

Letters from Experts re. Transmitters Installed at Stonington Commons, etc.

1. Magda Havas, PhD, Professor Emerita, Trent School of the Environment, Trent University, Canada.

2. Kent Chamberlin, PhD, Professor & Chair Emeritus, College of Engineering and Physical Sciences, Department of Electrical and Computer Engineering, University of New Hampshire; Fulbright Distinguished Chair; Member of the New Hampshire Commission formed in 2019 through bipartisan legislation to evaluate safety of wireless technologies; Vice-Chair, International Commission on the Biological Effects of Electromagnetic Fields.

3. Joel Moskowitz, PhD, Director, Center for Family & Community Health, School of Public Health, University of California, Berkeley.

4. Paul Héroux, PhD, Professor, McGill University Medicine and Commissioner of the International Commission on the Biological Effects of Electromagnetic Fields (<https://icbe-emf.org/>)

5. David O. Carpenter, MD, Director, Institute for Health and the Environment, University at Albany/SUNY and former Dean, School of Public Health.

6. Devra Davis, PhD, MPH, President and Founder, Environmental Health Trust and Visiting Professor, Hebrew University Hadassah Medical Center, **Anthony B. Miller, M.D.**, Professor Emeritus at the Dalla Lana School of Public Health, University of Toronto, Senior Advisor to Environmental Health Trust; **Theodora Scarato, MSW**, Executive Director, Environmental Health Trust.

7. Beatrice Alexandra Golumb, MD, PhD, Professor of Medicine, UC San Diego School of Medicine and Director, Golumb Research Group (Letter to CA Governor Jerry Brown in 2017 re. pending legislation that would have expanded wireless radiation exposures, describing the body of science.)

8. Karl Maret, MD, Medical doctor trained also in electrical and biomedical engineering; educator of physician groups on biological impacts of communication technologies; researcher and educator in Energy Medicine, and former electromagnetic field researcher in the Canadian military.

9. Olle Johansson, PhD, Professor (ret.), Karolinska Institute and Royal Institute of Technology, Stockholm, Sweden.

10. Martha Herbert, PhD, MD, Board-Certified Neurologist and Executive Director, Higher Synthesis Foundation, and Founder and First Director, TRANSCEND Research Program, Massachusetts General Hospital, Harvard Medical School.

Other:

11. Camilla Rees, MBA, Award-winning health and environmental activist. "*Declaration in Support of the Petition for Rulemaking to the Secretary of the U.S. Department of Health and Human Services (HHS)*", November 16, 2021 (summary of the EMF issue and the decades long science documenting risk).

Dr. Magda Havas, B.Sc., Ph.D., Professor Emerita



Trent School of the Environment
1600 West Bank Drive
Peterborough, ON, Canada, K9J 7B8
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Date: November 6, 2023

To: [REDACTED]

Cc: [REDACTED], Chair, Stonington Commons Board [REDACTED]
Building Manager, Stonington Commons [REDACTED]
Stonington Commons

RE: Wireless Transmitters Recently Installed at Stonington Commons Building,
32 Water Street Stonington, CT, 06378

Dear Mr. Smith,

I am writing regarding the very concerning situation at Stonington Commons due to recently installed antenna transmitters in the ceilings and changes in power quality on electrical wires within the building.

I am Professor Emerita at Trent University in Canada and, for the past 30 years, I have been focused on this area of research, specifically the biological and health risks to humans and the environment from radiofrequency radiation (RFR). I am a published scientist and I give educational lectures to physicians and other health care providers and provide expert testimony in legal cases on this subject.

I have seen the high RFR readings from exposures in your building in the Section C, 2nd and 3rd floor hallways, plus the readings near the lobby concierge desk, and am writing to recommend, for the sake of all in the building, that these transmitters be turned off, immediately.

In 2011, the International Agency on Cancer (IARC), which is part of the World Health Organization (WHO), classified RFR as a Class 2B carcinogen, a classification that also applies to lead and DDT. The risk of cancer is exacerbated with prolonged exposure, which is the situation for everyone living near one of these transmitters.

Radiofrequency radiation, emitted by these antennas, also contributes to a variety of symptoms collectively classified as electro-hyper-sensitivity (EHS). Symptoms include difficulty sleeping, chronic fatigue, chronic pain, cognitive dysfunction, mood disorders

(anxiety and depression among others), dizziness, nausea, tinnitus (ringing in the ear), skin problems and heart palpitations. We are especially concerned for the elderly who may experience initial memory problems and confusion, followed by an increased risk for dementia, as well as dizziness, that can lead to falls, which can be fatal in older persons. We are also concerned for adults and children with neurological challenges, ADHD and other cognitive difficulties, which can worsen with exposure since RFR is a neurotoxin.

Recently, the courts ruled that the Federal Communication Commission (FCC) that establishes guidelines for RFR has not been keeping up with recent scientific research in this area and hence their guidelines are outdated as they have remained unchanged since 1996 (prior to widespread use of cell phones, WiFi and smart meters). Those guidelines are based entirely on an acute thermal effect. The D.C. Circuit Court stated that the FCC's guidelines are 'arbitrary and capricious' and require justification, considering the 1,800 pages of evidence submitted in the case. The symptoms I mentioned above, including cancers, occur at levels orders of magnitude lower than current FCC guidelines. Cancer patients, and those in remission, need to be particularly careful as exposure to RFR can promote the growth of cancer cells.

A recent monograph may be of interest, "THE LARGEST UNETHICAL MEDICAL EXPERIMENT IN HUMAN HISTORY" (2020) by Ronald N. Kostoff, Research Affiliate, School of Public Policy, Georgia Institute of Technology, identifies a wide spectrum of adverse effects of wireless radiation as reported in the premier biomedical literature over seven decades.

While I recognize that the health and safety of the occupants is of utmost concern, as is providing residents with greater connectivity, most people are unaware that this radiation can be harmful and have not educated themselves on safest ways to obtain connectivity, believing instead what telecom carriers and other industry affiliated parties tell them, not realizing the conflicts of interest. I refer you to the Harvard University Edmond & Lilly Safra Center for Ethics report, *Captured Agency: How the Federal Communications Commission is Dominated by the Industries it Presumably Regulates*.

Real estate devaluation may be another concern for owners in your building, as is the case when cell phone antennas are placed near or on top of buildings. In this case, the antennas are inside the building and under control of the management. Consequently, this situation can be easily corrected by removing the transmitters inside the building. An alternative interim option is to turn the power way down (to ~10% of current exposure) and see if this minimizes effects for those particularly sensitive, while at the same time enabling connectivity for others. RF engineers have explained that the power needed for connectivity is dramatically less than the power antennas are transmitting at today, levels that are in the interest of the telecom industry, but not your residents. Know also that the frequencies used are also important to understand. If the carrier is using higher 5G frequencies, or plans to, biological effects may be significantly greater than what the literature shows to date.

One resident in your building, [REDACTED] who also works out of her apartment—is already severely impaired from approximately 12 hours of exposure, and most certainly others may become impaired, if they aren't already, with the level recorded in the hallway.

Ms. [REDACTED]'s symptoms include the following: off balance; severe fatigue; pressure in the head; foggy headed; unable to process complex information; blurred vision; slight trembling of hands; slowed reflexes; racing heart; extraordinary stress in the body--"like having 20 cups of caffeinated coffee"—while at the same time being exhausted; sleep disruption after spending a night which lasted through the following night in a hotel; swelling of parotid glands in front of ear; clumsy; not thinking straight; speech impaired, trouble getting words out sometimes; face feeling frozen; periodic shooting nerve pain on right side of chest; severe tension in lower part of skull, in the back of head and neck. These symptoms are consistent with electromagnetic hypersensitivity.

Another issue is a deterioration of power quality in your building, which may or may not be associated with the radiofrequency transmitters recently installed. Ms. [REDACTED] monitored power quality, also described as "dirty electricity", in her apartment and noted that values had changed recently. She used a microsurge meter that monitors high frequency voltage transients (HRVT) on electrical wires. The values in her apartment increased from less than 50 (which is considered safe) to well over 1900 units. Poor power quality is generated by electronic devices and has been associated with increases in blood sugar among sensitive diabetics and increased neurological symptoms among those with multiple sclerosis. Should occupants in your building be suffering from either diabetes or a variety of neurological disorders, their symptoms may be worse with the additional radio frequency radiation from the ceiling transmitters and increased levels of dirty electricity.

You are in a position where you can rectify the electromagnetic exposure within Stonington Commons for the benefit of those living and working in this building.

It is my hope that this issue can be resolved for the benefit of all concerned.



Magda Havas, PhD



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October 26, 2023

To: [REDACTED]

cc: [REDACTED], Board Chair, Stonington Commons, 32 Water Street, Stonington, CT 06378
[REDACTED], Building Manager, Stonington Commons
[REDACTED], Stonington Commons

Re: Installation of Indoor RFR Transmitters - Input from New Hampshire Commission

I have been informed that Radiofrequency Radiation-emitting transmitters have been installed in the ceilings of hallways, and in the lobby, of Stonington Commons at 32 Water Street, Stonington, CT. I am writing as a Professor and Chair Emeritus of the Department of Electrical and Computer Engineering at the University of New Hampshire and as a member of a New Hampshire Commission that was convened in 2019 to answer questions regarding the safety of wireless radiation both in terms of human health and the environment. The Commission was formed through [bipartisan legislation](#) that was passed by both houses of the legislature and was signed by the Governor on July 19, 2019.

The primary question posed to the Commission was whether wireless radiation is harmful, which is a somewhat contentious question because the telecom industry wrongfully claims that the radiation poses no harm while many people claim, and research studies demonstrate, that people can be significantly harmed by these exposures. To ensure that the findings of the Commission would be credible, its membership was comprised of independent experts in fields relating to wireless radiation and health. I was asked to serve on the Commission because of my background in Biomedical and Radiofrequency Engineering. I have been a Lifetime Member of the IEEE and prior to serving on the New Hampshire Commission I was unaware that low-level, wireless radiation could be harmful.

To carry out its mission, the Commission performed a thorough exploration of the relevant peer-reviewed literature dating back many decades and brought in internationally recognized experts familiar with wireless radiation and health effects. At the end of our year-long investigation we published our [final report](#) on November 1, 2020. What is relevant to the residents, Board and management of Stonington Commons is that our Commission found wireless radiation to be harmful to human health, significantly impairing physical health, cognitive function, DNA, and especially the health of children. That harm extends to wildlife and plants, including pollinators. The Commission also identified other issues such as the negative impact of a cell towers and antennas on residential property values. A twenty-minute overview of the Commission and its findings can be found [here](#).

The New Hampshire Commission also discovered why the Federal Communications Commission (FCC), the agency that is supposed to protect people against harmful radiation by

establishing protective safety guidelines, has not done their job. What we found out is that the FCC is a captured agency controlled by the industry they are tasked with regulating, as is described in the report by the Edmund J. Safra Center for Ethics at Harvard University. Because of this, they maintain radiation guidelines beneficial to industry and harmful to people's health and the environment.

The current FCC guidelines were created in the 1980s and last updated in 1996. They were based on short-term (around an hour) animal studies that only considered acute heating effects caused by the radiation. Because of the limited duration of those tests, they did not take into account biological effects from long-term exposures that are known to exist. Clearly, such early animal studies are inadequate to assess the effects from the longer exposures today, or effects from multiple and cumulative exposures over time.

Note, the FCC guidelines were recently called into question by the D.C. Circuit Court, which said they were arbitrary and capricious and not evidence-based. The Court also said the FDA's opinion, on which they were based, was also not evidence-based. The FDA has never conducted a comprehensive review of the risks from radiation exposures emitted from telecommunications equipment, yet the FCC, with no biology expertise itself, has justified its exposure guidelines based on cursory denial of risk by the FDA.

Because of my experience on the New Hampshire Commission evaluating the large body of RadioFrequency Radiation science, in addition to what I have learned since serving, I strongly encourage you take actions that will protect the people living in Stonington Commons from the health risks and property value implications associated with transmitters located inside your building. I am happy to meet with the building's Board of Directors and management to discuss the New Hampshire Commission findings as well as to answer questions you might have about wireless technologies and ways to protect people against the harms caused by wireless radiation exposure. Through the proper placement of the appropriate equipment, people in your building can enjoy robust connectivity with far lower exposure to a toxin that has been shown to be harmful.

Sincerely,

A handwritten signature in black ink, appearing to read "Kent Chamberlin". The signature is fluid and cursive, with a large initial "K" and a long, sweeping underline.

Kent Chamberlin, PhD

Professor & Chair Emeritus

Fulbright Distinguished Chair

Vice-Chair, International Commission on the Biological Effects of Electromagnetic Fields



Center for Family & Community Health
School of Public Health

Director: Joel M. Moskowitz, Ph.D.

October 27, 2023

To: [REDACTED]

cc: [REDACTED], Board Chair, Stonington Commons; [REDACTED], Building Manager, Stonington Commons; [REDACTED], Stonington Commons

Re: Transmitters in your building at 32 Water Street, Stonington, CT

I have known [REDACTED] since 2009, soon after my research center, the Center for Family and Community Health in the Department of Public Health at UC Berkeley, began to study the health effects from exposure to electromagnetic fields (EMF) from cellular and wireless technologies. She emailed me readings from several transmitters recently installed in your building.

I am writing to advise you, based on the large and growing body of research to date, that in order to protect the health of residents in your building, the most prudent action would be to follow the precautionary principle and turn the recently installed transmitters way down to levels tolerable to all residents, or disable them completely, which would be the best choice.

Home routers connected to cable or fiber do not transmit at the power densities recorded in the hallways of your building, impacting residents who don't want these exposures, either because they are sensitive to the radiation, like Ms. Rees, and/or for preventive reasons, because they are aware of the large and growing body of scientific literature showing biological and health risks, and that the adequacy of the FCC's exposure guidelines for this kind of radiation is presently in litigation.

Evidence for biological and health risks has been documented in U.S. government research for over half a century. Yet due to capture of the FCC by the telecommunications industry, the presence of wireless radiation in our lives, regrettably, has exploded. In August 2019, the adequacy and evidence base of the FCC exposure guidelines were called into question by the D.C. Circuit Court of Appeals, and this case is still ongoing. This case ought to have best been considered, I would suggest, in your buildings' due diligence process before allowing radiating transmitters in your building.

To become familiar with U.S. government studies on radiofrequency radiation risk, dating back decades, which confirm the inadequacy of the FCC exposure guidelines, the following might be worthwhile reading:

Naval Medical Research Institute (1971), "BIBLIOGRAPHY OF REPORTED BIOLOGICAL PHENOMENA ('EFFECTS') AND CLINICAL MANIFESTATIONS ATTRIBUTED TO MICROWAVE AND RADIO-FREQUENCY RADIATION", Zorach R. Glaser, PhD.

NASA publication (February 1972)– Translation of Russian Research, "INFLUENCE OF MICROWAVE RADIATION ON THE ORGANISM OF MAN AND ANIMALS

Defense Intelligence Agency (March 1976) "BIOLOGICAL EFFECTS OF ELECTROMAGNETIC RADIATION (RADIOWAVES AND MICROWAVES", prepared by U.S. Army Medical Intelligence and Information Agency

NASA Report (April 1981)"ELECTROMAGNETIC FIELD INTERACTIONS WITH THE HUMAN BODY: OBSERVED EFFECTS AND THEORIES"

U.S. Environmental Protection Agency, Office of Research and Development, "Evaluation of the Potential Carcinogenicity of Electromagnetic Fields" – Review Draft, October 1990

U.S. Air Force (June 1994)– "RADIOFREQUENCY/MICROWAVE RADIATION BIOLOGICAL EFFECTS AND SAFETY STANDARDS: A REVIEW". Original classified report June 1988.

Department of the Army – "Bioeffects of Selected Nonlethal Weapons" (February 1998, declassified Dec. 6, 2006), Addendum to the Nonlethal Technologies Worldwide Study -NGIC 1147-101-98 study) provided through FOIA request.

NIEHS's National Toxicology Program (NTP) published a large \$30 million animal study on cancer risks from radio frequency radiation in 2018, finding the very same cancers, glioma brain tumors and schwannomas (nerve sheath tumors), previously found in human epidemiology studies and in another recent large animal study subsequently published by the Ramazzini Institute in Italy. Dr. Ron Melnick, the leader of the team that designed the NTP study, said "The assumption has always been that RF radiation could not cause cancer. Now we know that was wrong." (Microwave News)

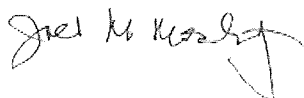
The symptoms Ms. [REDACTED] experiences in the presence of electromagnetic fields in your building, which have caused her to evacuate, are consistent with an environmental intolerance commonly known as electromagnetic hypersensitivity (EHS). The Americans with Disability Act recognizes this disability. According to Physician's Weekly, EHS "is a clinical syndrome characterized by the presence of a wide spectrum of non-specific multiple organ symptoms." It is estimated that 3-5% of the population suffer from serious EHS symptoms, which typically result in headaches, memory impairment, fatigue, insomnia, ringing of the ears, skin conditions and/or heart palpitations. Approximately 30% of populations in developed countries are estimated to be sensitive but to lesser degrees. Understand, it has also been established that biological effects are experienced by people exposed to wireless radiation who may not have noticeable symptoms at all, such that they, too, ought to be concerned about the long-term and cumulative effects. It is essential individuals who suffer from EHS, as well as those facing other health challenges, including cancer, reduce their EMF exposures at every opportunity to both improve biological functioning and prevent further biological dysregulation and escalation of symptoms.

For more information about the effects of exposure to Wi-Fi radiation, please see my website, Electromagnetic Radiation Safety, which has had over 3.5 million page views since 2013. Here you will be able to learn about the accumulating body of science documenting the biological and health effects from this radiation and learn about corporate influence on our government that has led to very significant illness and death since the rapid growth of this industry beginning in the 1990s.

I have directed the Center for Family and Community Health in the School of Public Health at the University of California, Berkeley since 1993 and have published numerous peer-reviewed studies on disease prevention including EHS and other health effects from EMF exposure. I am a member of the International Commission on the Biological Effects of Electromagnetic Fields and an advisor to the International EMF Scientist Appeal which has been signed by over 250 scientists who have published more than 2,000 papers and letters in professional journals on EMF and biology or health. The Commission has recently published a peer-reviewed paper which documents the inadequacy of the FCC's radio frequency exposure limits to protect workers and the public from harm.

I wish the best for people in your building. I hope you will take my advice to heart and take the steps necessary to create a safe environment in your building for all.

Sincerely,

A handwritten signature in black ink, appearing to read "Joel M. Moskowitz". The signature is fluid and cursive, with a long, sweeping underline that extends to the right.

Joel M. Moskowitz, Ph.D.

To: [REDACTED]
cc: [REDACTED], Board Chair, Stonington Commons
[REDACTED] Building Manager, Stonington Commons
[REDACTED], Stonington Commons

Re: Decision to install transmitters in your Stonington building

2023-10-24

Mr. Smith,

As a commissioner of the International Commission on the Biological Effects of Electromagnetic Fields (<https://icbe-emf.org/>) and a professor at McGill University Medicine who has studies the health effects of electromagnetic fields for more than 35 years, I feel competent to comment on your decision to install electromagnetic transmitters in your building in Stonington. Increasing electromagnetic field exposures in your building is a very bad idea from the point of view of human health. Such exposures have consequences on Electromagnetically HyperSensitive people (EHS), but also impact chronic diseases such as cancer, diabetes and other neurological diseases (Parkinson's and Alzheimer's in a significant way. The EHS people will feel the impacts right away, but all of your residents will ultimately suffer the longer-term consequences of these exposures.

CHARACTERISTICS OF ELECTRO-HYPERSENSITIVITY

Webster defines "microwave sickness" as a degraded health condition reported in particular in the Russian medical literature, characterized by headaches, anxiety, sleep disturbances, fatigue, and difficulty concentrating, and by changes in the cardiovascular and central nervous systems. An equivalent term, Electromagnetic HyperSensitivity (EHS), has been documented since the historical appearance of "non-natural" electromagnetic waves.

Neither humans nor other living things are adapted to these agents, which have been absent from the earth's environment for 2 billion years. But technical advances have allowed the generation of signals to which biological processes, particularly oxidative phosphorylation, are not adapted. Unable to compensate or detoxify the effects of this environment, some individuals begin to experience health consequences.

Pure or modulated sine waves are able to affect the nervous system, but the radio frequency pulses typical of digital telecommunications signals are even more effective at disturbing it. Historically, electrosensitivity in human populations has emerged with the enriched exposures due to the increasingly diverse types of electromagnetic fields.

It is probable that Nicola Tesla (1856 - 1943) was the first known victim, towards the end of his life. As is customary, new communications technologies are first used by the military, and electromagnetic electrosensitivity has emerged among them as "microwave sickness". But the Soviets were the first to make formal descriptions of it in the scientific literature, as shown in the table below (1974-2000).

BEFORE 2000	AUTHOR	TITLE	REFERENCE
1974	Sadchikova, M. N.	Clinical manifestations of reactions to microwave irradiation in various occupational groups. Eng.	Biologic Effects and Health Hazards of Microwave Radiation. Proceedings of an International Symposium. 15-18 October 1973. Warsaw: Polish Medical Publishers. p. 261-267
1976	Zaret. M. M.	Electronic smog as a potentiating factor in cardiovascular disease: a hypothesis of microwaves as an etiology for sudden death from heart attack in north karelia. Eng.	Med Res Eng 12(3):13-16
1976	Gus'kova, A. K.; Kochanova, I. M.	Some aspects of etiological diagnosis in occupational diseases due to the action of microwave radiation. Rus.	Inst. of Industrial Hygiene and Occupational Diseases of the USSR Academy of Medical Sciences. Moscow, USSR Gig Tr Prof Zabol (3):14-18
1979	Chudnovskii, V.S.	Psychoses in radio wave disease.	Sov Med (8):111-115
1981	Stocklin, P.L. et al.	Low power microwave effects on the human electroencephalogram: supporting results of Bise.	Physiol Chem Phys 13(2):175-177.
1982	Tiazhelova, V.G.	Three degrees of manifestations associated with the nonspecific changes occurring in an organism during chronic microwave irradiation. Rus.	All-Union Symposium on the Biological Effects of Electromagnetic Fields. Pushchino, USSR. p. 130
1983	Djordjevic, Z.; Kolak, A.; Djokovic, V.; Ristic, P.; Kelecevic, Z.	Results of our 15-year study into the biological effects of microwave exposure. Eng.	Aviat Space Environ Med 54(6):539-542
1984	Hecht K. and Savoley E. N.	Overloading of Towns and Cities with Radio Transmitters (Cellular Transmitter): a hazard for the human health and a disturbance of eco-ethic IRCTHE International Research Centre of Healths and Ecological Technology Berlin - Germany	https://ecfsapi.fcc.gov/file/3521097893.pdf
1988	Forman, S.	Sublethal exposure to	JAMA 259(24):3129-3130

	A.: Zaret, M. M.: Castillo. M.: Quencer. R. M.	microwave radar. Eng.	
1989	Suvorov, I. M.	Clinical variants of the disease caused by exposure to radio-frequency electromagnetic fields. Rus.	Gig Tr Prof Zabol (10):19-22
1992	Lu, S-T; Brown, D. O.; Johnson, C. L.; Mathur, S. P.; Elson, E. C.	Abnormal cardiovascular responses induced by localized high power microwave exposure. Eng.	IEEE Trans Biomed Eng 39(5):484-492
1994	Bolen S. M.	Radiofrequency/Microwave Radiation Biological Effects and Safety Standards: a review.	AI-TR-94-53, In-House Report, Rome Laboratory, Air Force Command, Griffiss Air Force Base, New York
1997	Rea, W.J. et al.	Electromagnetic field sensitivity.	Journal of Bioelectricity, 1991; 10(1 &2):243-256.
1998	Ergo, I	The premier ministre de Norvège et ancien directeur général de l'Organisation Mondiale de la Santé, Bro Brundtland, devient électrosensible après un accident impliquant un four micro-onde.	https://www.mast-victims.org/resources/docs/The-Laughing-stock-and-pursuit-of-Ciro-Plot-issue7.pdf
1998	Pakhomov, A.G. et al.	Current state and implications of research on biological effects of millimeter waves: a review of literature	McKesson BioServices, U. S. Army Medical Research Detachment of the Walter Reed Army Institute of Research, and Directed Energy Bioeffects Division, Human Effectiveness Directorate, Air Force Research Laboratory, Brooks Air Force Base, San Antonio, TX.

Below are some publications documenting electromagnetic electrosensitivity after the year 2000, confirming the contemporary existence of the syndrome. Reports in the scientific literature that deny the existence of the syndrome almost always result from very short-term experiments (concerned only with immediate detection of the signal by subjects), and insufficient knowledge of the phenomenon.

1. The 'sordid' Adaptation of Classification of Occupationally Related Disorders: (Diseases and Symptoms) to ICD-10, 2000. (ICD-10: International Statistical Classification of Diseases and Related Health Problems)

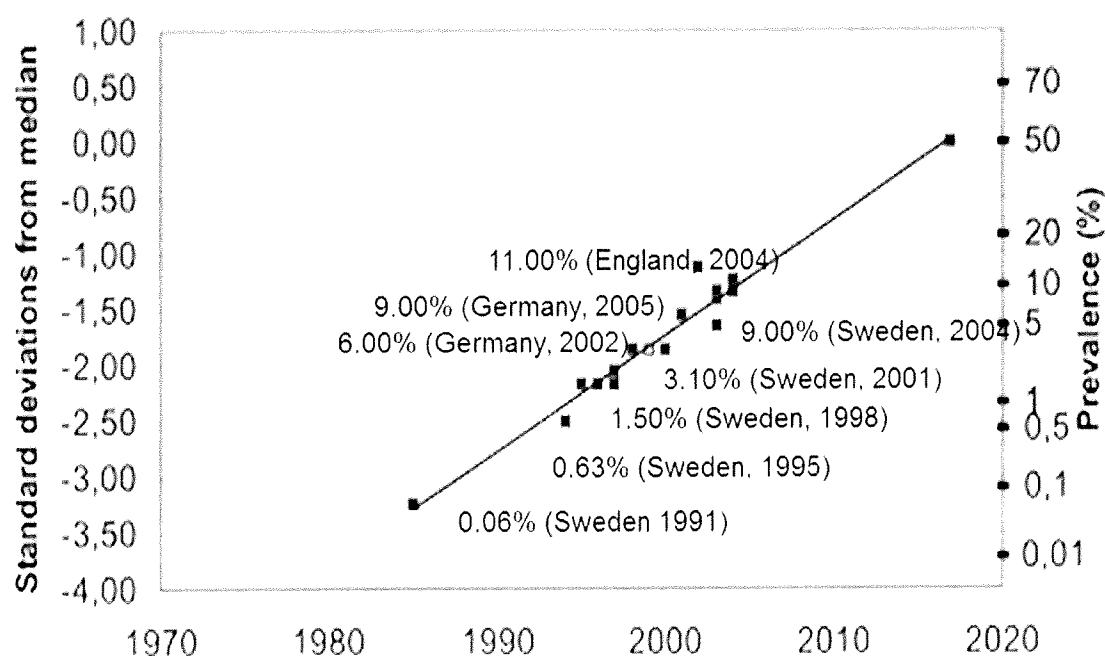
2. Lund, E. 'Micropulsed Ultra and Electrohypersensitivity' Med Hypotheses 2008; 64: 10-14

3. Santini R., Santini P., Danze J.M., et al. Study of the health of people living in the vicinity of mobile phone base stations: I. Influences of distance and sex. *Pathol Biol.* 2002. 50: 369-373.
4. Hietanen M. Hämäläinen AM. Husman T. Hypersensitivity symptoms associated with exposure to cellular telephones: no causal link. *Bioelectromagnetics.* 23(4):264-270. 2002.
5. Santini. R., Santini. P., Le Ruz. P., Danze. J. & Seigne. M. Survey Study of People Living in the Vicinity of Cellular Phone Base Stations. *Electromagnetic Biology and Medicine.* 22: 41-49. 2003
6. Johansson O. Electrohypersensitivity: state-of-the-art of a functional impairment. *Electromagn Biol Med.* 2006. 25(4): 245-258.
7. Hallberg O., Oberfeld G. Letter to the editor: will we all become electrosensitive? *Electromagn Biol Med.* 2006. 25(3): 189-191.
8. Landgrebe M. Hauser S. Langguth B. Frick U. Hajak G. Eichhammer P. Altered cortical excitability in subjectively electrosensitive patients: results of a pilot study. *J Psychosom Res.* 62(3):283-288. 2007.
9. Landgrebe M. Frick U. Hauser S. Langguth B. Rosner R. Hajak G. Eichhammer P. Cognitive and neurobiological alterations in electromagnetic hypersensitive patients: results of a case-control study. *Psychol Med.* 38(12):1781-1791. 2008.
10. Hardell L. Carlberg M. Söderqvist E. Hardell K. Björnfoth H. van Bavel B. Lindström G. Increased concentrations of certain persistent organic pollutants in subjects with self-reported electromagnetic hypersensitivity--a pilot study. *Electromagn Biol Med.* 27(2):197-203. 2008.
11. Landgrebe M. Frick U. Hauser S. Hajak G. Langguth B. Association of tinnitus and electromagnetic hypersensitivity: hints for a shared pathophysiology? *PLoS One.* 2009;4(3):e5026.
12. Buchner K., Eger H. [Changes of Clinically Important Neurotransmitters under the Influence of Modulated RF Fields – A Long-term Study under Real-life Conditions]. *Umwelt -Medizin- Gesellschaft* 2011. 24(1): 44-57.
13. Yakymenko L. Sidorik L., Tsybulin O., Chekhun V. Potential risks of microwaves from mobile phones for youth health. *Environment and Health.* 2011. 56(1): 48-51.
14. McCarty 2011 DE et al. Electromagnetic hypersensitivity: evidence for a novel neurological syndrome. *Int J Neurosci.* 2011 Dec;121(12):670-6. doi: 10.3109/00207454.2011.608139. E pub 2011 Sep 5.
15. Hagström M. Auranen J. Johansson O. Ekman R. Reducing electromagnetic irradiation and fields alleviates experienced health hazards of VDU work. *Pathophysiology.* 19(2):81-87. 2012
16. Genuis 2012 SJ et al. Electromagnetic hypersensitivity: fact or fiction? *Sci Total Environ.* 2012 Jan;414:103-12.
17. Shahbazi-Gahrouei. D., Karbalae. M., Moradi. H. & Baradaran-Ghahfarokhi. M. (2013). Health effects of living near mobile phone base transceiver station (BTS) antennae: a report from Isfahan, Iran. *Electromagn Biol Med.* 2014 Sep;33(3):206-10. doi: 10.3109/15368378.2013.801352. E pub 2013 Jun 19.
18. Gómez-Perretta C., Navarro E.A., Segura J., Portoles. M. Subjective symptoms related to GSM radiation from mobile phone base stations: a cross-sectional study. *BMJ Open.* 3e12rc003836. 2013
19. Hagström M. Auranen J. Ekman R. Electromagnetic hypersensitive (EHS) -Symptoms, perceived sources and treatments: a questionnaire study. *Pathophysiology.* 2013 Apr; E pub 20128.16800130000.

20. Andreas Tuengler & Lebrecht von Klitzing. Hypothesis on how to measure electromagnetic hypersensitivity. *Electromagnetic Biology and Medicine*. 2013; 32(3): 281–290. DOI: 10.3109/15368378.2012.712586
21. Havas M. Radiation from wireless technology affects the blood, the heart, and the autonomic nervous system. *Rev Environ Health*. 28(2-3):75-84. 2013.
22. Rifai. A.B. and Hakami. M.A. (2014) Health Hazards of Electromagnetic Radiation. *Journal of Biosciences and Medicines*. 2. 1-12. <http://dx.doi.org/10.4236/jbm.2014.28001>
23. Szyjewska A., Gadzicka E., Szymczak W., Bortkiewicz A. The risk of subjective symptoms in mobile phone users in Poland- an epidemiological study. *International journal of occupational medicine and environmental health*. 2014. 27(2): 293-303.6, 7.
24. De Luca 2014 C et al. Metabolic and Genetic Screening of Electromagnetic Hypersensitive Subjects as a Feasible Tool for Diagnostics and Intervention. *Mediators of Inflammation*. Volume 2014. Article ID 924184. 14 pages. <http://dx.doi.org/10.1155/2014/924184>.
25. Nordin S, Neely G, Olsson D, Sandström M. Odor and Noise Intolerance in Persons with Self-Reported Electromagnetic Hypersensitivity. *Int J Environ Res Public Health*. 11(9):8794-8805. 2014.
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The prevalence of this syndrome is on the rise, due to the continual increase in human exposure to waves in our environment, as shown in the historical development below (Hallberg & Oberfeld, 2006, reference 7). The disease rate in the population will climb as industry technicians expand the installation of emitters in buildings. Industry is even preparing to force the installation of such systems in individual rooms. The graph below suggests that if the electromagnetic environment continues to enrich itself, it is projected that a larger and larger fraction of the population will become “electrosensitive,” as shown by the percentage “prevalence” to the right of the graph.



Descriptions of electromagnetic hypersensitivity include fatigue, headache, drowsiness, irritability, loss of appetite, memory impairment, mental changes, unstable mood, hypochondria and anxiety, tinnitus, recurrent infections, difficulty concentrating, skin symptoms, insomnia, heart problems, bad blood circulation, disorientation, nasal congestion, reduced libido, thyroid disorders, eye discomfort, increased urge to urinate, listlessness, capillary fragility, cold hands and stiff feet and muscles.

The signs are usually reversible if exposure is interrupted. Other frequently described manifestations are a cluster of cardiovascular changes including bradycardia (or occasional tachycardia), high blood pressure (or hypotension), and changes in cardiac conduction. No serious cardiovascular disturbance has been described, however.

The diversity of symptoms is due to the fact that electromagnetic waves influence the base of metabolism, so the symptoms of different individual depend on the physiologic vulnerabilities of different tissues and different people.

Low level exposure to non-thermal electromagnetic radiation has been shown to affect the electroencephalogram. The cholinergic system of the rat brain has shown that after exposure, changes occur in muscarinic cholinergic receptors, mediated by opioids and corticotropin. Reduced spectral power and interhemispheric coherence in humans are observed in the alpha and beta bands of the frontal and temporal brain regions. These findings are corroborated using functional magnetic resonance imaging.

Electromagnetic hypersensitivity is usually diagnosed by exclusion, like other emerging diseases, such as fibromyalgia. But specific physiological changes have already been documented: inflammation, hypoperfusion in the temporal lobes during chemical stimulation in the clinic and a specific modification of the permeability of the blood-brain barrier (Bellepomme, 2015, **Reliable disease biomarkers characterizing and identifying electrohypersensitivity and multiple chemical sensitivity as two etiopathogenic aspects of a unique pathological disorder.** *Rev Environ Health* 2015; 30(4): 251–271).

These symptoms are worse in the vicinity of electrical devices, transformers, cell phone antennas and other sources of radiation. But patients do not show any symptoms if they are not exposed. People with electromagnetic hypersensitivity experience a severe deterioration in their quality of life from physical symptoms, and their lives are disrupted by their need to avoid exposure. Some have to avoid almost all public facilities, and often shield their own homes.

Electromagnetic hypersensitivity is recognized as a functional impairment in Sweden (<https://ecfsapi.fcc.gov/file/1092912632123/47%20-%20Attachment%2047%20-ElectroSensitivity%20UK%20-%20EHS%20in%20Sweden.pdf>), Spain has recognized electromagnetic hypersensitivity as a permanent disability (Genuis, 2012, reference 16), and the Nordic Council of Ministers classifies electromagnetic hypersensitivity as an occupational injury of international codification ICD-10 R68.8 ("electromagnetic intolerance").

Various Canadian governments recognize environmental hypersensitivity, but not necessarily electromagnetic hypersensitivity specifically (Canadian Human Rights Commission, 2007).

A working group of the Austrian Medical Association has developed guidelines for the diagnosis and treatment of electromagnetic hypersensitivity, or health problems and diseases associated with exposure to electromagnetic radiation (<http://freiburger-appell-2012.info/media/EMF%20Guideline%20OAK-AG%20%202012%2003%2003.pdf>).

The guidelines suggest a standard for diagnostic testing, as well as 24-hour blood pressure monitoring, ECG, heart rate variability testing, and electromagnetic radiation measurement. The

trigger thresholds (concern) and therapeutic limits (normal) are shown in the Table of section 7 of this report.

Electromagnetic hypersensitivity is often associated with chemical hypersensitivity, and as the syndrome develops, people may become sensitive to more sources of electromagnetic radiation. A connection has also been made with head injuries and mold exposures (Heuser, 2017, reference 37), and electromagnetic hypersensitivity is associated with genetic variations (De Luca, 2014, *ibid*). About a third of occupational hygienists and general practitioners in the Netherlands are seen by patients who attribute their symptoms to exposure to electromagnetic fields. Many of these professionals consider a causal relationship between electromagnetic fields and health problems plausible, and their approach often includes reducing exposure (Slottje, 2016, reference 36).

Two public hospitals and one clinic in Canada offer treatment:

Toronto: <https://www.womenscollegehospital.ca/care-programs/environmental-health-clinic>,

Nova Scotia: <http://www.nshealth.ca/content/integrated-chronic-care-service-iccs>,

and Ottawa Environmental Health Clinic: <https://www.oehc.ca>.

FIELD EXPOSURES

Readings provided by ██████████ report power densities of 46,000 microwatts per meter squared in the common areas outside her apartment. Such readings can lead to debilitating symptoms in EHS people, even for brief exposures.

In the table below, we summarize the reference values considered safe by various institutions for protection of sensitive individuals against EMR.

At the right in yellow, the limits suggested by ICNIRP, and in practice supported by the US Government, which only recognizes heat as a potential agent of physiological or health impacts. These limits (yellow) were maintained under the control of industry, and are based on an inappropriately narrowed view of the scientific literature on the toxicity of EMR.

2012			2016			1973	
AUSTRIAN MEDICAL ASSOCIATION			EUROPAEM			ICNIRP	
	RF-MW ($\mu\text{W}/\text{m}^2$)	ELF (nT)		RF-MW ($\mu\text{W}/\text{m}^2$)	ELF (nT)	RF-MW ($\mu\text{W}/\text{m}^2$)	ELF (nT)
Excessive						>10,000,000	>200,000
Very far above normal	>1000	400					
Far above normal	10-1000	100-400	Daytime	10 -100	100		
Slightly above normal	1-10	20-100	Nighttime	1-10	100		
Within normal	<1	<20	Sensitive	0.1-10	30		

Austrian Medical Association. Guideline of the Austrian Medical Association for the diagnosis

and treatment of EMF related health problems and illnesses (EMF syndrome).

<https://vagbrytaren.org/Guideline%20%20AG-EMF.pdf>

European Academy for Environmental Medicine. DOI: 10.1515/reveh-2016-0011.

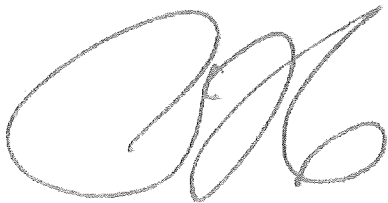
<https://www.degruyter.com/document/doi/10.1515/reveh-2016-0011/html>

The red and blue columns are more recent, very different, and were arrived at from an assessment of biological symptoms and health impacts. Even with the most tolerant view of these two columns, a level above 1000 $\mu\text{W}/\text{m}^2$ can be classified as inducing health risks.

The ratio between ICNIRP recommendations in the yellow column and those that are Public Health based is enormous. But it should be remembered that effects do not necessarily follow a dose-response.

Although there is considerable pressure by the telecommunications industry and its contractors to expand the electromagnetic radiation grid (wireless) much beyond what is acceptable from the point of view of public health, the much safer and hygienic alternative of optical fiber to every apartment is a cost effective solution that also provides superior Internet speeds.

I hope you will take the information above seriously if you take seriously the health for your residents as well as your own.



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Review

Cell Phone Radiation Exposure Limits and Engineering Solutions

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Abstract: In the 1990s, the Institute of Electrical and Electronics Engineers (IEEE) restricted its risk assessment for human exposure to radiofrequency radiation (RFR) in seven ways: (1) Inappropriate focus on heat, ignoring sub-thermal effects. (2) Reliance on exposure experiments performed over very short times. (3) Overlooking time/amplitude characteristics of RFR signals. (4) Ignoring carcinogenicity, hypersensitivity, and other health conditions connected with RFR. (5) Measuring cellphone Specific Absorption Rates (SAR) at arbitrary distances from the head. (6) Averaging SAR doses at volumetric/mass scales irrelevant to health. (7) Using unrealistic simulations for cell phone SAR estimations. Low-cost software and hardware modifications are proposed here for cellular phone RFR exposure mitigation: (1) inhibiting RFR emissions in contact with the body, (2) use of antenna patterns reducing the Percent of Power absorbed in the Head (PPHead) and body and increasing the Percent of Power Radiated for communications (PPR), and (3) automated protocol-based reductions of the number of RFR emissions, their duration, or integrated dose. These inexpensive measures do not fundamentally alter cell phone functions or communications quality. A health threat is scientifically documented at many levels and acknowledged by industries. Yet mitigation of RFR exposures to users does not appear as a priority with most cell phone manufacturers.

Keywords: cellular phone; SAR; cancer; electromagnetic hypersensitivity; radiofrequency radiation; antennas

1. Introduction

Historically, medical science has rapidly investigated newly available agents such as radiofrequency radiation (RFR) for possible therapeutic applications. As high RFR powers obviously heated tissues, microwaves were evaluated for various therapies such as diathermy and oncological hyperthermia [1]. Quantification of RFR absorption by the body was derived from older thermodynamic and pharmacokinetic concepts.

In the 18th century, Joseph Black noticed that equal masses of different substances needed different amounts of heat to raise their temperature, describing variations in “capacity for heat”. From his observations, the concept of specific heat [2] was derived later.

The absorption rate constant K_a is a value used in pharmacokinetics to describe the rate at which a drug enters a system. It is expressed in units of time^{-1} .

Early RFR therapies used different terms to specify the amount of RFR energy or power delivered to tissues while relating them to clinical outcomes. However, after 1975 [3,4], the specific absorption rate (SAR), in W/kg , was widely employed not only in medical applications, including ultrasound but also in RFR bioeffect research.

The choice of SAR, rather than electric and magnetic field strengths, as a basic variable for assessments of RFR exposures, was a harbinger of the industry’s focus on RFR heating. Still, the use of SAR was followed by further reductions in the scope of the RFR risk assessment performed by the Institute of Electrical and Electronics Engineers’ C95 Committee [5]. The collection of these restrictions, designated below as “blind spots”, severely restricted the scope of toxicity assessments and impaired protection against RFR-induced health effects. The first four “blind spots” relate to the protection standard, while the last three “blind spots” concern the processes allowing cellular phones into the marketplace.

The rapid deployment of cellular phones in a large proportion of the human population regularly exposed heads and bodies to high levels of completely novel RFR frequencies. The safety limits promoted by the IEEE and the International Commission on Non-Ionizing Radiation Protection (ICNIRP) [6–8] have been adopted by many nations despite the fact that these limits were only aimed at protecting workers and the public from acute heating effects of RFR. These limits ignored the non-thermal interactions between RFR fields and the free electric charges present within living tissues.

In addressing the potential health effects of RFR, IEEE focused on its “non-ionizing” property to emphasize its innocuousness. This is highly misleading since living tissues are already and unavoidably ionized [9]. The fact that non-ionizing radiation cannot ionize molecules does not prove that it is harmless. Other mechanisms beyond ionization are at work, producing deleterious health impacts.

The vital process called oxidative phosphorylation is long recognized to depend on sustained mitochondrial electron and proton flows [10]. All life rests on metabolism, which itself depends on the rapid transfer of electrons and protons within or between molecules. It is this electrical traffic, seated in the inner mitochondrial membranes of cells, which is responsible for the generation of adenosine triphosphate (ATP), the energy currency of living cells. Consequently, RFR does not need to reach ionization thresholds to interact with electrical charges and disrupt metabolism. RFR can act on the free electrical charges spontaneously generated by normal physiological processes.

The reduction in oxygen that is part of oxidative phosphorylation inevitably yields reactive oxygen species (ROS) in living cells, due to the leakage of electrons at Complexes I and III, and these leakages are increased by exposure to RFR [11,12].

The wireless industry has often claimed that there is “no mechanism” by which RFR can interact with biological systems at exposures below their thermal recommendations. In fact, the mechanisms are quite clear, involving the perturbation by RFR fields of the movement of charged particles, electrons, and protons that are spontaneously liberated by all living systems. These electric movements, which often occur over very short distances, are ruled not only by Coulomb’s Law but by quantum mechanics and the physics of nonequilibrium and nonlinear systems [13,14]. Living tissues are fundamentally different from metallic electrical conductors in their interactions with RFR. They contain both free

electrons and free protons (those of pH), while metals only allow for the movement of electrons. Yet, living systems share an exquisite sensitivity to RFR with metals. Metallic conductors conduct readily because their electrons behave like a degenerate Fermi gas [15]. Biological tissues, like metals, are easily disturbed by vanishingly small (adiabatic) RFR fields [16] by way of the quantum mechanical tunneling of both electrons and protons in respiratory enzymes and in the DNA molecule [17]. This explains why very small RFR fields impact life processes.

These basic mechanisms have a multitude of downstream consequences at an almost unlimited number of points of action within and between important molecules that influence biological events. Life's processes depend so heavily on the movement of electrical charges that there is no hope of cataloging all these points of action, although science should ultimately identify most of the highly vulnerable sites. It is the multiplicity of these RFR points of biological action that explains why the Oceania Radiofrequency Scientific Advisory Association database on Electro-Magnetic Field (EMF) Bioeffects already lists 400 scientific papers [18] describing altered enzyme activities at power levels that are typical of everyday exposures, much below the safety thresholds promoted by ICNIRP's industry guidelines.

As examples of important points of action, we will later discuss at the top of Table 1 on page 8 individual steps of electron and proton transfers in chloroplasts and mitochondria in the processes of photosynthesis (plants) and oxidative phosphorylation (animals).

A second category of RFR targets, enzymes, forms the bottom of Table 1. The action of all enzymes, protein interactions, and DNA stability involves hydrogen bonds, which are essentially the delocalization of protons spontaneously migrating between two positions. Six of these hydrogen bond-sensitive processes are listed in Table 1.

There are seven fundamental "Blind Spots" in the IEEE-ICNIRP evaluation of the biological effects of RFR.

2. Analysis

2.1. Blind Spot #1: RFR Toxicology and Risk Assessment

The principle of Threshold Risk Assessment is to look for transitions as one increases the intensity of exposures on cellular, animal, or population targets. If a sensitive model is available, one may find a no-observable-effect level (NOEL), which represents the exposure preceding the detection of any biological effect of the agent. As one increases exposures, no-observable-adverse-effect or lowest-observable-adverse-effect levels (NOAEL or LOAEL) can also be detected. Given the limitations of the individual models used to measure these levels, toxicologists prudently consider any biological changes as significant, as their models are restricted in the number of variables monitored, and the time over which observations are performed. In the most favorable situation where the NOEL is determined from experimental observations, it is divided by a Safety Factor to obtain the "Reference Dose" which is thought to be safe for humans. The adopted Safety Factor often compiles factors of 10 to cover uncertainties such as the choice of variables, the use of surrogates in experiments (inter-species), and individual variations (intra-species). If the NOEL is not known, the Safety Factor may be further increased since one then relies on the higher NOAEL or LOAEL levels.

In the late 1960s, when the discussion of RFR safety limits started, there were already many papers documenting non-thermal biological impacts at RFR levels much lower than the current IEEE-ICNIRP safety limits. Contemporary lists of such non-thermal effects are available [19,20]. Acknowledging these reports as genuine "effects" and classifying many of them as "observable" and "adverse" should have lowered the safety levels of RFR by many orders of magnitude. However, IEEE's C95 committees were reluctant to accept these reports as observable or adverse. This reluctance is well illustrated by the intense attention devoted to heat, with which the engineering community was familiar, and which was falsely promoted as the only genuine or reproducible effect of RFR. This

fixation on heat was used to supersede the traditional indicators of toxicity supported by biology and medicine.

To avoid acknowledging them as “observable”, a need for replication was claimed, with strict criteria. In science, studies are very rarely exactly replicated, as replications are generally unpopular with investigators. Not only is funding more difficult to obtain, but it also removes the investigator’s right to originality, discovery, and possibly even patent applications, blighting the image of science moving forward. A second problem is that in bio-medicine, as opposed to physics or engineering, it is almost impossible to reproduce molecular, genetic, cellular, and animal studies exactly. Biological material, in its genetic and microbiome variations, for example, is inherently more difficult to control. A biological model is sensitive to a large variety of variables and can be investigated by a wide diversity of techniques. Placing unrealistic reproducibility requirements on non-thermal RFR biological observations deliberately ignored the practical limits experienced in laboratories when seeking to simulate the physical and biological complexities of the real world [21].

Although there were reliable and repeatedly observed indicators of cell injury signals such as calcium efflux ([22] for a review) and oxidative stress [23–26] with highly likely connections to human diseases, these studies were not considered by IEEE as indicative of the adverse character of RFR. This opinion runs counter to the advice of the International Agency for Research on Cancer (IARC), for which oxidative stress has been commonly connected to DNA mutations [27].

Perceived problems of validity, reliability, and relevance to human health fueled this skepticism of the industrial community on the heuristic value of physiology and even animal experiments in determining the health risks of RFR. It pushed the center of weight of “acceptable” evidence away from biology towards epidemiology, where causation is even more difficult to establish due to confounding or exposure misclassification. IEEE’s skepticism was then extended to epidemiology when it, too, provided evidence of adverse health effects both at RFR [28] and extra-low frequencies (ELF) [29]. This epidemiological evidence was recently strengthened by two important animal studies [30,31].

The views of the IEEE on biomedical science allowed vast amounts of evidence confirming the health effects of low levels of RF radiation to be labeled by IEEE and ICNIRP as unreliable or not reproduced, and consequently of little value in establishing safety standards.

Despite its rejection of classic risk assessment science, IEEE sought to keep control of the determination of Electromagnetic Radiation (EMR) safety thresholds. IEEE ultimately relied for RFR risk assessment on two behavioral studies conducted by the Naval Aerospace Medical Research Laboratory, one in rats ([32] see the generic setup in Figure 1) and one in monkeys [33] to set a starting point for the determination of a reference dose. IEEE pointed out that in these two experiments, behavioral thresholds for monkeys were similar to those of rats and therefore constituted replication. In view of the species differences, IEEE’s exacting requirements for “replication” were considerably relaxed on this occasion. Other weaknesses of these two de Lorge studies are the very small numbers of animals and exposure sessions (8 rats and 5 monkeys; typically, 3 sessions) as well as their remarkably short durations (40-min in rats and 60-min in monkeys). An even more disturbing question is whether a single acute behavioral response is appropriate for general and long-term toxicity determinations.

Behavioral screening techniques for toxicity determinations were developing at about the same time as de Lorge’s experiments. However, the consensus among scientists in that field at the time was that toxicity thresholds using behavioral methods could only be obtained reliably by using multiple rather than single variables. A historical account of the development of behavioral screening for toxicology [34] states that a battery of tests is needed to find the most sensitive behavioral endpoint for a given agent. The testing arrays required are best described by the Functional Observational Battery (FOB) [35], first published in 1985 by the US Environmental Protection Agency to impose structure in

neurotoxicity tests. A FOB should include sensory effects, neuromuscular effects, learning and memory, and the histopathology of the nervous system.

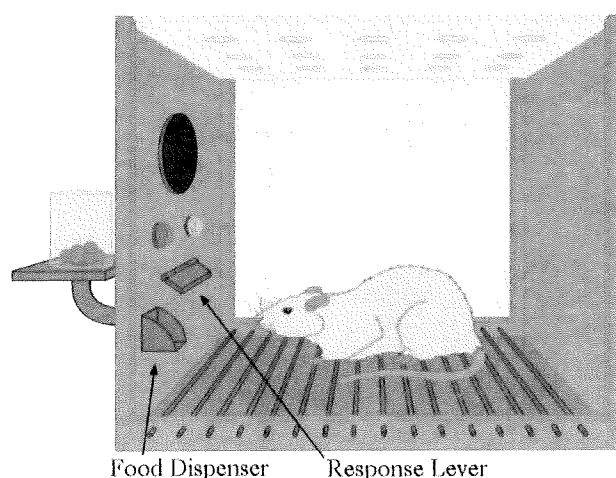


Figure 1. A version of a Skinner box for operant conditioning. The variable discussed is the rate at which a lever is pressed for food by the hungry animal when exposed to RFR.

In 1988, a FOB was indeed used to determine the differential toxicity of two pesticides, chlordimeform, and carbaryl [36], but that FOB included no less than 27 variables. Twenty to thirty endpoints are recommended [37], and scientific agencies have come to require or recommend such behavioral evaluations as a part of the standard behavioral toxicity evaluation of chemicals or therapeutic agents.

IEEE's and ICNIRP's determination, which underpins current guidance limits, rested on a single outcome, pressing a lever for food, while similar investigations of behavioral toxicity required 20 to 30 different endpoints. It should have been realized that the general toxicity of RFR could not be reliably determined using a test that did not even meet the standards of the day for behavioral toxicity, and certainly not for general toxicity or carcinogenicity. Such a decision could only be justified from an a priori conviction that the only real effects of RFR were thermal.

The rat and monkey tests conducted by de Lorge were 1 hour or less at 0.225, 1.3, and 5.8 GHz and were performed at extremely high doses of RFR. The lowest RFR exposure in any monkey test was 50,000,000 $\mu\text{W}/\text{m}^2$, and the highest was 1,500,000,000 $\mu\text{W}/\text{m}^2$. These RFR intensities were so high that they produced minor burns on the faces of three of the five monkeys. These levels are also huge compared to those now considered safe for long-term daytime human exposures by the European Academy for Environmental Medicine (EUROPAEM) working group, 10 to 100 $\mu\text{W}/\text{m}^2$ [38]. This factor of a million in intensities between de Lorge's acute data and EUROPAEM recommendations begs the question as to whether the same class of effects was being investigated. Facial burns to radar operators over 1 hour are clearly undesirable in a military context, but are these effects relevant to cancer induction over a lifetime of exposure to cell phone RFR? It is difficult to agree with the notion that the thresholds provided by this monkey data "allow a relatively complete picture of the biological effects of microwaves" as stated in de Lorge's article. Even the proposed threshold as a function of RFR intensity is dubious since for all frequencies and intensities examined, a delay in response time in the presence of RFR was observed ([39], Figure 3). This indicates that the true NOEL is inevitably smaller than the lowest exposures used within those experiments.

The context of de Lorge's tests is difficult to reconcile with a general toxicity determination because very high-power densities were used to disturb the animal's observing responses, and all these responses were exclusively interpreted in a thermal context. Rather, it seems that de Lorge investigated the Maximum Tolerable Doses of RFR heat over 40 min

("40m-MTD") and related them to a preferred variable, a 1 °C rectal temperature increase in the monkeys, a connection that is itself cast into doubt [39]. In toxicology, MTDs correspond to a dose that does not heavily alter physiology, will not compromise the survival of the animals by causes other than carcinogenicity, or that results in up to a 10% lower body weight after 3 months of exposure [40]. de Lorge's experiments were investigating tolerance to heat, but could not actually be used to determine general toxicity, NOELs, NOAELs, or LOAELs. The gulf between the RFR safety limits suggested in 1966 by the American National Standards Institute (ANSI), the precursor to IEEE's C95 committees [41], and those of EUROPAEM 50 years later is explained below.

First, although evidence of non-thermal effects of RFR had been accumulating for decades, a legal challenge to the thermal views of ANSI-1966 and of the commercial practices of the US Federal Communications Commission (FCC) was only successfully mounted in 2020 by multiple plaintiffs including the Environmental Health Trust and the Children's Health Defense in a US federal appeals court [42].

Second, common exposures in 1966 involved military personnel for field communications and radar operations, and the public, exposed to remote broadcasting towers. Fifty years later, most of the world's population (4.4 billion in 2017) uses cellular phones routinely placed against the head.

Third, the composition of the committee assessing RFR in 1966 was completely different from later health-oriented groups, reflecting a shift in the population of users. The 1966 representation of wireless "consumers" was mostly from the military (left in Figure 2). The EUROPAEM specialists, 50 years later (right of Figure 2), were devising "guidelines for differential diagnosis and potential treatment of EMF-related human health problems", essentially involved in the protection of the population now known as the electromagnetically hypersensitive, but earlier designated as victims of "microwave sickness". Two powerful RFR sources had been progressively added to the environment over 50 years: a source held against the head and the almost ubiquitous network of weaker signals from cell phone base station towers.

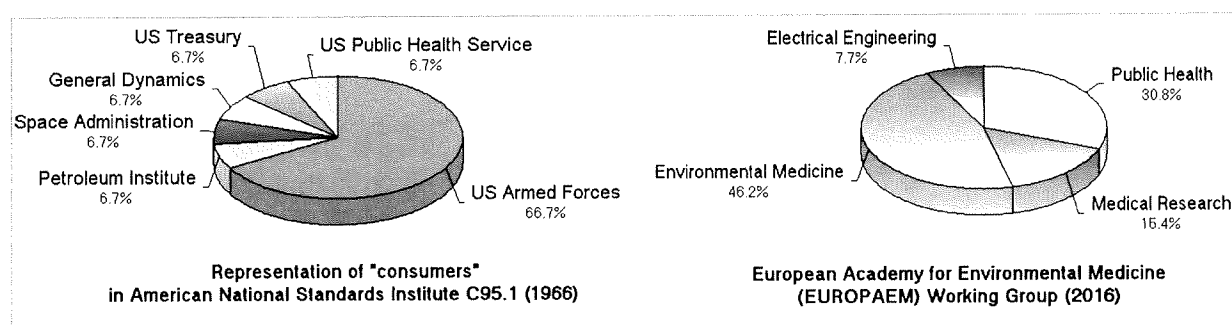


Figure 2. Task forces assessing biological impacts of RFR in 1966 (IEEE) at left, and EUROPAEM, 50 years later, at right.

At the moment of decision, a 1 °C body temperature rise might have seemed to IEEE as sufficiently equivalent to a slight fever to allay fears of RFR dangers when presented to the public. However, with this focus on heat, IEEE heavily shifted its reference dose towards higher exposures.

IEEE's 2005 document C95 on RFR safety acknowledges (page 2) that the "rules protect against adverse health effects associated with heating", and that the safety limits are "designed to protect against adverse health effects resulting from tissue heating, the only established adverse effect of exposure to RF energy at frequencies above 100 kHz". Further, the document restricts "established health effects" to shocks, "behavioral disruption, heat exhaustion or heat stroke due to excessive whole-body RF exposures". This document addresses heat as the only "established" effect of RFR and is clearly outdated and wrong

based on the many hundreds of scientific studies published on non-thermal effects over the past 25 years [43].

The symbiotic role of IEEE, ICNIRP, and the US FCC in the marketing of wireless devices can be summarized. IEEE, “the world’s largest technical professional organization dedicated to advancing technology” issues health protection limits based on heat. The baton is passed to ICNIRP, which is not a professional organization, but an ad hoc group formed to accommodate the rise in RFR exposures needed by new telecommunications hardware [44,45]. This is carried out by claiming that IEEE recommendations account for all risks beyond heat and that these limits could, in fact, be relaxed. The FCC, a regulator of interstate and international communications, and essentially a spectrum allocation agency with no in-house health expertise, is positioned to set RFR exposure limits in the US. The path of regulation from the 1960s to now is a tunnel mostly insulated from biomedical knowledge that inevitably led to inadequate protection from RFR health risks to humans and the biota.

2.2. Blind Spot #2: 40–60 Min Is Not a Lifetime

Notably, de Lorge’s short “performance” experiments could not credibly be extended to cover all possible chronic health effects of RFR, but some data were fortunately available on the long-term thermal adaptation of animals to RFR exposures [5]. This meant that a credible argument to support the high-exposure levels needed for future commercial deployments could be made if the discussion was entirely limited to thermal health effects.

Should de Lorge’s acute exposure experiments (40–60 min) assessing a single outcome, pressing a lever for food, become the basis for general chronic toxicity in humans typically living up to 75 years? The philosophy that allowed this leap of faith by IEEE-ICNIRP is well illustrated by an ICNIRP representative’s comment: “ICNIRP only considers acute effects in its precautionary principle approach. Consideration of long-term effects is not possible” [46]. Essentially, IEEE-ICNIRP believe that long-term effects of RFR are “not corroborated”, not replicated, or not consistent, imposing arbitrary requirements on the reproducibility and reliability of health effects research within the privacy of their committees. Notably, de Lorge’s acute (40–60 min) animal data represent a most extreme case of long-term extrapolation. IEEE used these acute experiments focused exclusively on heat and behavior (Blind Spot #1; [5]) to set safety limits within their C95 committee, while at the same time promoting in other public and government forums that their safety limits encompassed all risks and applied over a human lifetime.

2.3. Blind Spot #3: Averaging Human Exposures over 6 or 30 Min

IEEE-ICNIRP’s maximum permissible RFR limits quantify exposures by averaging and compiling 6- or 30-min exposures into a single number. This averaging was justified by the relation between the total energy of the RFR signal and the predictable temperature increase in tissues. However, IEEE-ICNIRP’s averaging procedure erases the rapid variations of the RFR signal over short time intervals, while it is precisely within these short times that biological reactions occur. Transfer of electrons and protons as well as enzymatic reactions occur over time intervals much shorter than 6 or 30 min, as shown in Table 1. This averaging procedure also allows extremely high RFR intensities during very short periods, exceeding the activation levels of specific biological reactions, as discussed below.

Table 1. Transition times in biological reactions cover frequencies from 0.5 Hz to 333 GHz, much faster than IEEE’s RFR integration time.

Biological Events	Execution Time (s)
Individual charge transfer jumps	
Electron and Hole Transfer steps of photosynthesis in Photosystem II [47]	3×10^{-12}
	2×10^{-10}
	$0.1\text{--}2 \times 10^{-7}$
	10^{-4}
	$0.1\text{--}2 \times 10^{-3}$
Electron and Proton translocations in oxidative phosphorylation Complex IV, cytochrome c oxidase [48]	10^{-2}
	6×10^{-5}
	10^{-3}
Enzymatic reaction times from turnover numbers (substrate) [49]	
Carbonic Anhydrase (CO_2)	2.5×10^{-6}
Fumarase (Fumarate de- and hydration)	1.25×10^{-3}
Ribonuclease (RNA degradation)	1.26×10^{-3}
Tyrosyl-tRNA synthetase (Transfer RNA)	0.13
Pepsin (Protein degradation)	2
Chymotrypsin (Peptide bonds)	7.14
IEEE RFR integration time	360 or 1800 (6 or 30 min)

The second column of Table 1, “Transition times in biological reactions”, lists the execution times of bio-electric charge transfers and enzymatic reactions. If RFR contains frequencies as modulation or carrier components that match the execution times of these processes, interaction is enhanced. Execution times of electron and proton transfers in photosynthesis and oxidative phosphorylation listed at the top of Table 1 correspond to frequencies from 100 Hz to 333 GHz. The execution times of enzyme reactions shown at the bottom of Table 1, protein interactions, as well as the stability of DNA, all involve hydrogen bonds, which are essentially proton exchanges. The enzyme reaction times correspond to frequencies from 0.5 Hz to 0.4 MHz. From Table 1, it can be expected that living systems will display some sensitivity to frequencies ranging from 0.5 Hz to 333 GHz. Such frequencies are widely used in newly deployed power and wireless communications systems. Very brief pulses called “bursts” are almost systematically used to encode information in digital wireless communications, because such strategies benefit signal-to-noise ratio and data capacity. Using an extreme example, a single data “burst” from a Global System for Mobile Communications (GSM) protocol lasts only 0.000577 s. For evidence of harm, IEEE-ICNIRP averages this pulse over 6 or 30 min. This reduces the single burst’s energy by a factor of 623,917 or 3,119,584 times, and its fields by 790 ($\sqrt{623,917}$) to 1766 ($\sqrt{3,119,584}$) times. If the energy of an RFR signal is concentrated in a short time but is averaged over a much longer one such as 6 or 30 min, then high instantaneous RFR intensities can disturb biological processes while satisfying IEEE-ICNIRP guidelines.

RFR safety recommendations from health groups such as EUROPAEM [48], the Austrian Medical Association [50], and Baubiologie [51] are based on observation of actual human reactions, and all use RFR exposure estimations based on peak fields rather than averages. This is because peak RFR levels reveal the breadth of biological events that can be activated. As cell phones emit a succession of pulse trains of different durations, the instantaneous fields of such RFR signals allow activation of molecular, electronic, and protonic components within cells that have different thresholds and relaxation times, enriching the non-thermal effects of RFR [52].

Exposure time, although a factor, seems less important than the set of biological reactions that can be activated if one aims to protect a subject from a deleterious environment. Averaging power densities over 6 or 30 min assesses heating, but is insensitive to peak intensities and modulation, even as these peak fields correlate well with neurological impacts, for example.

Biology depends on homeostasis and the large and unpredictable excursions typical of RFR exposures ($\frac{d(RFR)}{dt}$) leave little time for adaptation. Living systems have mostly evolved to deal in their natural environment with the slower rates of change typical of chemical reactions. This aspect of physiological regulation is critical enough in animals that they devote different systems (action potentials, cytokines, and hormones) to manage different time scales.

2.4. Blind Spot #4: RFR's Human Costs

2.4.1. Cancer

Epidemiological studies have reported significant associations between exposure to RFR and increased risks of glioma, acoustic neuroma, and thyroid cancer, among others. Numerous peer-reviewed studies on cell phones indicate that prolonged use leads to glioma as well as acoustic neuroma [53–62].

That the brains of vulnerable young children are more exposed to cell phone RFR compared to adults [63–66] and that children will likely use cell phones over their entire lifetime is a major concern. Moreover, the uncertainty in our basic understanding of cancer latencies [67] must be considered when comparing cell phone use with cancer trends.

Meta-analysis of cell phone use and glioma [68] yields an ipsilateral odds ratio (OR) of 2.54, 95% confidence interval, CI = 1.83–3.52, following >1640 h of call time. For meningioma, OR = 1.49, 95 % CI = 1.08–2.06, and for acoustic neuroma, OR = 2.71, 95 % CI = 1.72–4.28, were calculated in the same exposure category. For further details, see Hardell, Carlberg [68]. The attributable fraction (AF) or etiologic fraction is the proportion of cases that can be attributed to a particular exposure. That is the number of cases that would have been prevented if the study variable was not a risk factor. This is calculated as the exposed case fraction multiplied by $[(OR-1)/OR]$. Based on 247 glioma cases with ipsilateral exposure in Hardell, Carlberg's Table I [68], AF was calculated as 150 cases, 95 % CI = 112–177. According to Hardell, Carlberg's Table II [68], 119 meningioma cases reported ipsilateral exposure. AF was calculated as 39 cases, 95 % CI = 9–61. Regarding acoustic neuroma, see Hardell, Carlberg's Table III [68], 66 ipsilateral exposed cases yielded 42 cases, 95 % CI = 28–51, that could have been prevented.

In older cell phones (1G, 2G; 1980–2000), antennas protruded beyond the top of the units, while the dissimulated antennas of later smartphone models were mostly located at the bottom (3G–4G circa 2001–2022; [69]). This relocated much of the RFR away from the brain, and closer to the thyroid gland. The epidemiological literature linking brain cancer and cell phones peaked around 2011, while fewer recent (~2017) reports link thyroid cancer to cell phones. Keeping in mind that latency should be less in thyroid than in brain cancer [70], the Hardell group found an increased incidence of thyroid cancer in the Nordic countries in the last two decades [69] and confirmed its link to mobile phone use [71]. A case-control study followed by a genetics assessment suggested an increased risk for thyroid cancer associated with long-term use [72,73]. The connection made between cellular phone use and tumors generally [74] only adds to the urgency for exposure mitigation. Although reports of no significant increases in the risk of cancer have been published, it is irresponsible to dismiss the positive case-control studies and endorse negative studies that have limited exposure data, which can result in misclassifications and bias to the null.

EMR is already classified by the International Agency for Research on Cancer in categories 2B ("possibly carcinogenic to humans") both for ELF [29] and RFR [28], with the RFR classification expected to be reviewed again between 2023 and 2025 [15]. The epidemiological data on cancers are supported by in vivo animal studies, both older [75–78] and more recent ones. The National Toxicology Program [79,80] and the Ramazzini

Institute [31] have both documented that the nervous system is particularly vulnerable to RFR, even within 2 years of experiments on animals.

The adverse effects of EMR at the metabolic and genetic levels have been linked to the induction of reactive oxygen species both in vitro at ELF [81,82] and RFR [22–26]. Increased oxidative stress is a key characteristic of many human carcinogens [27] and can lead to oxidative DNA damage. Beyond cancer and the scope of this article, the effects of RFR are anticipated on human reproduction [83], diabetes, Alzheimer's, and Parkinson's diseases, primarily through the established link between RFR and ROS [84–90].

2.4.2. Electromagnetic Hypersensitivity

The increase in ELF exposures in the last century and of RFR exposures more recently resulted in the emergence of electromagnetic hypersensitivity (EHS) in human populations. Despite exploration and documentation of the EHS syndrome [91], industry and governments have not reacted to curb emissions. Yet, ICNIRP [92] acknowledged that their guidelines may not accommodate the sensitive: “Different groups in a population may have differences in their ability to tolerate a particular non-ionizing radiation (NIR) exposure. For example, children, the elderly, and some chronically ill people might have a lower tolerance for one or more forms of NIR exposure than the rest of the population”.

The victims of artificial EMR (ELF and RF) formed into self-help groups in 18 countries of the developed world, as shown in Table 2, which would have been much longer if not limited to a single entry per country.

Table 2. Electrosensitive Groups spontaneously formed throughout the world. All sites were accessible on 19 January 2023.

Australia	https://anres.org/information-for-individuals/
Belgium	https://www.bbemg.uliege.be/electrosensitivity-ehs/
Brazil	http://www.slowphone.org/
Canada	http://www.aveepinitiative.org/index.html
Denmark	https://EHS1.dk
Finland	https://sahkoherkkyyssaatio.fi/en-english/
France	https://www.electrosensible.org/b2/
Germany	https://www.buergerwelle.de/
Ireland	https://es-ireland.com/about-2/
Italy	https://www.elettrosensibili.it/
Netherlands	http://www.stichtingehs.nl/
Norway	https://www.felo.no/nyheter/
Portugal	http://antenasaquinas.blogspot.com/
Spain	https://www.avaate.org/
Sweden	http://eloverkanslig.org/
Switzerland	https://www.buergerwelle-schweiz.org/
United Kingdom	https://www.es-uk.info/
USA	https://www.meetup.com/emf-awareness-stop-the-stress/

The escalating public health importance of this issue was noted by the European Economic and Social Committee. The number of EHS sufferers appears to increase progressively beyond the present 3 to 5% [93]. Current thermal protection has clearly failed this group, which often faces the incomprehension and skepticism of physicians who rely on national recommendations. Not only do EHS sufferers need protection in the form of

low-field environments, but preventing an increased incidence of EHS is important in the maintenance of a healthy workforce.

EMR health impacts have spilled beyond humans to agricultural livestock [94] and the environment [95–97].

2.5. Blind Spot #5: Specific Absorption Rates Determined at Unrealistic Distances

In the earliest telephones, the users listened and spoke into a single hole. Soon, the microphone and speaker became separate units, the first with a fixed attachment, while the speaker, on a wire, was held against the head. Placing the speaker against the head improved sound intensity and excluded the surrounding noise. The handset, combining microphone and speaker, was introduced in 1878. The sound quality was poor in early telephones, but bandwidth gradually improved to the 300–3400 Hz range in current use. In the modern era, with better microphones and speakers, the ergonomics of voice communications improved. Today, speakerphones allow efficient communications with a cellular handset positioned up to about 1 m from the user's head. The evolution from telephones to cellular phones meant that wireless handsets emitted RFR, first amplitude modulated, but later digitized in the form of pulses. This entirely new environmental agent, potentially exposing large populations to new forms of pulsed radiation, would have needed a serious health impact evaluation by the industry prior to deployment. However, the thermal views of industry meant that recognition of the health consequences of RFR exposure would have to come later, and in great part from academic institutes through epidemiology and animal or laboratory experiments.

The placement of cell phones against the head made the nervous system a primary target, and epidemiological observations were quick to document cancer risks [98]. These risks correlated with mobile phone use, changes in metabolism [99] and the generation of ROS [100]. Even while considering heat only as a risk, anticipated health impacts from RFR prompted the industry to conduct tests designed to limit the heating of the brain by RFR.

In conformity with the view of the industry, a large emphasis was placed on quantifying the heat deposited in the head by a cell phone placed in proximity using experiments on phantoms [101] or by computation [102]. The laboratory experiments (Figure 3) used hollow head shapes filled with a fluid thought to represent the conductivity of human tissues. A probe was used to measure temperature rises due to RFR fields at various locations in the fluid.

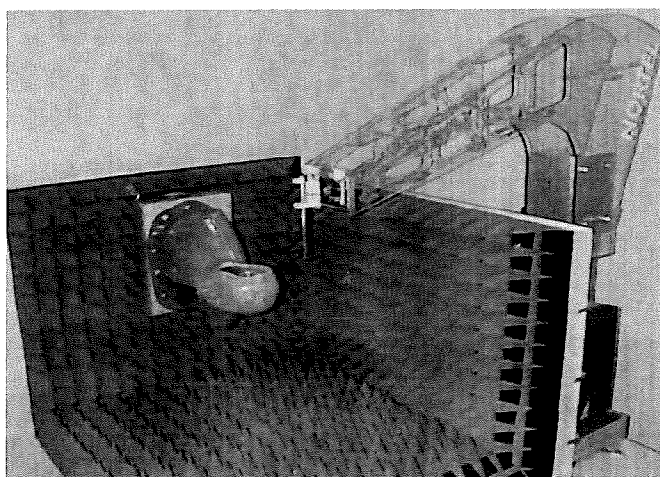


Figure 3. Experimental measurements of SAR used simple head shapes filled with homogeneous fluid.

Computational strategies based on the Finite-Difference Time-Domain (FDTD) method, by contrast, used computer simulations that were limited not only by resolution but also by the availability of basic data on the anatomy and conductivity/permittivity of real

tissues. These early simple models represented the situation depicted at the left of Figure 4, essentially a head together with a phone. Yet it was progressively realized that modeling SAR values with precision at small distances from the head (in the near field) and in proximity to complex layers of biological tissues is difficult and carries an uncertainty of at least 25% [103]. Most notably, SAR decreases by at least 12.5%/mm for very short distances as a cell phone is moved away [104–107]. Antenna designs and placements within the phone influence SAR, as antennas that radiate power over larger areas [108] or are remotely positioned [109] produce lower SARs.

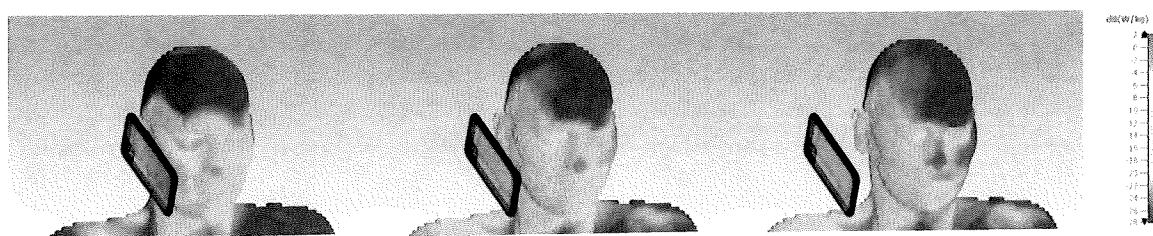


Figure 4. Placing a cell phone antenna at 0, 2, and 6 cm from the head reduces the Percentage of Power absorbed by the head (PPHead, %). 0 dB is 1 W/kg Specific Absorption Rate. Figures 4–7 are simulations from Bio extension 4.3 of CST Studio Suite.

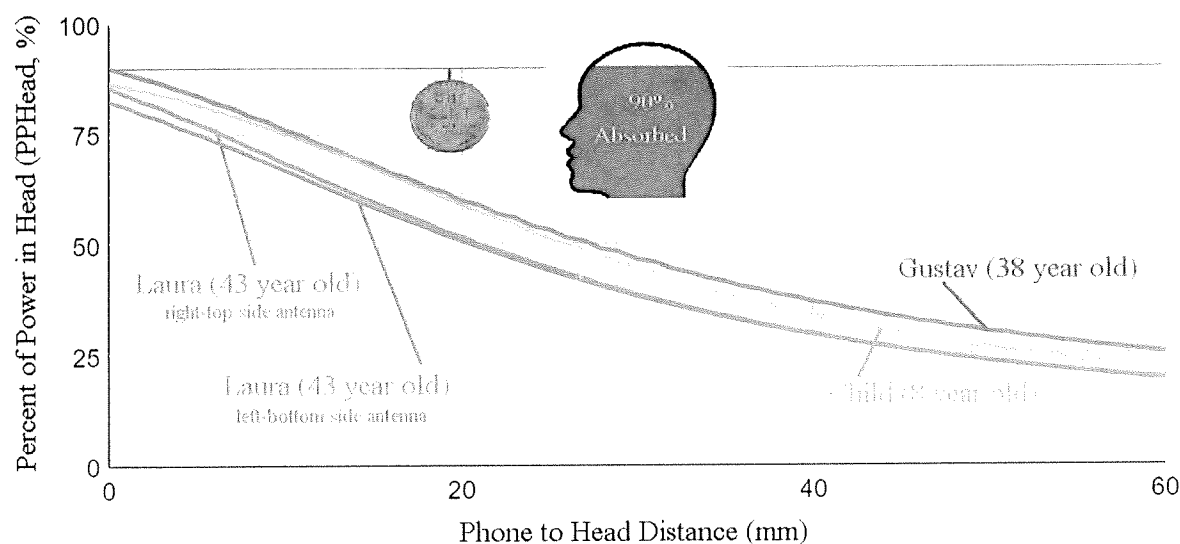


Figure 5. Percent of Power absorbed by the user's Head (PPHead, %) vs distance of phone to head for models "Laura", "Child" and "Gustave" using the Dassault Systèmes Simulia Academic CST Studio Suite Research Base Pack 2022 with CST Studio Suite Research Bio Model and CST Studio Suite Research Acceleration Token, purchased from Smarttech, Inc., 2503 Kilgore Street, Orlando, FL 32803 (<https://www.3ds.com/products-services/simulia/products/cst-studio-suite/>, accessed on 19 January 2023). The cell phone antenna, from the software Antenna Magus, included in the CST Studio package, is a Planar Inverted-F-type Antenna, as is the case for Figures 6 and 7. Placement is in different corners of the cell phone: left-bottom and right-top as indicated for Laura; left-bottom for Gustav and Child. The edges of the antenna and of the cell phone are parallel and the gaps between the antenna and external edges of the cell phone are 2 mm in the 3 axes. The cell phone model is a simple plastic box 147.2 mm × 74.56 mm × 10.48 mm. Only the antenna is powered, no electronic circuit is included in the model. Frequency is 900 MHz. Size of a US penny is shown for distance reference (19 mm).

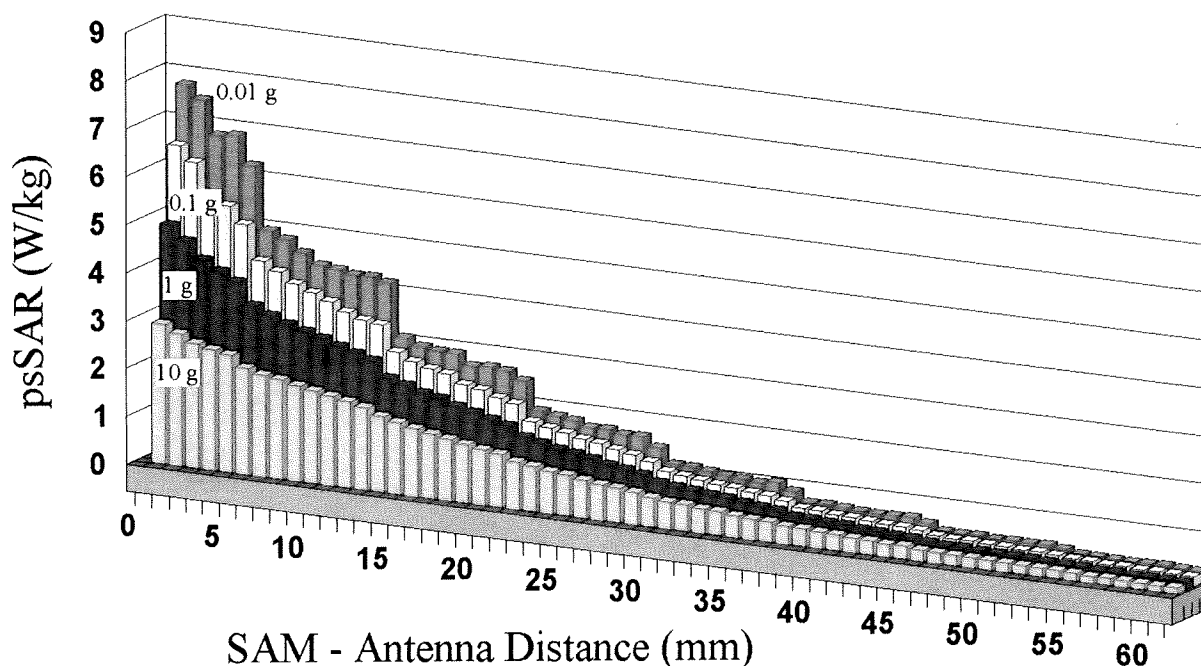


Figure 6. Peak Spatial Specific Absorption Rates (psSAR, W/kg) as a function of distance for four averaging masses. Frequency is 900 MHz and power 250 mW. Tissue and shell parameters, the shape of the Simulated Anthropomorphic Model (SAM) model (IEEE 1528), and voxels from a meshing tool with at least 10 voxels per wavelength are provided by CST Studio. Planar Inverted-F Antenna from Antenna Magus. Cell phone model is an empty plastic box with an antenna 2 mm away from the top edge. The irregularities in the curves stem from a mismatch between head shape and digitized voxels. ICNIRP uses 10 g, while IEEE-FCC uses 1 g. After [65].

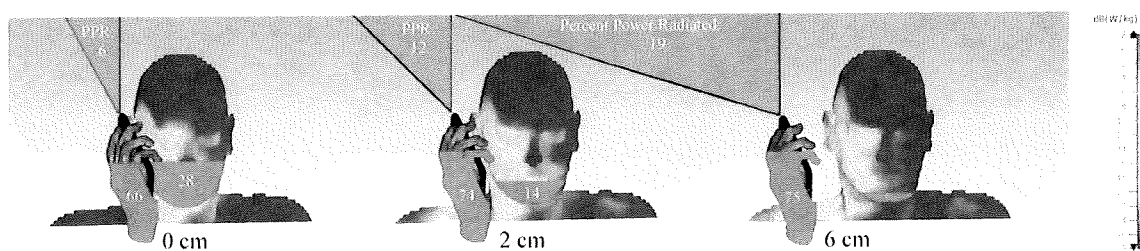


Figure 7. When including the hand holding the phone in psSAR simulations, the 0 cm position (touch) results in 66% of the power being absorbed by the hand (PPHand), 28% by the head (PPHead) for a total absorption of 94% in the body (PPB), and 6% (PPR) radiated for communication. At 2 cm, PPHand is 74%, PPHead is 14%, and PPR is 12%. At 6 cm, PPHand is 75%, PPHead is 6%, and PPR is 19%. The frequency of operation is 900 MHz, and the power delivered to a planar Inverted-F Antenna is 250 mW.

Even while acknowledging only thermal effects, the industry needed to document the amount of heating produced by RFR as well as how cell phones should be used or positioned, which resulted in the issue of precautionary recommendations to cell phone users. Nevertheless, industry and governments have struggled to control cellular phone emissions, even to meet the permissive thermally based standards of IEEE-ICNIRP [47,103,110]. Table 1 below, compiled from manufacturer's manuals, lists the minimum recommended distances between cell phones and the body. SAR limits are the same for all but are met at distances that vary from 5 to 25 mm, according to the table. This means that phones

are allowed on the market according to a SAR rating based on a protocol chosen by the manufacturer.

Table 3. Cell Phone Manufacturers' Recommended Body Separation Distances.

Brand	Cell Phone Model	Separation Distance from the Body in mm
Apple iPhone	11, 12, 13, SE, X, XR, XS	5
Huawei	Y6P	15
LG	G2	10
LG	G3	15
Motorola	razr	25
Nokia	8110 4G	15
Samsung	Galaxy S5	15
Samsung	Galaxy Note 3	10
Samsung	Galaxy Z Fold3 5G	15
Xiaomi	12X	5

In practice, it is difficult for users to maintain the recommended distances, either during a conversation or while simply carrying the device. In other words, most users cannot abide by the recommendations, which are often found deep in the cellphone's manual. In France, 30 different models of mobile phones with non-compliant SARs have been either withdrawn from the market by the Agence Nationale des Fréquences (ANFR) or have had their specific absorption rate (SAR) updated by software. In addition, the French Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail (ANSES) recommends that SAR homologation measurements be carried out with the phone in contact (0 mm) with the body, rather than at the distances presented in Table 3. In Canada, Innovation, Science and Economic Development (ISED) confirms that 9 out of 10 cell phones exceed regulatory limits when tested according to "real use" conditions, with the phone in contact with the body (0 mm) [110].

Figure 5 shows that in a scenario similar to Figure 4 and according to the distance between the phone and head, as much as 90% of the power emitted by the antenna is dissipated in the user's head, as opposed to contributing to communication.

Since the risk of glioma is associated with the cumulative use of cell phones [68,74,111], one would expect SAR reduction to be a priority, meaning that Hardell's glioma odds ratio of 2.54 [68] should decrease if cell phones were kept at an increased distance from the head/body. This means that the phone-to-head distance is a critical factor in terms of health impacts.

Unfortunately, the question of the distance between cell phones from the head and body is not the only contentious issue in dealing with SAR limits. As discussed below, the volume over which SAR is estimated is also influential.

2.6. Blind Spot #6: Specific Absorption Rates Averaged over 1 or 10 g

For estimation of cellular phone SARs, the FCC and IEEE-ICNIRP prescribe averaging to a single value the RFR exposures estimated over 1 or 10 g of tissue, respectively, in the shape of cubes. This implies that over these dimensions, 1 to 2.15 cm ($\sqrt[3]{10}$), the tissue is uniform in structure and in its sensitivity to RFR, while in fact, it is heterogeneous and anisotropic at the cellular, organelle, molecular, and particle levels. This misrepresentation of living tissues voids any contribution of biology to RFR risk assessment.

A gram of brain tissue may contain 50 million glial cells [112]. Individual exposures to single cells (see Table 1, cell sizes in humans compared to IEEE-ICNIRP averaging), especially stem cells, are significant for cancer risk. The somatic mutation theory of carcinogenesis, the dominant force driving cancer research in the 20th century, proposes that while

multiple mutations are usually needed for cancer development [113], even a single DNA mutation can lead to a tumor. Inside cells, small elements such as organelles and enzymes vary in terms of their shape, function, and vulnerability to RFR. The anatomical, electrical, and thermal structures of mitochondria, in particular [114,115], run entirely counter to IEEE-ICNIRP's philosophy of oversimplification.

Table 4. Cell sizes in humans compared to IEEE-ICNIRP averaging.

Cell Type	Average Volume (μm^3)	Average Weight (ng)
Sperm cell	30	0.030
Red blood cell	100	0.1
Lymphocyte	130	0.13
Neutrophil	300	0.3
Beta cell	1000	1
Enterocyte	1400	1.4
Fibroblast	2000	2
HeLa, cervix	3000	3
Hair cell (ear)	4000	4
Osteoblast	4000	4
Alveolar Macrophage	5000	5
Cardiomyocyte	15,000	15
Megakaryocyte	30,000	30
Fat cell	600,000 (0.0006 μL)	600
Oocyte	4,000,000 (0.004 μL)	4000
IEEE-ICNIRP 1 or 10 g	1,000,000,000,000 to 10,000,000,000,000	1 or 10

From: <http://book.bionumbers.org/how-big-is-a-human-cell/>, accessed on 19 January 2023.

Non-thermal effects of RFR are also seen to modify the reaction rates of organic molecules and enzymes in solution [116–119] or in living cells [120,121]. Electronic and protonic polarizations and their detectable impacts on oxidative phosphorylation charge transfers in mitochondria were already mentioned in the introduction. Inhomogeneities within living tissues from cellular to electronic levels will contribute to characteristics that cannot possibly be addressed by a thermalist view of RFR [49,122] that recognizes living tissues only on a scale of centimeters.

IEEE has historically only considered the properties of different biological tissues when there is a need to relax exposure criteria for specific body parts. For example, equipment already used in industry (dielectric heaters) or by the public (cell phones) needed higher exposures to the extremities (arms) or to the external ear to meet authorization criteria. So, the occasional amendments introduced over time for these tissues increased thermal limits to accommodate the hardware.

FCC-13-39A1 reclassified the external part of the ear (aka pinna) as an extremity [123] despite evidence that DNA damage in the ear canal was connected to cell phone use [124] and despite objections to classifying a body part proximate to the brain as a non-essential “extremity”.

In addition, now, ICNIRP is loosening IEEE recommendations to accommodate 5G, considering a temperature rise of 2 °C to 5 °C as the adverse effect thresholds for the head and limbs, respectively [3]. Those relaxations are unlikely to reflect changing knowledge of human physiology but rather reflect the need for new hardware, the industry's growing confidence in public demand for wireless communication devices, and its desire to expand the use of cellular phones.

The suggestions of IEEE-ICNIRP in averaging mass/volume are challenged by a series of simulations (Figure 6, [65]) of peak spatial SAR (psSAR) for cell phones as a function of distance to the head. Results show that both the distance of the phone from the body and cube size (or weight, 10 g to 0.01 g) influence psSAR, with smaller cubes producing larger psSARs. Thus, in each 10 g cube, the psSAR somewhere within 0.1 or 0.01 g is much larger than the average. In addition, the results of Figure 6 are far from extending even to cellular sizes (Table 2, Cell sizes in humans compared to IEEE-ICNIRP averaging). Therefore, it is probable that even higher psSAR values would be obtained by reducing cube sizes below 0.01 g. In addition, these estimations, obtained using a four-slab (skin, fat, bone, brain) flat phantom, fall far short of representing the true complexity and anisotropy of cells and mitochondria, both in terms of micro-anatomy and temperature uniformity [114,115].

A given phone's psSAR rating varies widely, depending on the distance from the head and cube size. The cubes promoted by IEEE-ICNIRP ignore micro-anatomy, which is actually more relevant to the determination of health risks, as it is precisely at the microscopic level that life places the most essential parts of its framework.

The psSAR measurements supporting a cell phone's access to the market result from a procedure that enables measured emissions to slip under the standard's safety limits (1.6 W/kg for any 1 g cube for IEEE and FCC or 2 W/kg for any 10 g cube for ICNIRP), rather than from a true scientific determination of exposure or risk.

2.7. Blind Spot #7: Enclosing the RFR Source

The SAR estimations of Figures 3–6 all feature a cell phone and a head. However, phones are typically held, so why was the hand not considered in simulations? As it turns out, a more realistic image that includes a hand holding a cell phone shows that a substantial proportion of the radiated power dissipates into the body, with a modest remainder actually available for wireless communication. In Figure 7, the Percent-Power-Radiated (PPR in %), which represents the fraction useable for wireless communication as a portion of total emitted power, is simulated using CST Studio with parameters similar to those indicated in Figures 5 and 6. As much as 94% of the power radiated ends up in human tissues in the most common scenario (0 mm).

Since in real-use scenarios, the head and hand together envelop the source, and since the power drawn by conductive/dissipative body tissues is larger than geometrically expected, a cell phone effectively acts as a microwave heater held close to the body. A surprising thermalist opinion which we do not accept even promotes heating people using microwaves within their homes in the winter, as an economical substitute for conventional house heating [125].

The SAR estimation techniques prescribed by IEEE-ICNIRP for cellular phones are defective not only because of distance to head and cube size but also because they have been established with highly unrealistic models.

2.8. Blind Spots Summary

Our introduction stated that neither the fact that environmental RFR is non-ionizing nor that its levels are low preclude RFR action on living systems. Non-ionizing radiation does not act by ionizing but acts by direct action on electrons and protons.

IEEE transformed risk assessment into a calorimetric exercise on inert materials while ignoring the processes and structures of life, specifically the motion of electrons and protons, and the properties of protein and enzymes.

Blind Spot #1 illustrates IEEE's focus on heat, a variable only relevant at extreme RFR intensities, limiting acknowledgment of "real" health effects to the acute, as stated in IEEE [7] and ICNIRP [6] guidelines, and reaffirmed in 2020 [8]. IEEE assumed that a single behavioral change (not pressing a lever for food in rats and monkeys) was the most sensitive and only reproducible effect of RFR exposure, rejecting all other mechanisms.

Blind Spot #2 inappropriately extended the significance of acute RFR experiments to chronic (75 years) situations.

Blind Spot #3 averages RFR exposures over times much longer (6 and 30 min) than the pulses of telecommunications signals, ignoring fast and sensitive biological reactions occurring at peak intensities which are entirely missed by averaging.

Blind Spot #4 denies the real suffering that RFR exposures induced in human populations such as increased tumor rates and electromagnetic hypersensitivity, as well as the environmental effects of EMR.

Blind Spots #5, 6, and 7 illustrate homologation procedures for cellular phone SARs that are not representative of even the thermal risks accepted by IEEE-ICNIRP: distance to the head, 1 or 10 g cubes, and poor representation of actual conditions of use.

The IEEE-ICNIRP has promoted a limited view of the important interactions of EMR with biological systems and health. The seven blind spots reflect a deep misunderstanding of toxicology, biology, and medicine. The deliberate design and promotion of safety limits based on heat is a red herring that avoided the recognition of important RFR toxic effects. Only electric shocks and heating were recognized, thus subverting health effects to the needs of engineering deployments.

The influence of industry extends inside the World Health Organization's International EMF Project, which anticipates a future where human exposure to EMF "will continue to increase as technology advances" [126]. Since there are no adequate health effects studies on the projected evolution of wireless systems such as 5G [127], and because the effects of 1G to 4G systems have been ignored, one can legitimately ask whether the WHO provides health protection independently from the wireless communications industry [128].

2.9. Engineering Solutions

We discuss below three practical approaches to cell phone exposure abatement:

1. Blocking the phone's RFR emissions, but not its reception, when it is positioned close to the head/body.
2. Modifying the antenna emission pattern (to hemispherical) to radiate away from the head and the body.
3. Limiting call durations according to an estimation of the effective radiated power emitted by the antenna over a specific period.

Those recommendations are germane to those suggested to heavy users [129] such as limiting call durations or keeping the phone away from the head (Figure 4). The most effective exposure reduction measures in hygiene involve control at or by the source, as opposed to reliance on personal habits. Engineering controls, either hard or soft-wired, are effective, while personal habits are less reliable, and need frequent reminders.

Substantial reductions in exposure would be needed to avoid risks of RFR-induced biological effects. For example, glioma risks should be considerably attenuated if the local exposure limit to the head of 1.6 or 2 W/kg was reduced to the whole-body exposure limit of 0.08 W/kg. It is not clear why IEEE-ICNIRP assumes that the glial cells of the brain, oligodendrocytes, astrocytes, ependymal cells, and microglia, are more resistant to RFR exposures than those in the peripheral nervous system or body such as Schwann cells, enteric glial cells, and satellite cells. Why are extremities more resistant to RFR risks than other body parts? A SAR reduction of 20 or 25 times would require much larger distancing, which is achievable by foregoing placing the portable phone against the head, instead keeping it at a distance, and using the speakerphone.

2.9.1. Cell Phone Emission Blocking

Cell phones could be configured to shut off RFR emissions when a proximity sensor detects the presence of the human body. Such body sensors in Android and iPhone devices use a reflected pulsed infrared signal to detect proximity, triggered by the user's face and switching off the screen, thus preventing any errant soft button presses by the skin, as well as saving battery power. These functions in the Android Application Programming Interface, for example, are under the `SensorManager` and `Sensor` classes. With this modification, a user could use the phone normally away from the head, in his hand, or on a table in

front. At the cost of a small change in personal habits, this would substantially reduce SAR exposures from cell phone usage.

The network could be designed to alert the user to incoming calls, but the cell phone would be prevented from autonomously sending out data when held against the body, a privacy gain. Essentially, this software adjustment is an automated “Airplane Mode” designed to protect users from radiation [130].

The quality of communication for the hand-held position has increased tremendously since the introduction of speakerphones and microphones integrated into cell phones. The phone against the head position only seems necessary if one must maintain classical phone handling, which is obsolete because of technical improvements. Note that since 2012, all handsets in India must have a hands-free mode [131].

Cell phone blocking is already applied in specific contexts, such as in automotive vehicles, because texting or conversing while driving impairs attention and is a growing cause of car accidents [132]. At least seven “apps” are currently available that use various techniques to prevent texting while driving [133]. The RFR inhibition upon detection of the vehicle’s motion can be provided by the cell phone service provider, by phone-resident software, or even by the car itself, as a virtual barrier around the driver [132]. Cell phone-blocking engineering solutions would save many lives and injuries immediately upon implementation.

2.9.2. Improved Antennas

Apparently, some manufacturers have received patents since the mid-1990s to reduce cell phone radiation to consumers [134]. From 15 different countries, no less than 26 different designs based on Artificial Magnetic Conductors (AMC) and Electromagnetic Band Gap (EBG) structures have been proposed in 25 different publications [135] between 2005 and 2020. Artificial Magnetic Conductors are characterized by negative magnetic permeability, which produces a phase-shifted electromagnetic reflection at a specific frequency. Electromagnetic Band Gap materials use the interference between the direct waves radiated by the antenna and the waves reflected from the material to reduce exposures. The main characteristics of EBG and AMC materials are described by Yang and Rahmat-Samii [136].

Both materials, when underlying antennas, can bring about SAR reductions ranging from 3 dB (6 examples) to 20 dB (14 examples), i.e., energy attenuations of 2- to 100-fold. These materials could be laid into cell phone circuit boards without affecting the quality of communication, and the battery power would be more rationally used in establishing contact with a base station. The general emission pattern would be hemispherical. Superior emission patterns are feasible, as low head SARs have already been implemented by some manufacturers such as Mudita Pure (0.06–0.07 W/kg) [137] and the ZTE Blade V10 [138] at 0.127 W/kg, much lower than the 1.6–2 W/kg exposure limits.

2.9.3. Improved Communication Procedures

Without degrading communications quality, reductions in radiation exposure to users can also be achieved using software capabilities already incorporated in cell phones. Some cell providers currently permit Wi-Fi calling, and a cell phone will switch to that mode of operation when the cell tower signal is unavailable, or when the user has manually selected the airplane mode. A cell phone should automatically use Wi-Fi calling upon the availability of a Wi-Fi connection. The reduction in radiation is realized because communication with the cell tower typically occurs with cell phone transmitter powers between 0.6 and 3.0 Watts, while the cell phone’s Wi-Fi transmitter is generally below 0.1 Watts. This reduction in cell phone transmitted power not only lowers user exposure but also extends battery life.

Another software change uses a cell phone’s existing position-sensing capabilities (accelerometer and GPS) to reduce handshake transmissions with the cell tower. Depending on whether cell phones are used as communication, tracking, surveillance, or policing devices, various levels of handshaking may be desired. Those handshake transmissions allow the cell tower to track cell phone location, and they are currently executed on a

regular basis whether the cell phone has moved or not. This increase in RFR traffic [139] is not strictly necessary. Should a cell phone placed on a bedside table emit regular bursts of RFR throughout the night? What is proposed here is that cell phone software be modified so that handshakes with the tower only occur when the cell phone has changed position, reducing radiation exposure and battery drain. Such a change will not prevent the user from receiving a call, as the cell tower will route any incoming calls to the last-known location for the cell phone.

To achieve power savings, most computing devices go into a quiescent mode when a device is not used. Displays, memory units, and processors are placed in sleep mode when their function is not needed, and a similar approach is recommended for cell phones. Unless radiation is necessary, units should drift to radiation levels that are As Low as Reasonably Achievable (ALARA). To realize this goal, airplane mode should be the default for cell phones.

2.9.4. Limiting Call Durations

Beyond the two solutions above, cell phone resident software could limit radiation exposures by controlling cumulative dose, a product of effective radiated power and time. This makes sense since much of the evidence regarding cancer and RFR has used cumulative exposure to establish links. Even if the placement of the phone was allowed against the head, users' RFR exposure could be automatically controlled by a limit on phone call durations, particularly when base stations are remote. Applications are available to display exposures instantaneously, log them cumulatively, and even control transmissions in high-exposure areas [140].

3. Conclusions

Protection measures against wireless RFR exposures need considerable improvement due to the parochial positions adopted in the IEEE-ICNIRP risk assessments. The expanding modern needs for data communications are obviously best served by established optical fiber solutions [141,142] which, in contrast to wireless, offer complete confinement, energy efficiency, and privacy.

Engineering can contemplate many technically practical solutions aimed at reducing cell phone users' RFR exposures. Software-based solutions controlling RFR emissions, as well as hardware changes to antenna designs, should not be expensive to implement, and would only mildly influence the habits of cell phone users. Although these solutions are available, it seems that in many cases, the industry has either not implemented them, or, in some cases, has even fought exposure abatements by preventing public education about RFR exposures [143,144].

The charters of professional organizations in the world, including engineering, usually state that they place human safety above all other considerations.

We firmly believe that RFR exposures to living tissues should be avoided when possible and that RFR power absorbed by the user's body is wasted and harmful to health. In all likelihood, our recommendations for cell phone alterations would improve the lifespan of both humans and batteries.

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26 October 2023

To: [REDACTED]

cc: [REDACTED], Board Chair, Stonington Commons, 32 Water Street, Stonington, CT 06378
[REDACTED], Building Manager, Stonington Commons
[REDACTED], Stonington Commons

Re: Installation of Indoor RFR Transmitters indoors at Stonington Commons

This is to strongly urge that the transmitters that have been placed in the hallways in the Stonington Commons building where Ms. [REDACTED] lives be immediately removed. These transmitters are generating extraordinarily elevated electromagnetic fields – as high as $46,030 \mu\text{W}/\text{m}^2$ in the hallway on the 2nd floor. Levels in the lobby near the concierge desk when one of my colleagues, Dr. Martha Herbert, MD, visited your building on October 18, 2023 were even higher at over $79,000 \mu\text{W}/\text{m}^2$. These electromagnetic fields are elevated in multiple locations in the building, except within the shielded elevator. Electromagnetic fields of this intensity are known to cause cancer, reproductive harm to both men and women, neurological issues and to cause the syndrome of electro-hypersensitivity, including cognitive impairment, which can often be mistaken for aging.

I am a public health physician and have been involved in issues related to electromagnetic fields (EMFs) for several decades. I served as the Executive Secretary for the New York Powerline Project in the 1980s, a program of research that showed that children living in homes with elevated magnetic fields coming from powerlines suffered from an elevated risk of developing leukemia. I served as Director of the Wadsworth Laboratory of the New York State Department of Health, as well as Dean of the School of Public Health at the University at Albany/SUNY, where I am now Director of the Institute for Health and the Environment. I have edited two books on effects of EMFs ranging from low frequency fields to radiofrequency/microwave radiation or the kind emitted by WiFi routers, cell phones, neighborhood antennas, smart meters and wireless computer equipment. I served as the co-editor of the BioInitiative Report (Bioinitiative.org), a comprehensive review of the literature showing biological effects at non-thermal levels of exposure, much of which has since been published in the peer-reviewed journal, Pathophysiology. Also, I served on the President's Cancer Panel that examined radiation exposures as they relate to cancer risk, in 2009. A report from that testimony is attached. Thus, this is a subject which I know well and one on which I take a public health approach rooted in the fundamental principle of the need to protect against risk of disease, even when one may not have all the information that would be desirable.

Your building should understand there is clear and strong evidence that cell phone radiation increases the risk of brain cancer, tumors of the auditory nerve and cancer of the parotid gland, the salivary gland in the cheek by the ear. The WHO's International Agency for Research on Cancer has also classified the radiation from cell phones, wireless devices and infrastructure as a Class 2B "Possible Carcinogen"

(2011). The difference between a cell phone and a wireless transmitter is that while the cell phone is used only intermittently, and at higher power, wireless in an environment, or an industrial transmitter, is continuous, and transmitting even when not being used. In addition, wireless transmitters are indoors, where people may be very close by the radiation, which can be intolerable to sensitive people.

Furthermore, commercial routers and cellular transmitters, like those that have been placed in your building, operate at much higher wattage than consumer routers. They are designed to penetrate through material like cement, wood and brick, to handle dozens to hundreds of users, and to reach in to outdoor areas, so these industrial grade transmitters are of much greater concern for human health.

An additional consideration to appreciate is that it is not only the power of wireless radiation that causes biological dysregulation, but the frequencies, pulsing, amplitude and the quantity and kind of information being transmitted can have effects, as well. These 'non-thermal effects' have been shown in thousands of studies to be biologically active and may be more important than the effects from the power. Thus, while a transmitter may be in the ceiling, or not right next to a person, the known biological and health effects even at some distance, particularly the non-thermal ones, are still very much occurring and may lead to electrosensitivity symptoms, such as cognitive effects impairing attention and memory, decline in energy levels, cardiac irregularities, headaches, etc., and, importantly, to serious long-term health consequences from cumulative exposures.

Given what we do know at this point about the many risks I must as a public health physician advise minimizing these exposures as much as possible. Indications are that wireless technologies may turn out to be a public health issue comparable to tobacco, asbestos, DDT, PCBs, pesticides and lead paint, or possibly worse given the ubiquitous nature of the exposures. While unfortunately we must wait for federal regulation to catch up with the science, the prudent thing to do in the interim would be to exercise precaution at every opportunity, and to respond promptly to mitigate situations known to be causing health effects.

The syndrome of electro-hypersensitivity (EHS) does not occur in everyone, but among sensitive people it can be completely disabling. This list of symptoms occurring among sensitive individuals is listed below, taken from a report by Dr. Riina Bray, MD, Medical Director of the Environmental Health Clinic at the Women's College Hospital at the University of Toronto, Canada.

Symptoms Commonly Occurring Singularly or in Combination:

- Irritability, lack of appetite, memory problems, vertigo, visual, skin and vascular problems.¹⁵
- Tinnitus, sleep disorders (disrupted stage 4 sleep) and therefore mood and personality changes (anxiety, depression, irritability).¹⁶
- Headache, weakness, pressure in the head, racing or fluttering heart.¹⁷
- Dermatological: Itch, pain, edema, erythema, Morgellons disease secondary to transthyretin concentrations.¹⁸
- Neurasthenic and vegetative symptoms: fatigue, tiredness, concentration difficulties, dizziness, nausea, heart palpitations, and digestive disturbances.¹⁹
- Blurry vision
- Adrenalin surges.

Allowing residents of your building to be exposure to such elevated levels of electromagnetic fields is not only unwise, causing harm to residents, but also exposes owners to significant liability. It is in your own self-interest to immediately remove these transmitters.

Yours sincerely,

A handwritten signature in cursive script, reading "David O. Carpenter". The signature is written in dark ink and is positioned above the printed name and title.

David O. Carpenter, MD
Director, Institute for Health
and the Environment
University at Albany

Electromagnetic Fields and Cancer: The Cost of Doing Nothing

President's Cancer Panel January 27, 2009

David O. Carpenter, M.D.

*Director, Institute for Health and the Environment, University at Albany, and Professor of Environmental Health Sciences, School of Public Health University at Albany,
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Abstract. Everyone is exposed to electromagnetic fields (EMFs) from electricity (extremely low frequency, ELF), communication frequencies, and wireless devices (radiofrequency, RF). Concern of health hazards from EMFs has increased as the use of cell phones and other wireless devices has grown in all segments of society, especially among children. While there has been strong evidence for an association between leukemia and residential or occupational exposure to ELF EMFs for many years, the standards in existence are not sufficiently stringent to protect from an increased risk of cancer. For RF EMFs, standards are set at levels designed to avoid tissue heating, in spite of convincing evidence of adverse biological effects at intensities too low to cause significant heating. Recent studies demonstrate elevations in rates of brain cancer and acoustic neuroma only on the side of the head where individuals used their cell phone. Individuals who begin exposure at younger ages are more vulnerable. These data indicate that the existing standards for radiofrequency exposure are not adequate. While there are many unanswered questions, the cost of doing nothing will result in an increasing number of people, many of them young, developing cancer.

INTRODUCTION

It has been known for many years that high frequency EMFs (X-rays, gamma rays, cosmic rays) have sufficient energy to directly break chemical bonds, causing damage to molecules ranging from water to DNA, leading to increased risk of cancer and birth defects /1/. Thus these forms of EMF are "ionizing". There is less consensus as to whether lower energy forms of EMFs, such as radiofrequency and ELF, can cause disease. In spite of strong documentation that exposure to non-ionizing EMFs is associated with an elevated risk of cancer, most national and international bodies have discounted this evidence, based on the belief that lower energy EMFs cannot possibly have adverse biological effects. This particular point of view is held by many in the physics and engineering communities, individuals not known for their

knowledge of biology or medicine /2/. There are legitimate concerns as to what mechanisms might explain the association between exposure and cancer. The purpose of this presentation is to provide an overview of the issues, explore both the associations between exposure and disease and the mechanisms that might explain them, and to propose biologically-based standards of exposure which, although difficult to achieve, would be more protective of human health. While there are a variety of diseases of possible concern, this review will focus on only cancer.

HEALTH EFFECTS OF ELF EMFS

There has been evidence that residential exposure to elevated magnetic fields results in an increased risk for childhood leukemia since the pioneering 1979 studies of Wertheimer and Leeper

/3/. Most subsequent studies have confirmed elevated risks of leukemia /4/, and several meta-analyses have shown significantly elevated odds ratios (ORs) whether exposure was determined through use of wire codes or measured magnetic fields /5/. In addition there is evidence that leukemia is elevated in adults employed in occupations that involve elevated exposure to EMFs from electricity /6/. Meta-analyses of occupational exposure have also reported elevated risks for leukemia, with less strong evidence for associations with other kinds of cancer /7/. A meta-analysis has also reported a significant elevation in rates of brain cancer among adults working in "electrical" occupations /8/. Thus the association between ELF exposure and cancer, especially leukemia, is very well documented in both children and adults and has been replicated in multiple investigations.

HUMAN DISEASE FROM EXPOSURE TO RF EMFS

Until recently there has been relatively little attention to RF exposures and human health. Older studies have reported elevations in both leukemia and brain tumors among individuals with occupational exposures to RF (see www.bioinitiative.org for references), but the results were not very consistent across studies. Recent reports have found elevated rates of leukemia among children who live near AM radio transmitter sites /12/. This is the same cancer elevated with exposure to power-line frequency EMFs, suggesting that leukemia is the cancer most likely to show elevated risk with whole body exposure to EMFs of any frequency. With the advent of enormous increases in the use of cell phones, we now have a situation in which a very large segment of society is regularly exposed to high levels of RF. In addition, the whole population has increased exposure through the placement of cell phone towers,

wireless buildings and even wireless cities. The strongest evidence for hazards has come from Europe, especially Scandinavia, where cell phones were initially manufactured and have been in wide use for a longer period of time than in other parts of the world. Long-term use of a cell phone is associated with an elevated risk of ipsilateral brain tumors and acoustic neuromas. A meta-analysis by Hardell et al. /13/, based on four studies, reported an OR of 2.0 (95% CL = 1.2-3.4) for glioma among adults who have used a cell phone for ten years or more, but only on the side of the head where the phone was used. There was also an OR of 2.4 (95% CL = 1.1-5.3) for acoustic neuroma among long-term users. Risks for meningioma were elevated, but not significantly so. Kundi /14/ has reported on 33 epidemiological studies, and finds that the combined ORs from these studies show an OR of 1.5 (95% CL = 1.2-1.8) for glioma. There was also a non-significant elevation in ORs for acoustic neuroma but no relationship with meningioma. Hopefully, additional information will come from the pooled results of the INTERPHONE study, a 13-nation investigation coordinated by the World Health Organization (WHO), which should be available in the near future. The Israeli component of this study has also found an elevated risk of ipsilateral parotid gland cancer with long-term cell phone use /15/. There is reason for particular concern about risks to children exposed to RF. Hardell et al. /16/ studied relative risk based on the age when a person began to use a cell phone. For use of either analog or cordless phones when assessed at >1 or >5 year latency, he found that individuals whose use began while they were in their 20s has higher ORs for brain cancer than those whose use began use at an older age. Later Hardell reported at a meeting in London last September that children who began use of a cell phone prior to the age of 20 had an OR of developing glioma of 5.2 (95% CL = 2.2-12) after only one+ year of cell phone use, while for all ages the OR was 1.4 (95% CL = 1.1-1.7).

The same relative relationship was seen with use of a cordless phone, where use before the age of 20 years gave an OR of 4.4 (95% CL = 1.9-10), whereas for all ages the OR was 1.4 (95% CL = 1.1-1.8). These studies support the conclusion that use of cordless phones also increases risk, and that children are more vulnerable to risk of brain cancer than adults. The elevated risk to children poses a major concern given the current extensive use of cell phones by even young children.

WHY HAVE THESE RESULTS NOT BEEN REFLECTED IN NEW STANDARDS OF EXPOSURE?

In spite of this consistency in observations relating to ELF EMFs and leukemia, and the developing evidence for a relationship between cell phone use and elevated risk of brain cancer and acoustic neuroma, there has been a general failure of governments and international advisory bodies to accept the reported relationships as being cause and effect, and to follow through with standards designed to reduce exposure. This is a consequence of two major scientific problems, public support of wireless technologies and the political power of the industry. No single mechanism has been identified to be the basis for the development of cancer following exposure to EMFs. In addition, animal studies have not consistently demonstrated cancer as a result of exposure to ELF EMFs. This dilemma is captured well by a statement from the 2007 WHO report /17/: *"Resolving the conflict between epidemiological data (which show an association between ELF magnetic field exposure and an increased risk of childhood leukemia) and experimental and mechanistic data (which do not support this association) is the highest research priority in this field."* The central question in this issue is whether the statement that the experimental and mechanistic data "do not support this association" is correct. There is the widespread

but mistaken belief that all carcinogens act by causing direct DNA damage, as is the case with ionizing radiation. However, many proven human carcinogens do not cause direct DNA damage. These agents are identified as "non-mutagenic carcinogens" by the US Environmental Protection Agency and include such well-documented carcinogens as arsenic /18/ and dioxin /19/. Exact mechanisms are not known to explain the carcinogenicity of either. Thus the fact that ELF and RF EMFs are "non-ionizing" does not mean they are not carcinogens. Both ELF and RF EMFs are known to induce genes /20/, generate reactive oxygen species /21/, trigger formation of heat shock proteins /20,22/ and cause indirect DNA damage /21,23/, any one of which might lead to cancer (see www.bioinitiative.org for additional references and detailed discussion). Thus the argument that mechanistic data does not support a relationship between EMF exposure and cancer is simply wrong. The other argument for discounting the human health information is that animal models have not consistently demonstrated cancer as an outcome. While this is the case for most rodent laboratory studies, Reif et al. /24/ have demonstrated that dogs living in homes with very high wire codes (comparable to those associated with elevated risk of childhood cancer) showed a significant 6.8-fold elevated risk of developing lymphoma. EMFs differ significantly from chemical carcinogens, and it is not clear exactly what field parameters would be comparable to those levels resulting in cancer in humans. It is important to note that the US Supreme Court in the case of Daubert vs. Merrell Dow Pharmaceuticals /25/ effectively ruled that animal studies were not relevant to human health, and that the only admissible evidence must be from human studies. While this is certainly not a justifiable conclusion, in the case of EMFs we have strong evidence for a relationship between exposure and cancer in humans, but much weaker evidence from animal studies. For all of the above reasons lack of strong

evidence for cancer in animals is not a sufficient reason to disregard that strong evidence for a relationship between both ELF and RF exposure and cancer in humans.

PROPOSED EMF STANDARDS THAT ARE BASED ON STUDIES OF HUMAN HEALTH AFTER EXPOSURE

The Bioinitiative Report (www.bioinitiative.org) presents recommendations for standards of EMF exposure that are based on the epidemiological evidence in human populations. For ELF EMFs the proposed standard is 1 mG (0.1 μ T), to be compared with the current International Commission on Non-ionizing Radiation Protection standard of 1,000 mG (100 μ T). For RF radiation the proposed standard is 0.1 μ W/cm², to be compared with the US Federal Communications Commission standard of 583 μ W/cm² for 875 MHz cell phone frequency, and 1,000 μ W/cm² in the frequency range of 1,800-1,950 MHz. The differences between these numbers show the magnitude of the problem. There is no question that a sudden imposition of standards so drastically different from those existing would impose hardship. However, there is also no question that the human studies clearly indicate that the existing standards are not protective of human health. The benefits to society derived from electricity and wireless communications are significant, and certainly none of us is willing to return to the pre-electric age. However it is imperative that society at least acknowledge the disparities between current standards and current evidence of risk of cancer. Rigid and sudden imposition of the standards we propose is unrealistic, but these levels are appropriate goals that could at least be approached by a combination of development of new technology and changes in behaviors.

THE COSTS OF BEING WRONG

At present we do not know precisely to what degree the risk of cancer is increased by exposure to EMFs. Human studies are difficult under any circumstances, but those difficulties are even greater when studying the effects of EMFs. Levels of exposure for each of us vary over the course of every day as we move through our environment and use appliances, cell phones and other wireless devices. This makes exposure assessment extremely difficult. Given the long latency for development of cancer, one would expect that the actual risk of EMF-induced cancer is significantly greater than that indicated by studies with inadequate exposure assessment. There is considerable evidence that children are more vulnerable to many environmental insults than are adults /26/. The reality is that children are using cell phones at increasing rates and for long durations. Therefore, if the risks are real, and especially if children are more susceptible, we may be facing an epidemic of brain and other cancers. The concern is increased because to date, there has been little warning advising restrictions on use of cell phones, especially by children. While questions regarding mechanisms are not all answered, the evidence for a relationship between EMF exposure and cancer is sufficiently strong so as to demand action. The alternative may be significant increases in certain cancers, especially leukemia and brain cancer. It is not clear whether there is increased risk of other kinds of cancer following exposure because there has not been a study of, for example, the health hazards of wearing a cell phone on your belt and pelvic cancers. Fortunately, the rates of leukemia and brain cancer are not high, at least not at present.

There have recently been significant improvements in treatment of leukemia, especially among children. Kundi /14/ has hypothesized that use of cell phones may increase the rates of brain cancer by as much as 50%. Even if this is true, this

certainly does not mean that every exposed person will develop brain cancer. However an increase in brain cancer of 50% would still have a significant impact, not only on the individuals affected but also on society, especially given that much of this increase is likely to occur among young people. It is not appropriate to deny the well-documented relationship between EMF exposure and cancer only because the mechanistic details are uncertain. The evidence that we have at present is too convincing to be ignored. Our national and international standards are obsolete, and ignore evidence reported by many different investigators. The lack of certainty with regard to mechanisms and animal models is no reason to ignore studies of human health.

We need the electric and communications industries to be proactive in developing products that can be used with reduced exposures. We need governments and international organizations to set standards that are based on the evidence of hazard, not on a hypothesis that is not credible based on the evidence from animal, cellular and human studies. Most importantly, we need individuals to understand that personal decisions will significantly impact the level to which they are exposed to both ELF and RF EMFs.

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October 26, 2023

To: [REDACTED]

cc: [REDACTED] Board Chair, Stonington Commons
[REDACTED] Building Manager, Stonington Commons
[REDACTED], Stonington Commons

Re: Decision to install wireless transmitters in your building

We write you regarding the installation of wireless transmitters in your building. Safety is not assured even if a network is compliant with government guidelines. U.S. FCC guidelines for public exposures to wireless radiation were designed to address acute heating effects from short term exposures, not the biological and health effects from long term daily exposures people receive in buildings with wireless transmitters, nor the cumulative effects experienced over time.

On August 13, 2021, the United States Court of Appeals for the District of Columbia Circuit ruled in our case against the FCC that the decision by the Federal Communications Commission (FCC) not to update its 1996 safety guidelines for human exposure to wireless radiation was "arbitrary and capricious." One of the most important aspects of the court decision was that the court found the FCC did not adequately explain why it ignored scientific evidence on impacts from long term wireless radiation exposure, and especially in regards to children, who the American Academy of Pediatrics states are more vulnerable to wireless radiation. The court ordered the FCC to re-examine the record evidence regarding long term exposure. So far, the FCC has not responded. Thus, this landmark court ruling highlights how FCC regulations are outdated and do not rest on an up to date science review. No federal health agency has reviewed the full body of current research to ensure current safety standards are protective.

Extensive published scientific evidence indicates that radiofrequency radiation *at levels far below FCC guidelines* can cause cancer, increased oxidative stress, genetic damage, structural and functional changes of the reproductive system, memory deficits, behavioral problems, headaches and neurological impacts. We consider radiofrequency radiation (RFR) to be a human carcinogen based on the current body of evidence.

The exposure guidelines of the US Federal Communications Commission are totally outdated and do not protect the health of the public, especially not the health of children nor the medically vulnerable, which includes elderly persons. Children are more vulnerable to RF radiation, just as they are to other environmental exposures. Even very low exposures to children can have serious impacts later in life because their nervous and immune systems are rapidly developing. Children absorb higher levels of RF radiation deeper into their brains and bodies because they have thinner skulls, a higher water content in

their tissues. Children will have a longer lifetime of higher exposures, compared to adults today. Children living in or visiting your building at Stonington Commons, and pregnancy women carrying a child, are at special risk.

The American Academy of Pediatrics states:

“In recent years, concern has increased about exposure to radio frequency (RF) electromagnetic radiation emitted from cell phones and phone station antennas. An Egyptian study confirmed concerns that living nearby mobile phone base stations increased the risk for developing:

- Headaches
- Memory problems
- Dizziness
- Depression
- Sleep problems

Short-term exposure to these fields in experimental studies have not always shown negative effects, but this does not rule out cumulative damage from these fields, so larger studies over longer periods are needed to help understand who is at risk. In large studies, an association has been observed between symptoms and exposure to these fields in the everyday environment.”

We recommend policies to reduce human exposure to RFR. We strongly recommend against installing cell towers, wireless antenna base stations and inside building wireless networks/transmitters within residential buildings, or near schools, daycares, parks, homes, hospitals or other places where children, elderly or people with preexisting health challenges live or visit.

Recent research on people living near cell antennas has found increases in molecular markers in the blood that predict cancer. This study evaluated effects in the human blood of individuals living near mobile phone base stations (for study purposes, they chose a distance of 80 meters) compared with healthy controls living more than 300 meters from a base station. The study measured higher RFR levels in the homes of people living in homes within 80 meters from the cell antennas (documenting the impact of increased RFR radiation from the antenna installations) and found statistically significant differences in their blood. The group living closer to the antennas had statistically significant higher frequency of micronuclei and a rise in lipid peroxidation in their blood; these changes are considered biomarkers predictive of cancer (Zothansiana et al. 2017).

A key publication in the industry journal *Building and Environment* entitled “Building Science and Radiofrequency Radiation: What Makes Smart and Healthy Buildings”(Clegg et al. 2019) details best practices in buildings which includes installing wired technology instead of Wi-Fi and other wireless networks. We have attached this publication as it also documents the extensive research confirming serious safety risks from overexposure to wireless radiation.

A review paper entitled “Limiting liability with positioning to minimize negative health effects of cellular phone towers” reviewed the “large and growing body of evidence that human exposure to RFR from cellular phone base stations causes negative health effects.” The authors recommend restricting antennas

near homes and within 500 meters of schools and hospitals to protect companies from future liability (Pearce 2020). In buildings, wireless transmitters increase exposure to cellular radiation levels.

Please note the following scientific publications regarding cell towers and cell phone radiation:

- European Parliament requested a research report “Health Impact of 5G” which was released in July 2021 and concluded that commonly used RFR frequencies (450 to 6000 MHz) are probably carcinogenic for humans and clearly affect male fertility with possible adverse effects on the development of embryos, fetuses and newborns.
- A review entitled “Evidence for a health risk by RF on humans living around mobile phone base stations: From radiofrequency sickness to cancer” reviewed the existing scientific literature and found radiofrequency sickness, cancer and changes in biochemical parameters (Balmori 2022).
- The U.S. National Toxicology Program \$25 million animal study on long-term exposure to radiofrequency radiation found DNA Damage, heart damage, increased brain tumors, and increased heart tumors deemed “clear evidence of cancer.” Importantly, this study was launched almost two decades ago by the FDA because the US government had not performed research on the long-term effects of RFR exposure and the FDA wanted data on long-term safety.
- Also note, in 1996, the EPA was defunded on the brink of developing proper safety standards, and since then there has been no systematic review of the science by any U.S. agency.
- Researchers with the renowned Ramazzini Institute in Italy published findings that lab animals exposed to levels of RFR (below FCC limits) set to mimic cell tower exposures developed the same types of cancerous cancers as the US National Toxicology Program found in their large-scale animal study.
- In 2011, radiofrequency radiation was classified as a Class 2B possible carcinogen by the World Health Organization’s International Agency for Research on Cancer. This classification applies to RF regardless of the source. Between 2011 and today, the published peer-reviewed scientific evidence has significantly increased. Now, many scientists are of the opinion that the weight of current peer-reviewed evidence supports the conclusion that radiofrequency radiation should be regarded as a human carcinogen (Hardell and Carlberg 2017, Peleg et al. 2018, Miller et al 2018).
- Oxidative stress is considered to play a key role in the development of numerous diseases and health issues as it can damage cells, proteins, and DNA. A 2015 review found that in 93 out of 100 studies, RFR exposure caused oxidative stress (Yakymenko 2015). A 2021 review again confirmed non ionizing radiation has oxidative effects (Schuermann 2021). Many well-known causes of cancer in humans (such as asbestos and arsenic) are understood to also induce oxidative stress.

- Studies also show that when combined with lead or a known carcinogen, RFR has magnified the carcinogen's effects. For example, RFR at levels far below FCC limits more than doubled the numbers of liver and lung tumors in carcinogen-exposed mice ([Lerchl 2015](#)).
- 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](#)). Examples of other effects linked to cell towers in research studies include [neuropsychiatric problems](#), [elevated diabetes](#), [headaches](#), [sleep problems](#), and [genetic damage](#). 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](#)).
- The [International EMF Scientist Appeal](#) was submitted to the United Nations urging immediate protective policy action in light of the scientific evidence that has found adverse biological effects from electromagnetic radiation, including radiofrequency radiation, and, as of January 2019, this Appeal is signed by 247 scientists from 42 nations; these are scientists who have published peer-reviewed articles about electromagnetic fields. They state, "numerous recent scientific publications have shown that EMF affects living organisms at levels well below most international and national guidelines. Effects include increased cancer risk, cellular stress, increase in harmful free radicals, genetic damages, structural and functional changes of the reproductive system, learning and memory deficits, neurological disorders, and negative impacts on general well-being."

The installation of wireless transmitters inside buildings will increase daily Radiofrequency radiation exposures to people living and working in the building. The scientific evidence indicates that increasing exposures will increase health risks, especially in the long term.

EHT's position is that radiofrequency wireless exposures to the public should be reduced to as low as possible in order to protect health. We strongly advise you to remove the transmitters from the Stonington Commons building immediately to protect the vulnerable already experiencing symptoms, and that you investigate options to achieve cell coverage for your residents in the safest ways possible.

Please feel free to contact us with any questions.

Sincerely,

Devra Davis, PhD, MPH
 President and Founder, Environmental Health Trust
 Visiting Professor, Hebrew University Hadassah Medical Center
<https://ehtrust.org>

Anthony B. Miller, MD
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November 15, 2023

Dear [REDACTED],

You asked that I send you the letter I produced related to SB649. It was not intended to be made public, but since it is now in the public domain, I am happy to share it.

Warm regards,

A handwritten signature in cursive script, appearing to read "BeaT BG", followed by a horizontal line.

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September 18, 2017

Dear Governor Brown,

I urge in the strongest terms that you veto California SB 649. If you sign this bill, many people will suffer greatly, and needlessly, as a direct result. This sounds like hyperbole. It is not.

My research group at UC San Diego alone has received hundreds of communications from people who have developed serious health problems from electromagnetic radiation, following introduction of new technologies. Others with whom I am in communication, have independently received hundreds of similar reports. Most likely these are a tip of an iceberg of tens or perhaps hundreds of thousands of affected person. As each new technology leading to further exposure to electromagnetic radiation is introduced – and particularly introduced in a fashion that prevents vulnerable individuals from avoiding it – a new group become sensitized to health effects. This is particularly true for pulsed signals in the radiowave and microwave portion of the spectrum, the type for which the proposed bill SB 649 will bypass local control.

Mechanisms by which health effects are exerted have been shown to include oxidative stress (the type of injury against which antioxidants protect, see optional section below), damage to mitochondria (the energy producing parts of cells), damage to cell membranes^{1, 21}, and via these mechanisms, an impaired “blood brain barrier”³⁻⁵ (the blood brain barrier defends the brain against introduction of foreign substances and toxins; additionally, disruption can lead to brain edema⁶), constriction of blood vessels and impaired blood flow to the brain⁷, and triggering of autoimmune reactions^{8, 9}. Following a large exposure, that depresses antioxidant defenses, magnifying vulnerability to future exposures, some persons no longer tolerate many other forms and intensities of electromagnetic radiation that previously caused them no problem, and that currently cause others no problem. But this group deserves – nay needs -- the right to be able to avoid these exposures.

Affected individuals not only experience “symptoms” that “merely” cause them distress and suffering, when they are exposed – symptoms like headaches^{10, 11}, ringing ears^{10, 11} and chest pain¹⁰ from impaired blood flow, heart rhythm abnormalities^{10, 11}, and inability to sleep^{10, 11}. These symptoms arise from physiological injury. Moreover, **many experience significant health problems that can include seizures¹¹, heart failure, hearing loss¹²⁻¹⁴ and severe cognitive impairment^{11, 15}**. The mechanisms involved are those also involved in development and progression of neurodegenerative conditions including Alzheimer’s disease¹⁶.



Fully half who were employed when their problems developed lost their job because of the problem, among participants of a survey we conducted. They reported that their condition had cost them up to 2 million dollars to date. Many had lost their homes. A number became homeless, and have swelled the ranks of so-called "EMF refugees"¹⁷⁻¹⁹. Among those affected, many were previously high functioning individuals – engineers, doctors, lawyers. The best and the brightest are among those whose lives – and ability to contribute to society – will be destroyed. High profile individuals with acknowledged electrohypersensitivity include, for instance, Gro Harlem Brundtland – the former 3-time Prime Minister of Norway and former Director General of the World Health Organization²⁰; Matti Niemela, former Nokia Technology chief²¹; as well as the wife of Frank Clegg²², who formerly headed Microsoft Canada and is current head of Canadians for Safe Technology²³.

Each new roll-out of electromagnetic technology for which exposure is obligatory, swells the ranks of those who develop problems with electromagnetic fields (EMF). - particularly following a significant exposure to pulsed radiowave-microwave radiation, and particularly when people have no ability to avoid it.

Many state that they didn't give credence to the problem (if they had heard of it at all) **until they themselves fell prey to it.**

This is not a psychologically driven condition. Multiple objective physiological changes reflecting mechanisms of injury have been shown in persons with this condition^{24, 25}.

The role for oxidative stress, that has been shown in innumerable studies (below), is affirmed by evidence of a link of this condition to genetic variants in antioxidant defenses, that are less avid in defending against oxidative stress³⁰⁷. People cannot manipulate their genes, to produce such an outcome by suggestibility.

An analysis by a University of Washington researcher showed that most studies funded by industry reported failure to show physiological effects. However, most studies without such industry bias affirmed effects. This is redolent of findings shown in medicine²⁶, regarding which the former editor in chief of the BMJ (the British Medical Journal), Richard Smith, noted, based on findings of a study, "This {result} suggests that, far from conflict of interest being unimportant in the objective and pure world of science where method and the quality of data is everything, it is the main factor determining the result of studies."²⁷. So where articles deny injury from nonionizing radiowave-microwave radiation, there is commonly a stake aligned with financial benefit from such denial.

Those who are affected are in desperate need of protection by our elected officials. They need creation of safe spaces and housing, and roadways to allow travel, not removal of any prospect of one; protection of local rights to make decisions - **not removal of any recourse or ability to avoid what injures them.** They are far more strongly in need of protections than a great many protected classes – their problems arose due to actions of others, against which they were given no control – *and can be reversed*, in most cases, if the assault on them is rolled back. Through no fault of their own, and in some cases against their will (e.g. before opt out was permitted with smart meters), they were subjected to an



exposure that has altered their lives as they knew them, and forced them – needlessly - to the margins of society.

Let our focus be on safer, wired and well shielded technology – not more wireless.

This legislation, if passed, and the resulting unrestricted roll-out of this technology, will predictably and directly injure and disable a new group, and add depth of suffering to those already affected.

In other spheres we abridge freedoms to protect the vulnerable few. We require that every schoolchild be vaccinated, supposedly to protect the vulnerable few who may not respond effectively to a vaccine. The need to protect the vulnerable group is deemed to be so great that it justifies the decision to abridge individual rights.

In contrast, this bill seeks to abridge individual freedoms, and local rights, in the service of harming a vulnerable group, and creating a new one.

(The common factor appears to be that in both cases, the direction is aligned with a powerful industry that influences political decisions.) Luckily, no abridgment of individual rights and freedoms is required to protect here.

If any group can opt out (such as, I understand, firefighters*)²⁸; **then every group deserves that equal right.** Others should not be second class citizens, subject to fewer protections.

It would go far to helping this cause if anyone complicit in promoting or passing the legislation (and then after that, *their* families) were required to be the first subjected, for a substantial test period, to the *greatest* amount of exposure that anyone *else* (and their families) may be subjected to, when new policies of this type are rolled out. It will still not do them equal damage; because they may not represent the vulnerabilities that others will have; but such a policy might help them to think twice. *That* is a bill I would strongly endorse.

Most who are now affected – were not, until they were. This may become you – or your child or grandchild. Moreover, if you have a child, or a grandchild, his sperm, or her eggs (all of which she will already have by the time she is a fetus in utero), will be affected by the oxidative stress damage created by the electromagnetic radiation, in a fashion that may affect your future generations irreparably.

It was noted above that, among survey completers, fully half of those who were employed at the time they developed electrosensitivity, lost employment *due to* this problem. (This may understate the scope of the tragedy, since this most-affected group may be least likely to be able to respond to an online survey.) **Many who previously had no problem navigating in the world are now restricted from access to basic services** like hospital care, post offices and libraries because of these problems. With each new introduction of technology that exposes many to yet a new nondiscretionary source of electromagnetic radiation, particularly (but not exclusively) that which emits pulsed radiation in the radiowave-microwave part of the spectrum, a new group of people are affected; and the suffering of those who are already affected increases greatly.



Please, defend the public and our future. Protect the rights of the individual and the locality, against a form of incursion that will lead to serious harm to some – and set a terrible precedent. **Please veto SB 649.**

Sincerely,

Beatrice Alexandra Golomb, MD, PhD
Professor of Medicine
UC San Diego School of Medicine

*Comment on the fire fighter exemption: “The legislature granted an exemption from SB 649 to the firefighters who requested it for health reasons. Throughout California firefighters have long complained of often disabling symptoms from cell towers on their stations. Cities frequently rent out space on fire stations to add to city revenue. ...Symptoms experienced by the firefighters have included neurological impairment including severe headache, confusion, inability to focus, lethargy, inability to sleep, and inability to wake up for 911 emergency calls. Firefighters have reported getting lost on 911 calls in the same community they grew up in, and one veteran medic forgot where he was in the midst of basic CPR on a cardiac victim and couldn’t recall how to start the procedure over again...Prior to the installation of the tower on his station, this medic had not made a single mistake in 20 years. A pilot study (2004) of California firefighters showed brain abnormalities, cognitive impairment, delayed reaction time, and lack of impulse control in all 6 firefighters tested (<https://ecfsapi.fcc.gov/file/7022117660.pdf>). This study led to the overwhelming passage of Resolution 15 by the International Association of Firefighters in Boston in August 2004. Res. 15 called for further study and was amended to impose a moratorium on the placement of cell towers on fire stations throughout the US and Canada.”^{15 28}
Clearly, others who experience similar problems also deserve protections.

Optional – More on the Science

There is a robust literature showing that electromagnetic radiation, including in nonionizing frequencies, and at levels^{29, 30} below those that are cause thermal effects (heating) – causes physiological effects, injury, and cell death –not only in humans but many animals and plants^{3, 7, 31-49}. Unsurprisingly, industry has sought – against the tide of evidence to the contrary - to maintain that radiation must be ionizing or heating to cause injury.

Scores or hundreds of studies show that radiation, including specifically radiowave-microwave spectrum radiation, and including low-level exposure, can impair antioxidant defenses, increase “oxidative stress” (free radical injury) and damage mitochondria, the energy producing parts of cells^{1, 2, 34, 50-6930, 70-104105-13646, 137-171}. These effects occur with ionizing and nonionizing radiation, at thermal and subthermal levels. (Indeed, much or most of the damage by ionizing radiation, and radiation above the thermal limit, occurs by mechanisms also documented to occur without ionization, and below the thermal limit.) These



mechanisms cohere with the mechanisms documented to play a role in symptoms and health conditions that are reported in those who are electrosensitive – extending to seizures¹⁷²⁻¹⁷⁶, heart failure¹⁷⁷⁻¹⁸⁴ and cognitive decline^{5, 32, 57, 108, 185-195}.

These mechanisms have known involvement in induction of brain cancer, metabolic diseases like obesity and diabetes, autism, autoimmune disease, and neurodegenerative conditions, conditions that have exploded. In each case these have been linked, or presumptively linked, in some studies to electromagnetic radiation^{8, 9, 16, 34, 196-219}.

Such radiation also has effects on sperm^{33, 100, 220-228}; and the DNA of sperm²²⁹ (consistent with recent news reports of marked recent declines in sperm counts and function)..

Such radiation also has toxic effects in pregnancy²³⁰, to the fetus and subsequent offspring²³¹⁻²³⁵ including at low levels²³⁶, and is tied to developmental problems in later life, including attention deficit and hyperactivity^{31, 235-241}. It is critical to defend pregnant women (and eggs of girls who may at a later time become pregnant) from exposures with such toxicity.

Electromagnetic radiation across much or most of the spectrum (not excluding visible light) has been shown to depress levels of melatonin^{40, 72, 242-252}, which is best known for its role in sleep (and indeed, impaired sleep is the most consistent symptom in affected individuals^{10, 11}).

Melatonin is in fact a critical antioxidant that defends the body against harm from many toxic exposures²⁵³⁻²⁶⁶ including electromagnetic radiation itself^{61, 66, 67, 82, 101, 107, 118, 121, 138, 144, 151, 204, 249, 267-284} - **reducing the oxidative stress** that is implicated in cancer, metabolic diseases like obesity and diabetes, autism, autoimmune disease, bipolar disorder and neurodegenerative conditions, and that also plays a role in heart attack and stroke^{9, 285-329, 330-343}.

Radiation, and specifically radiation in the radiowave-microwave portion of the spectrum can also depress levels of other critical antioxidant systems that also defend the body against chemical, radiation, and other sources of injury. These other antioxidant systems include the glutathione system, superoxide dismutase and catalase^{81, 102, 115, 116, 233, 344-358} - which are also involved in defending against health problems.

This suggests that depression of antioxidant defenses due to electromagnetic radiation may magnify risk of chemically induced health effects (and depression of antioxidant systems due to some chemicals may amplify risk of harm from electromagnetic radiation). Indeed just such effects have been reported^{359, 360}.



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Karl Maret, B.Sc., M.Eng., M.D. (Canada)

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October 28, 2023

To Whom it May Concern:

I have been asked to give my expert opinion on the current danger of wireless radiation in today's increasingly radio frequency and microwave radiation environment including sources from cell towers and antennas, WiFi and wireless transmitters, wireless devices in the home and office environment, cell phones and other cordless phones, and wireless smart meters. These wireless transmitters typically operate at present between 800 Megahertz (MHz) and 5 Gigahertz (GHz), with new devices now coming into use with the latest 5G technologies that are capable of operating between 2.4 and 95 GHz using very short wavelengths called millimeter waves.

I have given expert testimony regarding the dangers of this type of radio frequency radiation (RFR) based on my background as an electrical engineer, biomedical engineer and medical doctor who has completed also a post-doctoral fellowship in physiology and served as a Bioscience Officer in the Canadian Armed Forces. Details of my background can be found at the end of this letter.

Since the 1996 Telecommunications Act that established the U.S. nation-wide cellular communications network, there have been essentially no new health protection standards implemented to protect the general population despite massive research studies showing evidence of harm to the general population. Especially problematic is RFR that comes from transmitters close to the body as well as high powered transmitters from cell towers and antennas, microwave transmitters covering schools, housing projects and apartment complexes where the transmitters are often hidden in ceilings and walls. The Federal Communications Commission (FCC), which is charged with protecting the public, has exposure standards that are principally suitable for short-term exposure and only those that concern heating or thermal effects while ignoring any long-term exposure and non-thermal effects that are now the norm.

The widespread proliferation of this technology now in its 5th generation of development (5G), is viewed by hundreds of scientists throughout the world as hazardous to human welfare. The United States has one of the highest exposure guidelines in the developed world which is hundreds of times higher than permitted in other countries including China, Eastern European countries and Russia which have studied the long-term health effects of these RF radiations and chosen to protect their populations appropriately.

We have known of the adverse health effects for at least five decades with thousands of studies demonstrating an increased incidence of brain tumors (gliomas, acoustic neuromas, glioblastomas and pituitary tumors) in addition to thyroid and parotid gland tumors. Breast cancers have been demonstrated in young women exactly at the multiple antenna sites who

carried their cell phones inside their bras. The International Agency for Research on Cancer (IARC), a division of the World Health Organization (WHO), has classified electromagnetic radiation as a Class 2B possible carcinogen in 2011 based on numerous scientific studies.

It has been extensively shown that RFR causes oxidative stress in tissues which leads to increased inflammation, causes reproductive damage in both men and women, leads to altered hormone profiles including melatonin production in the brain leading to sleep disturbances. A large number of studies show single and double-stranded DNA breaks that can lead to the development of cancer from RFR damage. Additionally, RFR causes cellular stress responses, changes in gene expression and apoptosis (programmed cell death) leading to chronic degenerative conditions (including cancer and brain dysfunction).

A long-term study of neurodegenerative diseases and associated deaths in older men and women between 1989 and 2010 (published in 2015) showed a 3-fold increase in men and a greater than 5-fold increase in women during the early years of introduction of cell phones and cordless phones. There is a growing incidence of Parkinson's disease, major depressive disorders, Alzheimer's disease, chronic fatigue syndrome among some of the neurodegenerative disorders. We also know there are demonstrated direct effects of RFR on mitochondrial damage (leading cause of aging), effects on calcium channel signaling leading to cellular dysfunction, cell membrane leakage and cellular stress responses mediated by heat shock proteins.

The most concerning finding is that these adverse health effects take place without any direct tissue heating; specifically, these are non-thermal effects which are not considered in our current health protection guidelines as recommended by professional engineering groups like the IEEE which advise the FCC. As such, our regulatory agencies, that are meant to protect us, are failing at their mandate. The most vulnerable people are the aged and those members of the population that are considered to be electrically hypersensitive, estimated to be between 6 to 35% of the general population, many of whom are not even aware of their health challenges caused by long-term exposure to radio frequency radiation. When Senator Blumenthal in February 2019 asked the telecommunications industry to describe the safety studies done as 5G wireless radiation was being rolled out, they replied that no safety studies had been specifically carried out. To this he replied: "So, we are flying blind here on health and safety."

With this background, I recommend that all stakeholders in the general population be notified before further roll-outs of wireless technology take place in their immediate environment; and further, that the precautionary principle be applied. Only when there is an informed conditional acceptance from all those who are going to be exposed to new technology installations can we let the public be able to take responsibility for their health and welfare and hold the industry responsible for the safety of their technology.

Respectfully submitted,



Karl Maret,

B.SC.(EE), M.Eng (Biomedical Engineering), M.D. (Canada)

References available upon request

Background of the Author of this Letter

Karl Maret, MD was for 25 years the President of the Dove Health Alliance, a nonprofit foundation, focused on the creation and promotion of global research and education networks in Energy Medicine. Trained in both electrical and biomedical engineering before his medical studies in Canada, he also completed a 4-year post-doctoral research fellowship at the University of California San Diego, where he developed all the instrumentation for the successful American Medical Research Expedition to Mt. Everest in 1981. Dr. Maret practices complementary medical modalities including nutrition, functional medicine and energy medicine at the Dove Center for Integral Medicine. Early in his career he performed research on impacts of electromagnetic fields for the Canadian military. He is a former director of the International Society for the Study of Subtle Energy and Energy Medicine (ISSEEM) and currently serves on the ISSSEEM Wisdom Council. He has presented at many international conferences including annual presentations at the German Society for Energy and Informational Medicine, (DGEIM). He educates physician groups specifically on the biological impacts of communication technologies, such as cell phones, wireless technologies, 'smart meters' and antenna infrastructure. Dr. Maret has made many presentations on the dangers of wireless radiation technologies including to physicians in Phoenix in 2011 at the Healthy Medicine Academy's *Cancer Strategies Conference* entitled "**Electromagnetic Fields and Cancer**". A copy of his presentation is available by contacting Dr Maret.

Olle Johansson - November 6, 2023

To: [REDACTED]

Cc: [REDACTED] Board Chair, Stonington Commons, 32 Water Street, Stonington, CT 06378, USA

[REDACTED] Building Manager
[REDACTED]

The subject of my letter: New wireless transmitters in your building - the serious truth about potential risks from radiofrequency radiation emitted by wireless technologies needs to be urgently heeded to protect residents of your building from short-term acute effects and from long-term cumulative effects that possibly will be experienced by all.

My name is Dr. Olle Johansson, and I am a professor, retired from the world-famous Karolinska Institute and the equally famous Royal Institute of Technology, Stockholm, Sweden, both with their close associations to the Nobel Prizes in Physiology or Medicine, Chemistry and Physics, respectively.

I am contacting you because I understand your building, where my colleague Camilla Rees resides, and works, has recently installed wireless transmitters in the hallways and lobby without notice, causing her, very unfortunately, to have to base elsewhere since October 14, 2023 due to intolerable symptoms experienced on spending only one night in the building after the transmitters were turned on.

For many years, I have been studying the health effects of wireless devices and technologies, such as cell phones, WiFi, and general wireless infrastructure. My research decades ago was instrumental to determine the old CRT computer monitors were biologically harmful and that's why we switched them out for the less impactful flat-screen monitors. I also played a similar role in the protection of pregnant women in front of computers.

Wireless communication is now being implemented in our daily life in a very fast way. At the same time, it is becoming more and more obvious that exposure to electromagnetic fields may result in highly unwanted health effects. This has been demonstrated in a very large number of studies and includes cellular DNA damage (which may lead to the initiation of cancer as well as mutations that carry down generations), disruptions and alterations of cellular functions like increases in intracellular stimulatory pathways and calcium handling, disruption of tissue structures like the blood-brain barrier (which may allow toxins to enter the brain), impact on the vessel and immune functions, and loss of fertility. It should be noted that we are not the only species in jeopardy, practically all animals, plants, and bacteria may be at stake. For the latter, Taheri et al (2017) have demonstrated that the exposure to 900 MHz GSM mobile phone radiation and 2.4 GHz radiofrequency radiation emitted from common Wi-Fi routers made *Listeria monocytogenes* and *Escherichia coli* resistant to different antibiotics. To say this finding is "scary" is a classical English understatement.

Because the effects are reproducibly observed and links to pathology can not be excluded, the Precautionary Principle should be in force in the implementation of this new technology within the society. Therefore, policymakers immediately should strictly control exposure by defining biologically-based maximal exposure guidelines also taking into account long-term, non-thermal effects, and including especially vulnerable groups, such as the elderly, the ill, the genetically and/or immunologically challenged, children and fetuses, and persons with the

functional impairment electrohypersensitivity (which in Sweden is a fully recognized functional impairment, and therefore receives an annual governmental disability subsidy). Until revised exposure guidelines are developed, professional adults responsible for human lives in institutional or group settings, such as schools, offices, residential buildings, government buildings, hospitals, etc., should take heed of the large body of science showing serious risks and minimize these exposures at every opportunity by taking hard-wired approaches to internet connectivity. My firm advice is to not increase exposures, as has recently been done at Stonington Commons.

Science is providing ever more convincing evidence that the radiation emitted by our wireless telecommunications systems can affect biological systems including humans, wildlife, plants, and bacteria. These biological effects are acting even at very low exposure levels.

The consequences on health and the environment can be all the more serious because:

- exposure is ubiquitous, repeated and/or prolonged,
- radiation from wireless technologies is modulated, pulsed, polarized,
- some individuals may be more vulnerable (fetuses, children, sick patients, people with preexisting conditions), and/or the effects being much more prolonged (fetuses, children),
- exposure is combined with other pollutants, in our air, water, and food (e.g. chemical pollutants).

Damages on health and the environment are already noticeable at exposure levels similar to those at your building since the new transmitters were installed, but also at lower levels.

It is clearly not enough just to ensure exposure levels are below WHO recommended levels. WHO recommendations are designed to protect cells from excessive temperature increase successive to a single (!) maximal 30 minutes exposure to radiofrequency/microwave radiations. The bases for these recommendations were established in the late 1990s and have not been revised since then, even though:

- wireless technologies have developed very rapidly over the past 20 years,
- exposure pattern has completely changed (ubiquitous, repeated, prolonged exposure, exposure of children, fetuses, etc.)
- considerable scientific progress has been made in the identification of biological and health effects.

Not everyone agrees on the question of absolute proof of damage because a certain number of unknowns remain, even at the scientific level. But there is no point using the fact that not all the grey areas have yet been dispelled to assert that there would be no health and environmental effects caused by the widespread deployment of wireless devices and networks. This could even end badly from a legal point of view.

To date, we can no longer deny that thousands and thousands of studies indicate very real effects. The unbridled development of wireless systems is, in the more or less short term, conflicting with the health and protection of ecosystems. Observations and return on experience indicate that damages are already in action.

I would like to remind you that, in 2011, the World Health Organization classified the radiofrequency and microwave emissions of wireless technologies as possible carcinogens. However, cancer is only one of the long-term consequences of prolonged exposure. Radiofrequency radiation affects our cells long before cancer develops. Our body reacts with

oxidative stress and inflammatory processes. When the exposure is repeated or prolonged, these mechanisms are maintained and may cause sleep disorders, disturbances in cognitive and reproductive functions, damage to cells and DNA. In the long run, the body's defense systems are being exhausted and diseases are threatening:

- repeated infections,
- infertility,
- developmental disorders (e. g. embryonic),
- neurological and neuropsychiatric disorders,
- cardiovascular diseases,
- neurodegenerative diseases including Alzheimer's disease,
- cancers.

Fetuses, and children, are particularly affected because they may be more vulnerable, and/or the effects being much more prolonged. Also, they form the only basis for the future of mankind.

Every generation of wireless technology also swells the ranks of electrosensitive people who physically suffer from being exposed to electromagnetic radiations, whether or not they are aware of their electrosensitivity. Nocebo or psychological explanations are clearly not sufficient to explain the phenomenon.

Deploying 5G (the 5th Generation mobile telephony technologies) in addition to existing technologies, for sure, will increase exposures for all. But beyond the additional layer of electromagnetic pollution it will constitute, there is a strong suspicion that 5G, because of its highly artificial nature due to new and different technological specificities (frequencies, modulations, pulsations, narrowly focused and directional beams, densification of the antenna networks), will present even more serious health and environmental risks than existing technologies.

Engineers and the telecom industry readily argue that there is nothing to worry about because the high-frequency radiation of 5G will be absorbed mainly at the periphery of the body. This is based on the presumed skin characteristic that the higher the frequency of radiation, the shallower the depth of radiation penetration. In other words, most of the electromagnetic absorption (and heating) would occur over the first few millimeters of the body's surface. But from practical tests, no such shielding effect has ever been demonstrated pointing to that the penetration is, after all, total.

Concluding that there is no risk is, furthermore, forgetting that surface effects can be significant on external cells and tissues (skin, eyes for example), as well as on all blood cells which will pass the outer portion of the skin every five minutes. There are reasons to suspect that the deployment of 5G may be accompanied by an increase in the number of melanomas and other skin cancers and eye disorders.

But not only surface effects are of concern. There is also a strong suspicion that 5G radiation can have impacts far beyond the peripheral layers of the body. Living materials are not just homogeneous and inert conductive materials. It is a major mistake to omit the complexity of biological systems capable of responding to external electromagnetic stimuli otherwise than just through heating. Electromagnetic disturbances and chemical mediators (e.g. inflammatory mediators) can rapidly be spread throughout the body and induce biological (non-thermal)

effects deep into the body. Such disturbances will also have an ideal avenue of spread via the peripheral nerves, the latter being found as superficial as 20-40 μm from the outer surface.

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It is important to understand that, in fact, all living beings are electrosensitive! And given the extraordinary electromagnetic sensitivity of living systems, it is not a surprise that they can be affected even at lower exposure levels, especially if the exposure is ubiquitous and prolonged. And the exposure levels, as you know, are not "low" - compared to the natural background of such frequencies the man-made ones come at colossal, astronomical, biblical levels; for example, the 3G systems are allowed at a maximal exposure level that is 1,000,000,000,000,000 times the natural background!

All around the world dramatic reductions in pollinating insect populations are noted, for instance in Germany where more than 75% of them are just gone, Canada has lost more than 90% of their honey bees, and the USA more than 90% of their bumble bees. I am particularly concerned about this because I already have a number of papers in my files dealing with this angle; I have even recently written a short commentary based on them: Johansson O, "To bee, or not to bee, that is the five "G" question", Newsvoice.se 28/5, 2019, <https://newsvoice.se/2019/05/5g-question-olle-johansson/>. I also know that other areas around the world have reported similar huge bee colony collapses, and my strong efforts now are to seek ways to conserve, protect and enhance our pollinators, wherever they reside, and thus conserve, protect and enhance ourselves. If we do not engage, then we certainly may head towards a moment in history where future generations - if any - will ask us "*Why didn't you react and act?*"

You, and your building's Board, have an incredible opportunity to take a stand for your residents' health by reversing the decision to install transmitters in your building. Such a step, while preventing more people from becoming ill, and preventing cumulative biological effects, that possibly all could experience, would also preserve owner's equity, as real estate values are known to significantly decline in high electromagnetic field environments.

Remember, this issue is *not* about natural exposures, it is about adverse health and biological effects of *artificial* electromagnetic fields. It behooves all of us to understand this distinction and take steps to minimize biologically disregulating effects from *artificial* electromagnetic fields.

Thank you so much for your time and consideration. Please, do not hesitate to contact me if I can provide additional information, more complete scientific references, or present a lecture on the risks from wireless radiation to your Board and the condominium owners at Stonington Commons. I'd be very happy to support your further due diligence process on this matter.

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For further reading, see e.g.:

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Respectfully, Stockholm, November 6, 2023



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Martha R. Herbert, PhD, MD

TO: [REDACTED]
CC: [REDACTED], Board Chair, Stonington Commons
[REDACTED], Building Manager, Stonington Commons
[REDACTED], Stonington Commons
FROM: Martha R. Herbert, Ph.D., M.D.
Board-Certified Neurologist and Child Neurologist
Founder and first director of the TRANSCEND Research Program,
Massachusetts General Hospital, Harvard Medical School
Executive Director, Higher Synthesis Foundation
DATE: October 31, 2023.
RE: Health hazards from emissions from recently installed transmitters in your
Stonington building

I am writing to share concerning information about the health hazards associated with the strong emissions from multiple wireless transmitters recently installed in your Stonington Commons building. I observed meter readings showing radiofrequency radiation emissions from the transmitters when I visited your building on October 18, 2023. I suspect that the decision to install these transmitters was made without knowledge of these health hazards. So, I will review these hazards in a simple, public-facing fashion.

As a board-certified neurologist and child neurologist with special expertise in environmental influences on brain and systemic health, I have been quite concerned about the rise of developmental and neurocognitive problems in both adults and children as well as the rise of other chronic illnesses including autoimmune disease. Over the past decade, after a decade and a half of looking at the impacts of chemical toxicities, I have been taking a particular interest in the impacts of electromagnetic fields and radiofrequency radiation (RFR) generated by newer communications technologies, including cellular and wireless technologies and infrastructure.

It is key to appreciate that while noxious chemicals need to work their way through our body systems to get to the nervous system, electromagnetic fields are directly speaking the language of the nervous system and the brain (electrical transmission and brain waves). But the man-made electromagnetic waves and fields are produced in wave-forms entirely new on our planet, using wave shapes such as square waves that are not found in nature, and to which no living organism is pre-adapted.

These exposures are transmitted through air and get through walls, windows and rooftops. Some people are more susceptible to adverse impacts than others (for combinations of health history, exposure history and genomic vulnerabilities). But the exposure is ongoing, the biological effects are cumulative, and over time continual exposure to radiofrequency radiation, also from multiple sources, can cause much wear and tear on anyone's biology.

Baseline exposures have increased by orders of magnitude in the past few decades, and the tech industry, quite irresponsibly, aims to increase them further – good for their profits but bad for everyone else and for life on earth. This despite global reports of people being harmed since the exponential growth of this industry beginning in the 1990s, decades of scientific evidence demonstrating risks of many kinds (including numerous studies from the U.S. governments own research), radiofrequency radiation classified as a Group 2B 'Possible Carcinogen' by the

WHO's International Agency for Research on Cancer in 2011, and the FCC's 27-year-old exposure guidelines presently being challenged in court by the D.C. Circuit Court of Appeals, which has instructed the FCC to explain to the court how it can justify its exposure guidelines given the evidence for risk submitted in the case. Please note that these instructions were given *two years ago* and yet to date the FCC has not complied with a response.

And also, antenna proliferation is continuing, despite the former Chairman of the FCC, Tom Wheeler (formerly President and CEO for twelve years of the CTIA, the wireless industry association) and a long-time advocate for wireless connectivity, more recently advocated to prioritize fiber-optic cable use rather than wireless, testifying to Congress that on technological grounds, "Wireless may be a last resort option in the most isolated areas, but it should not be a first resort for most of America. To prioritize symmetrical 1 gigabit capacity...is to prioritize a "fiber first" policy."

I co-authored a 40,000-word chapter in the 2012 update of the BioInitiative report¹, which was published in a condensed 30,000-word two-part review in the peer-reviewed journal *Pathophysiology*,^{2,3} that looked at the similarities between biological effects of EMF/RFR (electromagnetic fields/radiofrequency radiation) and physiological changes in children with autism (that largely overlap with changes seen other chronic illnesses). Below, I will present a brief summary (prepared for a lay audience, with citations at the end of this document) of the biological effects known to be occurring from EMF/RFR exposures that I reviewed more extensively in the publications:

- **EMF/RFR stresses cells.** It leads to cellular stress, such as production of heat shock proteins, even when the EMF/RFR isn't intense enough to cause measurable heat increase.⁴⁻⁶
- **EMF/RFR damages cell membranes**, and makes them leaky, which makes it hard for them to maintain important chemical and electrical differences between what is inside and outside the membrane. This degrades metabolism in many ways – makes it inefficient.⁷⁻¹⁵
- **EMF/RFR damages mitochondria.** Mitochondria are the energy factories of our cells. Mitochondria conduct their chemical reactions on their membranes. When those membranes get damaged, the mitochondria struggle to do their work and don't do it so well. Mitochondria can also be damaged through direct hits to steps in their chemical assembly line. When mitochondria get inefficient, so do we. This can hit our brains especially hard, since electrical communication and synapses in the brain require huge amounts of energy.
- **EMF/RFR creates "oxidative stress."** Oxidative stress is something that occurs when the system can't keep up with the stress caused by utilizing oxygen, which has greatly empowered life on earth, but which also generates damaging "free radicals," the price we pay oxygen's advantages. In the normal course of events, free radicals are generated, and then they are quickly "quenched" by antioxidants like we get in fresh fruits and vegetables. But when the antioxidants available can't keep up with new free radicals, such as those created as a result of EMF/RFR, the free radicals start damaging cells and DNA, pushing us toward disease.
- **EMF/RFR is genotoxic, and this damaging genetic change can transmit across generations.**, with a major mechanism being EMF/RFR-created free radicals which damage cell membranes, DNA, proteins, anything they touch. When free radicals

damage DNA they can cause mutations. This is one of the main ways that EMF/RFR is genotoxic – toxic to the genes, which impact our biological functioning today, as well as the biological functioning of our children and later generations.

- **EMF/RFR's genotoxicity can cause disease.** When DNA is damaged it can change the proteins for which DNA codes. When proteins are altered like this, they fold up in peculiar ways which can make them function very differently, and often harmfully. We are learning that diseases like Alzheimer's are related to the accumulation of "misfolded proteins," and the failure of the brain to clear out this biological trash from its tissues and fluids.
- **EMF/RFR** has been shown to be associated with cancer by a growing body of papers, enough that it may soon be recognized as a Class 1 Carcinogen.
- **EMF/RFR depletes glutathione**, which is the body's premier antioxidant and detoxification substance. So, on the one hand EMF/RFR creates damage that increases the need for antioxidants, and on the other hand they deplete those very antioxidants that the body needs for repair.^{1, 16}
- **EMF/RFR damages vital barriers in the body, particularly the blood-brain barrier**, which protects the brain from things in the blood that might hurt the brain. When the blood-brain barrier gets leaky, cells inside the brain can be damaged, or even die.^{1, 16, 17}
- **EMF/RFR can alter the function of calcium channels**, which are openings in the cell membranes that play a huge number of vital roles in brain and body. This can cause problems in the nervous system and other systems as well.¹⁸⁻²⁷
- **EMF/RFR degrades the rich, complex integration of brainwaves, and increase the "entropy" or disorganization of signals in the brain** – this means that brainwaves can become less synchronized or coordinated which makes the brain less efficient.²⁸⁻⁴⁰

You may ask, if these technologies are so hazardous, why do so many people believe they are safe and harmless? The answer has to do with several things, including:

- 1) The FCC exposure guidelines are out of date, having not been updated since 1996 (and originally were based only on very brief 30-minute exposures to rodents, whereas now exposures are often constant, 24/7 as well as multi-source). The guidelines don't take account of thousands of peer reviewed scientific papers showing health hazards at exposure levels far lower than what the FCC presently considers acceptable.
- 2) The regulatory agencies are "captured" by the industries they are supposed to control, with various members having unchallenged conflicts of interest and resultant unwillingness to challenge the industries.
- 3) The media receive massive advertising dollars from the telecommunications industry sources which leads them to keep to the narrative that benefits these industries.
- 4) Members of Congress receive substantial financial support from the telecommunications industry.

Gentlemen, I would strongly encourage you to heed the abundant science, not the claims of safety by the wireless industry. Please take to heart these concerns, and protect your building's residents by simply turning off the new transmitters in your building. A home is where a body needs to rest safely to repair wear and tear so as to maintain health and well-being. An electromagnetically clean environment is essential to support biology and health.

Unfortunately, the newly installed high-powered wireless transmitters throughout your building create serious 24/7 exposures not conducive to good health. People and staff may begin to experience sleep disruption, cognitive difficulties and worsening of preexisting neurological, autoimmune, and immunological disorders, which leads to depletion of resilience and increased vulnerability to serious chronic illnesses.

Moreover, since there are other and safer ways to increase the connectivity available to the building residents, such as fiber optic cable to each person's home, you really should do the right thing, so that each resident can have more control over their exposure, and the overall exposure is greatly reduced while still satisfying everyone's connectivity needs.

Sincerely,



Martha Herbert, PhD, MD
Board-Certified Neurologist and Child Neurologist
Founder and first director of the TRANSCEND Research Program, Massachusetts General Hospital, Harvard Medical School
Executive Director, Higher Synthesis Foundation

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F. Camilla R. G. Rees

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Declaration in Support of the Petition for Rulemaking to the Secretary of the U.S. Department of Health and Human Services (HHS) by Americans for Responsible Technology (ART) et al. under the Imminent Hazard Rules Requesting an Immediate Clarification of FDA Official Policy on RFR/EMF Safety.

November 16, 2021

My name is Camilla R. G. Rees and I reside at 32 Water Street, Stonington, CT 06378.

I have been significantly injured in four different settings from exposures to wireless radiation (RFR), twice in residential settings and twice in office environments, and mildly impacted in several other situations. It is because of these experiences that I have come to be a researcher, educator and consultant on the biological and health risks of wireless technologies, and an advocate for safer, technologically superior, hard-wired Internet access via fiber or cable. These experiences are also the reason why today I live in a low-density, non-urban, non-commercial environment to avoid the acute, chronic and cumulative effects of 24/7 Radio Frequency Radiation (RFR).

I conduct my work through the National Institute for Science, Law and Public Policy (NISLAPP) in Washington, D.C., where as a Senior Policy Advisor I have led its EMF Education and Advocacy Project for over a decade. In collaboration with many other pioneers in this field of education and advocacy, I have sought to raise awareness of the risks and alternatives to wireless technology. At NISLAPP, we have initiated, directed and overseen policy papers on electromagnetic fields, the smart grid and telecommunications, including the landmark papers, "Getting Smarter About the Smart Grid" and "Re-Inventing Wires: The Future of Landlines and Networks". "Re-Inventing Wires" explains, from technological and other perspectives, why hard-wired, fiber optics to the premises (FTTP) is superior to wireless Internet access networks and "antenna densification", and is clearly the safer alternative to 5G.

NISLAPP has organized dozens of programs on this subject around the country, including pioneering early programs on wireless risks to children, fiber alternatives to wireless, on the benefits of hard-wired utility meters over wireless, and on tech overuse and addiction, as well as presenting five programs featuring international experts on RFR risk at the largest public affairs forum in the U.S., the Commonwealth Club of California. Also, I authored "The Wireless Elephant in the Room" and co-authored, with Dr. Magda Havas of Trent University, Canada, "Public Health SOS: The Shadow Side of the Wireless Revolution".

For thirteen years, I have conducted in-depth interviews with leading international scientists on the biological and health risks of electromagnetic fields; was co-author of a published paper on wireless radiation's impact on the heart; and have created websites for the public, ElectromagneticHealth.org and Manhattan Neighbors for Safer Telecommunications, as well as a Facebook group aimed at parents, teachers and school administrators, focused on RFR risks to children, Campaign for Radiation Free Schools. We have also produced hundreds of videos featuring EMF experts, now circulating in 163 countries, including the International EMF Scientist Appeal to the United Nations (2015). I have been a long-time source for the media, and a source of support for new activist groups, physicians, major online

consumer health newsletters, government officials, schools, employers, lawyers, and for scientists themselves, since 2008. I also serve on the Advisory Board of the [Building Biology Institute](#), a leading educator of architects, builders and environmental consultants on environmental risks.

At the core of all of my work has been explaining: **1)** the inadequacy of the FCC's RFR thermal-only exposure guidelines to protect public health; **2)** that there has been no pre-market safety testing, or post-market surveillance, of health effects of wireless technologies and infrastructure; and **3)** that our government, including the FCC and FDA, has turned a blind eye to well-established RFR risks, and enabled harmful, RFR-emitting technologies to become pervasive throughout our lives, fueling growth of a trillion dollar, and now extremely powerful, industry that is making people sick.

In 2018, I was awarded the American Academy of Environmental Medicine's most prestigious award for outstanding contribution to Environmental Medicine, the [Jonathan Forman Award](#), and the "2018 Public Health Award" from the Global Foundation for Integrative Medicines.



Most recently, in collaboration with the New York 501(c)(3), Wired Broadband, Inc., and other groups, NISLAPP and Manhattan Neighbors for Safer Telecommunications are [opposing the 'Jumbo 5G Antennas'](#) being proposed for several neighborhoods in New York City. Massive radiating antennas (see photo at left) are being proposed for residential city streets, concentrated initially in 10 disadvantaged neighborhoods, and are being justified by the misleading claim that these antennas will close the 'digital divide' (which they will not).

Publicly available material on the proposed 'Jumbo' 5G antennas indicate there will be no more than one Jumbo 5G Antenna per block in these neighborhoods, but the materials also say any limitation (such as this) may be reversed by the New York City Commissioner in her sole discretion. No

detail has to date been provided about the power, frequencies, and other technical specifications of the 'Jumbo' antennas, except drawings showing that each pole will contain not one, but many radiating antennas on multiple tiers (see drawing on the right). Each antenna within the structure would, alone, pose a serious health risk to those nearby. There is no provision we know of for monitoring the RF emissions of these Jumbo 5G Antenna arrays, or for determining whether the aggregate exposures of the initial 4,000 antenna arrays planned for these disadvantaged neighborhoods would be in compliance with FCC guidelines. The proposed antennas present enormous health and environmental risks to New York City residents. It is frankly egregious that they are being clustered in disadvantaged areas, leading to the possibility these communities are being used as guinea pigs to test for the likely harms these new giant-sized antennas will cause to nearby residents.



As we often find, it appears City officials have been misled into believing FCC exposure guidelines are protective, and have also been told that the FCC exposure guidelines have the support of the FDA, despite the fact that the FDA does not formally evaluate RF-emitting telecom devices and infrastructure, like they do with medical devices. Repeatedly, government officials across the country, as well as employers, schools, churches and property owners, are believing these false claims, and thus ignorantly jeopardizing people's health from small and macro towers on their premises, when safer Internet access options exist and could have been chosen over the wireless options.

Local officials are being told new 5G antennas are 'faster' than older wireless antennas, but not told about the safer, higher performance, and far superior, hard-wired technology option, Fiber to the Premises (FTTP). Fiber to the premises will always be faster than any generation of wireless, as wireless communications is a shared medium used by many on-line users at once. This critical fact is not mentioned by champions of wireless in the interest of selling communities on an inferior technology that will rapidly become obsolete. Wireless is not enduring technology, like fiber, which is paid for once and that former FCC Chairman, Tom Wheeler calls 'future-proof'.

Local officials have likely also not been told about the full range of advantages fiber offers over wireless, beyond speed, each one of which is a compelling reason on its own to choose fiber over wireless. See chart below about the advantages of fiber over wireless.

'Fiber To The Premises' - Advantages Over Wireless

- | | |
|--|--|
| <ul style="list-style-type: none">• faster transmission speed• reliability of Internet access• neighborhood aesthetics• national cybersecurity• preserves human health from ambient radiation• neutrality of internet access• digital equity• personal privacy• protects the biological ecosystem• safety & fire prevention• resiliency in extreme weather events• reduces climate impacts from this sector | <ul style="list-style-type: none">• supports equality in high-speed internet access• lowers energy usage and improves energy efficiency• supports health in patients with chronic illnesses• preserves hard-earned equity in peoples' homes• quality of voice communications• supports physical and cognitive health in the elderly• supports children's health• makes enduring tech choices not prone to rapid and costly obsolescence• preserves the sanctity of neighborhoods with revered churches, temples, mosques, and landmark and historic buildings• protects parks as a place of biological peace and refuge• value for the money for all users |
|--|--|

Without sharing the truth about the full range of Internet access options, the deception about both the adequacy of wireless to meet growing needs, and the inadequacy of regulatory oversight, American communities, businesses and individuals have been duped into believing an inferior technology is superior, and that wireless radiation does not present health risks, when nothing could be further than the truth.

Worth mentioning is the history of the LinkNYC free wireless access program in New York City, now expanding into the Link5G program with the 'Jumbo' antennas in the photo above. Originally, the LinkNYC business model was expected to rely solely on advertising. That business model failed, as evidently there were insufficient advertisers wanting to advertise on the RFR-radiating kiosks being placed around the City. By 2019, LinkNYC faced bankruptcy. Then in 2021, the City introduced a "mixed financial model" comprised of "advertising and 5G cellular services revenue" so that the expansion of the LinkNYC wireless network throughout the city could become viable. Since LinkNYC's mission is to offer free wireless access, it appears the wireless companies are underwriting part of the cost of the NYC wireless network, a compromised position for the City. The City is essentially in a long-term partnership with the telecom industry enabling widespread, harmful RFR radiation to blanket peoples' lives, all while the adequacy of the FCC safety guidelines have long been called into question.

It is telling to look back to an early U.S. government funded meta-study on RFR effects published by the U.S. Naval Medical Research Institute in 1971, by Zorach Glaser, PhD, "Reported Biological Phenomena (Effects) and Clinical Manifestations Attributed to Microwave and Radio-Frequency Radiation". In this review of global scientific studies on the effects of RFR--a half a century

ago--Dr. Glaser found 2,308 studies that linked RFR and other forms of EMF with 132 different biological effects, symptoms and diseases, including:

- | | |
|------------------------------------|--|
| • Central Nervous System Effects | • Blood Disorders |
| • Autonomic Nervous System Effects | • Enzyme and other Biochemical Changes |
| • Genetic and Chromosomal Changes | • Metabolic Disorders |
| • Psychological Disorders | • Endocrine Gland Changes |
| • Vascular Disorders | • Changes in Physiological Function |

Thirty six years later, a 1,540-page meta-study, published in 2007, updated in 2012, co-authored by a group of 29 international scientists, the BioInitiative Report, cited more than 1,800 scientific studies that associate low-intensity, non-thermal radiation exposures from wireless technologies and other sources of electromagnetic radiation (EMR) with dozens of diseases and biological effects in humans, including:

- | | | | |
|------------------------------|--|------------------------------------|--------------------------------|
| • Neurological Effects | • Stress Response | • Breast Cancer Promotion | • Childhood Cancers (leukemia) |
| • Oxidative Damage | • Brain Cancer | • Biochemical Imbalances | • Genotoxic Effects |
| • Effects on Immune Function | • Acoustic Neuromas & Other Brain Tumors | • Fertility & Reproductive Effects | • Fetal & Neonatal Effects |
| | • Blood Brain Barrier Damage | | |

These are just two examples of meta reviews of the scientific literature, but there are many additional meta reviews, as well as decades of published studies showing risks from RFR. These include rigorous studies documenting RFR effects conducted by the U.S. Government.

A recent monograph, "THE LARGEST UNETHICAL MEDICAL EXPERIMENT IN HUMAN HISTORY" (2020) by Ronald N. Kostoff, Research Affiliate, School of Public Policy, Georgia Institute of Technology, identifies a wide spectrum of adverse effects of wireless radiation as reported in the premier biomedical literature over seven decades.

In the case of the Jumbo 5G antennas being proposed for New York City, it is unacceptable that the truth about the technological choices, and their advantages and risks, is not being transparently presented to City officials. Very dangerous wireless densification is being carried out and further planned under the banner of 'closing the digital divide' by officials who have made poor decisions. Poor decisions have been made as a result of having been misled about the adequacy of the FCC RFR exposure guidelines--misled by the FCC, the FDA, and the telecommunications industry itself wanting to sell its products and services.

Over time, many individuals and groups have attempted to encourage government officials to focus on wireless radiation risks, but a blind eye has been turned to the topic by politicians, many of whom accept contributions from the telecom industry. Meanwhile, since 1990, millions of U.S. citizens having been harmed by this radiation, and are increasingly being harmed, with more and more radiating

devices and infrastructure continually going up all around. Overall health in the U.S. has substantially declined since 1990 and there has been a dramatic, yet underrecognized, rise in chronic disease. Acute symptoms from wireless exposures, like sleep issues, mood swings, irritability, joint pain, brain fog, memory issues and poor learning capacity are plaguing our nation. The fastest-growing diseases have been associated with biological changes known to be caused by wireless radiation. And, importantly, DNA damage occurring remains a wild card over the long-term for our species as well as for the ecosystem.

Our government appears to have been 'captured' by the telecom industry, believing its false claims about safety without looking to the scientific literature itself, or to the tremendous amount of evidence for risk from RFR well documented in U.S. government studies. Many departments and agencies of the federal government have documented RFR risks going back decades, including the U.S. Naval Medical Research Institute, EPA, U.S. Air Force, U.S. Department of the Army, NIH, NASA, Department of Interior and the Defense Intelligence Agency (See "Wireless Radiation - Is the U.S. Government Ignoring its Own Evidence for Risk?").

The crux of the issue causing so much suffering and driving health costs is that FCC exposure guidelines for RFR are wholly inadequate, do not reflect the science, and are being used across the country, with FDA complicity, to mislead about the antennas' safety.

The RFR exposure guidelines aim only to protect against thermal effects of the radiation. They do not address the well-established 'non-thermal' effects, including biologically disruptive frequencies, the peaks and pulsing, and increasingly complex signaling characteristics.

Importantly, the FCC guidelines have misled manufacturers of wireless devices and equipment, infrastructure installers, service providers, retailers, real estate owners, building managers and the public into believing RFR radiation is safe if in compliance with the FCC's thermal guidelines. Businesses and property owners have been able to take cover from liability in relying on these government sanctioned FCC guidelines. The public naively believes antennas outside their windows (as in the case of the photo below from New York City) must be safe if they have been permitted or otherwise approved. I certainly made that assumption--and most others, unfortunately, do, too.



Citizens have placed faith in the permitting process and government oversight, only to learn proper procedures have not been followed to protect public health. Even people suffering terrible illnesses who are aware there are antennas outside their window, often do not think to connect the antennas with their health challenges, because they make the false assumption that our government would not have permitted the antennas were there actually science showing RFR radiation is not safe.

This situation has been going on far too long and must stop. The truth about the FCC's inadequate exposure guidelines, and the FDA's hollow endorsement of the guidelines, must be known.

Here is one example of how people are being misled by the FCC's exposure guidelines and by the FDA's agreement on those guidelines. In a Manhattan co-op, where antennas were proposed to be placed on a water tower on the building's roof, I advised the Co-Op's Board of Directors not to allow the

antennas. I read, and formally rebutted, Pinnacle Telecom Group's report to the Board of Directors and attended the Board meeting, along with representatives of Pinnacle and Verizon. I heard Pinnacle's misleading presentation that the FCC and FDA had certified there was no RFR risk from the antennas. Pinnacle's report to the Board of Directors stated the following:

"Note that both the FCC and the Food and Drug Administration (FDA) have certified that continuous human exposure at RF levels up to and including the FCC MPE [Maximum Permitted] limit is considered to present no RF health risk. Moreover, the FCC MPE limit has been designed to provide appropriate protection for humans of either sex, all ages, all sizes, and under all conditions."

This is false. Were it not for my quickly commandeering the meeting, telling the Board Members that what they were hearing was false, and then delivering a scientific presentation on the matter, the proposed antennas would have been approved, and then impacted the health of people on the higher floors of this building, as well as those living in many neighboring buildings.

The media also regularly misleads about RFR risk. Reference to the FDA deeming the radiation 'harmless' is found in the recent *Wall Street Journal* article, dated November 13, 2021, "*Are AirPods Out? Why Cool Kids Are Wearing Wired Headphones*". The message that the FDA currently deems the radiation "to be harmless to humans" presumably reached the Wall Street Journal's 3.4 million circulation.

"...Biz Sherbert, a cultural specialist at youth culture-focused creative agency the Digital Fairy, narrated a TikTok video on corded headphones. "It seems that people are very concerned about the potential Bluetooth radiation that comes from AirPods," she concluded based on the video's comments. (While Bluetooth headphones do emit non-ionizing radiation, the Food and Drug Administration currently deems it to be harmless to humans.)"

It is time for the FCC and FDA to come into integrity and make clear the limited nature of their investigation into RFR risks, acknowledging that they, too, have become captured by the telecom industry. (See Harvard University's Edmond J. Safra report, "How the Federal Communications Commission is Dominated by the Industries it Presumably Regulates"). We must stop suppressing the truth about risks of RFR radiation.

If the FCC says it relies on the safety expertise of the FDA, and states it considered opinions of the FDA in setting its safety guidelines, but the FDA officially does not review the safety of radiation emitting telecommunications technologies, as it does with new drugs or medical devices, then where is the responsibility for assuring safety actually domiciled? Has responsibility for ascertaining safety potentially fallen through the cracks between these two agencies, resulting in a situation where proper protection of human, animal and environmental health interests is not taking place? And on what basis does the FCC, a communications commission charged with regulating interstate and international communications, and not a health agency, have authority to ascertain safety and establish RFR safety guidelines in the first place?

It is essential that clarity be obtained regarding FCC and FDA responsibility for:

- 1) Setting protective, biologically-based exposure guidelines for RFR;
- 2) Clarifying the pros and cons of different telecommunications technologies (fiber, wireless, cable, advanced copper, etc.) so that the public, government officials and businesses can make fully informed choices;
- 3) Conducting pre-market safety testing of wireless devices and wireless infrastructure prior to release onto the market;
- 4) Conducting post-market monitoring of RFR exposures from each antenna, and the aggregate antennas in a neighborhood, to assure compliance with FCC guidelines;
- 5) Conducting short- and long-term post-market health monitoring of individuals living in dense wireless environments;
- 6) Conducting short- and long-term post-market health monitoring of natural environments exposed to RFR;
- 7) Educating the public about health risks associated with RFR exposures and how they might be able to be reduced.

The American people must be assured that regulators' top priority is public health and safety.

Additional steps that can restore trust that has been lost due to lack of clarity on responsibility between the FCC and FDA and failure of government to protect public health can be found in "33 Recommendations for the FCC, FDA and Congress".

Respectfully submitted in support of the Petition for Rulemaking to the Secretary of the U.S. Department of Health and Human Services by Americans for Responsible Technology et al.

A handwritten signature in black ink, reading "Camilla R. G. Rees", followed by a horizontal line.

Camilla R. G. Rees