of electromagnetic emissions or radiation.”

⁵ [Amicus of NRDC: Natural Resources Defense Council](#), [Amicus of Attorney Joe Sandri](#) including declaration of Dr. Linda Birnbaum, former Director of the National Institute of Environmental Health Sciences [Amicus of Catherine Kleiber](#), [Amicus of the Building Biology Institute](#).

⁶ Global Health Observatory Data Repository, [“Exposure limits for radio-frequency fields \(public\).”](#) World Health Organization, last modified May 31, 2017.

⁷ Ting Wu et al., [“Safe for Generations to Come.”](#) *IEEE Microw Mag* 16, no. 2 (March 2015): 65-84.

⁸ Huai Chiang, [“Rationale for Setting EMF Exposure Standards.”](#) as cited in Wu, Rappaport and Collins, 2015.

⁹ Rianne Stam, [“Comparison of international policies on electromagnetic fields \(power frequency and radiofrequency fields\).”](#) National Institute for Public Health and the Environment, 2017.

¹⁰ Mary Redmayne, [“International policy and advisory response regarding children’s exposure to radio frequency electromagnetic fields \(RF-EMF\).”](#) *Electromagnetic Biology and Medicine* 35, no. 2 (March 2015): 176-185.

¹¹ Committee on the Environment, Agriculture and Local and Regional Affairs, Resolution 1815: [“The Potential Dangers of Electromagnetic Fields and Their Effect on the Environment.”](#) Parliamentary Assembly of the Council of Europe, May 6, 2011.

¹² Parliamentary Assembly of the Council of Europe, [Resolution 1815 Final Version](#), May 27, 2011.

While many European countries have stronger limits based on their framework of precaution, countries such as India, China and Russia have much lower limits than ICNIRP and are “science based¹³.” Their limits are more stringent because their scientists completed research indicating adverse health effects at nonthermal levels of exposure. According to Russian radiation experts who have studied microwaves for decades, the following health hazards are likely to be faced in the near future by children who regularly use mobile phones: disruption of memory, decline in attention, diminished learning and cognitive abilities, increased irritability, sleep problems, increase in sensitivity to stress, and increased epileptic readiness. For these reasons, special recommendations on child safety from mobile phones have been incorporated into the current Russian mobile phone standard.”¹⁴ China’s cell tower limits are based on science showing effects which include behavioral, neurological, reproductive abnormalities, and DNA damage¹⁵.

In 2012, India’s National Ministry of the Environment and Forest issued a [report](#) on the potential impacts of communication towers on wildlife with a focus on birds and bees, citing hundreds of research studies that found adverse effects. Recommendations from the Ministry include, “Introduce a law for protection of urban flora and fauna from emerging threats like ERM/EMF as conservation issues in urban areas are different from forested or wildlife habitats.”¹⁶ This [research](#) was published in the journal *Biology and Medicine* concluding that “out of the 919 research papers collected on birds, bees, plants, other animals, and humans, 593 showed impacts, 180 showed no impacts, and 196 were inconclusive studies.” As a result of this research, the government tightened their allowable levels of radiofrequency radiation to 1/10th of ICNIRP limits¹⁷.

We note that these more stringent limits of some countries still *do not assure safety* as harm has been found at levels far far lower than FCC/ ICNIRP limits¹⁸. Research has found power levels do not adequately characterize the biological impact from exposure as wireless signals are complex and power level is only one of numerous other characteristics of exposure that can influence study outcomes. As stated in the monograph of the International Agency for Research on Cancer (IARC) on carcinogenesis of radiofrequency (RF, 30 kHz - 300 GHz) radiations, pages 101-102; “The reproducibility of reported effects may be influenced by exposure characteristics (including SAR or power density, duration of exposure, carrier frequency, type of modulation, polarization, continuous versus intermittent exposures, pulsed-field variables, and background electromagnetic environment), biological parameters (including cell type, growth phase, cell density, sex, and age) and environmental conditions (including culture medium, aeration, and antioxidant levels).”¹⁹

Until adequate exposure limits and measurement metrics are developed based on biological effects, the recommended course of action is to decrease environmental exposure as much as possible and support

¹³ Ting Wu et al., “[Safe for Generations to Come.](#)” *IEEE Microw Mag* 16, no. 2 (March 2015): 65-84.

¹⁴ Michael Repacholi et al., “[Scientific Basis for the Soviet and Russian Radiofrequency Standards for the General Public.](#)” *Bio Electro Magnetics* 33 no. 8 (December 2012): 623-633.

¹⁵ Huai Chiang, “[Rationale for Setting EMF Exposure Standards.](#)” accessed July 8, 2020.

¹⁶ Expert Committee, Ministry of Environment and Forest, Government of India, “[Report on Possible Impacts of Communication Towers on Wildlife Including Birds and Bees.](#)” constituted August 30, 2010. [Link to advisory](#)

¹⁷ S. Sivani et al., “[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 (January 2013): 202-216.

¹⁸ “[Reported Biological Effects from Radiofrequency Radiation at Low-Intensity Exposure \(Cell Tower, Wi-Fi, Wireless Laptop and 'Smart' Meter RF Intensities\).](#)” The Bioinitiative Report.

¹⁹ [Non-ionizing Radiation, Part 2: Radiofrequency Electromagnetic Fields](#), (IARC Press).

wired technology in order to decrease the need for additional wireless infrastructure. The public needs to be educated so they know how to reduce exposure. Companies should market 100% wired devices and peripherals and promote in-building networks that use cables/cords/ethernet to connect instead of Wi-Fi, Bluetooth and wireless²⁰. The densification of wireless networks should be halted.

ICNIRP and FCC exposure limits were not designed to protect wildlife, plants or trees. As part of this letter, we are also submitting to you the July 8, 2020 letter to EHT Director Theodora Scarato from the Environmental Protection Agency's Director of the Radiation Protection Division and Office of Radiation and Indoor Air, Lee Ann B. Veal, that confirms that the EPA has never reviewed the impact of microwave radiation on birds, bees, or trees. Nor has any U.S. federal health agency ever set safety limits for trees, birds, or bees or the physical environment. No agency in the United States nor internationally has a funded mandate to ensure flora and fauna are safe from cell tower radiation. In other words, it is a gaping hole in federal accountability worldwide.

The [U.S. Department of the Interior sent a letter](#) in 2014²¹ reviewing several research studies showing harm to birds and concluding 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."

A now-retired U.S. Fish and Wildlife Service wildlife biologist, the former lead on telecommunications impacts, Dr. Albert Manville, has [written to the FCC](#) on impacts to birds and on [higher frequencies to be used in 5G](#). Dr. Manville authored numerous [publications](#) detailing research showing harm to birds.^{22,23,24} "The race to implement 5G and the push by FCC to approve the related 5G license frequencies to industry are very troubling and downright dangerous."

Scientists have not developed a safety standard that stipulates a "safe level."

A Sampling of Documented Impacts to Wildlife and the Environment

- "[A review of the ecological effects of RF-EMF](#)" reviewed 113 studies finding RF-EMF had a significant effect on birds, insects, vertebrates, other organisms, and plants in 70% of the studies ([Cucurachi 2013](#)). Development and reproduction in birds and insects were the most strongly affected. As an example of the several studies on wildlife impacts, a study focusing on RF from antennas found increased sperm abnormalities in mice exposed to RF from GSM antennas ([Otitoloju 2010](#)).
- "[Exposure of Insects to Radio-Frequency Electromagnetic Fields from 2 to 120 GHz](#)" published in Scientific Reports is the first study to investigate how insects (including the Western honeybee) absorb the higher frequencies (2 GHz to 120 GHz) to be used in the 4G/5G rollout. The scientific

²⁰ Frank M. Clegg et al., "[Building science and radiofrequency Radiation:What makes smart and healthy buildings.](#)" *Building and Environment* 176 (June 2020).

²¹ Willie R. Taylor to Eli Veenendaal, [Department of Interior Letter](#), *United States Department of the Interior OFFICE OF THE SECRETARY*, February 7, 2014.

²² Albert M. Manville, [ECFS Filing Detail](#), accessed July 8, 2020.

²³ Albert M. Manville, "[Memorandum on the Bird and Wildlife Impacts of Non-ionizing Radiation.](#)" Environmental Health Trust, accessed July 8, 2020.

²⁴ Albert M. Manville, "[Bird Strikes and Electrocutions at Power Lines, Communication Towers, and Wind Turbines: State of the Art and State of the Science-Next Steps Toward Mitigation.](#)" 2002.

simulations showed increases in absorbed power between 3% to 370% when the insects were exposed to the frequencies. Researchers concluded, “This could lead to changes in insect behaviour, physiology, and morphology over time....”

- A research review on insects [“Biological effects of electromagnetic fields on insects by Alain Thill”](#) found 72 of 83 peer reviewed published studies found effects.
- Studies on bees have found behavioral effects ([Kumar 2011](#), [Favre 2011](#)), disrupted navigation ([Goldsworthy 2009](#), [Sainudeen 2011](#), [Kimmel et al. 2007](#)), decreasing egg laying rate ([Sharma and Kumar, 2010](#)), and reduced colony strength ([Sharma and Kumar, 2010](#), [Harst et al. 2006](#)).
- Research has also found a high level of damage to trees from cell antenna radiation. For example, a field monitoring study spanning nine years involving over 100 trees ([Waldmann-Selsam 2016](#)) found trees sustained more damage on the side of the tree facing the antenna.
- A study on Aspen trees near Lyons, Colorado entitled [“Adverse Influence of Radio Frequency Background on Trembling Aspen Seedlings”](#) published in the *International Journal of Forestry* found adverse effects on growth rate and fall anthocyanin production, concluding that “results of this preliminary experiment indicate that the RF background may be adversely affecting leaf and shoot growth and inhibiting fall production of anthocyanins associated with leaf senescence in Trembling Aspen seedlings. These effects suggest that exposure to the RF background may be an underlying factor in the recent rapid decline of Aspen populations. Further studies are underway to test this hypothesis in a more rigorous way.”²⁵
- An analysis of 45 peer-reviewed scientific publications (1996–2016) on changes in plants due to the non-thermal RF-EMF effects from mobile phone radiation entitled [“Weak radiofrequency radiation exposure from mobile phone radiation on plants”](#) concludes, “Our analysis demonstrates that the data from a substantial amount of the studies on RF-EMFs from mobile phones show physiological and/or morphological effects (89.9%, $p < 0.001$). Additionally, our analysis of the results from these reported studies demonstrates that the maize, roselle, pea, fenugreek, duckweeds, tomato, onions and mung bean plants seem to be very sensitive to RF-EMFs. Our findings also suggest that plants seem to be more responsive to certain frequencies....”²⁶

Electromagnetic Fields Alter Animal and Insect Orientation

[The European Scientific Committee on Health, Environmental and Emerging Risks](#) states “The lack of clear evidence to inform the development of exposure guidelines to 5G technology leaves open the possibility of unintended biological consequences.”

Science of the Total Environment published environmental scientist Alforso Balmori’s [“Anthropogenic radiofrequency electromagnetic fields as an emerging threat to wildlife orientation,”](#) which states, “Current evidence indicates that exposure at levels that are found in the environment (in urban areas and near base stations) may particularly alter the receptor organs to orient in the magnetic field of the earth. These results could have important implications for migratory birds and insects, especially in urban areas, but could also apply to birds and insects in natural and protected areas where there are powerful base

²⁵ Katie Haggerty, [“Adverse Influence of Radio Frequency Background on Trembling Aspen Seedlings: Preliminary Observations,”](#) *International Journal of Forestry Research* 2010 (May 2010).

²⁶ Malka N. Halgamuge, [“Review: Weak radiofrequency radiation exposure from mobile phone radiation on plants,”](#) *Electromagnetic Biology and Medicine* 36, no. 2 (September 2016): 213-235.

station emitters of radio frequencies. Therefore, more research on the effects of electromagnetic radiation in nature is needed to investigate this emerging threat.”²⁷

Multiple research studies have documented how animals’ magnetoreception can be disrupted by external electromagnetic fields, from [mice](#)²⁸ to [cows](#) to [dogs](#) to [birds](#).²⁹ Electromagnetic exposure is especially disruptive to migratory birds.³⁰ Electromagnetic fields have been shown to disrupt the magnetic compass orientation used by birds to navigate.^{31,32} Researchers have suggested this disruption of magnetoreception is due to cryptochrome photoreceptors that allow birds to use built-in receptors as a biological compass.

A [2017 report to UNESCO](#)³³ by botanist Mark Broomhall details the association between increasing amounts of electromagnetic radiation from cellular antennas on the Mt. Nardi tower complex and species disappearance and exodus from the Mt. Nardi area of the Nightcap National Park World Heritage Area during a 15-year period (2000–2015). He estimates “in both volume and species that from 70 to 90% of the wildlife has become rare or has disappeared from the Nightcap National Park within a radius of the Mt. Nardi tower complex. This statement can be summarised with concrete data: 3 bat species once common have become rare or gone, 11 threatened and endangered bird species are gone, 11 migratory bird species are gone, 86 bird species are demonstrating unnatural behaviours, 66 once common bird species are now rare or gone.” The Report concludes, “With these short explanations of events we can appreciate that the effects of this technology and its application on Mt. Nardi over the last fifteen years, affect not only the top of the life chain species but they are devastating the fabric of the continuity of the World Heritage, causing genetic deterioration in an insidious, massive and ever escalating scale. To truly understand what these studies reveal is to stare into the abyss.”

It is very important that in considering antenna placement, there be a full environmental assessment on migratory animal patterns (from the smallest to the largest) and not simply on birds and mammals like the pronghorn but also on impacts to amphibians and insects.

Wireless Radiation is a Public Health Issue

Human health effects include impaired reproduction, increased incidence of brain cancer, DNA breaks, oxidative stress, immune dysfunction, altered brain development, sleep changes, hyperactivity, and memory and cognitive problems.³⁴ Since the WHO/IARC [classified EMF as a Group 2B Possible](#)

²⁷ Alfonso Balmori, “[Anthropogenic radiofrequency electromagnetic fields as an emerging threat to wildlife orientation.](#)” *Science of The Total Environment* 518–519 (June 2015): 58-60.

²⁸ E. Pascal Malkemper et al., “[Magnetoreception in the wood mouse \(Apodemus sylvaticus\): influence of weak frequency-modulated radio frequency fields.](#)” *Scientific Reports* 5, no. 9917 (April 2015).

²⁹ Roswitha Wiltschko et al., “[Magnetoreception in birds: the effect of radio-frequency fields.](#)” *Journal of The Royal Society Interface* 12, no. 103 (February 2015).

³⁰ Svenja Engels et al., “[Anthropogenic electromagnetic noise disrupts magnetic compass orientation in a migratory bird.](#)” *Nature* 509 (May 2014): 353-356.

³¹ Roswitha Wiltschko et al., “[Magnetoreception in birds: the effect of radio-frequency fields.](#)” *Journal of The Royal Society Interface* 12, no. 103 (February 2015).

³² Susanne Schwarze et al., “[Weak Broadband Electromagnetic Fields are More Disruptive to Magnetic Compass Orientation in a Night-Migratory Songbird \(Erithacus rubecula\) than Strong Narrow-Band Fields.](#)” *Frontiers in Behavioral Neuroscience* (March 2016).

³³ Mark Broomhall, “[Report detailing the exodus of species from the Mt. Nardi area of the Nightcap National Park World Heritage Area during a 15-year period \(2000-2015\).](#)” United Nations Scientific and Cultural Organization, 2017.

³⁴ For more information on acute health symptoms, see Martin Pall, “[Microwave Frequency Electromagnetic Fields \(EMFs\) Produce Widespread Neuropsychiatric Effects Including Depression.](#)” *Journal of Chemical Neuroanatomy* 75, part B (September 2016): 43-51. [Response of residents living in the vicinity of a cellular phone base station in France ; Electromagnetic Fields: A Hazard to Your Health?](#), Healthy Children.

[Carcinogen](#) in 2011, the peer-reviewed research connecting wireless exposure to cancer is significantly stronger, and several scientists have published documentation that the weight of current peer-reviewed evidence supports the conclusion that radiofrequency radiation should be regarded as a human carcinogen.^{35,36,37}

- The 10-year \$30 million National Institute of Environmental Health Sciences National Toxicology Program’s (NTP) [“Studies of the Toxicology and Carcinogenicity of Cell Phone Radiation”](#)^{38,39} found that RFR was associated with “clear evidence” of cancer due to the increased malignant schwannomas found in RFR-exposed male rats. The brain (glioma) cancers and tumors in the adrenal glands were also considered evidence of an association with cancer. In addition, exposed animals had significantly more [DNA damage](#), heart damage, and low birth weight.
- The Ramazzini Institute published its [findings](#)⁴⁰ that animals exposed to very low-level RFR developed the same types of cancers as reported by the NTP.
- A 2020 [Yale study](#) funded by the American Cancer Society found that cell phone use was significantly associated with thyroid cancer in people with genetic susceptibilities⁴¹.
- Long-term [research](#) on humans who have used cell phones has found increased tumors—schwannomas and glioblastomas—the same cell type as found in the NTP and Ramazzini Institute studies. Persons who started using cell phones under age 20 had the highest risk.⁴²
- A 2015 Jacobs University [study](#) (replicating a [2010 study](#)) found that weak cell phone signals significantly promote the growth of tumors in mice and that combining a toxic chemical exposure with RF more than doubled the tumor response.^{43,44}
- A [study published in Electromagnetic Biology and Medicine](#), “Impact of radiofrequency radiation on DNA damage and antioxidants in peripheral blood lymphocytes of humans residing in the vicinity of mobile phone base station,” compared people living close and far from cell antennas and found that people living closer to cell antennas had higher radiation levels in the homes and several significant changes in their blood predictive of cancer development.⁴⁵

³⁵ Jessica A. Adams et al., [“Effect of mobile telephones on sperm quality: a systematic review and meta-analysis.”](#) *Environment International* 70 (September 2014): 106-112.

³⁶ Pravin Suryakantrao Deshmukh et al., [“Cognitive impairment and neurogenotoxic effects in rats exposed to low-intensity microwave radiation.”](#) *International Journal of Toxicology* 34, no. 3 (March 2015): 284-290.

³⁷ Tamir S. Aldad et al., [“Fetal Radiofrequency Radiation Exposure From 800-1900 MHz-Rated Cellular Telephones Affects Neurodevelopment and Behavior in Mice.”](#) *Scientific Reports* 2, no. 312 (March 2012).

³⁸ [“Cell Phone Radio Frequency Radiation.”](#) National Toxicology Program, accessed July 8, 2020.

³⁹ Virginia Guidry, [“High exposure to radio frequency radiation associated with cancer in male rats.”](#) National Institute of Environmental Health Sciences, last modified November 2018.

⁴⁰ L. 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* 165 (August 2018): 496-503.

⁴¹ [Genetic susceptibility may modify the association between cell phone use and thyroid cancer: A population-based case-control study in Connecticut](#)

⁴² Lennart Hardell and Michael Carlberg, [“Mobile phone and cordless phone use and the risk for glioma-Analysis of pooled case-control studies in Sweden, 1997-2003 and 2007-2009.”](#) *Pathophysiology* 22, no. 1 (March 2015): 1-13.
[https://www.pathophysiologyjournal.com/article/S0928-4680\(14\)00064-9/fulltext](https://www.pathophysiologyjournal.com/article/S0928-4680(14)00064-9/fulltext)

⁴³ Alexander Lerchl et al., [“Tumor promotion by exposure to radiofrequency electromagnetic fields below exposure limits for humans.”](#) *Biochemical and Biophysical Research Communications* 459, no. 4 (April 2015) 585-590.

⁴⁴ Thomas Tillmann et al., [“Indication of cocarcinogenic potential of chronic UMTS-modulated radiofrequency exposure in an ethylnitrosourea mouse model.”](#) *International Journal of Radiation Biology* 86, no. 7 (June 2010): 529-541.

⁴⁵ Mary Zosangzuali et al., [“Impact of radiofrequency radiation on DNA damage and antioxidants in peripheral blood lymphocytes of humans residing in the vicinity of mobile phone base stations.”](#) *Electromagnetic Biology and Medicine* 36, no. 1 (August 2017): 1-11.

- A 2019 [study](#) of students in schools near cell towers found their higher RF exposure was associated with impacts on motor skills, memory, and attention ([Meo 2019](#)).⁴⁶ Examples of other effects linked to cell towers in research studies include [neuropsychiatric problems](#),⁴⁷ [elevated diabetes](#),⁴⁸ [headaches](#),⁴⁹ [sleep problems](#),⁵⁰ and [genetic damage](#).⁵¹ Such research continues to accumulate after the 2010 landmark [review study](#) on 56 studies that reported biological effects found at very low intensities of wireless radiation, including impacts on reproduction, permeability of the blood-brain barrier, behavior, cellular changes, and metabolic changes, and increases in cancer risk ([Lai and Levitt 2010](#)).⁵²
- Published research has found impacts from wireless radiation exposure to [reproduction](#) and [brain development](#) in addition to a myriad of other adverse effects.^{53,54,55,56} Although renowned institutions, such as the Cleveland Clinic, advise men to keep phones and wireless devices away from their reproductive organs, the public remains largely unaware.

As more and more wireless antenna sites are built, they will be upgraded over time with new antennas and soon 5G technology. 5G would use today's wireless frequencies while adding new, higher frequencies to transmit more data to (unnecessarily) connect everything to the internet, and at faster speeds. These higher frequency sub-millimeter waves are absorbed to a higher degree by the eyes and skin,^{57,20,21,22} and have been shown to accelerate bacterial growth.⁵⁸ Currently accepted standards are not sophisticated enough to quantify the risks of cumulative exposure.^{59,60} Any future applications of these technologies must consider the biological effect of cumulative exposures to these frequencies.

⁴⁶ Sultan Ayoub Meo et al., "[Mobile Phone Base Station Tower Settings Adjacent to School Buildings: Impact on Students' Cognitive Health](#)," *American Journal of Men's Health* 13, no. 1 (January 2019).

⁴⁷ G. Abdel-Rassou et al., "[Neurobehavioral effects among inhabitants around mobile phone base stations](#)," *NeuroToxicology* 28, no. 2 (March 2007): 434-440.

⁴⁸ Meo SA et al., "[Association of Exposure to Radio-Frequency Electromagnetic Field Radiation \(RF-EMFR\) Generated by Mobile Phone Base Stations with Glycated Hemoglobin \(HbA1c\) and Risk of Type 2 Diabetes Mellitus](#)," *International Journal of Environmental Research and Public Health* 12, no. 11 (November 2015): 14519-14528.

⁴⁹ H.P. Hutter et al., "[Subjective symptoms, sleeping problems, and cognitive performance in subjects living near mobile phone base stations](#)," *Occupational and Environmental Medicine* 63, no. 5 (May 2006): 307-313.

⁵⁰ R. Santini et al., "[Enquête sur la santé de riverains de stations relais de téléphonie mobile: I/Incidence de la distance et du sexe](#)," *Pathologie Biologie (Paris)* 50, no. 6 (July 2002): 369-373.

⁵¹ Gursatej Gandhi et al., "[A cross-sectional case control study on genetic damage in individuals residing in the vicinity of a mobile phone base station](#)," *Electromagnetic Biology and Medicine* 34, no. 4 (2015): 344-354.

⁵² B. Blake Levitt and Henry Lai, "[Biological effects from exposure to electromagnetic radiation emitted by cell tower base stations and other antenna arrays](#)," *Environmental Reviews* (2010), downloaded from www.nrcresearchpress.com by 172.58.41.200 on 04/10/19

⁵³ Jessica A. Adams et al., "[Effect of mobile telephones on sperm quality: a systematic review and meta-analysis](#)," *Environment International* 70 (September 2014): 106-112.

⁵⁴ Pravin Suryakantrao Deshmukh et al., "[Cognitive impairment and neurogenotoxic effects in rats exposed to low-intensity microwave radiation](#)," *International Journal of Toxicology* 34, no. 3 (March 2015): 284-290.

⁵⁵ Tamir S. Aldad et al., "[Fetal Radiofrequency Radiation Exposure From 800-1900 MHz-Rated Cellular Telephones Affects Neurodevelopment and Behavior in Mice](#)," *Scientific Reports* 2, no. 312 (March 2012).

⁵⁶ Osman Fikret Sonmez et al., "[Purkinje cell number decreases in the adult female rat cerebellum following exposure to 900 MHz electromagnetic field](#)," *Brain Research* 1356 (October 2010): 95-101.

⁵⁷ Paul Ben-Ishai, "[Potential Risks to Human Health Originating from Future Sub-MM Communication Systems](#)," lecture, 2017 Israel Institute for Advanced Studies Conference at Hebrew University, Jerusalem, Israel, January 2017. Transcript: Yuri Feldman and Paul Ben-Ishai, "[Potential Risks to Human Health Originating from Future Sub-MM Communication Systems](#)," 2017.

⁵⁸ Cindy L. Russell, "[5G Wireless Telecommunications Expansion: Public Health and Environmental Implications](#)," *Environmental Research* 165 (August 2018): 484-495.

⁵⁹ Paul Ben-Ishai, "[Potential Risks to Human Health Originating from Future Sub-MM Communication Systems](#)," lecture, 2017 Israel Institute for Advanced Studies Conference at Hebrew University, Jerusalem, Israel, January 2017. Transcript: Yuri Feldman and Paul Ben-Ishai, "[Potential Risks to Human Health Originating from Future Sub-MM Communication Systems](#)," 2017.

⁶⁰ Itai Hayut et al., "[Circular polarization induced by the three-dimensional chiral structure of human sweat ducts](#)," *Physical Review E* 89, no. 4 (April 2014).

[“5G wireless telecommunications expansion: Public health and environmental implications,”](#) is a research review published in *Environmental Research*, which documents the range of adverse effects reported in the published literature, from cancer to bacteria growth changes to DNA damage, concludes that “a moratorium on the deployment of 5G is warranted” and “the addition of this added high-frequency 5G radiation to an already complex mix of lower frequencies, will contribute to a negative public health outcome both from both physical and mental health perspectives.”⁶¹

[“Adverse Health Effects of 5G Mobile Networking Technology Under Real Life Conditions”](#) published in *Toxicology Letters* concludes that 5G mobile networking technology will affect not only the skin and eyes, but will have adverse systemic effects as well. The researchers conclude that in aggregate, for the high frequency (radiofrequency-RF) part of the spectrum, currently published reviews show that RF radiation below the ICNIRP/FCC guidelines can result in: carcinogenicity (brain tumors/glioma, breast cancer, acoustic neuromas, leukemia, parotid gland tumors), genotoxicity (DNA damage, DNA repair inhibition, chromatin structure), mutagenicity, teratogenicity, neurodegenerative diseases (Alzheimer’s Disease, Amyotrophic Lateral Sclerosis), neurobehavioral problems, autism, reproductive problems, pregnancy outcomes, excessive reactive oxygen species/oxidative stress, inflammation, apoptosis, blood-brain barrier disruption, pineal gland/melatonin production, sleep disturbance, headache, irritability, fatigue, concentration difficulties, depression, dizziness, tinnitus, burning and flushed skin, digestive disturbance, tremor, cardiac irregularities, adverse impacts on the neural, circulatory, immune, endocrine, and skeletal systems” and “from this perspective, RF is a highly pervasive cause of disease.”

Radiofrequency radiation exposure is increasing at a rapid pace due to the proliferation of base stations.

A [2018 article](#) published in *The Lancet Planetary Health* points to unprecedented increasing RF exposures, and the abstract concludes, “due to the exponential increase in the use of wireless personal communication devices (eg, mobile or cordless phones and WiFi or Bluetooth-enabled devices) and the infrastructure facilitating them, levels of exposure to radiofrequency electromagnetic radiation around the 1 GHz frequency band, which is mostly used for modern wireless communications, have increased from extremely low natural levels by about 1018 times....”(Bandara and Carpenter, 2018).⁶²

Another key finding from [Zothansiam 2017](#) was that homes closer to antennas had measurably higher radiation levels – adding to the documentation that antennas increase RF levels. An [Australian study](#) also found that children in kindergartens with nearby antenna installations had nearly three-and-a-half times higher RF exposures than children with installations further away (more than 300 meters) ([Bhatt 2016](#)).⁶³

A 2018 multi-country [study](#) that measured RF levels in several countries found that cell phone tower radiation is the dominant contributor to RF exposure in most outdoor areas. Exposure levels in urban

⁶¹ Cindy L. Russell, [“5G Wireless Telecommunications Expansion: Public Health and Environmental Implications.”](#) *Environmental Research* 165 (August 2018): 484-495.

⁶² Priyanka Bandara and David O. Carpenter, [“Planetary electromagnetic pollution: it is time to assess its impact.”](#) *The Lancet Planetary Health* 2, no. 12 (December 2018): 512-514.

⁶³ Chhavi Raj Bhatt et al., [“Radiofrequency-electromagnetic field exposures in kindergarten children.”](#) *Journal Of Exposure Science And Environmental Epidemiology* 27, no. 5 (September 2017): 497-504.

areas were higher and had drastically increased. As an example, the measurements the researchers [took](#) in Los Angeles, USA were 70 times higher than the US EPA estimate 40 years ago.⁶⁴

5G and 4G Densification Will increase Radiofrequency Radiation

A 2020 paper [“Radiation Analysis in a Gradual 5G Network Deployment Strategy.”](#) documents how engineers found significant increases in levels of radio frequency radiation that would result if a mmWave-based 5G network were fully deployed. The researchers first mapped the pre-existing LTE antennas and then laid out the real-world design for the densification of cell towers and signal repeaters which would be needed in the City in order to fully build out a mmWave-based 5G network. The engineers found the fully deployed 5G mmWave network would result in significant increases in outdoor RF levels and conclude, “This suggests that 5G mobile networks cannot yet be classified as safe for the public, and demands serious considerations before using mmWave communications for 5G networks, given the potential harms it could afflict on the public.”

A [2018 study](#) published in Annals of Telecommunications found increased RF-EMF exposure from small cell LTE networks in two urban cities in France and the Netherlands. Researchers measured the RF-EMF from LTE (Long-Term Evolution), MC (macro cells meaning large cell towers), and SC networks (low-powered small cell base stations) and found that the small cell networks increased the radio emissions from base stations (called downlink) by a factor of 7–46 while decreasing the radio emissions from user equipment exposure (called uplink) by a factor of 5–17. So, while the devices themselves could emit less radiation, the cell antennas will increase the ambient environmental levels ([Mazloun et al., 2019](#)).

Telecommunications Companies Warn Their Shareholders but Not Consumers or People Living Near Their Antennas

A number of corporations already advise their shareholders that they could face serious financial risks from the health damages due to RF. For instance, Crown Castle’s [2019 10-K ANNUAL REPORT](#) states:

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

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

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.

⁶⁴ Sanjay Sagar et al., [“Comparison of radiofrequency electromagnetic field exposure levels in different everyday microenvironments in an international context.”](#) *Environment International* 114 (May 2018): 297-306.

Most wireless companies, from AT&T to Nokia to T-Mobile to Verizon Wireless, have issued [similar warnings](#) to their shareholders. Why are shareholders being warned but not the people living near the equipment? These disclosures show that even corporations cannot assure safety.

Insurance Companies Classify 5G as High Risk

For years, the insurance industry has ranked⁶⁵ the risk of non-ionizing radiation as “High” and has excluded coverage for damage as the industry standard in commercial policies⁶⁶. In the United States insurance companies do not cover cell phone manufacturers and wireless infrastructure providers.

In 2019, the insurance authority Swiss Re released a [white paper](#) classifying 5G as a “high” emerging risk. “To allow for a functional network coverage and increased capacity overall, more antennas will be needed, including acceptance of higher levels of electromagnetic radiation.” The report cautions that “potential claims for health impairments may come with a long latency.”

Due to these evaluations and the published scientific evidence, cell phone manufacturers cannot insure against health damages from the radiofrequency radiation emitted by their products and networks. In fact, most insurance plans do not cover electromagnetic fields (EMF) and have very clear “electromagnetic field exclusions.”

Wireless Companies Define Non-Ionizing Radiation as a Pollutant

Both [AT&T Mobile Insurance \(pg. 4\)](#) and [Verizon Total Mobile Protection \(page 10\)](#) state that their coverage is excluded for pollutants.

“Pollutants” are defined as “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 non-ionizing radiation and waste.”

If insurance companies will not insure EMF, and if even telecommunications companies consider EMF as a “pollutant,” how can governments allow such an environmental pollutant, moreover without even warning their citizens?

5G Will Increase RF Exposures to the Environment, and 5G Antenna Beamforming Exposures Cannot Be Accurately Measured

Studies on small cell deployment show increased environmental exposures from the densification of cellular antennas⁶⁷. Engineers simulating a 5G network for Austin Texas also found significant increases

⁶⁵ [“Insurance Authorities Rate 5G and Electromagnetic Radiation as ‘High Risk.’”](#) Environmental Health Trust, accessed July 8, 2020.

⁶⁶ [“Electromagnetic Field Insurance Policy Exclusion Are The Standard.”](#) Environmental Health Trust, accessed July 8, 2020.

⁶⁷ Taghrid Mazloum et al., [“RF-EMF exposure induced by mobile phones operating in LTE small cells in two different urban cities.”](#) *Annals of Telecommunications* 74 (November 2018): 35-42.

for a fully deployed millimeter wave⁶⁸. A 2018 multi-country study published in *Environment International* found that cell phone tower radiation is the dominant contributor to RF exposure in most outdoor areas and environmental exposure has significantly increased over the last four decades⁶⁹.

A 2019 European Parliament Report “[5G Deployment: State of Play in Europe, USA, and Asia](#)”⁷⁰ confirms increased exposure from the 5G/4G Densification, stating, “increased exposure may result not only from the use of much higher frequencies in 5G but also from the potential for the aggregation of different signals, their dynamic nature, and the complex interference effects that may result, especially in dense urban areas.” The report points out that it currently “is not possible to accurately simulate or measure 5G emissions in the real world,” stating,

The 5G radio emission fields are quite different to those of previous generations because of their complex beamformed transmissions in both directions – from base station to handset and for the return. Although fields are highly focused by beams, they vary rapidly with time and movement and so are unpredictable, as the signal levels and patterns interact as a closed loop system. This has yet to be mapped reliably for real situations, outside the laboratory.

5G Will Increase Energy Consumption

Since 5G networks are being built in addition to existing cellular networks, the energy consumption of cellular and wireless device networks and infrastructure as a whole will increase. This reality has been repeatedly documented in [industry reports](#) and [research publications](#)⁷¹⁷²⁷³. A [2020 Report](#) by the High Council for Climate found that 5G technology [could add](#) between 2.7 to 6.7 million tonnes of CO2 equivalents per year by 2030⁷⁴. Because more 5G base stations are needed to cover the same area, there will be millions of new base stations worldwide as well as billions of new interconnected devices, all contributing to increased overall energy consumption. Gains in energy efficiency will be swamped by the sheer number of new devices⁷⁵⁷⁶.

“A typical 5G base station consumes up to twice or more the power of a 4G base station. The disparity can grow at higher frequencies, due to a need for more antennas and a denser layer of small cells. Edge compute facilities needed to support local processing and new Internet of things (IoT) services add to overall network power usage.”- Matt Walker [Operators facing power cost crunch](#) MNT Consulting

⁶⁸ Ahmad M. El-Hajj and Tarek Naous, “[Radiation Analysis in a Gradual 5G Network Deployment Strategy](#),” in *2020 IEEE 3rd 5G World Forum (5GWF)* (Bangalore, India: IEEE, 2020), 448-453.

⁶⁹ Sanjay Sagar et al., “[Comparison of radiofrequency electromagnetic field exposure levels in different everyday microenvironments in an international context](#),” *Environment International* 114 (May 2018): 297-306.

⁷⁰ Colin Blackman and Simon Forge, “[5G Deployment State of Play in Europe, USA and Asia](#),” European Parliament's Committee on Industry, Research and Energy, accessed February 24, 2020.

⁷¹ Mark P. Mills, “[The Cloud Begins with Coal – Big Data, Big Networks, Big Infrastructure, and Big Power. An overview of the electricity used by the global digital ecosystem](#),” National Mining Association and American Coalition for Clean Coal Electricity, August 2013.

⁷² Anders S.G. Andrae and Tomas Edler, “[On Global Electricity Usage of Communication Technology: Trends to 2030](#),” *Challenges* 6, no. 1 (April 2015): 117-157.

⁷³ “[Controlling the carbon impact of 5G](#),” High Council for the Climate Report, December 2020.

⁷⁴ “[French study finds 5G increases risk to climate](#),” The Connexion, last modified December 19, 2020.

⁷⁵ Linda Hardesty, “[5G base stations use a lot more energy than 4G base stations: MTN](#),” Fierce Wireless, last modified April 3, 2020.

⁷⁶ Matt Walker, “[Operators facing power cost crunch](#),” MTN Consulting, March 27, 2020.

The Shift Project Report⁷⁷, "[LEAN ICT: TOWARDS DIGITAL SOBRIETY](#)": OUR NEW REPORT ON THE ENVIRONMENTAL IMPACT OF ICT" documented the increased energy consumption and concludes that "the current trend for digital overconsumption in the world is not sustainable with respect to the supply of energy and materials it requires...The digital transition as it is currently implemented participates to global warming more than it helps preventing it. The need for action is therefore urgent."

5G and the Internet of Things Is Increasing E-Waste

In 2019 the [Global E-waste Monitor](#) documented that a record 53.6 million metric tonnes (Mt) of e-waste was generated by discarded digital products, up 9.2 Mt in five years. The [report](#) predicts global e-waste will reach 74 Mt by 2030, almost double from 2014⁷⁸.

Wired Technology is Safer for Humans and Wildlife

Access to information is indisputably critical for the modern world. But, contrary to what some in the telecommunications world argue, this access need not be wireless. Wired technologies such as fiber or coaxial cable are far superior to wireless as they are faster, more reliable, resilient, energy-efficient, and more easily defended from cyber-attacks. Above all, wired connections are significantly less hazardous to our health and to other life forms with whom we share this planet.

Worldwide Action to Halt 5G

Over [600 cities in Italy](#) have passed resolutions to halt 5G, as have numerous cities throughout Europe, such as [Trafford, United Kingdom](#); [Lille, France](#); [Ormidia, Cyprus](#); and [Balchik, Bulgaria](#). The Pancyprian Medical Association and Cyprus National Committee on the Environment and Child Health sent Parliament their position paper, "[The Risks to Public Health from the Use of the 5G Network](#)." Bermuda has halted 5G pending an investigation into health and safety and we recently testified to the regulatory authority along with several other experts⁷⁹.

Switzerland's report on 5G health effects resulted in the [Parliament's refusal](#) to loosen their radiation limits despite heavy industry lobbying efforts. The Netherlands issued a [5G report](#) that recommended measuring radiation levels and also advised against using the 26 GHz frequency band for 5G "for as long as the potential health risks have not been investigated."

In the United States, the [New Hampshire Commission to Study the Environmental and Health Effects of Evolving 5G Technology](#) has released its [final report](#) with 15 recommendations to reduce public exposure to radio frequency radiation, ensure setbacks so that cell antennas are at a distance from homes and

⁷⁷ "[Lean ICT: Towards Digital Sobriety: Our New Report on the Environmental Impact of ICT](#)." The Shift Project, March 6, 2019.

⁷⁸ "[Global E-waste-Monitor 2020](#)." ITU, last accessed December 30, 2020.

⁷⁹ "[5G Health Effects Testimony to Bermuda Regulatory Authority](#)." Environmental Health Trust, last modified December 3, 2020.

schools, protect children by reducing wireless exposures and prioritizing safer wired connections, designate wireless free areas and create federal regulations for exposure that protect wildlife and the environment.

In the United States, resolutions to halt 5G have been passed by [Hawaii County](#), [Farragut Tennessee](#), [Coconut Creek Florida](#), and [Easton Connecticut](#). US cities such as [Los Altos](#), [Petaluma](#), [Mill Valley](#), and [San Diego County](#) California have adopted policies to restrict 5G small cells near homes. Oregon passed a [Bill](#) to study Wi-Fi health effects with a final report due in 2021.

The increased exposures of 5G are involuntary. We can turn off our phones, but we cannot turn off the antennas in the neighborhood. The birds, bees, and trees also have no choice.

Thank you for your consideration of this issue. We would be happy to set up a meeting to discuss this issue further.

Sincerely,



Devra Davis, PhD, MPH
Fellow, American College of Epidemiology
Visiting Prof. Hebrew Univ. Hadassah Medical Center & Ondokuz Mayis Univ. Medical School
Associate Editor, *Frontiers in Radiation and Health*
President, Environmental Health Trust

Theodora Scarato
Executive Director, Environmental Health Trust

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Letter from the EPA

----- Forwarded message -----

From: **Veal, Lee**<Veal.Lee@epa.gov>

Date: Wed, Jul 8, 2020 at 11:32 AM

Subject: RE: Letter with specific Questions Related to the FDA review and to the EPA, CDC, NIOSH and FDA Jurisdiction on EMFs

To: Theodora Scarato <Theodora.Scarato@ehtrust.org>

Dear Director Scarato;

Thank you for sending us your questions and references regarding radiofrequency (RF) radiation. Up through the mid-1990s, EPA did study non-ionizing radiation. The Telecommunications Act of 1996 directs the Federal Communications Commission (FCC) to establish rules regarding RF exposure, while the U.S. Food and Drug Administration (FDA) sets standards for electronic devices that emit non-ionizing or ionizing radiation. EPA does not have a funded mandate for radiofrequency matters, nor do we have a dedicated subject matter expert in radiofrequency exposure. The EPA defers to other agencies possessing a defined role regarding RF. Although your questions are outside our current area of responsibilities, we have provided a response to each one as you requested.

1. *What is your response to these scientists' statements regarding the FDA report and the call to retract it?*

EPA Response: The EPA does not have a funded mandate for radiofrequency matters, has not conducted a review of the FDA report you cited or the scientists' statements, and therefore has no response to it.

2. *To the FDA- What consultants were hired for the FDA review and report on cell phone radiation?*

EPA Response: This is not an EPA matter. Please refer this question to the FDA.

3. *What US agency has reviewed the research on cell phone radiation and brain damage? I ask this because the FDA only has looked at selected studies on cancer. If your agency has not, please*

simply state you have not.

EPA Response: EPA's last review was in the 1984 document [Biological Effects of Radiofrequency Radiation \(EPA 600/8-83-026F\)](#). The EPA does not currently have a funded mandate for radiofrequency matters.

4. What US agency has reviewed the research on damage to memory by cell phone radiation? If so, when and send a link to the review.

EPA Response: EPA's last review was in the 1984 document [Biological Effects of Radiofrequency Radiation \(EPA 600/8-83-026F\)](#). The EPA does not currently have a funded mandate for radiofrequency matters.

5. *What US agency has reviewed the research on damage to trees from cell phone radiation? If so, when was it issued and send a link to the review.*[Note this study showing damage from long term exposure to cell antennas.](#)

EPA Response: The EPA does not have a funded mandate for radiofrequency matters, and we are not aware of any EPA reviews that have been conducted on this topic. We do not know if any other US agencies have reviewed it.

6. *What US agency has reviewed the research on impacts to birds and bees? If so, when and send a link to the review. I will note the latest research showing [possible impacts to bees](#) from higher frequencies to be used in 5G.*

EPA Response: The EPA does not have a funded mandate for radiofrequency matters, and we are not aware of any EPA reviews that have been conducted on this topic. We do not know if any other US agencies have reviewed it.



Planetary electromagnetic pollution: it is time to assess its impact

As the Planetary Health Alliance moves forward after a productive second annual meeting, a discussion on the rapid global proliferation of artificial electromagnetic fields would now be apt. The most notable is the blanket of radiofrequency electromagnetic radiation, largely microwave radiation generated for wireless communication and surveillance technologies, as mounting scientific evidence suggests that prolonged exposure to radiofrequency electromagnetic radiation has serious biological and health effects. However, public exposure regulations in most countries continue to be based on the guidelines of the International Commission on Non-Ionizing Radiation Protection¹ and Institute of Electrical and Electronics Engineers,² which were established in the 1990s on the belief that only acute thermal effects are hazardous. Prevention of tissue heating by radiofrequency electromagnetic radiation is now proven to be ineffective in preventing biochemical and physiological interference. For example, acute non-thermal exposure has been shown to alter human brain metabolism by NIH scientists,³ electrical activity in the brain,⁴ and systemic immune responses.⁵ Chronic exposure has been associated with increased oxidative stress and DNA damage^{6,7} and cancer risk.⁸ Laboratory studies, including large rodent studies by the US National Toxicology Program⁹ and Ramazzini Institute of Italy,¹⁰ confirm these biological and health effects in vivo. As we address the threats to human health from the changing environmental conditions due to human activity,¹¹ the increasing exposure to artificial electromagnetic radiation needs to be included in this discussion.

Due to the exponential increase in the use of wireless personal communication devices (eg, mobile or cordless phones and WiFi or Bluetooth-enabled devices) and the infrastructure facilitating them, levels of exposure to radiofrequency electromagnetic radiation around the 1 GHz frequency band, which is mostly used for modern wireless communications, have increased from extremely low natural levels by about 10^{18} times (figure). Radiofrequency electromagnetic radiation is also used for radar, security scanners, smart meters, and medical equipment (MRI, diathermy, and radiofrequency ablation). It is plausibly the most rapidly increasing

anthropogenic environmental exposure since the mid-20th century, and levels will surge considerably again, as technologies like the Internet of Things and 5G add millions more radiofrequency transmitters around us.

Unprecedented human exposure to radiofrequency electromagnetic radiation from conception until death has been occurring in the past two decades. Evidence of its effects on the CNS, including altered neurodevelopment¹⁴ and increased risk of some neurodegenerative diseases,¹⁵ is a major concern considering the steady increase in their incidence. Evidence exists for an association between neurodevelopmental or

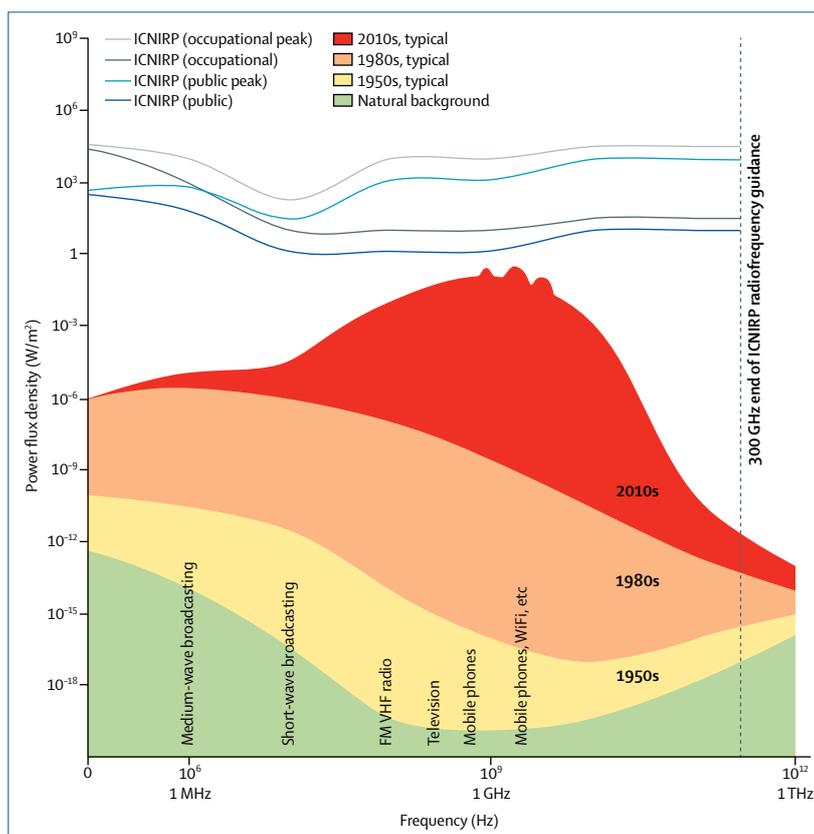


Figure: Typical maximum daily exposure to radiofrequency electromagnetic radiation from man-made and natural power flux densities in comparison with International Commission on Non-Ionizing Radiation Protection safety guidelines¹

Anthropogenic radiofrequency electromagnetic radiation levels are illustrated for different periods in the evolution of wireless communication technologies. These exposure levels are frequently experienced daily by people using various wireless devices. The levels are instantaneous and not time-averaged over 6 minutes as specified by International Commission on Non-Ionizing Radiation Protection for thermal reasons. Figure modified from Philips and Lamburn¹² with permission. Natural levels of radiofrequency electromagnetic radiation were based on the NASA review report CR-166661.¹³

Electromagnetic fields, 5G and health: what about the precautionary principle?

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ABSTRACT

New fifth generation (5G) telecommunications systems, now being rolled out globally, have become the subject of a fierce controversy. Some health protection agencies and their scientific advisory committees have concluded that there is no conclusive scientific evidence of harm. Several recent reviews by independent scientists, however, suggest that there is significant uncertainty on this question, with rapidly emerging evidence of potentially harmful biological effects from radio frequency electromagnetic field (RF-EMF) exposures, at the levels 5G roll-out will entail. This essay identifies four relevant sources of scientific uncertainty and concern: (1) lack of clarity about precisely what technology is included in 5G; (2) a rapidly accumulating body of laboratory studies documenting disruptive *in vitro* and *in vivo* effects of RF-EMFs—but one with many gaps in it; (3) an almost total lack (as yet) of high-quality epidemiological studies of adverse human health effects from 5G EMF exposure specifically, but rapidly emerging epidemiological evidence of such effects from past generations of RF-EMF exposure; (4) persistent allegations that some national telecommunications regulatory authorities do not base their RF-EMF safety policies on the latest science, related to unmanaged conflicts of interest. The author, an experienced epidemiologist, concludes that one cannot dismiss the growing health concerns about RF-EMFs, especially in an era when higher population levels of exposure are occurring widely, due to the spatially dense transmitters which 5G systems require. Based on the precautionary principle, the author echoes the calls of others for a moratorium on the further roll-out of 5G systems globally, pending more conclusive research on their safety.

BACKGROUND

Fifth generation (5G) technology is being widely promoted by politicians, government officials, and private sector interests.^{1–3} They contend that its advent will bring clear economic and lifestyle benefits, through massive increases in wireless and mobile connectivity at home, work, school and in the community. Examples of these 5G benefits include driverless vehicles and ‘The Internet of Things’—automated and continuous communication between the machines in our daily lives.^{4,5} On the other hand, the public health response to this wave of communications innovation has become a sense of deep concern, related to widespread scientific uncertainties, as well as a lack of use of existing evidence, in the current international safety guidelines for 5G and related radio frequency

electromagnetic field (RF-EMF) exposures.^{5–8} This commentary sets out the reasons for such concern.

WHAT IS 5G AND WHY IS IT DIFFERENT FROM PAST EMF EXPOSURES?

Developed over just the last decade, radio frequency (wireless) transmission systems in the 5G category are being rolled out throughout the world. These systems will massively increase the volume, speed and spatial reach of digital data transfer.^{4–6} The four successive previous generations (1G, 2G, 3G and 4G) of wireless transmission systems were deployed initially for wireless and mobile phones (1980s and 1990s), followed by WiFi (2000s), and then smart metres and the Internet of Things (2010s). Each successive generation of transmission systems has used higher frequencies of electromagnetic waves to carry ever-larger volumes of data, faster, in more ubiquitous locations. 5G is widely acknowledged to be a step change in this sequence, since it additionally uses much higher frequency (3 to 300 GHz) radio waves than in the past. 5G will also make use of very new—and thus relatively unevaluated, in terms of safety—supportive technology (including pulsing, beaming, phased arrays and massive input/massive output (MIMO)—see below) to enable this higher data transmission capacity.^{4–6}

However—unlike prior generations of wireless transmission systems—5G ultrahigh-frequency waves are easily interrupted by vegetation foliage (and building walls, often requiring additional signal boosting within each building). This inherent fragility of 5G high-frequency waves means that transmission boosting ‘cell’ antennae are generally required every 100–300 m or less—far more spatially dense than the miles-apart transmission masts required for older 2G, 3G and 4G technology using lower frequency waves.^{4–6}

This dense transmission network is also required in order to achieve the ‘everywhere/anytime’ connectivity promised by 5G developers, and necessitated by new technology such as driverless cars, which must never be out of internet contact, for safety reasons. Critics of 5G agree^{6–8}—but its supporters do not^{9,10}—that the overall population levels of exposure to RF-EMFs will be greatly increased by the 5G roll-out. One compelling argument for that view is the ‘inverse square law’ of EMF exposure: intensity varies as the inverse of the square of the distance from the emitting source.¹¹ With plans afoot internationally to put a 5G booster antenna on ‘every second or third lamp-post’, it is difficult to believe that overall population exposures will not increase substantially. Existing 4G



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Main Regularities and Health Risks from Exposure to Non-Thermal Microwaves of Mobile Communication

Igor Belyaev

Abstract — Various responses to non-thermal microwaves (MW) from mobile communication including adverse health effects related to electrohypersensitivity, cancer risks, neurological effects, and reproductive impacts have been reported while some studies reported no such effects. This presentation provides an overview of the complex dependence of the MW effects on various physical and biological variables, which account for, at least partially, an apparent inconsistency in the published data. Among other variables, dependencies on carrier frequency, polarization, modulation, intermittence, electromagnetic stray fields, genotype, physiological traits, and cell density during exposure were reported. Nowadays, biological and health effects of 5G communication, which will use microwaves of extremely high frequencies (millimeter waves MMW, wavelength 1- 10 mm), are of significant public concern. It follows from available studies that MMW, under specific conditions of exposure at very low intensities below the ICNIRP guidelines, can affect biological systems and human health. Both positive and negative effects were observed in dependence on exposure parameters. In particular, MMW inhibited repair of DNA damage induced by ionizing radiation at specific frequencies and polarizations. To what extent the 5G technology and the Internet of Things will affect the biota and human health is definitely not known. However, based on possible fundamental role of MMW in regulation of homeostasis and almost complete absence of MMW in atmosphere due to effective absorption, which suggests the lack of adaptation to this type of radiation, the health effects of chronic MMW exposures may be more significant than for any other frequency range.

Keywords — Thermal and non-thermal effects of microwaves, Millimeter waves, 5G mobile communication, Health risks, Cancer, Physical mechanisms.

I. THERMAL VERSUS NON-THERMAL MICROWAVE EFFECTS, THEIR MAIN REGULARITIES

Exposures to microwaves (MW, 300 MHz-300 GHz) vary in many parameters: incident power density (PD), specific absorption rate (SAR), frequency/wavelength, polarization (linear, ellipsoidal, circular, unpolarized), continuous wave (CW) and pulsed fields, modulation (amplitude, frequency, phase, complex), far field/near field, static magnetic field (SMF) and stray electromagnetic fields (EMF) of extremely

low frequency (ELF, 3-300 Hz) at the location of exposure, overall duration and intermittence of exposure (interrupted, continuous), short-term acute and prolonged chronic exposures. With increased SAR, so-called thermal effects of MW are usually observed that result in significant MW-induced heating. SAR is a main determinate of thermal MW effects. The SAR based safety limits, which intend to protect from the thermal MW effects, were developed based on computer simulation of the MW energy absorption in standardized male phantoms. Thus, they do not take into account individual variability in voxel SAR distribution, which may be observed in dependence on polarization, frequency, age, sex, and pregnancy status [1-8]. In addition, the mobile phone SAR values are usually obtained when the phone is positioned about 2 cm from the standard male phantom head, a condition, which is not usually maintained during mobile phone calls. Other aforementioned physical variables of MW exposure have been linked to occurrence of so-called non-thermal (NT) biological effects, which are induced by MW at intensities well below measurable heating [9-21] [22]. The classification of MW effects into thermal and non-thermal is not based on physics of interaction between MW and biological tissues but rather reflects experimental observation of heating induced by MW exposure, which at SAR levels higher than 2 W/kg may result in thermal injury. Of note, slight temperature increase is also observed in the head tissues during exposure to mobile handset radiation, but this increase is too weak to produce thermal injury [23] and even to be sensed by the exposed subjects [24] while some mobile phone users reported sensation of warmth around the ear [25].

Vilenskaya and co-authors [26] and Devyatkov [27] have reported pioneering data on the NT effects of millimeter waves (MMW, 30-300 GHz, wavelength 1-10 mm in vacuum, to be used in 5G mobile communication) upon exposure of various biological objects. Webb was the first to establish the highly resonant effects of ultra-weak MMW on the induction of λ -phage in lysogenic bacterial *E. coli* cells [28]. These findings were subsequently corroborated by independent research groups [29, 30]. In these and subsequent studies the observed spectra of MMW action were found to have the following regularities: (1) strong dependence on frequency (frequency windows of resonance type), (2) there was a specific PD threshold below which no effect was observed, and above which the effects of exposure depended only weakly on power over several orders of magnitude (so-called

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