



## **ANSES Consultation on Environmental and Human Health Effects of 5G**

### **Submission of Comments of Environmental Health Trust**

All links are part of this submission

1. [The ANSES Report Section “4.1.3 Icnirp guidelines published in 2020” needs to include the full list of countries with limits more restrictive than ICNIRP](#)
2. [ANSES Section 3.2 Foreign National Bodies should include the fact that over twenty countries have public health department recommendations or policy that recommends reducing cell phone radiation, especially for children.](#)
3. [ANSES should add a section that includes recommendations by medical organizations on reducing cell phone and radiofrequency radiation.](#)
4. [The ANSES 5G Report is missing important government initiatives to halt 5g. Report Section 2.2.4 Opposition and Table 2: Forms of mobilization against 5G should be updated with additional government actions.](#)
5. [ANSES should include a section on the fact that current limits were not designed to protect non-human organism such as birds, bees and wildlife](#)
6. [ANSES conducts expert appraisals to assess the risks to plant health and forest tree species and thus should include a section in the ANSES 5G report on impacts to plants and trees as harm is documented.](#)
7. [The ANSES 5G Report should include documentation of how children are more vulnerable to wireless radiation and how ICNIRP limits do not protect the rapidly developing brains, immune systems, and reproductive organs of young children.](#)
8. [The ANSES Report on 5G should include a section on the increasing energy consumption from 5G and the Internet of Things as wireless densification will impact human health in numerous ways.](#)
9. [The ANSES Report on 5G should Include a section on synergistic effects as documented in the scientific literature on non ionizing radiation.](#)
10. [The ANSES Report should clarify that ICNIRP limits do not protect humans nor the environment from adverse biological effects and that numerous adverse effects have been documented in the scientific literature for low and mid band radiofrequency radiation which will be increased with 5G/4G network densification.](#)
11. [The ANSES 5G Report should include documentation of the conflicts of interests and history of industry ties of ICNIRP and the WHO EMF Project.](#)

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The ANSES Report Section “4.1.3 Icnirp guidelines published in 2020” needs to include the full list of countries with limits more restrictive than ICNIRP

**Over a Dozen Countries have Stricter Limits for Ambient Cell Antenna Emissions or Policies in Place to Reduce Exposure Near Schools and/or Homes- Areas designated as sensitive areas.**

**The ANSES Report only lists China, Russia, Bulgaria, areas in Belgium, Slovenia, Croatia, Italy, Switzerland, Greece, India and the Grand Duchy of Luxembourg.**

Recommendation: The ANSES Report should include the full list of countries with RF network limits **more restrictive than ICNIRP** <sup>12345</sup>.

Countries ANSES needs to include are listed here and documentation below.

- Canada <https://www.hc-sc.gc.ca>
- Israel <http://www.tnuda.org.il>
- Turkey <http://www.btk.gov.tr>
- Chile
- Belarus
- Serbia
- [Ukraine](#)
- Montenegro
- Liechtenstein
- Tajikistan
- Kazakhstan
- Kyrgyzstan
- Kuwait Source: <http://www.moh.gov.kw/>
- Bosnia Herzegovina has network RFR limits of ICNIRP with an additional reduction factor. (Source <https://rak.ba/bs-Latn-BA/>)
- Republic of Moldova has network RFR limits more restrictive than ICNIRP. Flat 0.1 W/m2 for mobile services. Source: <http://www.cnspl.md/> .

#### **Documentation on Regulatory Laws and Limits Cited**

- <https://apps.who.int/gho/data/node.main.EMFLIMITSPUBLICRADIOFREQUENCY?lang=en>
- [International policy and advisory response regarding children’s exposure to radio frequency electromagnetic fields \(RF-EMF\)](#)

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<sup>1</sup> <https://apps.who.int/gho/data/node.main.EMFLIMITSPUBLICRADIOFREQUENCY?lang=en>

<sup>2</sup> Wu T, Rappaport TS, Collins CM. [Safe for Generations to Come](#). *IEEE Microw Mag*. 2015;16(2):65-84. doi:10.1109/MMM.2014.2377587

<sup>3</sup> China [Rationale for Setting EMF Exposure Standards\\*](#) Prof. Dr. Huai Chiang as referenced by Wu 2015

<sup>4</sup> [Comparison of international policies on electromagnetic fields \(power frequency and radiofrequency fields\)](#). Rianne Stam, National Institute for Public Health and the Environment

<sup>5</sup> Mary Redmayne (2016) [International policy and advisory response regarding children’s exposure to radio frequency electromagnetic fields \(RF-EMF\)](#) *Electromagnetic Biology and Medicine*, 35:2, 176-185, DOI: [10.3109/15368378.2015.1038832](https://doi.org/10.3109/15368378.2015.1038832)

- [Comparison of international policies on electromagnetic fields \(power frequency and radiofrequency fields\)](#), Rianne Stam, National Institute for Public Health and the Environment, [RIVM powerpoint](#)
- [Human radio frequency exposure limits: An update of reference levels in Europe, USA, Canada, China,](#)
- [World Health Organization Map of Countries With EMF Legislation](#)
- [World Health Organization](#) [https://www.researchgate.net/publication/228104887\\_Scientific\\_basis\\_for\\_the\\_Soviet\\_and\\_Russian\\_radiofrequency\\_standards\\_for\\_the\\_general\\_publication\\_exposure\\_limits\\_for\\_radio-frequency\\_fields\\_\(public,\\_worker\)](https://www.researchgate.net/publication/228104887_Scientific_basis_for_the_Soviet_and_Russian_radiofrequency_standards_for_the_general_publication_exposure_limits_for_radio-frequency_fields_(public,_worker))
- [World Health Organization Map of Countries with reports on their EMF activities](#)

ANSES Section 3.2 Foreign National Bodies should include the fact that over twenty countries have public health department recommendations or policy that recommends reducing cell phone radiation, especially for children.

Examples of these countries include Belgium, Switzerland, French Polynesia, Finland, Ireland, Germany, Greece, Israel, Turkey, Singapore, France, United Kingdom, Russia, Denmark, India, Australia, Austria, Cyprus, Canada, Italy, Korea, Sri Lanka, Croatia, Krakow Poland, European Parliament Resolution 1815.

#### Belgium

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

The Belgium health agency has long issued [Tips for prudents use](#) and in 2013 the government has [banned phones](#) designed for young children. In 2014 Ghent Belgium [banned](#) wi-fi from pre-schools and day care. In [Brussels](#), a map of all the locations of antennas is accessible online where the technical data of each installation is listed. People can ask for a compliance measurement, free of charge.

#### Canada

“What you should do: Limit the length of cell phone calls, Replace cell phone calls with text messages or use "hands-free" devices, Encourage children under the age of 18 to limit their cell phone usage.” [Health Canada](#)

In 2011 Health Canada issued “[Practical Advice on reducing exposure](#)” which states, “the department also encourages parents to reduce their children's RF exposure from cell phones since children are typically more sensitive to a variety of environmental agents.”

#### French Polynesia

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

In 2016 passed [landmark legislation](#) which created a [public educational campaign on](#) how to reduce cell phone, wireless and other electromagnetic radiation. The law prohibits advertising of cell phones to children under 14, prohibits advertising cell phones without showing how to minimize radiation exposure to the head, prohibits wireless in nursery schools, restricts wireless in primary schools and reduces exposures to workers. The government is implementing measurement and monitoring of levels of public exposure to electromagnetic fields throughout the country. The multimedia campaign of the French Polynesia Directorate-General for the Digital Economy (DGEN) includes a [video](#), [posters](#) and a [brochure](#) promoted on television, radio, and social networking platforms translated into [Tahitian](#) and [French](#). The [video](#) visually depicts how common household electronics – such as a Wi-Fi router, video game console, and wireless baby monitor – emit microwave electromagnetic radiation like cell phone emissions. The campaign also addresses the electromagnetic radiation from electricity-powered alarm clocks and appliances.

- “Advice from the Chief Medical Officer on mobile phone use: We may not truly understand the health affects of mobile phones for many years. However, research does show that using mobile phones affects brain activity. There is general consensus that children are more vulnerable to radiation from mobile phones than adults. Therefore the sensible thing to do is to adopt a precautionary approach rather than wait to have the risks confirmed. In the light of these findings, the Chief Medical Officer of the Department of Health and Children strongly advises that children and young people who do use mobile phones, should be encouraged to use mobile phones for “essential purposes only” All calls should be kept short as talking for long periods prolongs exposure to radiofrequency electromagnetic fields. All mobile phone users can reduce their exposure to radiofrequency energy by making fewer calls, reducing the length of calls, sending text messages instead of calling, using cell phones only when landline phones are unavailable, using a wired “hands free” device so that the phone need not be held against the head and refraining from keeping an active phone clipped to the belt or in the pocket”.
- “Children are thought to be at higher risk of health implications from the use of mobile phones. This is because their skulls and cells are still growing and tend to absorb radiation more easily.
- It is recommended that children use mobile phones only if absolutely necessary.”

[Press Release: Advice from the Chief Medical Officer on Mobile Phone Use From Ireland Department of Health Published on 1 June 2011 Last updated on 24 October 2019](#)

Italy

“To reduce exposure to electromagnetic waves on your mobile phone, we recommend using text messages, the speakerphone or the headset.” [Italian Ministry of Health](#)

“It must also be considered that starting to use the mobile phone by children and adolescents means that tomorrow's adults will have exposure times much longer than those experienced by today's adults... In this perspective, pending specific studies in progress to provide useful evidence, it is prudent for parents to educate their children on the appropriate use of the telephone as a communication tool and on the [correct ways to reduce the level of exposure to radio frequencies](#).” [Italian Ministry of Health](#).

In 2019 after a [court ruling](#), the Health Ministry launched a campaign on the [“Correct Use of Mobile Phones”](#) which includes an [Infographic](#) and public service video on [“Reducing Cell Phone Radiation”](#). In

2017 a [2017 Decree of the Environment Minister](#) recommended reducing exposure to indoor electromagnetic radiation, both wireless and ELF-EMF.

## Republic of Korea

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

## Cyprus

In 2017 the Minister of Culture and Education issued a [directive](#) to ban Wi-Fi from kindergartens, remove Wi-Fi from elementary classrooms. The [Cyprus National Committee on Environment and Child Health](#) along with the Ministry of Health launched a public information campaign in 2019 that ran largescale ads on the backs of buses and featured 5 ways to reduce cell phone and Wi-Fi exposure. The Committee has long issued a [brochure](#) how to reduce EMF for families and has PSA videos for [parents](#), [pregnant women](#) and [teens](#). In 2017 the Cyprus Medical Association issued [Sixteen recommendations](#) to reduce cell phone radiation exposure.

### Campaign Materials

- Cyprus Children’s Health and Wireless [Poster for Bus Greek](#)
- Cyprus Children’s Health and Wireless [Poster for Bus English](#)
- Cyprus Children’s Health and Wireless [Leaflet Greek](#)
- Cyprus Children’s Health and Wireless [Awareness Leaflet English](#)
- Press Release [Children’s Health Campaign to Reduce Direct and Passive Wireless Radiation Exposure to Children, Press Conference: 24th of June 2019, 11:30 am, at the Ministry of Health](#)
- [Cyprus Committee Brochure \(16 page \)on How to reduce Wireless at Home in Greek](#)
- [The Cyprus National Committee on Environment and Children’s Health http://paidi.com.cy/](#)

### 2019: Initiative to Reduce EMF in Archbishop Makarios III Hospital

The Archbishop Makarios III Hospital hospital has launched a project to minimize cell phone and wireless radiation exposures.

- Wi-Fi is disabled and replaced with ethernet connections in the Intensive Care Unit and Neonatal unit.
- Parents are educated to keep cell phones away from children and out of the pediatric units.

The Campaign is a cooperation between the Archbishop Makarios III Hospital (NAM III) and the [Cyprus Committee on the Environment and Children’s Health \(CyCECH\)](#) with the active support of the Executive Director of the Archbishop Makarios III Hospital, Dr. A. Neophytou, the Director of the Pediatrics Department, Dr. A. Elia. It is a collaboration of Dr. Andreas Sergis and Dr Antonis Kleanthous and the nursing staff of the Pediatric Intensive Care Unit (PICU).

Read more [Press Conference: 24th of June 2019, 11:30 am, at the Ministry of Health](#)

### Public Awareness Videos on How to Reduce Exposures

- PSA Video on Removing Wi-Fi from Makarios Hospital in [Greek & English](#)
- PSA Video on Children’s Health and Wi-Fi: Original Video in [Greek](#) & [English](#)

- PSA Video on Pregnant Women and Wireless: Original Video in [Greek & English](#)
- PSA Video on Teenagers and Wireless: Original Video [with English subtitles](#).
- [Youtube Channel](#) (Former [Youtube channel](#))

#### Greece

“Even though it hasn’t been proven conclusively that children are more sensitive/reactive than adults to exposure to radiation, nevertheless, the direct recommendation of international organizations is that children be discouraged from using cell phones. The above statement is supported by the following: Up to about the age of 16, the nervous system of the human body is in the process of development. Consequently, it’s totally possible (although not conclusively proven by relevant scientific research) that up until this age, human being are more sensitive to any number of factors/elements/determinants. Greek government website [brochure](#)

#### Sri Lanka

The Ministry of Health 2018 press release [informs](#) people of the "serious risks" to the brain and the rest of nervous system from cell phones. They advise people not to keep mobile phones and electronic communication devices in the sleeping areas and to minimize their use. [Watch video of the recommendations](#). Hiru News, [“Risk of Cancer by Keeping Mobile Phones Near Bed”](#) 10/6/2018

#### Finland

“unnecessary exposure to radiation from mobile phones should be avoided. In particular, children’s unnecessary exposure should be avoided as their life-long exposure will be longer than that of those who begin using mobile phone as adults...”

- [Radiation and Nuclear Safety Authority](#)

The Radiation and Nuclear Safety Authority (STUK) recommends reducing exposure to children in a webpage [“Exposure can be reduced by simple means”](#).

#### Israel

“the Ministry of Health advises parents to reduce children’s exposure to mobile phones as much as possible, consider the age they start using them, reduce the amount of time mobile phones are used, and in any event, make sure they use earphones (not wireless) or a speaker when using the mobile phone.”

The government of Israel has a [public information website](#) on wireless that recommends reducing cell phone radiation. They also [state](#), “Keep the computer away from the body as much as possible.” Since 2002, the government has had compulsory cell phone radiation labeling. Since 2013, the Israeli Ministry Of Education has issued [guidelines](#) banning wireless networks in preschool and kindergartens and restricting use in elementary grades. In 2002 [Israel Consumer Protection Regulations](#) ensured compulsory cell phone radiation labeling for consumers. A mobile phone may not be sold unless they have a clearly visible sticker on cell phone packaging that says, ““This mobile phone emits non-ionizing radiation; details and information about the radiation levels of this mobile phone model and the maximum permissible level of radiation are included in the attached leaflet.”

Since 2015, the Ministry of Environmental Protection has operated a [radiation monitoring system](#) with 17 permanent monitoring stations deployed throughout the country. In addition, they have taken [measurements of ELF-EMF](#) in the incubators in neonatal units.

#### Germany

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

The German Federal Office for Radiation Protection [Website](#) provides advice and tips for reducing radiation exposure to smartphones, tablets and wireless devices stating, “Since long term effects could not be sufficiently examined up to now the Federal Office for Radiation Protection (BfS) recommends to keep exposures to these fields as low as reasonably achievable.”

#### India

“If you have a choice, use a landline (wired) phone, not a mobile phone.” [Government of India](#)  
India has a law reducing the allowable radiation from cell towers to 1/10 of ICNIRP levels and [official guidelines](#) for people to reduce exposure to cell phones that people “hold the cell phone away from body to the extent possible, use a headset and more. The Government issued [public service advertisements](#) with the steps to reducing radiation. The India Department of Telecom has a web portal for mobile tower compliance called Tarang Sanchar. India Ministries are [researching](#) the issue and have issued reports such as the 2011 Ministry of Environment and Forest Study [“Report on Possible Impacts of Communication Towers on Wildlife Including Birds and Bees.”](#) Municipal policies include the [State of Karnataka](#) where cell towers should be at a minimum distance of 50 meters from schools, hospitals and places of worship; [“Brihanmumbai Municipal Corporation](#) which bans mobile towers at parks, playgrounds; [Zilla Parishad](#) which ordered the removal of all cellphone towers within a 50-metre radius to schools citing exposure to “harmful radiation”; the State of Rajasthan decisions to remove all cell towers from the vicinity of schools, hospitals and playgrounds because of radiation “hazardous to life” was upheld by the Indian Supreme Court; [the city of Mumbai](#) prohibits cell towers within 100 meters of schools, colleges, orphanages, child rehabilitation centers, and old age homes.

#### Bangladesh

Following a High Court decision, [2019 regulations](#) banned mobile phone towers from “sensitive areas” on rooftops of residences, schools, colleges, playing fields, populated areas and heritage areas.

#### Slovenia

The Slovenia Institute for Non-ionizing Radiation [webpage](#) has a [brochure](#) recommending the prudent use of cell phones by taking measures to reduce radiation exposure including: Limit the number and duration of call, use a handsfree kit, and avoid use when the signal is weak.

#### Russia



“Thus, for the first time in the human history, children using mobile telecommunications along with the adult population are included into the health risk group due to the RF EMF exposure....In children, the amount of so-called stem cells is larger than in adults and the stem cells were shown to be the most sensitive to RF EMF exposure....It is reasonable to set limits on mobile telecommunications use by children and adolescents, including ban on all types of advertisement of mobile telecommunications for children.”

-Russian National Committee on Non-Ionizing Radiation Protection

In 2020 the Russian Federal Service for Supervision of Consumer Rights Protection and Human Well-Being issued ["Recommendations to Parents"](#) with measures to reduce radiation and minimize health risks and during the COVID-19 Pandemic, the Ministry of Health and Russian Committee for Non-ionizing Radiations Protection issued [recommendations](#) to limit screentime, reduce wireless radiation and limit cell phone use by children for education during the pandemic. In [2019](#), the Russian National Committee on Non-Ionizing Radiation Protection [created warning stickers](#) for cell phones and [Wi-Fi devices](#) and appealed to make the campaign worldwide.

The Russian government scientists has researched EMFs for decades and [set cell tower limits](#) based on their understanding of biological effects at non thermal levels. Russia has long recommended people minimize exposure to cell phone radiation. A 2011 [Resolution](#) of the [Russian National Committee on Non-Ionizing Radiation Protection](#) specifically advised that those under the age of 18 should not use a mobile phone at all, recommends low- emission phones; and requires the following: on-device labelling notifying users that it is a source of RF-EMF, user guide information advising that “it is a source of harmful RF-EMF exposure” and the inclusion of courses in schools regarding mobile phones use and RF-EMF exposure issues.

#### Singapore

“While further research is being carried out to study the long-term adverse health effects of the low level RF field, individuals could take precautionary measures to reduce RF exposure by limiting the length of calls, or using ‘hands-free’ devices to keep the mobile phones away from the head and body.” Singapore Ministry of Health

Singapore Ministry of Health has advice to the public on cell phone use on their webpage on radiation protection: “While further research is being carried out to study the long-term health effects of RF field, individuals could take precautionary measures to reduce RF exposure to themselves or their children by limiting the length of calls, or using 'hands-free' devices to keep the mobile phones away from the head and body.” The authorities have been monitoring the levels of radiofrequency (RF) exposure from base stations in the country.

#### Poland

The City of Krakow organizes a yearly [International Forum on Protection from Electromagnetic Environmental Pollution](#) with international experts ([2018](#)). Krakow residents are now being consulted on the “EMF protection and safety program for the City of Krakow for the years 2018-2022. Moreover, “Reducing of EMF emission” will be included in the City Development Strategies 2030 in the “Quality of



Life” section.” A public education project of Krakow Poland is entitled [Let's be EcoDigital](#)" and 2017 events included contests for Children and Youth: A Photography Contest “A Day Without My Smartphone” and Literary Contest “A Day Without My Smartphone.

Eminent Polish artist [Paweł Kuczyński](#) created a series of illustrations presenting satirical view of some difficult aspects of digital reality. In 2015, a map of residents' exposure to cell tower radiation was created and the City [earmarked money](#) for protection against electromagnetic fields in the city budget and bought measurement equipment..The City maintains a [webpage](#) with measurements and visual images of radiation from cellular antennas. They also have an [electromagnetic fields webpage](#) with [recommendations](#) on how to reduce cell phone, Wi-Fi and wireless exposures.

#### Croatia

The Ministry of Health maintains a dedicated [web page](#), a video and brochures on [Non-ionizing electromagnetic radiation: The most common questions and answers](#), [EMF Protection Principles](#) and [Non-ionizing electromagnetic radiation](#) are part of their public information campaign. Croatia has “sensitive areas” with [lower cell tower radiation levels](#) for buildings, schools, maternity hospitals and hospitals. The owner of the electromagnetic field source is obliged to provide a new measurement of the electromagnetic field levels every three years and submit the results to the Ministry of Health.

#### Tunisia

The government defines schools, kindergartens, hospitals, and nursery schools as “sensitive institutions” and [does not allow](#) cell antennas within 100m of these “sensitive institutions.” The government monitors cell tower radiation and publicly posts measurements on the website <http://www.cartoradio.tn>.

#### Brazil

Since 2009, [Federal Law](#) ensures any cell antennas s installed within 50-meters-radius surrounding hospitals, clinics, schools, day care centers and nursing homes are compliant with RF limits. In 2013, Brazil [updated](#) cell phone labeling guidelines to ensure the separation distance was stated in the manuals, in a visible and readable way. For all products tested for SAR, the following statement must be present: “This product is approved by Anatel in accordance with the procedures regulated by Resolution No. 242/2000 and meets the technical requirements applied, including the exposure limits of the Specific Absorption Rate for electric, magnetic and electromagnetic fields of radio frequency, in accordance with Resolutions 303/2002 and 533/2009. This device complies with the radio frequency exposure guidelines when positioned at least X centimeters away from the body. For more information, see the ANATEL website.” The Anatel [webpage](#) also has the Specific Absorption Ratio (SAR) of all mobile phones certificated in Brazil. The country also has [continuous monitoring](#) of electromagnetic fields in specific locations: cities, schools, hospitals, etc

#### United Kingdom

In 2020 the UK government updated [recommendations](#) for children to reduce exposure to cell phone radiation, especially for children stating that excessive use of mobile phones by children should be discouraged and adults should be able to make their own choices but be able to do this from an informed

position. Measures that can be taken to reduce exposure include: moving the phone away from the body, as when texting, results in very much lower exposures than if a phone is held to the head using a hands-free kit, keeping calls short, making calls where the network signals are strong choosing a phone with a low specific energy absorption rate (SAR) value quoted by the manufacturer.

The UK National Health Service has recommended reducing cell phone exposure for children since the [2002 Steward Report](#). In 2005, the [Department of Health - 2005 "Mobile Phones and Health" brochure](#) read "The expert group has therefore recommended that in line with a precautionary approach, the widespread use of mobile phones by children (under the age of 16) should be discouraged for non-essential calls. In the light of this recommendation the UK Chief Medical Officers strongly advise that where children and young people do use mobile phones, they should be encouraged to: • use mobile phones for essential purposes only • keep all calls short - talking for long periods prolongs exposure and should be discouraged The UK CMOs recommend that if parents want to avoid their children being subject to any possible risk that might be identified in the future, the way to do so is to exercise their choice not to let their children use mobile phones." However the official text has been downplayed over the years as evidenced by the early [2015 Webpage](#) compared to the [2015 Mobile Phone Safety - Risks Webpage](#) and the [2011 Mobile Phones and Base Stations page](#), 2015 "[Mobiles and mums-to-be" web page](#) and [Mobile effect on sleep" webpage](#) compared to the "[Mobile phone safety - FAQs.](#)"

## Turkey

The Ministry of Health has issued public information [brochures](#) that recommend limiting exposure especially for pregnant women and children. The [Brochure](#) starts by saying the research on cell phone radiation shows low levels of electromagnetic frequencies "may cause cancer". 13 Recommendations to Reduce Exposure which include: Pregnant women and children (under 16) are more vulnerable and they should use the phone only when necessary, Prefer speaker or headset, Decrease time on phones, Use low SAR phone, Keep phone away from the body, Keep phones out of baby and children's bedroom, Turn phone off when you sleep or keep it one meter away from bedside, using phones in cars increases your EMF exposure so it is not recommended. In 2014, the Ministry of Health started working on [new regulations](#) to prohibit cellphone usage for children under 14 year-old. However by 2016, the proposed regulation was weakened and officials [stated](#) the regulation would only pertain to children under 7 years old- a change from 14 years old. The Ministry of Communications and Maritime Affairs [monitors](#) electromagnetic fields around the schools and homes.

ANSES should add a section that includes recommendations by medical organizations on reducing cell phone and radiofrequency radiation.

Hundreds of scientists, experts and government officials have appealed to halt 5G and reduce exposure to non ionizing radiation. The ANSES 5G Draft report is missing several of them. For example see the [2020 Consensus Statement of UK and International Medical and Scientific Experts](#) [3500 Medical Doctors](#), [Switzerland Doctors for the Environment](#), [US Doctors and](#)

[Experts National 5G Resolution](#), [International EMF Scientist Appeal](#), [Appeal to the European Union](#), [Belgium Doctors Appeal](#), [Canadian Doctors](#), [Cyprus Medical Association](#), [Physicians of Turin, Italy](#), [the German Doctors Appeal](#), [International Appeal to Stop 5G on Earth and Space](#), [International Society of Doctors for the Environment](#), [Officials in France](#), [600 Municipalities in Italy](#), [150 Doctors in Chile](#), and the [Alliance of Nurses for Healthy Environments](#).

The ANSES Report is missing important government initiatives to halt 5g. Report Section 2.2.4 Opposition and Table 2: Forms of mobilization against 5G should be updated with more government actions.

The ANSES Report did include the United States, [New Hampshire Commission to Study the Environmental and Health Effects of Evolving 5G Technology final report](#) recommending reducing public exposure to radio frequency radiation, measuring RF radiation levels and replacing Wi-Fi with wireless devices.

However, in addition, Resolutions to halt 5G have been passed by [Hawaii County](#), [Farragut Tennessee](#), [Coconut Creek Florida](#), and [Easton Connecticut](#). Numerous US Cities such as [Los Altos](#), [Petaluma](#), [Mill Valley](#), and [San Diego County](#) California have adopted policies to restrict 5G small cells near homes. Oregon passed [a Bill to study Wi-Fi health effects](#).

The Washington DC Advisory 3/4G Committee passed a resolution [“Opposing Small Cell Wireless and 5G Technology Without Studies Confirming Safety”](#). Washington DC 2E Advisory Council passed [a resolution asking to minimize 5G small cells](#) and require radiofrequency radiation measurements stating that “ANC 2E’s entire community will be subjected to involuntary radio frequency exposure and this exposure may have negative effects for people with radio frequency emission disabilities or sensitivities.” The Washington DC 3B Advisory Council [asked that the City](#) “analyze in greater depth and report to the public on the potential impacts of the installation of small cell technology on the city’s streetscape, quality of life, and the health and well-being of the public.” The [Kalorama Citizens Association testified](#) that that small cell infrastructure be prohibited from placement on public parks and schools and that street trees “not be butchered.”

Several cities are passing resolutions calling for local control of the placement of 5G and “small cell” towers as federal FCC and new state 5g streamlining laws have stripped their local authority. Greendale Wisconsin passed a [Resolution R2018-20](#) referring to the FCC’s actions stripping local authority as “an unprecedented attack on local control” which “threaten the Village of Greendale’s responsibility to protect the health, safety and welfare of its residents.” Oak Brook Illinois’ [Resolution 2020-ITGL-R-1891](#) and the City of Jersey City, New Jerseys [Resolution 20-362](#) both call for local control. The [Hallandale Beach Florida Resolution](#) urges the federal government to initiate independent health studies on 5G. The [Carmel City, Indiana Council](#) approved a resolution asking state lawmakers, the Federal Communications Commission and Congress to limit 5G technology deployment in Indiana until the health effects are fully understood.

ANSES report on 5G references the FDA web pages but not research reviews, nor safety evaluations. The fact is there is no US health agency -- not the FDA, not the EPA, not the National Cancer Institute, not the CDC, nor any other federal health or safety agency -- that has ever reviewed the full body of research on the health effects of wireless radiation in the last three decades. There was no pre-market safety testing before cell phones or Wi-Fi came on the market. There also is no post-market surveillance. The EPA was [fully defunded](#) from [setting proper safety limits](#) in 1996, despite being tasked to do so, and in 1996 the federal government adopted 'safety limits' created by groups dominated by industry. [These limits](#) did not consider long-term exposure, and they didn't incorporate research on health effects to children whose brains are developing. Yet despite over a [thousand studies](#) showing harm from non-heating effects, FCC wireless radiation limits have not changed since 1996. This is why the Environmental Health Trust filed [legal action](#) against the FCC which erroneously decided to maintain their 1996 human exposure limits.

## No Systematic Research Review by US Agencies

### The U.S. Food & Drug Administration (FDA)

ANSES links to the [FDA website](#), majorly updated on February 10, 2020. Although the FDA webpages on cell phones seem to indicate safety, the indisputable fact is that the FDA has not reviewed the full body of research as clearly shown when you consider the documentation provided by the FDA.

- **Cancer and tumors only:** The FDA report cited as documentation is entitled “[Review of Published Literature between 2008 and 2018 of Relevance to Radiofrequency Radiation and Cancer](#)”, and *this report is only about cancer- not for example -brain damage, oxidative stress or reproductive damage*. It is not a systematic review of all the research evidence. Furthermore, it is focused on cancer from cell phones, not Wi-Fi. The FDA literature Review states, “here were two main foci for the review: i) epidemiological evidence for the existence of any tumor risk from cell phone usage, and ii) *in vivo* (animal) studies assessing any causality of tumorigenesis from of RFR exposure.”
- **Animal cancer findings dismissed:** Notably, the FDA dismisses the NTP and Ramazzinni study findings as relevant to humans despite the fact that the FDA asked the NTP to do the cell phone radiation animal study.
- **FDA Review criticized by experts:** The FDA webpage update did not go unnoticed. [Numerous scientists](#) including several now retired US government scientists - are calling for the FDA to retract the review as it offers unsubstantiated assurance of safety ([EHT 2020](#)). They asked questions and penned a letter to the FDA with several individual statements. So far the FDA has not responded to the specific questions.

Letters which have been sent to the FDA include:

- [Letter calling for a retraction signed by several scientists.](#)
- [Ronald Melnick PhD's letter to the FDA](#)

- [Albert Manville PhD, retired Senior Wildlife Biologist, Division of Migratory Bird Management, U.S. Fish & Wildlife Service, Wash. DC HQ Office \(17 years\); Senior Lecturer, Johns Hopkins University](#)
- [Prof. Tom Butler of the University College in Cork, Ireland's letter to the FDA](#)
- [Igor Belyaev, PhD, Dr. Sc. Head, Department of Radiobiology of the Cancer Research Institute, Biomedical Research Center of the Slovak Academy of Science letter to the FDA](#)
- [Paul Heroux PhD, McGill University](#)
- [Alfonso Balmori, BSc statement to the FDA](#)
- [PDF of all letters and statements.](#)

Dr. Ronald Melnick, a 28 year NIH scientist [wrote to the FDA](#):

*"I am writing this letter to detail major incorrect statements and omissions of relevant data in the FDA document titled "Review of Published Literature between 2008 and 2018 of Relevance to Radiofrequency Radiation and Cancer." I led the design of the National Toxicology Program's (NTP) toxicity and carcinogenicity studies on cell phone radiation and I strongly believe that the anonymously written FDA document misrepresents the utility of the NTP study for assessing human health risks. In addition, the report's casual dismissal of both the mechanistic findings and the numerous results from epidemiological studies that have shown increased cancer risks associated with exposure to radiofrequency radiation (RFR) are inconsistent with the FDA's stated core mission "to protect and promote the public health."*

*"The dismissal of the NTP study results by the FDA is rather peculiar since it was the FDA's Center for Device and Radiological Health that requested the toxicity and carcinogenicity of RFR in experimental animals ([CDRH nomination of RFR](#)) "to provide the basis to assess the risk to human health," and FDA scientists were fully aware of the exposure methodology that was used in the NTP study long before those studies were begun."*

- **Confirmation by the GAO:** The Government Accountability Report on 5G ([GAO 2020](#)) confirmed the fact that the FDA review was very selective stating that the FDA and other organizations "only reviewed a subset of the relevant research" and "The assessment focused on cancer-related animal and human studies of frequencies below 6 GHz."

**Federal Appeals Court Judges:** In the January 25, 2021 oral arguments for [EHT et al v. the FCC](#) ([Transcript](#)) the judges asked pointed questions of the FCC about how in 2019, they determined to maintain the 1996 adopted guidelines. The FCC referred back to the FDA as substantiating their safety determination. However the judges pointed out that the FDA did not show documentation of a comprehensive review outside of a narrow scope related to cell phones and cancer.

**Here are some quotes by the judges:**

- [Minute 26.17](#) There's so many new devices, and people are using multiple devices...The FDA came back and talked about cellphones and cancer. How was that reasonable for the FCC to rely so heavily on a response from the FDA that there's no indication relied on this specialized Committee and did not address the very things you asked for information on: other devices, the use of multiple devices, and physical harms other than cancer?" [Listen](#)
- [Minute 28.29](#): The Honorable Patricia Ann Millet states, "People don't use their phones... hardly use them for phone calls anymore. They are constantly in the hand— not two centimeters away, they're constantly in the hand. And the fingers are constantly on them. And so I'm just trying to understand how the FDA coming back and talking about cellphones that are in a holster—where nobody keeps them anymore—or in a purse when they're not being used is at all... and looking only at cancer is at all relevant to an Inquiry, again, into the effect of this radiation frequency from multiple devices that are used in entirely different ways now, in entirely different volume, and throughout the population, including children who live on iPads." [Listen](#)
- [Minute 35:02](#) The FCC says, "we said repeatedly that there was no evidence of any effect—not just cancer, any illness—from, ah, radiofrequency emissions below our existing levels," and the Honorable Patricia Ann Millet asks the FCC "Sorry, can you point me to that paragraph where it said... where it was addressing cumulative impacts?" and the FCC attorney refers to "scientific conclusions" and "the scientific studies that the FDA and others have looked at," at which time the judge states, "No, the FDA didn't. The FDA was only talking about cellphones. That's my point." [Listen](#)

As the FDA literature review shows, the FDA has not expanded its consideration outside of the issue of the issue of cancer as discussed in the oral argument for EHT et al., v the FCC.

### **The Centers for Disease Control and Prevention (CDC)**

- **No research review:** The [webpage of the CDC](#) but does not cite a scientific reference for the CDC because there is no research review or report with conclusions by the CDC to cite. The CDC has never done a scientific research review on this issue. There are no reports, no reviews and no documentation that exists showing the CDC did any research review to determine safety of health effects.
- **Warnings removed:** In June 2014 the CDC posted cautionary text about cell phones and health ([See the CDC text here](#)). The CDC [stated at that time](#), "*along with many organizations worldwide, we recommend caution in cell phone use. More research is needed before we know for sure if using cell phones causes cancer.*" This text was removed weeks later. [Microwave News](#) and a [New York Times January 1, 2016 exposé](#) details how CDC officials retracted these warnings about cell phone radiation.

- **Industry tied scientist group told the CDC to remove cautionary text.** EHT posted [500+ internal CDC emails](#), obtained as part of our FOIA request, detailing how - in fact- scientists known to have received money from the cell phone industry, sent emails to the CDC directing changes in the CDC website content stating, “Changes are truly needed.”
  - See also Microwave News [“NCRP Pressured CDC To Remove Cell Phone Safety Advice: You Say “Caution,” We Say “Precaution,” Let’s Call the Whole Thing Off”](#).
- **Deleted Information on Children:** The CDC also deleted text on children’s vulnerability. On August 18, 2014, the bulk of sentences cautioning the public of the greater risk to children from phone radiation were removed because—according to what CDC officials state in the emails—“We thought the struck language was hard to understand.” ([page 397 of internal documents](#)). Although most statements about children were removed in August 2014, the



question about children was fully removed by January 2016.

## Radiation and Your Health

### Frequently Asked Questions about Cell Phones and Your Health

Most of us depend on cell phones every day. Some people wonder if cell phones can cause health problems. Here's what you should know about cell phones and your health.



#### Can using a cell phone cause cancer?

There is no scientific evidence that provides a definite answer to that question. **Along with many organizations worldwide, we recommend caution in cell phone use.** More research is needed before we know for sure if using cell phones causes cancer.

#### Do cell phones give off (emit) radiation?

Yes – cell phones and cordless phones use radio frequency radiation (RF) to send signals. RF is different from other types of radiation (like x-rays) that we know can be harmful. We don't know for sure if RF radiation from cell phones can cause health problems years later. The International Agency for Research on Cancer (IARC) has classified RF radiation as a "possible human carcinogen." (A carcinogen is an agent that causes cancer.)

#### Should people stop using cell phones?

Scientific studies are ongoing. **Someday cell phones may be found to cause health problems we are not aware of at this time.** However it is also important to consider the benefits of cell phones. They can be valuable in an urgent or emergency situation– and even save lives.

If you are worried about cell phone use, follow the tips below.

#### Cell phone tips

To reduce radio frequency radiation near your body:

- Get a hands free headset that connects directly to your phone.
- Use speakerphone more often.
- If you have a pacemaker, keep the phone at least 8 inches away from it.



#### Do cell phones cause health problems in children?

It's too soon to know for sure. **Children who use cell phones – and continue to use them as they get older – are likely to be around RF for many years. If RF does cause health problems, kids who use cell phones may have a higher chance of developing these problems in the future.**

#### What research is being done to learn more about cell phones and health?

Scientists are continuing to study the possible health effects of cell phone use. For example, the World Health Organization (WHO) is currently looking into how cell phones may affect:

- Some types of tumors (a lump or growth)
- Our eyes
- Sleep
- Memory
- Headaches



#### In the News: Acoustic Neuroma

Scientists are looking into a possible link between cell phone use and certain types of tumor. One type is called an acoustic neuroma ("ah-COOS-tik nur-OH-ma"). This type of tumor grows on the nerve that connects the ear to the brain. It doesn't cause cancer, but it may lead to other health problems, like hearing loss. Another type scientists are looking into is called a glioma ("glee-OH-ma"). This is a tumor found in the brain or central nervous system of the body.

#### Where can I get more information about cell phones and health?

For more information, visit: The Federal Communications Commission (<http://www.fcc.gov/cgb/cellular.html>) (<http://www.cdc.gov/Other/disclaimer.html>)  
World Health Organization (<http://www.who.int/mediacentre/factsheets/fs193/en>)  
(<http://www.cdc.gov/Other/disclaimer.html>) The Food and Drug Administration (<http://www.fda.gov/Radiation-EmittingProducts>)

Page last reviewed: June 9, 2014  
Page last updated: June 9, 2014  
Content source: Centers for Disease Control and Prevention

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Yes – cell phones and cordless phones use radio frequency radiation (RF) to send signals. RF is different from other types of radiation (like x-rays) that we know can be harmful. We don't know for sure if RF radiation from cell phones can cause health problems years later. The International Agency for Research on Cancer (IARC) has classified RF radiation as a "possible human carcinogen." (A carcinogen is an agent that causes cancer.)

#### Should people stop using cell phones?

**Scientific studies are ongoing. Someday cell phones may be found to cause health problems we are not aware of at this time.** (Add) At this time we do not have the science to link health problems with cell phone use. Scientific studies are underway to determine whether cell phones may cause health effects. However it is also important to consider the benefits of cell phones. They can be valuable in an urgent or emergency situation– and even save lives.

If you are worried about cell phone use, follow the tips below.

#### Cell phone tips

To reduce radio frequency radiation near your body:

- Get a hands free headset that connects directly to your phone.
- Use speakerphone more often.
- **If you have a pacemaker, keep the phone at least 8 inches away from it.** (Add) In the past, RF interfered with the operation of some pacemakers. If you have a pacemaker and are concerned about how your cell phone use may affect it, contact your health care provider.



#### Do cell phones cause health problems in children?

It's too soon to know for sure. **Children who use cell phones – and continue to use them as they get older – are likely to be around RF for many years. If RF does cause health problems, kids who use cell phones may have a higher chance of developing these problems in the future.**

#### What research is being done to learn more about cell phones and health?

Scientists are continuing to study the possible health effects of cell phone use. For example, the World Health Organization (WHO) is currently looking into how cell phones may affect:

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#### Where can I get more information about cell phones and health?

For more information, visit: The Federal Communications Commission (<http://www.fcc.gov/cgb/cellular.html>) (<http://www.cdc.gov/Other/disclaimer.html>)  
World Health Organization (<http://www.who.int/mediacentre/factsheets/fs193/en>)  
(<http://www.cdc.gov/Other/disclaimer.html>) The Food and Drug Administration (<http://www.fda.gov/Radiation-EmittingProducts>)  
(<http://www.fda.gov/Radiation-EmittingProducts/HomeBusinessandEntertainment/CellPhones/ucm116282.htm>) (<http://www.cdc.gov/Other/disclaimer.html>)

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- **Industry tied consultation:** If you go to the CDC website you might think they have done a review as the CDC website seems to indicate experts reviewed the research. In fact, in 2014, the CDC [hired an industry consultant](#) to draft and provide subject matter expertise to several web pages related to radiofrequency radiation as detailed in a recent investigation [Wireless Hazards](#) by journalist Barbara Koepfel published in the Washington Spectator. Two of the web pages that the consultant (known to receive money from industry) worked on with the CDC were posted ([Wearable Technology](#) and [Non-Ionizing Radiation](#)) and three were not ever posted (Wireless Networks -[Click here to see a CDC draft never published](#); Power Lines and Electromagnetic Hypersensitivity- [Click here to see a CDC draft never published](#))
- **Outdated:** The [CDC webpage](#) was last updated in 2014 well before the NTP study and studies were published.

## **The National Cancer Institute (NCI)**

**However the fact is that the NCI also has never done a scientific research review to determine the safety of RFR to the public.** They have not done any published systematic review nor issued any written reports on the matter in the last few decades. Even if scientists had an opinion, they *only are focused on cancer*, but do not investigate the brain damaging effects or the reproductive damaging effects. NCI has confirmed this repeatedly. Documentation includes:

- **New Hampshire 5G Commission letter:** The NCI confirmed that they have not issued an opinion nor evaluated the safety of RFR in a 2020 letter to New Hampshire 5G Commission Member Denise Ricciardi [stating](#), “*NCI does not make recommendations or issue guidelines... The FDA and FCC are the responsible federal agencies with authority to issue opinions on the safety of these exposures. As a Federal research agency, the NCI is not involved in the regulation of radiofrequency telecommunications infrastructure and devices, nor do we make recommendations for policies related to this technology.*” ([NCI 2020 Letter](#))
- **Letter to Scarato:** The NCI also confirmed this fact in a 2016 letter to EHT’s Executive Director Theodora Scarato, as well stating that, “*Neither the literature reviews, nor the fact sheets, make safety determinations.*” ([Letter from NCI to Scarato](#), [PDF of Communications](#))

**The Environmental Protection Agency (EPA) has not done a research review since 1984.**

The EPA has not released any report nor done any review on RFR or EMF since 1984 and has no current funded mandate to research the issue. The EPA confirmed all of these facts in a [2020 letter to EHT Director Theodora Scarato](#).

- Previous to 1996 the EPA conducted robust research on electromagnetic radiation ([EPA Letter](#)) and was in development of safety limits for wireless radiation (See [EPA Briefing](#)) but just as they were poised to issue these recommendations, the EPA lost all of their research funding and has no funded mandate to do any research since then (See [2020 EPA letter](#)). See EPA reports going back decades here. See a1995 [EPA Letter to the FCC on their near completion of EMF Guidelines](#)
- Regarding FCC limits, the EPA has officially stated that the 1996 human exposure limits adopted by the FCC were not set to protect against long term exposures, nor did they incorporate scientific understanding of impacts to children. A [2002 letter from Norbert Hankin, of the Radiation Protection Division of the EPA](#) stated, “I believe that it is correct to say that there is uncertainty about whether or not current guidelines adequately treat nonthermal, prolonged exposures (exposures that may continue on an intermittent basis for many years)...Federal health and safety agencies have not yet developed policies concerning possible risk from long-term, nonthermal exposures. When developing exposure standards for other physical agents such as toxic substances, health risk uncertainties, with emphasis given to sensitive populations, are often considered. Incorporating information on exposure scenarios involving repeated short duration/nonthermal exposures that may continue over very long periods of time (years), with an exposed population that includes children, the elderly, and people with various debilitating physical and medical conditions, could be beneficial in delineating appropriate protective exposure guidelines.”
- See 1993 [EPA Comments to the Federal Communication Commission’s \(FCC’s\) proposed RF/MW radiation limits 93-142 Guidelines For Evaluating the Non Thermal Effects of Radiofrequency Radiation](#): The EPA states that certain subgroups are more at risk (pregnant women, children and the elderly) and calls for an updated, comprehensive review that considers the biological effects of RF, specifically pointing to the need to update the NCRP Report 86 (Note: NCRP 86 is still the basis for US regulations according to the FCC and has not been updated to include biological effects). “The FCC should not adopt the 1992 ANSI IEEE standard; there are serious flaws in the standard that call into question whether the proposed use of the 1992 ANSI IEEE is sufficiently protective.” The report also states that “the claim of protection for all persons from all interactive mechanisms” has “not been supported”. [Read the letter and comments here](#).
- [Read the 1984 US Science Advisory Board \(SAB\) Recommendation to the EPA To Develop RF Guidelines](#) providing more documentation of how the EPA was tasked to develop safety limits, and was later defunded.

Over [600 cities in Italy](#) have passed resolutions to halt 5G, as have cities throughout Europe, such as [Trafford, United Kingdom](#), [Lille, France](#), [Ormidia, Cyprus](#), [Balchik, Bulgaria](#). The Pancyprrian Medical Association and Cyprus National Committee on the Environment and Child Health sent Parliament their position paper “[The Risks to Public Health from the Use of the 5G Network](#).”



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

**ANSES should include a section on the fact that current limits were not designed to protect non-human organisms.**

*ICNIRP limits do not protect birds, animals nor trees. ANSES should note the limitations of the radiofrequency radiation limits and the lack of safety standards for wildlife. Research documents harm to trees, bees, insects and birds- which will be in close proximity to cell antennas. In addition to the need for development of safety limits that protect the natural environment and wildlife, radiofrequency radiation measurements should be done in close proximity to base stations to evaluate exposures to insect, flora and fauna.*

The fact that current limits do not ensure protections for insects or non human organisms is documented in the the May 31, 2021 European Parliament Panel for the Future of Science and Technology - Presentation of the studies: 'Health impact of 5G' and 'Environmental impacts of 5G'. See the [Presentation of Arno Thielens \(PDF - 1 MB\)](#)

- [Watch Video of Presentation here.](#)
- [Presentation of Fiorella Belpoggi \(PDF - 814 KB\)](#)
- [Presentation of Arno Thielens \(PDF - 1 MB\)](#)
- [Presentation of Julia Köberlein and Bernhard Scholz \(PDF - 2 MB\)](#)
- [Webstreaming link](#)

A 2021 review ([Balmori 2021](#)) found "sufficient evidence on the damage caused by electromagnetic radiation" to insects to state that "electromagnetic radiation should be considered seriously as a complementary driver for the dramatic decline in insects, acting in synergy with agricultural intensification, pesticides, invasive species and climate change." The paper concludes that "the precautionary principle should be applied before any new deployment (such 5G) is considered."

As part of this letter, we refer you to the [July 8, 2020 letter](#) sent to EHT Director Theodora Scarato by the Environmental Protection Agency's Director of the Radiation Protection Division and Office of Radiation and Indoor Air, Lee Ann B. Veal, that confirms that the EPA has never reviewed the impact of microwave radiation on birds, bees, or trees<sup>6</sup>. Nor has any U.S. federal health agency ever set safety limits for trees, birds, or bees or the physical environment. No agency in the United States nor internationally has a funded mandate to ensure flora and fauna

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<sup>6</sup> [July 8, 2020, Lee Ann B. Veal Director, Radiation Protection Division Office of Radiation and Indoor Air, Environmental Protection Agency](#)

are safe from cell tower radiation. In other words, it is a gaping hole in federal accountability worldwide. ICNIRP members criticise the science finding health effects but is unable to provide adequate documentation of safety.

The [U.S. Department of the Interior sent a letter](#) in 2014<sup>7</sup> reviewing several research studies showing harm to birds and concluding that “The electromagnetic radiation standards used by the Federal Communications Commission (FCC) continue to be based on thermal heating, a criterion now nearly 30 years out of date and inapplicable today.”

A now-retired U.S. Fish and Wildlife Service wildlife biologist, the former lead on telecommunications impacts, Dr. Albert Manville, has [written to the FCC](#) on impacts to birds and on [higher frequencies to be used in 5G](#). Dr. Manville authored numerous [publications](#) detailing research showing harm to birds.<sup>8,9,10</sup> “The race to implement 5G and the push by FCC to approve the related 5G license frequencies to industry are very troubling and downright dangerous.”

As stated by governmental experts on wildlife in the U.S. Department of Agriculture, Fish and Wildlife Service, FCC limits protect neither wildlife nor the natural environment. Until safety limits have been developed for flora and fauna, radiofrequency radiation exposures should be reduced to lowest feasible levels and the moratorium on 5G should be maintained.

Statements that nonionizing radiation cannot cause harm at levels that do not induce heat are out of step with the latest science.

A recent report on peer reviewed published science on impacts to insects found that 72 of 83 peer reviewed published studies found effects. Please see the report [Biological effects of electromagnetic fields on insects by Alain Thill](#) here. Research has found that nonthermal levels of RFR can have damaging environmental impacts including: damage to plants and trees from operating cell antennas ([Waldmann Selsam 2016](#), [Helmut 2016](#), [Haggerty 2010](#), [Halgamuge 2017](#), [Pall 2016](#), [Halgamuge and Davis 2019](#)); impairment of action in honeybees (and other pollinators) such as inducing artificial worker piping ([Favre, 2011](#)), disrupting navigation abilities ([Goldsworthy, 2009](#); [Sainudeen, 2011](#); [Kimmel et al., 2007](#)) decreasing rate egg laying rate and reducing colony strength ([Sharma and Kumar, 2010](#) ; [Harst et al., 2006](#)); and impacts to birds ([Schwarze 2016](#), [Engels et al., 2014](#), [Balmori 2009](#), [Balmori 2015](#), [Manville 2009](#), [Wiltchko 2015](#), [Kavokin 2014](#), [Tsybulin 2013](#), [Everaert 2007](#), [Broomhall 2015](#)).

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<sup>7</sup> Washington DC, Veenendaal ME. [Department of Interior Letter](#). United States Department of the Interior OFFICE OF THE SECRETARY.

<sup>8</sup> ECFS Filing Detail. <https://www.fcc.gov/ecfs/filing/1060315601199>. Accessed July 8, 2020.

<sup>9</sup> Albert M. Manville Ph.D. Former U.S. Fish and Wildlife Service Senior Biologist. [Memorandum on the Bird and Wildlife Impacts of Non-ionizing Radiation](#). Environmental Health Trust. Accessed July 8, 2020.

<sup>10</sup> Manville AM. *Collisions, Electrocutions, and Next Steps-Manville BIRD STRIKES AND ELECTROCUTIONS AT POWER LINES, COMMUNICATION TOWERS, AND WIND TURBINES: STATE OF THE ART AND STATE OF THE SCIENCE B NEXT STEPS TOWARD MITIGATION I.*; 2002.

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Alfonso Balmori, [Electromagnetic radiation as an emerging driver factor for the decline of insects,](#) Science of The Total Environment, Volume 767, 2021,

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Shepherd et al., [Increased aggression and reduced aversive learning in honey bees exposed to extremely low frequency electromagnetic fields.](#) PLoS One. 2019 Oct 10

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Favre, Daniel. [“Mobile phone induced honeybee worker piping.”](#) Apidologie, vol. 42, 2011, pp. 270-9.

[“Briefing Paper on the Need for Research into the Cumulative Impacts of Communication Towers on Migratory Birds and Other Wildlife in the United States.”](#) Division of Migratory Bird Management (DMBM), U.S. Fish & Wildlife Service, 2009.

[“The potential dangers of electromagnetic fields and their effect on the environment.”](#) Council of Europe Parliamentary Assembly, resolution 1815, 2011.

Engels, S. et al. [“Anthropogenic electromagnetic noise disrupts magnetic compass orientation in a migratory bird.”](#) Nature, vol. 509, 2014, pp. 353–6.

Balmori A. [“Possible Effects of Electromagnetic Fields from Phone Masts on a Population of White Stork \(Ciconia ciconia\).”](#) Electromagn Biol Med, vol. 24, no. 2, 2005, pp. 109-19.

Balmori, A. [“Mobile phone mast effects on common frog \(Rana temporaria\) tadpoles.”](#) Electromagnetic Biology and Medicine, vol. 29, no. 1-2, 2010, pp. 31-5.

### *ICNIRP Limits are non protective.*

Along with more than 400 independent specialists in the field, we do not think Federal Communications Commission (FCC) standards nor do we think ICNIRP reference limits protect public health and the environment in Europe or anywhere else. These outmoded standards based on scientific findings from the last century reflect the views of ‘captured’ agencies and do not take into account growing expert concerns about public health and environmental documented impacts of telecommunications networks.

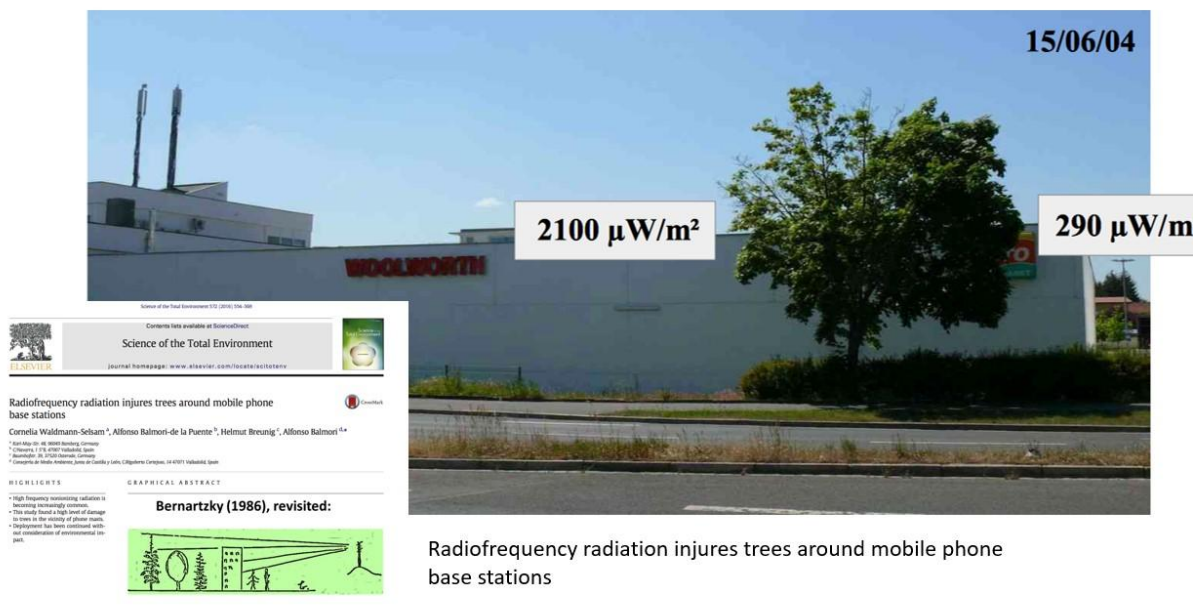
ANSES conducts collective expert appraisals to assess the risks to plant health and forest tree species and should include a section in the ANSES 5G report on impacts to plants and trees as harm is documented.

The ANSES 5G Draft report does not include a section on wireless impacts to trees or plants. This should be added as a section. Tree limbs will be in line of sight to beams from the cell antennas.

Electromagnetic (EMF) frequencies have been found to alter the growth and development of plants. Studies on wireless EMF frequencies have found [physiological and morphological changes](#), [increased micronuclei formation](#), [altered growth](#) as well as [adverse cell characteristics](#) such as thinner cell walls and smaller mitochondria. Electromagnetic exposure results in biochemical changes Research shows that plants [perceive](#) and respond to electromagnetic fields and are a good model to study the biological effects of exposure.

Documentation of tree damage from base stations is made visible in the Report “Tree Damage Caused by Mobile phone base stations” in which he states, “RF radiation effects on plants have not been considered. In the Explosive Proliferation of the diverse wireless communication technologies across the entire environment and almost all areas of life, this represents an uncovered risk” ([Breunig, 2017](#)).

Trees in Bamberg and Hallstadt in the radiation field of 65 mobile phone base stations



Radiofrequency radiation injures trees around mobile phone base stations



## Scientific Citations to Include

Waldmann-Selsam, C., et al. [“Radiofrequency radiation injures trees around mobile phone base stations.”](#) Science of the Total Environment 572 (2016): 554-69.

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

You can also download the Tree Observation Guide at: [Competence Initiative for the Protection of Humanity, the Environment and Democracy](#)

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Haggerty, Katie. [“Adverse Influence of Radio Frequency Background on Trembling Aspen Seedlings.”](#) International Journal of Forestry Research 2010.836278 (2010).

Halgamuge, M.N. [“Weak radiofrequency radiation exposure from mobile phone radiation on plants.”](#)

Martin Pall. [“Electromagnetic Fields Act Similarly in Plants as in Animals: Probable Activation of Calcium Channels via Their Voltage Sensor”](#) Current Chemical Biology, Volume 10 , Issue 1 , 2016

Shikha Chandel, et al. [“Exposure to 2100 MHz electromagnetic field radiations induces reactive oxygen species generation in Allium cepa roots.”](#) Journal of Microscopy and Ultrastructure 5.4 (2017): 225-229. doi:10.1016/J.ENVRES.2020.109227

Senavirathna, M.D., et al. [“Nanometer-scale elongation rate fluctuations in the Myriophyllum aquaticum \(Parrot feather\) stem were altered by radio-frequency electromagnetic radiation.”](#) Plant Signal Behav 9.3 (2014).

Soran, M.L., et al. [“Influence of microwave frequency electromagnetic radiation on terpene emission and content in aromatic plants.”](#) Journal of Plant Physiology 171.15 (2014): 1436-43.

- Microwave irradiation resulted in thinner cell walls, smaller chloroplasts and mitochondria, and enhanced emissions of volatile compounds, in particular, monoterpenes and green leaf volatiles (GLV). These data collectively demonstrate that human-generated microwave pollution can potentially constitute a stress to the plants.
- The above is only a small sampling of the research showing biological effects at non thermal levels on living organisms.

Kouzmanova, M., et al. [“Alterations in enzyme activities in leaves after exposure of Plectranthus sp. plants to 900 MHz electromagnetic field.”](#) Biotechnology & Biotechnological Equipment 23.sup1 (2009): 611-615.

Trebbi, Grazia, et al. [“Extremely low frequency weak magnetic fields enhance resistance of NN tobacco plants to tobacco mosaic virus and elicit stress-related biochemical activities.”](#) Bioelectromagnetics 28.3 (2007): 214

Soran, M.L., et al. [“Influence of microwave frequency electromagnetic radiation on terpene emission and content in aromatic plants.”](#) Journal of Plant Physiology 171.15 (2014): 1436-43.

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(GLV). These data collectively demonstrate that human-generated microwave pollution can potentially constitute a stress to the plants.

- The above is only a small sampling of the research showing biological effects at non thermal levels on living organisms.

Gustavino, B., et al. [“Exposure to 915 MHz radiation induces micronuclei in Vicia faba root tips.”](#) Mutagenesis 31.2 (2016): 187-92.

- The increasing use of mobile phones and wireless networks raised a great debate about the real carcinogenic potential of radiofrequency-electromagnetic field (RF-EMF) exposure associated with these devices. Conflicting results are reported by the great majority of in vivo and in vitro studies on the capability of RF-EMF exposure to induce DNA damage and mutations in mammalian systems. Aimed at understanding whether less ambiguous responses to RF-EMF exposure might be evidenced in plant systems with respect to mammalian ones, in the present work the mutagenic effect of RF-EMF has been studied through the micronucleus (MN) test in secondary roots of Vicia faba seedlings exposed to mobile phone transmission in controlled conditions, inside a transverse electro magnetic (TEM) cell.
- Results of three independent experiments show the induction of a significant increase of MN frequency after exposure, ranging from a 2.3-fold increase above the sham value, at the lowest SAR level, up to a 7-fold increase at the highest SAR. These findings are in agreement with the limited number of data on cytogenetic effects detected in other plant systems exposed to mobile phone RF-EMF frequencies and clearly show the capability of radiofrequency exposure to induce DNA damage in this eukaryotic cell system.
- It is worth noticing that this range of SAR values is well below the international limits for localised exposure (head, trunk), according to the ICNIRP guidelines (35) and IEEE std C95.1 (38), which are 10 (8.0) W/kg for occupational exposure and 2.0 (1.6) W/kg for general public exposure respectively.

Halgamuge, Malka N., See Kye Yak and Jacob L. Eberhardt. [“Reduced growth of soybean seedlings after exposure to weak microwave radiation from GSM 900 mobile phone and base station.”](#)

Bioelectromagnetics 36.2 (2015): 87-95.

International Conference on EMF Impacts to Trees “The effect of electromagnetic radiation on trees” The Groene Paviljoen, Baarn, 2  
2/18/2011

[Watch Full Conference \(Several languages\)](#)

Website of Conference <http://www.boomaantastingen.nl/>

[Download Program of Conference](#)

- Tree Damage from Chronic High Frequency Exposure
- Volker Schorpp; physicist [Lecture](#) (about 31 MB)
- Unknown Tree Diseases in Urban Surroundings and the Possible Effects of WiFi Access Points on Ash Trees (in the lab) – Dr. André van Lammeren
- Unexpected Effects on Changing Environmental Factors – Dr. Ing. Rein Roos
- Innovative Assessments of Tree Health – Ir. Lies Steel
- Visible Damage on Free-standing Trees – Dr. ing. Dipl. Phys. Volker Schorpp

Click here to see a PDF of one of the presentations [“Tree Damage from Chronic High Frequency Exposure Mobile Telecommunications, Wi-Fi, Radar, Radio Relay Systems, Terrestrial Radio, TV etc.”](#) by

Dr. Volker Schorpp

Effects of Electromagnetic Stress on Trees – BSc PhD. Andrew Goldsworthy

Call for Support for Further Study – Hans Groen in 't Wout  
[“Trees Under High Frequency” PDF German](#)

The ANSES 5G Report should include documentation of how children and pregnant women are more vulnerable to wireless radiation and how ICNIRP limits do not protect the rapidly developing brains, immune systems, and reproductive organs of young children.

As the American Academy of Pediatrics and other experts have noted, young children, and especially fetuses, are more vulnerable than adults for most environmental exposures ([Sly and Carpenter, 2012](#)). This is because their cells are rapidly dividing and their organ systems are not mature. There is a growing body of experimental and epidemiological evidence indicating that exposure to RF-EMFs has adverse effects on cognition and neurobehavior, especially in children and adolescents. Adverse effects during development can have life-long consequences and children will receive a greater cumulative exposure than adults ([Belpomme et. al, 2018](#)).

Research on animals ([Bas et al., 2009](#); [Deshmukh et al., 2015](#); [Shahin et al., 2017](#); [Megha et al., 2015](#); [Aldad et al., 2012](#); [Zhang et al., 2015](#)) shows impacts from RFR to the brain such as alterations in neurodevelopment and behavior of offspring, impaired learning and spatial memory, a deleterious impact on hippocampal, pyramidal or cortical neurons and induced markers of oxidative stress and inflammation in the brain. Human data is consistent with these animal studies as they have found higher cell phone radiation associated with behavioral problems and memory damage ([Divan et al., 2012](#); [Birks et al. 2017](#); [Foerster et. al., 2018](#) ).

### **Pregnancy: ICNIRP limits do not protect babies nor the developing baby**

Pregnancy is a time of the highest vulnerability as the fetal skull is thin and environmental impacts during early development can have [long lasting effects](#) later in life. [Studies](#) on pregnant women who used cell phones more heavily have been found to have newborns with [biochemical changes to their blood](#), [impaired fetal growth](#). Yale [animal studies](#) linked prenatal cellphone radiation exposure to damaged memory and hyperactivity. Although more research still needs to be done, replicated [studies](#) of thousands of [children](#) and [pregnant](#) women found increased behavioral problems associated with cell phone exposure which led to Yale doctors recommending that children reduce cell phone and wireless radiation exposure. See [BabySafe Project](#) , [PDF of Brochure](#), EHHI [Cell Phones: Technology, Exposures, Health Effects](#)

[Cabot 2014](#) simulated the exposure to the developing fetus at different gestational stages and found some simulations exceeded RFR limits for occupational exposure. FCC limits are based on

animal studies of short term exposures from decades ago. They were not designed to protect against cancer or reproductive damage. Even if RFR exposures are compliant with FCC limits, this does not guarantee protection from health effects.

“The developing brain is more sensitive to toxins, and it is still developing until over 20 years of age. The greater absorption of RF energy per unit of time, the greater sensitivity of their brains, and their longer lifetimes with the risk to develop a brain tumor or other health effects leaves children at a higher risk than adults from mobile phone radiation,”—[Lennart Hardell 2017](#)

The ANSES Report should clearly outline how children are more vulnerable to wireless networks, including 5G which will use low, mid and high band frequencies.

- **Proportionately deeper penetration of RFR into the brain:** Children have smaller heads than adults with shorter distances from their skull to the brain center, resulting in higher RFR absorption extending deeper into the brain compared to an adult ([Morris et al., 2015](#), [Ghandi 2015](#), [Ferreira and de Salles 2015](#), [Wiart et. al., 2008](#)).
- **Thinner skulls and higher conductivity of tissues allow higher intensities of RFR into the eye and brain:** Scientific modeling finds younger brains absorb proportionally more radiation in the eyes and brain—grey matter, cerebellum and hippocampus ([Fernandez et al. 2018](#), [Christ et al., 2010](#), [Mohammed 2017](#)).
- **More active stem cells in their bodies:** Research shows that stem cells are more sensitive to microwave radiation, and children have more active stem cells ([Belyaev 2010](#), [Williams et al. 2006](#)).
- **Developing brains are more vulnerable to neurotoxic exposures:** Not only do children absorb higher peak doses in the brain than adults, their brain is growing rapidly, subject to different windows of vulnerability, and thus more susceptible to adverse impacts and environmental neurotoxicants. Exposures that take place during fetal development or early childhood may cause permanent brain injury, whereas the same doses may have little impact in adults ([Heindel et al., 2015](#), [Weiss 2000](#), [Lanphear 2015](#), [Redmayne and Johansson 2014](#) and [2015](#)).
- **Regulations based on an adult head and body:** Government regulations were based on a 220-pound man’s head, not a child’s head. This is one reason why the American Academy of Pediatrics has repeatedly written to the FCC and FDA calling for more protective laws ([Ghandi 2012](#), [AAP 2012 & 2013](#)).
- **A lifetime of exposure:** Children will receive a greater cumulative exposure than adults ([Belpomme et. al. 2018](#), [Miller et al. 2019](#)).

The ANSES Report on 5G should include a section on the increasing energy consumption from 5g and the Internet of things as this will impact human health in numerous ways.

Numerous environmental groups have written letters and appeals on the issue of the unfettered energy consumption and the harm to trees, bees and wildlife. Greenpeace France released a [position on 5G](#) as creating “digital pollution” that will increase carbon emissions, increase e-waste, strip the earth of natural resources and contribute to human tragedies on a global scale. The [Green Party of California, Ecologists in Action of Spain](#), and the Sierra Clubs of [California](#), [Washington DC](#), and [Montgomery County Maryland](#) have taken positions for protecting trees/environment and addressing the energy consumption of 5G networks.

*“New research from Greenpeace East Asia finds that electricity consumption from digital infrastructure in China is on track to increase an estimated 289% by 2035.4 Electricity use at 5G base stations in China is rising at an even more dramatic rate and is projected to increase nearly 500% over the same period.”*

As the headlines worldwide read “[5G Network Set to Double Emissions by 2035](#)[The amount of electricity used by the two industries is forecast to nearly quadruple](#)” according to Greenpeace’s Report [China 5G and Data Center Carbon Emissions Outlook 2035](#) that documents the following:

- Power consumption from digital infrastructure in China is on track to shoot up 289% between 2020 and 2035
- Carbon emissions from digital infrastructure in China are projected to reach 310 million tonnes by 2035.
- 5G is one of the fastest growing sources of internet sector emissions in China. Power consumption from 5G in China is on track to skyrocket 488% by 2035, reaching 297 billion kWh by 2035, roughly equivalent to Sichuan’s total electricity consumption in 2020.

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

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

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

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

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Greenpeace (2021) [China 5G and Data Center Carbon Emissions Outlook 2035](#)

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The ANSES Report on 5G should Include a section on synergistic effects as documented in the scientific literature on non ionizing radiation.

**ICNIRP and FCC limits were not developed with an understanding of synergistic effects.**

[“Adverse Health Effects of 5G Mobile Networking Technology Under Real Life Conditions”](#) published in Toxicology Letters identifies the wide-spectrum of adverse health effects of non-ionizing non-visible radiation and concludes that 5 G mobile networking technology will affect not only the skin and eyes, but will have adverse systemic effects as well. They state that 5G will increase the cell tower densities by an order of magnitude. The researchers conclude that in aggregate, for the high frequency (radiofrequency-RF) part of the spectrum, currently published reviews show that RF radiation below the FCC guidelines can result in: carcinogenicity (brain tumors/glioma, breast cancer, acoustic neuromas, leukemia, parotid gland tumors), genotoxicity (DNA damage, DNA repair inhibition, chromatin structure), mutagenicity, teratogenicity, neurodegenerative diseases (Alzheimer’s Disease, Amyotrophic Lateral Sclerosis), neurobehavioral problems, autism, reproductive problems, pregnancy outcomes, excessive reactive oxygen species/oxidative stress, inflammation, apoptosis, blood-brain barrier disruption, pineal gland/melatonin production, sleep disturbance, headache, irritability, fatigue, concentration difficulties, depression, dizziness, tinnitus, burning and flushed skin, digestive disturbance, tremor, cardiac irregularities, adverse impacts on the neural, circulatory, immune, endocrine, and skeletal systems” and “from this perspective, RF is a highly pervasive cause of disease” ([Kostoff et al., 2020](#)).

According to [Belyaev 2019](#), “the health effects of chronic MMW exposures may be more significant than for any other frequency range.” The abstract states that, “ Various responses to non-thermal microwaves (MW) from mobile communication including adverse health effects related to electrohypersensitivity, cancer risks, neurological effects, and reproductive impacts have been reported while some studies reported no such effects. This presentation provides an overview of the complex dependence of the MW effects on various physical and biological variables, which account for, at least partially, an apparent inconsistency in the published data. Among other variables, dependencies on carrier frequency, polarization, modulation, intermittence, electromagnetic stray fields, genotype, physiological traits, and cell density during exposure were reported. Nowadays, biological and health effects of 5G communication, which will use microwaves of extremely high frequencies (millimeter waves MMW, wavelength 1- 10 mm), are of significant public concern. It follows from available studies that MMW, under specific conditions of exposure at very low intensities below the ICNIRP guidelines, can affect biological systems and human health. Both positive and negative effects were observed in dependence on exposure parameters. In particular, MMW inhibited repair of DNA damage induced by ionizing radiation

at specific frequencies and polarizations. To what extent the 5G technology and the Internet of Things will affect the biota and human health is definitely not known. However, based on possible fundamental role of MMW in regulation of homeostasis and almost complete absence of MMW in atmosphere due to effective absorption, which suggests the lack of adaptation to this type of radiation, the health effects of chronic MMW exposures may be more significant than for any other frequency range.”

Research has found that EMF exposure can act synergistically with other environmental pollutants. Prenatal ([Choi et al., 2017](#)) and postnatal ([Byun et al., 2017](#)) mobile phone exposure has been found to result in greater neurobehavioral effects in children with elevated lead levels than those seen with elevated lead alone. These results indicate that EMFs can act synergistically with other environmental contaminants known to cause a reduction in intelligence quotient (IQ).

Replicated results from animal studies show co-carcinogenic and tumor promoting effects from RF-EMF when RF is combined with a known carcinogen ([Tillmann et al., 2010](#); [Lerchl et al., 2015](#)). The studies used a very low level of radiofrequency radiation, far lower than FCC SAR limits for cell phones, yet found increases in tumors from the combined exposures.

In 2016, Morgando Soffritti and colleagues published two papers, one which examined the synergistic effects between sinusoidal-50 Hz magnetic fields and [formaldehyde](#) and the second between magnetic fields and [low-dose  \$\gamma\$  radiation](#). Compared to untreated controls, exposure to MF and formaldehyde caused a statistically significant increased incidence of malignant tumors (P 0.01), thyroid C-cell carcinomas (P 0.01), and hemolymphoreticular neoplasias (P 0.05) in males. No statistically significant differences were observed among female groups. In the second study, results showed significant carcinogenic effects for the mammary gland in males and females and a significant increased incidence of malignant schwannomas of the heart as well as increased incidence of lymphomas/leukemias in males, leading researchers to call for a re-evaluation of the safety of non-ionizing radiation.

In 2006, Jukka Juutilainen and colleagues conducted a [meta-analysis](#) of data from in vitro studies and short-term animal studies that have combined extremely low frequency magnetic fields with known carcinogens or other toxic physical or chemical agents, finding that the majority of the studies were positive, “suggesting that magnetic fields do interact with other chemical and physical exposures.”

Dariusz Leszczynski PhD who published “[Physiological effects of millimeter-waves on skin and skin cells: an overview of the to-date published studies \(2020\)](#)” stated:

*“As I presented in recent [review of science](#), the whole scientific evidence on the possible effects of mm-waves on skin and skin cells consists of only some 99 studies, where 11 are human volunteer studies, 54 are animal in vivo studies (rats & mice) and 34 are in vitro laboratory studies using human and animal cell cultures. These studies examined only short-term acute effects of the exposure that do not provide any information about the possible delayed or long-term-exposure effects. Furthermore, the effects of mm-waves were examined in separation from other frequencies used by 5G and in separation from other environmental stressors (chemicals and radiations). Possibility of any co-effects and/or synergistic effects were not yet examined at all.”*

**Until large scale research studies are done on the synergistic effects of wireless radiation, governments should take caution with 5G. Please include these studies.**

Kostoff, R.N. and Clifford G.Y. Lau. 2017. [“Modified health effects of non-ionizing electromagnetic radiation combined with other agents reported in the biomedical literature.”](#) Microwave Effects on DNA and Proteins (2017): 97-158.

Soffritti M, Giuliani L. [The carcinogenic potential of non-ionizing radiations: The cases of S-50 Hz MF and 1.8 GHz GSM radiofrequency radiation.](#) Basic Clin Pharmacol Toxicol. 2019;125 Suppl 3:58-69. doi:10.1111/bcpt.13215

Soffritti, Morando, et al. [“Synergism between sinusoidal-50 Hz magnetic field and formaldehyde in triggering carcinogenic effects in male Sprague–Dawley rats.”](#) American Journal of Industrial Medicine 59.7 (2016) 509-21.

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Vila et al., [Occupational exposure to high-frequency electromagnetic fields and brain tumor risk in the INTEROCC study: An individualized assessment approach.](#) Environ Int. 2018 Oct;119:353-365. doi: 10.1016/j.envint.2018.06.038. Epub 2018 Jul 8.

Byun, Yoon-Hwan, et al. [“Mobile Phone Use, Blood Lead Levels, and Attention Deficit Hyperactivity Symptoms in Children: A Longitudinal Study.](#) PLoS ONE 8.3 (2013).

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Belyaev, I. (2019). [Main regularities and health risks from exposure to non-thermal microwaves of mobile communication.](#) t14th IEEE International Conference meeting on Advanced Technologies, Systems and Services in Telecommunications – TELSIS 2019 (<http://www.telsiks.org.rs>), Niš, Serbia.

The ANSES Report should clarify that ICNIRP limits do not protect humans nor the environment from adverse biological effects and that numerous adverse effects have been documented in the scientific literature for low and mid band radiofrequency radiation which will be increased with 5G/4G network densification.

**The ANSES Report should clearly state for the public the fact that wireless frequencies as well as other non ionizing frequencies have been linked to numerous harmful effects. Currently the ANSES report states throughout the review that “ the evidence does not support a conclusion as to whether or not there is an effect” which downplays the fact that 5G safety assurances cannot be provided.**

**Threshold based on adverse biological impacts are urgently needed.**

ICNIRP limits are based on protection from thermal (heating) effects despite a large body of evidence that has found non thermal effects ([Bandara 2018](#), [Clegg 2020](#), [Miller 2019](#), [Miller 2018](#), [Kostoff 2013](#), [Yakymenko 2016](#), [Pall 2013](#), [Smith Roe 2020](#), [Houston 2016](#)).

A review missing from the ANSES report [Lai 2021](#) states, “Thus, it is safe to conclude that genotoxic effects of EMF have been reported. The most common effects found are: DNA strand breaks, micronucleus formation, and chromosomal structural changes...There are similarly many studies that showed changes in gene expression after EMF exposure (Supplement 3). Changes in expression of many different genes have been reported. Studies in gene expression by static/ELF-EMF are far more diversified than those of RFR. The most interesting results are the expression of genes related to stress response both in vitro and in vivo in plants and animals. Another important finding is the expression of heat shock proteins, particularly HSP70, which is an important protein involved in protein misfolding and protecting cells from environmental stress....EMF also interacts synergistically with different entities on genetic functions. Interactions, particularly with chemotherapeutic compounds, raise the possibility of using EMF as an adjuvant for cancer treatment to increase the efficacy and decrease side effects of traditional chemotherapeutic drugs. Other data, such as adaptive effects and mitotic spindle aberrations after EMF exposure, further support the notion that EMF causes genetic effects in living organisms.”

Schuermann and Mevissen (2021) [Manmade Electromagnetic Fields and Oxidative Stress—Biological Effects and Consequences for Health](#)<sup>11</sup> states:

- “In summary, indications for increased oxidative stress caused by RF-EMF and ELF-MF were reported in the majority of the animal studies and in more than half of the cell studies. Investigations in Wistar and Sprague-Dawley rats provided consistent evidence for oxidative stress occurring after RF-EMF exposure in the brain and testes and some indication of oxidative stress in the heart. Observations in Sprague-Dawley rats also seem to provide consistent evidence for oxidative stress in the liver and kidneys. In mice, oxidative stress induced by RF-EMF was predominantly demonstrated in the brain and testes, as well as in liver, kidneys, and ovaries. These observations were made with a variety of cell types, exposure times, and dosages (SAR or field strengths), within the range of the regulatory limits and recommendations.”
- “Adverse conditions, such as diseases (diabetes, neurodegenerative diseases), compromise the body’s defense mechanisms, including antioxidant protection mechanisms, and individuals with such pre-existing conditions are more likely to experience health effects. The studies show that very young or old individuals can react less efficiently to oxidative stress, which of course also applies to other stressors that cause oxidative stress. Further investigations under standardized conditions are necessary to better understand and confirm these phenomena and observations.”

Human health effects include impaired reproduction, increased incidence of brain cancer, DNA breaks, oxidative stress, immune dysfunction, altered brain development, sleep changes, hyperactivity, and memory and cognitive problems.<sup>12</sup> Since the WHO/IARC [classified EMF as a Group 2B Possible Carcinogen](#) in 2011, the peer-reviewed research connecting wireless exposure to cancer has significantly strengthened and several scientists have published documentation that the weight of current peer-reviewed evidence supports the conclusion that radiofrequency radiation should be regarded as a human carcinogen.<sup>13,14,15</sup>

- The 10-year \$30 million National Institute of Environmental Health Sciences National Toxicology Program’s (NTP) [“Studies of the Toxicology and Carcinogenicity of Cell Phone Radiation”](#)<sup>16,17</sup> found that RFR was associated with “clear evidence” of cancer due to the increased malignant schwannomas found in RFR-exposed male rats. The brain

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<sup>11</sup> Schuermann D, Mevissen M. [Manmade Electromagnetic Fields and Oxidative Stress—Biological Effects and Consequences for Health](#). *International Journal of Molecular Sciences*. 2021; 22(7):3772. <https://doi.org/10.3390/ijms22073772>

<sup>12</sup> For more information on acute health symptoms, see, e.g., Martin Pall, Microwave Frequency Electromagnetic Fields (EMFs) Produce Widespread Neuropsychiatric Effects Including Depression, 75 *J. Chemical Neuroanatomy* 43-51 (Sept. 2016); [Response of residents living in the vicinity of a cellular phone base station in France](#) ; [Electromagnetic Fields: A Hazard to Your Health?](#), Healthy Children.

<sup>13</sup> Adams, Jessica A., et al. ["Effect of mobile telephones on sperm quality: a systematic review and meta-analysis."](#) *Environment International*, 70, 2014, pp. 106-112.

<sup>14</sup> Deshmukh, P.S., et al. ["Cognitive impairment and neurogenotoxic effects in rats exposed to low-intensity microwave radiation."](#) *International Journal of Toxicology*, vol. 34, no. 3, 2015, pp. 284-90.

<sup>15</sup> Aldad, T.S., et al. ["Fetal Radiofrequency Radiation Exposure From 800-1900 MHz-Rated Cellular Telephones Affects Neurodevelopment and Behavior in Mice."](#) *Scientific Reports*, vol. 2, no. 312, 2012.

<sup>16</sup> National Toxicology Program, [Cell Phone Radio Frequency Radiation](#)

<sup>17</sup> [High exposure to radio frequency radiation associated with cancer in male rats](#)

(glioma) cancers and tumors in the adrenal glands were also considered evidence of an association with cancer. In addition, exposed animals had significantly more DNA damage, heart damage, and low birth weight.

- The Ramazzini Institute published its [findings](#)<sup>18</sup> that animals exposed to very low-level RFR developed the same types of cancers as reported by the NTP.
- Long-term [research](#) on humans who have used cell phones has found increased tumors—schwannomas and glioblastomas—the same cell type as found in the NTP and Ramazzini Institute studies. Persons who started using cell phones under age 20 had the highest risk.<sup>19</sup>
- A 2015 Jacobs University [study](#) (replicating a [2010 study](#)) found that weak cell phone signals significantly promote the growth of tumors in mice and that combining a toxic chemical exposure with RF more than doubled the tumor response.<sup>20,21</sup>
- “[5G wireless telecommunications expansion: Public health and environmental implications](#),” is a research review published in *Environmental Research*, which documents the range of adverse effects reported in the published literature, from cancer to bacteria growth changes to DNA damage, concludes that “a moratorium on the deployment of 5G is warranted” and “the addition of this added high-frequency 5G radiation to an already complex mix of lower frequencies, will contribute to a negative public health outcome both from both physical and mental health perspectives.”<sup>22</sup>
- A [study published in Electromagnetic Biology and Medicine](#), “Impact of radiofrequency radiation on DNA damage and antioxidants in peripheral blood lymphocytes of humans residing in the vicinity of mobile phone base station,” compared people living close and far from cell antennas and found that people living closer to cell antennas had higher radiation levels in the homes and several significant changes in their blood predictive of cancer development.”<sup>23</sup>
- 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](#)).<sup>24</sup> Examples of other effects linked to cell towers in research studies include [neuropsychiatric](#)

<sup>18</sup> L. Falcioni, L. Bua, E. Tibaldi, M. Lauriola, L. De Angelis, F. Gnudi, D. Mandrioli, M. Manservigi, F. Manservigi, I. Manzoli, I. Menghetti, R. Montella, S. Panzacchi, D. Sgargi, V. Stollo, A. Vornoli, F. Belpoggi, [Report of final results regarding brain and heart tumors in Sprague-Dawley rats exposed from prenatal life until natural death to mobile phone radiofrequency field representative of a 1.8 GHz GSM base station environmental emission](#), *Environmental Research*, Volume 165, 2018, Pages 496-503, ISSN 0013-9351, doi.org/10.1016/j.envres.2018.01.037.

<sup>19</sup> [https://www.pathophysiologyjournal.com/article/S0928-4680\(14\)00064-9/fulltext](https://www.pathophysiologyjournal.com/article/S0928-4680(14)00064-9/fulltext)

<sup>20</sup> Lerchl, Alexander, et al. “[Tumor promotion by exposure to radiofrequency electromagnetic fields below exposure limits for humans](#),” *Biochemical and Biophysical Research Communications*, vol. 459, no. 4, 2015, pp. 585-90.

<sup>21</sup> Tillmann, Thomas, et al. “[Indication of cocarcinogenic potential of chronic UMTS-modulated radiofrequency exposure in an ethylnitrosourea mouse model](#),” *International Journal of Radiation Biology*, vol. 86, no. 7, 2010, pp. 529-41.

<sup>22</sup> <https://doi.org/10.1016/j.envres.2018.01.016>

<sup>23</sup> Zothansama & Zosangzuali, Mary & Lalramdinpuii, Miriam & Jagetia, Ganesh & Siam, Zothan. (2017). [Impact of radiofrequency radiation on DNA damage and antioxidants in peripheral blood lymphocytes of humans residing in the vicinity of mobile phone base stations](#). *Electromagnetic Biology and Medicine*. 36. 1-11. 10.1080/15368378.2017.1350584.

<sup>24</sup> Meo, S. A., Almahmoud, M., Alsultan, Q., Alotaibi, N., Alnajashi, I., & Hajjar, W. M. (2019). [Mobile Phone Base Station Tower Settings Adjacent to School Buildings: Impact on Students’ Cognitive Health](#). *American Journal of Men’s Health*. doi.org/10.1177/1557988318816914.



[problems](#),<sup>25</sup> [elevated diabetes](#),<sup>26</sup> [headaches](#),<sup>27</sup> [sleep problems](#),<sup>28</sup> and [genetic damage](#).<sup>29</sup>

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](#)).<sup>30</sup>

- Published research has found impacts from wireless radiation exposure to [reproduction](#) and [brain development](#) in addition to a myriad of other adverse effects.<sup>31,32,33,34</sup> Although renowned institutions, such as the [Cleveland Clinic](#), advise men to keep phones and wireless devices away from their reproductive organs, the public remains largely unaware.

Once the towers are erected, they will be upgraded over time with new antennas and soon 5G technology. 5G would use today's wireless frequencies while adding new, higher frequencies to transmit data at faster speeds. These higher frequency millimeter waves uniquely penetrate the eyes and skin,<sup>35,20,21,22</sup> and have been shown to accelerate bacterial and viral cell growth.<sup>36</sup> Currently accepted standards are not sophisticated enough to measure effects on sweat glands or

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<sup>25</sup> G. Abdel-Rassoul, O. Abou El-Fateh, M. Abou Salem, A. Michael, F. Farahat, M. El-Batanouny, E. Salem, [Neurobehavioral effects among inhabitants around mobile phone base stations](#), *NeuroToxicology*, Volume 28, Issue 2, 2007, Pages 434-440, ISSN 0161-813X, doi.org/10.1016/j.neuro.2006.07.012.

<sup>26</sup> SA, Meo & Alsubaie, Yazeed & Almubarak, Zaid & Almutawa, Hisham & AlQasem, Yazeed & Hasanato, Rana. (2015). [Association of Exposure to Radio-Frequency Electromagnetic Field Radiation \(RF-EMFR\) Generated by Mobile Phone Base Stations with Glycated Hemoglobin \(HbA1c\) and Risk of Type 2 Diabetes Mellitus](#). *International Journal of Environmental Research and Public Health*. 12. 14519-14528;. 10.3390/ijerph121114519.

<sup>27</sup> Hutter, H. P., Moshammer, H., Wallner, P., & Kundi, M. (2006). [Subjective symptoms, sleeping problems, and cognitive performance in subjects living near mobile phone base stations](#). *Occupational and environmental medicine*, 63(5), 307–313. doi:10.1136/oem.2005.020784.

<sup>28</sup> R. Santini, P. Santini, J.M. Danze, P. Le Ruz, M. Seigne, [Enquête sur la santé de riverains de stations relais de téléphonie mobile: l'Incidence de la distance et du sexe](#), *Pathologie Biologie*, Volume 50, Issue 6, 2002, Pages 369-373, ISSN 0369-8114, doi.org/10.1016/S0369-8114(02)00311-5.

<sup>29</sup> Gursatej Gandhi, Gurpreet Kaur & Uzma Nisar (2015) [A cross-sectional case control study on genetic damage in individuals residing in the vicinity of a mobile phone base station](#), *Electromagnetic Biology and Medicine*, 34:4,344-354, DOI: 10.3109/15368378.2014.933349.

<sup>30</sup> B. Blake Levitt and Henry Lai, [Biological effects from exposure to electromagnetic radiation emitted by cell tower base stations and other antenna arrays](#), *Environ. Rev.* Downloaded from www.nrcresearchpress.com by 172.58.41.200 on 04/10/19

<sup>31</sup> Adams, Jessica A., et al. ["Effect of mobile telephones on sperm quality: a systematic review and meta-analysis."](#) *Environment International*, 70, 2014, pp. 106-112.

<sup>32</sup> Deshmukh, P.S., et al. ["Cognitive impairment and neurogenotoxic effects in rats exposed to low-intensity microwave radiation."](#) *International Journal of Toxicology*, vol. 34, no. 3, 2015, pp. 284-90.

<sup>33</sup> Aldad, T.S., et al. ["Fetal Radiofrequency Radiation Exposure From 800-1900 MHz-Rated Cellular Telephones Affects Neurodevelopment and Behavior in Mice."](#) *Scientific Reports*, vol. 2, no. 312, 2012.

<sup>34</sup> Sonmez, O.F., et al. ["Purkinje cell number decreases in the adult female rat cerebellum following exposure to 900 MHz electromagnetic field."](#) *Brain Research*, vol. 1356, 2010, pp. 95-101.

<sup>35</sup> A [lecture](#) by Paul Ben-Ishai, PhD at the Israel Institute for Advanced Studies on this finding can be found on the [2017 IIAS Conference website](#). Feldman, Yuri and Paul Ben-Ishai. ["Potential Risks to Human Health Originating from Future Sub-MM Communication Systems."](#) *Conference on Wireless and Health*, 2017.

<sup>36</sup> Cindy L. Russell, [5G Wireless Telecommunications Expansion: Public Health and Environmental Implications](#), 165 *Env'tl Res.* 484 (2018).



quantify the risks of cumulative exposure.<sup>37,38</sup> Any future applications of these technologies must consider the biological effect of cumulative exposures to these frequencies.

The following scientific reviews on impacts to reproduction indicate safety is not assured.

- [Negi and Singh 2020](#) states in their review, “Cell phone radiation harms male fertility by affecting the different parameters like sperm motility, sperm count, sperm morphology, semen concentration, morphometric abnormalities, increased oxidative stress along with some hormonal changes.”
- [Kesari et al. 2018](#) states, “From currently available studies it is clear that radiofrequency electromagnetic fields (RF-EMF) have deleterious effects on sperm parameters (like sperm count, morphology, motility), affects the role of kinases in cellular metabolism and the endocrine system, and produces genotoxicity, genomic instability and oxidative stress.”
- [Singh et al., 2018](#) states, “available data indicate that exposure to EMF can cause adverse health effects...Persistent exposures of EMF radiation can result in health hazards because these radiations interfere with normal physiological and biological function of the body. EMF works as an environmental pollutant and has undesirable health effects on animals and humans.”
- [Houston et al., 2016](#) states “Among a total of 27 studies investigating the effects of RF-EMR on the male reproductive system, negative consequences of exposure were reported in 21. Within these 21 studies, 11 of the 15 that investigated sperm motility reported significant declines, 7 of 7 that measured the production of reactive oxygen species documented elevated levels and 4 of 5 studies that probed for DNA damage highlighted increased damage, due to RF-EMR exposure.”
- [Sepehrimanesh and Davis 2016](#) states, “This paper reviews proteomic experimental and clinical evidence that EMF acts as a male-mediated teratogen and contributor to infertility.”

EHT is submitting to ANSES our Proposed FCC changes to Measuring and Evaluating Human Exposure to Radiofrequency Electromagnetic Fields and Wireless Power Transfer Devices are Flawed: need for biologically-based standards submitted to ( ET Docket No. 19–226; FCC 19–126; FRS 16618) by Paul Ben Ishai<sup>1\*</sup>, Mikko Ahonen<sup>2</sup>, Hugo Gonçalves Silva<sup>3</sup> and Devra Davis<sup>4</sup>

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<sup>37</sup> A [lecture](#) by Paul Ben-Ishai, PhD at the Israel Institute for Advanced Studies on this finding can be found on the [2017 IIAS Conference website](#). Feldman, Yuri and Paul Ben-Ishai. “[Potential Risks to Human Health Originating from Future Sub-MM Communication Systems](#).” *Conference on Wireless and Health*, 2017.

<sup>38</sup> Hayut, Itai, Paul Ben Ishai, Aharon J. Agranat and Yuri Feldman. “[Circular polarization induced by the three-dimensional chiral structure of human sweat ducts](#).” *Physical Review E*, vol. 89, no. 042715, 2014.



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## Executive Summary

- The NPRM of the FCC in its Docket No. ET 19-226, “Human Exposure to Radiofrequency (RF) Electromagnetic Fields.” seeks to extend the current 24-year old recommended methods for testing radiofrequency radiation exposures for the general public and occupational arenas in force below 3 GHz to the frequency band from 3 GHz to 3,000 GHz (3 THz).
- It is our professional opinion that the agency should not move forward with the above proposal and needs to develop safety standards that protect against long-term health and environmental effects. Further, the agency should provide revised standards for testing and monitoring that reflect submitted peer-reviewed evidence that protection is required against nonthermal effects from current levels of non-ionizing radiation. ET 19-226 closes dockets opened since 2013, fails to take seriously the hundreds of peer-reviewed publications and other expert comments submitted as part of this docket, uncritically adopts the minority scientific guidelines developed by ICNIRP for internal fields in the frequency band below 3 GHz and extends them to those up to 3,000 GHz. In adopting ICNIRP positions of a group of 13 scientists many of which have close ties to industry, the agency also fails to take into account the fact that the majority including several hundred experts in the fields of bioelectromagnetics and related matters strongly dissent from the conclusions of ICNIRP, which remains a self-appointed self-governing minority group that has no independent oversight or accounting for its funding.
- We recommend a halt to the roll-out of the fifth generation, 5G, for telecommunication and for the expansion of wireless networks until hazards for human health and the environment of these new frequencies and the densification of networks have been fully investigated by scientists independent from industry. 5G paired with densification of 4G antennas will substantially increase environmental exposure to radiofrequency electromagnetic fields. We also recommend federally developed safety limits based on empirical scientific studies that have thoroughly investigated long term effects to humans, animals, insects, trees and the environment. Federal safety limits should be based on adequate data from animal and human research, not based on assumptions.
- The FCC lacks staff expertise to assess health implications of its proposed policies and has neglected its regulatory duty to take a “hard look” at the hundreds of comments and peer-reviewed publications submitted to the record since 2013. Furthermore, it is noted that the FDA, in advising the FCC, has dismissed the results of research that they themselves commissioned from the NTP when those findings negated their insistence that only thermal effects are relevant in exposure studies.
- FCC plans for satellite-based 5G coverage will involve an unprecedented number of satellites, disrupt weather forecasting, astronomy and critical science programs. As such, these FCC plans are opposed by NASA, NOAA and the US Navy. As noted below the space-based transmissions from these satellites fall in the same frequency range as the critical atmospheric water emission line (23.8 GHz) and would effectively ‘blind’ radiometric readings of airborne moisture, undermining the capacity for accurate weather forecasting. Pointedly the FCC also lacks expertise or knowledge to properly assess the lasting global impacts of this action.

- Despite extensive peer-reviewed scientific evidence submitted to the docket by EHT on more than 60 occasions that document nonthermal impacts of RF, the FCC persists in adopting the view that thermal damage is the sole effect to be prevented from exposures to Radio frequency radiation. Accordingly, it sets the exposure levels to a SAR level 1.6 W/kg averaged over a 1 g volume of the entire head (which is treated as a homogenous entity) and a power density of 10 W/m<sup>2</sup> and treats the ear (pinna) like the hand, wrist or foot, where the spatial peak SAR shall not exceed 4 W/kg, as averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) [averaged over 30 minutes] This statement of the docket is fundamentally flawed, even in the narrow definition of heating effects, as it ignores well known EM wave/tissue coupling effects as outlined herein.
- The FCC has failed in its obligation to maintain an accessible and searchable database of previous submissions to this docket and thus has abrogated its duty to accord serious consideration of such submissions.
- Contrary to the FCC position, non-thermal effects that are biologically important can occur from currently permitted and lower levels of RF and include disruption of cellular signaling and membrane integrity, the rise of reactive oxygen and nitrogen species (RONS) in the cell interiors and in blood, indirect damage to DNA, impairment of human reproduction and increased risk of cancer, infertility and neurological disease, altered neurotransmitter functions, permeability of the blood-brain barrier, morphology, electrophysiology, cellular metabolism, calcium efflux, and gene and protein expression.
- We and hundreds of other expert scientists do not agree with the FCC assumption that because transmissions at higher frequencies of 5G cellular networks would be absorbed superficially by the skin, such frequencies pose no danger to the public. First, in the foreseeable future for 5G to operate, these networks will have to include 3G and 4G frequencies, judged to cause an array of biological impacts by French, Israeli, Indian governments and other expert groups, including [Oceania Radiofrequency Scientific Advisory Association](#) (ORSAA, EHT, the Bioinitiative Report, among others. Second, the interaction between the higher frequencies of 5G and the skin has not been demonstrated to be benign. Instead the currently available research suggests biological and physiologically relevant effects.
- Submitted peer-reviewed publications document that exposures that take place in the top layers of the skin can have major immunologic and other systemic effects. The FCC ignores numerous submitted peer-reviewed publications from us and other experts detailing the complex biological role of the skin, including the fact that it is the largest organ of the body, that it carries out important immunological roles and is vital for the production of vitamin D.
- Furthermore the FCC ignores the fact that hotspots can form as a result of more efficient modalities of absorption in the skin, such as Standing Wave Coupling, due to the layered nature of the tissues and the short wavelength of the radiation, as is documented in peer-reviewed publications submitted to the docket.
- In addition, the effect of time division signals--time pulses---has been shown by numerous authors in peer-reviewed publication and submitted comments to be detrimental and lead to peaks of heightened skin temperatures, to the point of pain. The FCC ignores this fact, despite the publications in the scientific record, and claims that average values (that eliminate these peaks) are sufficient.



- The FCC intends no change to the Specific Anthropomorphic Mannequin (SAM) method for modeling compliance to RF exposures that employs the large homogenous head and body of an adult male. This, despite the indisputable fact that, by design, SAM does not gauge exposures within the specific tissues of the brain, skull, reproductive organs and bodies of infants, toddlers, and elementary school children that are among the fastest growing users of new wireless devices. At least Finite-Difference Time-Domain (FDTD) algorithm-based method should be utilised in modelling compliance to RF exposures.
- The FCC has ignored peer-reviewed publications regarding the possible impact of 5G on insect life, especially bees. As bees and other pollinators are critical to the production of food, this issue requires critical attention as the increase in wireless frequencies and use of higher frequencies will impact agriculture.
- In its refusal to update testing regimes, models and standards, the FCC ignores over 30,000 peer-reviewed scientific articles that form the solid foundation for questioning its decisions as illustrated by the EMF Scientists Appeal, ORSAA, the French ANSES assessments, the German national radiation assessments, among others.
- There are major national differences in monitoring and surveillance of exposures that reflect policy differences more so than technical ones. Thus, the Israeli Ministry of Environmental Protection regularly monitors on-line all cell towers and antennas and has canceled 20 towers in 2019 for exceeding their guidelines. Several countries have federal agencies that regularly monitor radiofrequency levels and provide this information to the public. U.S. (with more than 150,000 towers and up to a million planned in the next two years), Canada, Australia, and other nations have no regular federal monitoring, nor means of ensuring compliance with their standards for towers.
- Exposure limits in Russia, China, Switzerland and Italy are 100 times lower than those proposed by the FCC. Russia and China have “science based” limits.
- No secondary insurance companies provide coverage for liability from health or environmental damages from tower operation, with Swiss Re in 2019 terming 5G “off the leash” as a risk comparable to asbestos. Proposed expansions of wireless power transfer will rely on standards that are at least a decade old and need regulation in terms of acceptable body internal fields. Despite advances in technology and the need to take into account far-field wireless transfer as distances between the device and its charging station grow, the FCC intends to adopt the 2010 standard of the ICNIRP. The authors and many other well-published experts in the field strongly advise that there be an independent scientific review of this and other proposed FCC policies.
- Other nations are adopting positions that consider the public good before the communications industry. Thus, France has recalled dozens of cellphones found to emit unsafe levels of RF, Israel has cancelled cell towers found to exceed acceptable levels, India has set levels for tower radiation that are one tenth those of ICNIRP, many Italian cities have called to halt 5G, and national governments from Switzerland to Belgium and Greece are questioning the rush to 5G, especially in light of the refusal of secondary insurance firms to provide coverage for any health or environmental damages tied with electromagnetic fields generally, including 5G.
- As experts in the field, we recommend that the FCC seek the advice of an independent multidisciplinary panel of an organization such as ORSAA, ANSES. the Royal College of

Physicians of the UK, or the U.S. National Academies of Sciences, Engineering and Medicine to carry out an independent study of the health and environmental implications of 5G and its current exposure levels. Until such an expert panel can produce a biologically-based exposure standard, we recommend that safe exposure levels be adopted using the As Low As Reasonably Achievable (ALARA) principle (currently employed in radiology) that employs advances in hardware and software to achieve the lowest exposures. Connections using ethernet and cable should be preferred (rather than wireless) in buildings and homes to drastically reduce the need for wireless.

- Further, as scientific evidence continues to grow linking RF exposures to cancer and other serious health impacts, the communications industry will be faced with a mounting burden of litigation and liability. As the regulatory authority that failed to provide protection from such exposures, the FCC will find itself culpable.

## Introduction

On the 4<sup>th</sup> April 2020, the Federal Communication Commission (FCC) issued a Notice of Proposed Rulemaking (NPRM) in its Docket No. ET 19-226, “Human Exposure to Radiofrequency Electromagnetic Fields.” [1]. The NPRM seeks public comment on several proposals to change how best to measure and evaluate human exposure to radiofrequency radiation (RF) under safety standards set forth in FCC regulations. The NPRM did not propose to make any changes to the safety standards themselves although the safety standards have not been substantially altered since their implementation in 1997.

In the introduction to its notice FCC-19-126A1 [2] the FCC states:

*“Modern communications technologies are an ever-increasingly critical part of our everyday lives and play a vital role in the execution of our businesses and daily affairs. The number and types of radiofrequency (RF) devices have proliferated, and the ways we interact with them are continuously changing. As a result, our environment is populated with RF sources, at times located in close proximity to humans. The National Environmental Policy Act of 1969 (NEPA) requires the Commission to evaluate the effects of our actions on the quality of the human environment, including human exposure to RF energy emitted by Commission-regulated transmitters and facilities. The Commission has accordingly promulgated rules that set limits for RF exposure and, through the years, has created a framework to ensure compliance with these limits.”*

As a general statement we note that the powers granted to the FCC in the race for the implementation of 5G cellular services are widespread, almost without precedent and include the power to approve satellite positioning and transmission [3], [4]. We note that the agency lacks expertise in public health, meteorology, and astronomy. Yet, its recent proposals have ignored a growing body of scientific and engineering concerns that the proposed use of 5G will drastically and permanently alter the capacity to predict weather [5], [6], monitor impacts on public health, or locations of satellites [7]. As representatives of the scientific community we find the FCC’s dismissal of the concerns of august bodies such as NASA, NOAA and the US Navy [7] to be worrying and baffling [8]. It is indicative of a corporate culture that has lost sight of its original purpose to regulate in the name of the public good. It is illustrative that out of over 150,000 cell towers in the US today [9] the Enforcement bureau of the FCC has issued only a handful of fines for violations of SAR limits in the last 10 years of enforcement [10]. As a comparison the State of Israel, with only 7,000 towers, maintains continuous online monitoring of tower transmission powers [11] and in 2019 shut down 20 for transmission power violations. It is difficult to accept the opening statement, quoted above, as accurately reflecting the role of the FCC.

Our submission provides detailed comments on the FCC’s proposal to apply 24-year old standards for evaluating exposures to radiofrequency radiation (RF) currently employed for frequencies up to 3 GHz to frequencies that are up to 1000 times higher-- from 6 GHz up to 3000 GHz. It is notable that while stipulating conditions and methods for averaging both the time and area employed in evaluating RF exposure, the FCC is not proposing any safety or environmental testing of those higher frequencies, nor has any been carried out on behalf of the federal government. We also address proposed FCC methods for evaluating Wireless Power Transfer Devices (WPT), defined as “a category of Industrial, Scientific, and Medical (ISM) equipment which generates and emits RF energy for local use by inductive, capacitive, or radiative coupling, for transfer of electromagnetic energy between a power transfer unit (TU) and receiving unit(s) (RU) of a WPT system.”

While the technical issues raised in this FCC docket are complex and challenging, this does not mean that they cannot be understood. Moreover, we appreciate that approaches being established at this time are not likely to change easily in the future, especially because they reflect and dictate parameters that will be relied on for technology for decades to come. Accordingly, our statement to the FCC will critically comment on: (1) the FCC desire to extend outdated exposure limits and test standards that currently apply to 3 GHz up to 3000 GHz, without considering the growing body of peer-reviewed scientific evidence submitted to the docket that demonstrate a range of important non-thermal effects that can take place at or below current levels of exposure; (2) the proposed standardization of WPT including what distance is considered local and methods for evaluating the totality of scientific and engineering evidence relevant to assessing impacts on public health and the environment; and (3) the need to create, evaluate and implement biologically-based standards for combined frequency evaluations to replace outdated systems that presume that thermal impacts are the only ones to be avoided over short periods of time for cumulative waves and to incorporate anatomically-based modeling and averaging times and areas based on the concept of achieving exposures that are As Low As Reasonably Achievable (ALARA).

Public concerns about the impact of non-ionizing radiation exposure have been on the increase in recent years [12]–[16], despite repeated attempts to reassure that there is no notable health hazard [17], [18]. In general, the FCC has adopted the position of the International Commission on Non-Ionizing Radiation Protection (ICNIRP) that the only impact on the human body from cell phone or other wireless radiation to be avoided is that of thermal effects [19]. In fact, the ICNIRP constitutes an unelected, self-appointed international group that is not subject to any governmental or other oversight. As part of its mandate the ICNIRP is supposed to carry out an ongoing assessment of the scientific literature pertaining to exposure standards [20]. Given the body of current research demonstrating worrying trends in adverse health effects, one must question if the ICNIRP is carrying out this task. As this submission will document, there are serious grounds [21] for challenging the authority currently conferred on ICNIRP by the FCC, Health Canada, and other such entities, even though there have been calls for this body to disband [22]. Moreover, as our comment will also document, a number of high-tech nations including France and India (See Section below National Responses to Current Safety Standards) and other expert groups, including more than 360 experts in the highly specialized field of bioelectromagnetics, have updated their own approaches to wireless radiation and accordingly adopted positions that also differ markedly from those of ICNIRP and the FCC. These expert groups have reviewed the scientific literature on the topic and concluded that there are major chronic health and environmental impacts from exposures to wireless radiation that are non-thermal in nature and that the ICNIRP standards are not sufficiently protective of children and others. It should be noted that in issuing its call for comments, the FCC has not indicated that it has undertaken a systematic review of relevant evidence, nor identified what specific body of evidence or scientific criteria on which it will rely to formulate its decision in this docket. Moreover, the proposed continuation of the outdated RF policies and standards rests entirely on avoiding impacts from short-term exposures and ignores the reality that millions are regularly being exposed to numerous wireless transmitting devices throughout their lifetimes.

As this comment will make clear, a growing number of distinguished experts are calling for a major revision of current standards and guidelines. To name but two, Professors Frank Barnes and Ben Greenbaum [23] have recently declared:

*“Long-term exposures are not addressed in the current guidelines. Nor do the proposals in the NPRM address issues arising as a consequence of the increasingly long-term exposures to which much of the world’s billions of phone and other wireless radiating device users are exposed over their lifetimes”.*

Amongst other titles and honours, Professor Barnes has a long and distinguished record in bioelectromagnetics, serving as Chair of the Bioelectromagnetic Society, an elected member of the National Academies of Sciences and Engineering, editor in chief of *Bioelectromagnetics*, the most cited specialized journal in the field, Executive Editor of the *Annual Reviews of Telecommunications* and many other positions. Professor Greenbaum has served as the editor in chief of Bioelectromagnetics and has been a consultant to the WHO International EMF Project in Geneva. They have jointly edited the 4th edition of the *Handbook of Biological Effects of Electromagnetic Fields*, published by CRC Press. In short their opinion is not one to be dismissed and is shared by many other experts in the field, as is indicated below and in other submissions to this docket from Victor Leach and others from the Oceania Radiofrequency Scientific Advisory Association.

According to the industry and private sector supported extensive database of relevant literature, provided by the EMF-Portal [24], there is currently an inventory of 31,195 publications and 6,724 summaries of individual scientific studies on the effects of electromagnetic fields. A recent research review on the health risks of Radio Frequency Radiation (RFR), involving independent verification based on 5,400 studies in the MedLine database, concludes that “the literature shows there is much valid reason for concern about potential adverse health effects from both 4G and 5G technology” and that extant research “should be viewed as extremely conservative, substantially underestimating the adverse impacts of this new technology” [25].

Further, this body of evidence has already led to changes in the regulatory stances of national agencies from several other high-tech countries that distinctly differ from those proposed by the FCC. Notably, the French national agency for Food, Environmental and occupational health & Safety (ANSES) has examined the current permitted exposure to cell phone radiation and found that 9 out of 10 phones tested exceeded their guidelines when tested directly next to the body, rather than at a distance that would be created if a plastic holster were to be used to carry phones [26]. Specifically, in reviewing all relevant evidence, ANSES acknowledges growing experimental and epidemiological evidence about non-thermal biological effects [27]. Indeed, there are significant non-thermal biological effects from the exposure of the population to low-level cellphone radiation, even at frequencies that are not able to ionize molecules. Furthermore, effects can also take place in non-mammalian organisms, such as insects and birds which are not addressed in the FCC docket.

Worryingly for industry the burden of litigation claiming tort from adverse health effects stemming from the use of cell o]phones and wireless is growing [28]

In the following pages we will examine the validity of several of the basic assumptions and assertions that guide the FCC policy statements and show them to reflect an incomplete, limited and biased reading of current science and to be out of step with the mainstream scientific findings. Their reading is fundamentally inaccurate as they rest on flawed interpretations of engineering and other technical evidence. They have ignored policy recommendations from numerous industry and other experts regarding the need to update standards and testing procedures, especially to protect children and other sensitive groups. This is inconsistent with the obligations of a federal regulatory agency to take into account the totality of the weight of all relevant scientific evidence in making policy determinations. Moreover, as we will further establish, over the past decade, EHT and other expert groups have filed more than 80 different submissions including specific peer-reviewed publications in support of the request for revising current standards (see Appendix 3 for comparison of ICNIRP reviewed materials in contrast with those in the ORSAA database).

## The FCC did not take a “hard look” that is “searching and careful” of the extensive materials submitted to this and related dockets.

Serious database management flaws have rendered the submissions to the FCC inaccessible. In not providing a written record of consideration of submissions provided from 2013 to 2019, the FCC has failed to provide any indication of having taken a “hard look” at the submitted materials that is “searching and careful.” [29] Other submissions to ET Docket No. 19–226; FCC 19–126; FRS 16618 will make clear that, in this regard the FCC has acted in an “arbitrary and capricious” manner indicating a callous disregard for submitted materials. This has been done by rendering the publicly submitted materials inaccessible for public review and consideration and by failing to maintain its own manageable system that relies on accessible computer tools for retrieval and review for the docket. Further, the FCC was unable to review "the full administrative record that was before the Secretary [Commissioners] at the time he made his decision."

According to the Court in *Overton Park* [29], any federal agency subject to the Administrative Procedures Act (APA) should provide an account of decision-making that constitutes "the full administrative record that was before the Secretary at the time he made his decision." While acknowledging that "the APA does not require the agency to create a formal record in informal adjudications," agencies are obliged to "create some form of a record so that courts can review their actions, and that record must be comprehensive." In their decision in *Overton Park* the courts have effectively required that the agency provide a written account of their comprehensive review of submitted materials [30] The FCC must "create some form of a record so that courts can review their actions, and that record must be comprehensive." [31] No such record exists in this docket, despite more than 900 different submissions being provided. Nor is the resulting database of submitted documents accessible using standard search and evaluation tools consistent with additional requirements stipulated by the APA.

## The FCC claims that only thermal effects need be considered

Fundamental to the FCC permissible exposure levels is the premise that the only relevant potential adverse impact of low intensity RF signals at any frequency is to cause a measurable change in heating of the human body. Although they are also highly relevant, adverse nonthermal impacts on non-human biota are not considered in this docket at all. As stated in the docket:

*"7. Although the radio spectrum is managed up to 3,000 GHz (3 THz), the Commission's exposure limits are currently specified only up to 100 GHz. The Commission is unaware of any reason the limits should be different above 100 GHz. As frequency increases up to 3,000 GHz (3 THz), body penetration is reduced and ultimately approaches zero. Accordingly, there is no reason to expect that thermal effects will effectively change at the increasingly higher frequencies. Accordingly, the Commission proposes to extend the same constant exposure limits that presently apply from 6 GHz to 100 GHz up to an upper frequency of 3,000 GHz (3 THz), which is considered to be the upper bound of existing radiofrequency bands."*

This statement fundamentally errs in three major respects. First of all it asserts, without proof, that the only effect to be avoided is that of heating. Second, it ignores the pivotal fact that in any modern wireless communication system - including the future 5G networks operating at frequencies above 3 GHz, will operate relying on multiple antennas that send and receive multiple pulse trains rather than continuous modulated waves. These pulses can be far more consequential for biological systems than continuous wave transmissions at any frequency. Finally, it assumes that biological effects are directly proportional to level of absorption, ignoring growing evidence on the immunological functions of the skin, described below.



## Harmful non-thermal effects have been demonstrated at current levels of exposure

The agency position that heating is the only effect from RF that poses a risk to human health ignores a solid and growing body of research demonstrating non-thermal biological effects of RF electromagnetic field (EMF) exposure in both experimental animals and humans. Both adverse and beneficial biological effects of RF have been demonstrated throughout species. These impacts can take place at the level of cells and sub-cellular structures, including mitochondrial processes critical to cellular energy and metabolism. On the microscopic cellular level harmful effects on both the structures and functions of cells have been demonstrated to arise from mobile phone radiation; these include effects on protein expression, transcription and stability mediated by the MAPK (mitogen-activated protein kinase) cascades [32], enzyme activity [33], ovarian follicle development [34] and increased reactive oxygen species in stem cells [35]. These studies are representative of a large body of work - more than 3000 studies according to EMF Portal [24] and the [ORSAA database](#) of studies demonstrating non-thermal effects at the cellular level [36], [37]. Another noted pathway to cellular damage has been the effect of mobile EMF exposure on cell metabolism and membranes termed Voltage-Gated Calcium Channels (VGCC) [38]. VGCCs are a class of membrane proteins responsible for the transport of calcium and other ions into and out of the cellular interior. One of the roles played by these ions is the control of reactive oxygen species (ROS) [39]. ROS can lead to the production of free radicals that have the capacity to damage DNA and to destroy essential cellular components. Further, ROS have been identified as important precursors or early biological markers for a number of chronic neurological and other diseases as well as indicators of harmful effects on reproduction [40]–[43].

In addition to increasing these harmful cellular processes, current levels of RF also affect health at the level of tissues and organs relevant to both neurological and male reproductive health. Experimental studies reveal that animals prenatally exposed to nonthermal levels of pulsed cellphone radiation produce offspring with significant damage to their hippocampus, including limited development of pyramidal cells [44].

## FCC ignores substantial peer-reviewed scientific evidence demonstrating harmful non-thermal effects at current levels of RF exposure

On the tissue level of the organism (human being), EMF exposure has been linked to degradation of the antioxidant defence system [45]. A common argument against the relevance of this body of work is that it is mainly *in vitro* and therefore not applicable to the “real world” situation of mobile phone use. However, recent studies of people living in proximity to mobile base stations have found evidence for ROS in their blood, which is recognized as a biochemical indicator of stress that has been associated with increased risks of cancer and other chronic diseases [46]. Another important 2015 review of existing studies on radio frequency radiation (RFR) effects was published by the National Academy of Sciences in the Ukraine, Indiana University, and the University of Campinas in Brazil [41]. Based on 93 out of 100 peer-reviewed studies, that paper concluded that low-intensity RFR is an oxidative agent for living cells with a high pathological potential. The oxidative stress induced by RFR exposure explains a range of RFR health impacts, both cancer and non-cancer illnesses. In addition to chronicling illnesses, this study outlines 6 different biological mechanisms that may explain these RFR effects in the body. To quote this source: “In conclusion, our analysis demonstrates that low-intensity radio frequency radiation (RFR) is an expressive oxidative agent for living cells with a high pathogenic potential and that the oxidative stress induced by RFR exposure should be recognized as one of the primary mechanisms of the biological activity of this kind of radiation.” [22]

Studies have also found that nonthermal cellphone radiation and laptop radiation can damage human sperm, reducing sperm quantity and quality, impair mitochondrial DNA of sperm, and appear to play a role in testicular dysgenesis and erectile dysfunction. We should note, as have other commentators, that male infertility clinics in Australia, the United States and India regularly advise men having difficulty impregnating their partners to remove all wireless devices from their bodies. This advice is consistent with studies showing that current levels of cell phone radiation can damage mitochondrial DNA of sperm,, increase reactive oxygen species (ROS), and reduce sperm quantity and quality [26]–[28].

As many have observed, it is especially remarkable that the FCC has rejected [47] the findings of the U.S. government's largest experimental study ever conducted of cellphone radiation--that of the National Toxicology Program (NTP) [48]–[52]. Using protocols honed over more than four decades, the NTP study relied on protocols for exposure developed by industrial designers and advisors of the Swiss IT'IS Foundation, and approved by the Interagency Work Group on RF. Thus, the NTP design followed well-established protocols used to evaluate more than 400 other compounds.

Moreover, unlike all other compounds evaluated by the NTP, their study of cellphone radiation underwent an unprecedented 3-day peer-review [53] at the behest of the FDA and NIH Director who were pressured to carry this out. Contrary to the expectations, that review strengthened the findings of the NTP scientists and found 'clear evidence' of cancer in male rats, some evidence of other cancers, and strong evidence of DNA damage in both rats and mice in multiple organs.

In the peer-reviewed journal *Environmental Research*, Ronald Melnick PhD, the former Senior Toxicologist who designed the NTP study, provided a detailed commentary on the utility of the National Toxicology Program study on cell phone radio frequency exposure [54], debunking the widely circulated criticisms of the NTP study. (PDF from FCC) Among his observations were the facts that the NTP study reported significantly increased incidences and/or trends for gliomas and glial cell hyperplasias in the brain and schwannomas and Schwann cell hyperplasias in the heart of exposed male rats. Further he noted significantly increased DNA damage (strand breaks) in the brains of exposed rats and mice, reduced pup birth weights when pregnant dams were exposed to GSM- or CDMA-modulated RFR and the induction of cardiomyopathy of the right ventricle in male and female rats. These results clearly demonstrate that cellphone radiation at levels not known to induce any measurable change in temperature, can be damaging.

We agree with Melnick and others that the NTP findings are especially important because the International Agency for Research on Cancer (IARC) in 2011 classified RFR as a "possible human carcinogen" based largely on increased risks of gliomas and acoustic neuromas (which are Schwann cell tumors on the acoustic nerve) among long term users of cell phones. The fact that similar tumors have now also been detected in both rodents and humans in cell types affected by RF further strengthens the association of this exposure with cancer. In his commentary [54], Melnick addresses several unfounded criticisms about the design and results of the NTP study that have been promoted to minimize the utility of the experimental data on RFR for assessing human health risks. Regarding the alleged major difference in survival between control and exposed animals, he noted that this difference did not in any way negate the positive findings of cancer and DNA damage in exposed animals. Moreover, the expert peer-review panel also concluded the NTP studies were well designed, and that the results demonstrated that both GSM- and CDMA-modulated RFR were carcinogenic to the heart (schwannomas) and brain (gliomas) of male rats.

In rejecting the findings of the NTP, the FCC relies on a brief conclusory sentence from the Food and Drug Administration (FDA) questioning the relevance of the government study that previous officials of the FDA had in fact ordered to be carried out [47]. No detailed reasoning for this extraordinary rejection of government research by the original requesting agency has ever been offered. Moreover, this rejection is inconsistent with the views of many national expert bodies as outlined below.

## Conflicting Scientific Opinions and Analyses Manufacture Doubt

As is evident from the extraordinary dismissal of the NTP findings by the FDA-- the government agency that initially requested the study--there are major ongoing disputes between experts in the field. Unfortunately, the FCC in its reliance solely on the FDA and ICNIRP is excluding detailed and substantiated materials that have been generated by hundreds of experts over the past several decades. As the ORSAA group recently noted in a publication, there are ongoing conflicts of interest where agencies designated to evaluate health and environmental impacts of the technology (including FDA, and Australian Radiation Protection and Nuclear Safety Agency (ARPANSA)) are also charged with promoting the same technology:

”RF technology is a booming multi-trillion dollar industry globally, and changing current prescribed safety levels to more stringent standards would bring about unfavorable financial consequences and affect industrial and military functions. In some countries, such as Australia, the regulator, which has a health protection responsibility, also sells RF spectrum licenses, which represents a clear conflict of interest. The very same agencies with responsibility for providing safety advice to the public are also considered by some to have been captured by the industry ” [39].

One illustration of this capture for ARPANSA is the fact that, prior to COVID-19, that agency offered meters to the public for monitoring exposures to radon, ionizing radiation, and power lines, but did not offer any meters for measuring exposures to non-ionizing radiation from mobile phones, smart meters or other wireless radiating devices. Moreover, ORSAA documents the difficulties scientists face in publishing results that question some of the assumptions on which ICNIRP and the FCC depend, not least of which is their mistaken view that nonthermal effects either do not occur, or where there is undeniable evidence that such effects have happened as with the NTP, then the view is that these findings are not of any biological importance.

The conclusion of the recent ORSAA publication bears quoting here in full as it encapsulates the dilemma that is faced by those seeking to obtain a complete assessment of relevant science:

“People from countries following the Federal Communications Commission (FCC) recommendations or ICNIRP guidelines need to ask why their regulators hold such opposed views from the same body of scientific research. Low-dose ionizing radiation dose limits are in the same category as man-made RF-EMF, yet the International Commission on Radiological Protection (ICRP) takes a precautionary approach when setting limits, whereas this paradigm is completely absent in the ICNIRP's philosophy on radiation protection.”

Industry scientists are often accorded considerable weight in evaluating scientific evidence and constitute welcomed members of the relevant “extended peer community.” Much of the uncertainty characteristic of the understanding of the health and environmental risks of wireless radiation can be understood to be manufactured, in a parallel sense to that detailed by Naomi Oreskes for the tobacco industry [55]. For instance, the national ombudsman for the media in Ireland [56], upheld a complaint filed by Professor Tom Butler regarding a widely circulated media report that appeared in the Irish Times claiming that those concerned with health risks of 5G “can be traced to a single scientist and a single chart.”

That independent review concluded:

*“That The Irish Times breached Principle 1 (Truth and Accuracy) of the Code of Practice of the Press Council of Ireland.*

*Professor Butler made a formal complaint to the Office of the Press Ombudsman claiming that Principle 1 (Truth and Accuracy) and Principle 2 (Distinguishing Fact and Comment) of the Code of Practice had been breached. Professor Butler challenged what he understood to be the subtext of the article which was, he said, that there were “no real links between wireless technology and health”. In particular, he disputed the accuracy of the sub-heading to the article, claiming that there was “significant scientific concern that dates back to the 1950s, at the very least”. He referenced many scientific papers and research findings which questioned the safety of microwave radiation, stating that “there is a significant body of scientific evidence on hazardous non-thermal levels of microwave radiation”. He questioned the statement of the author of the article that “mainstream scientists continue to see no evidence of harm from cell phone radio waves” which he described as “demonstrably false”.*

*The Press Ombudsman’s task is to decide if the Code of Practice of the Press Council has been breached. Principle 1 requires the press to strive at all times for truth and accuracy. In the article the author made assertions about the effects of wireless technology which Professor Butler claimed were inaccurate. His complaint, which included substantial supporting documentation and international research, contained sufficiently persuasive evidence to allow a decision that the article did not meet requirements in regard to Principle 1. It is a frequently repeated truism that everyone is entitled to his own opinion but not his own facts. An opinion piece in a newspaper has the same obligation to facts as any other part of a newspaper. I am upholding this complaint on the basis that the article, in not taking more account of scientific research that raised concerns about the impact on human health of radio waves, breached the accuracy requirements found in Principle 1.”*

We note that, were an ombudsman to review ICNIRP opinions, they might reach a similar conclusion regarding the failure to take into account the full range of scientific research in reaching its conclusions about human health.

Others, notably Harvard’s Center for Ethics, have questioned the revolving door of leadership at the FCC, where telecom industry chiefs regularly come from and return to their industry, after serving as commissioners at the FCC. Effectively, the agency has become the champion of the industry, unconcerned with potential health or environmental implications of that technology. ICNIRP’s international guidelines only recognize thermal effects, and pay no recognition to the non-thermal effects of non-ionizing EMF. However, a large body of scientific evidence suggests that bio-effects and health impacts can and do occur at low exposure levels, which can be thousands of times below public safety limits. Thus, as our comment on this docket makes clear, ICNIRP’s presumption that exposure to non-thermal levels is safe is fundamentally flawed.

Useful policy recommendations and challenges for research arising from rapid technological changes are outlined by Miller et al. [57]. In addition to addressing total cumulative exposure across the spectrum from multiple sources and for sensitive populations such as children, due to the exponential changes in technology and its uses, there is:

“Advances in RFR-related technologies have been and continue to be rapid. Changes in carrier frequencies and the growing complexity of modulation technologies can quickly render “yesterdays” technologies obsolete.”

## Internal Fields $E_i$ and Wireless Power Transfer Potential Hazards

Although the greater portion of our comments on this docket is devoted to human exposure at the higher frequencies, some words must be devoted to the subjects of Internal fields and Wireless power transfer (Section E. of the NPRM).

### Internal Fields

Point 5 of the docket states:

*“5. While each of the standards appears to provide appropriate  $E_i$  guidelines, the ICNIRP 2010 guidelines are the most widely accepted from an international perspective. The Commission proposes to adopt limits on  $E_i$  similar to the ICNIRP 2010 guidelines into its rules for frequencies between 3 kHz to 10 MHz.”*

While we applaud the decision to state internal fields as part of device compliance, it is unacceptable for a federal government agency to rely on a 10-year-old standard devised by a self-appointed group of 11 experts (ICNIRP) without a dedicated literature search or funded study to assess the validity of these older guidelines. As others have noted, the technologies, users and applications have changed radically during this time. Again many other expert groups have reached quite different conclusions regarding appropriate policies.

We insist that such a study be undertaken before a standard is set relying on decades-old approaches for these new technologies. Further such a study should take into account investigations carried out by ORSAA ([www.orsaa.org](http://www.orsaa.org)), as well as researchers at IT'IS (<https://itis.swiss/virtual-population/>) that have developed anatomically based models of exposure. Among the major issues such a study should address are questions regarding the increased susceptibility of the young developing brain, poorly myelinated nervous systems, and fast-growing bodies to changing internal fields that have been raised repeatedly by other submissions to the FCC by the American Academy of Pediatrics, and clinical experts such as David Carpenter, Torril Jeter, Robert Morris, neurologist, Maya Shetreet-Klein and psychiatrists, Martha Herbert and Victoria L. Dunckley [29], and many others from international groups noted below.

### Wireless Power Transfer

Item 20 of the of the NPRM states the following:

*“20. Locally operated wireless power transfer systems. Part 18 allows the use of potentially unlimited power if a device operates within a designated Industrial, Scientific and Medical (ISM) frequency band, so long as the device operates “locally.” Because the Commission’s rules do not define what would constitute “local” usage, measurement and compliance challenges arise in assessing wireless power transfer devices that provide charging of receiving units located at a distance from the wireless power transfer transmitting unit. The Commission seeks comment on whether the term “local” should be defined in terms of distance between the transmitting and receiving units. If the Commission defines “local” based on this distance, what is the maximum distance between the transmitting and receiving units that should be considered as “local” operation?”*

Currently the most efficient form of WPT is by inductive coupling [59], via the magnetic component of the field. The obvious applications of WPT like cell phone charging [59] or remote charging of an electric car [60] represent two extremes in terms of power that are topical. Although the FCC recognizes

the need to define what exactly the term ‘local’ means, their concerns are couched solely in the terms of device operations and compliance, while avoiding interference with other devices, and ignores concerns about health impacts. The document completely fails to investigate any possible health implications of proposed WPT that could occur over larger distances, and instead focuses only on how to define what distance between transmitting and receiving units should be considered “local.” This lack of consideration is especially worrying given the outdated definition of allowable internal fields and the growing applications for WPT in such realms as the powering of prosthetics [56] or other medical devices [61], as well as those employing Virtual Reality [62] and other consumer applications. Given the lack of technical expertise within the FCC to consider these concerns, it is inappropriate to base the entire consideration of safety on outdated and under-researched values for internal fields.

At its core, far field WPT operations involve communication between a transmitter and a receiver on the same bands as WiFi. Once contact is established between a device and charging station, the station sends out focused RF signals that are then absorbed and converted into DC power by an embedded microchip [63]. These chips can be built into phones, computers, hairdryers, washing machines, dishwashers, or any standalone energy-using device in the household. Given their anticipated expansion into many spheres of commerce, WPT stations will increase indoor exposures to wireless radiation through free-flowing power. The FCC has recently granted its first certification for over-the-air, power-at-a-distance wireless charging [64], [65].

While our document focuses on technical and scientific deficiencies of the proposed rule, we must note that with respect to WPT markets are rapidly expanding as these words are being written, with no consideration of the absence of health and safety information. Industry analysts report that the wireless charging market including Starbucks and McDonalds and a growing number of retailers exceeded 11 billion in 2019 and is expected to grow at 14.5% CAGR between 2020 and 2026 driven largely by a rise in global sales of wearable devices and high-end smartphones [66]. While health and environmental impacts of WPT are currently unknown, as the remainder of this document will make clear, they are not unknowable. Indeed evidence already amassed on the health and environmental risks of 3G and 4G that is discussed below, indicates that there are serious health concerns, especially for children, pregnant women and men who wish to father healthy children.

WPT and 5G have in common that they both involve bringing exposures much closer to dense human contact than at any time in history. The environment around WPT is filled with more free flowing power than standard WiFi or cordless phones emit. Indeed, a report from an international tech online magazine provided this telling statement from an anonymous executive of a major hardware company:

“I don’t think I would want to be in a room with free moving power signals.”

The exponential growth in wireless power transfer and charging constitutes an unparalleled increase in the amount of EMF radiation in our everyday world taking place without any prior evaluation of potential health and environmental impacts. The online technology evaluating website, Engadget [65] reported that dishwashers are being designed that can charge a cell phone wirelessly at a distance of 15 feet, noting that sending wireless signals that are different for that purpose will result in much wasted radiation distributed in the environment.

“Wireless charging is a little bit more convenient than plugging your device in, but was picking up a microUSB lead ever that much of a chore in the first place?...Then there’s the question of if it wouldn’t be damaging to health in the same way that people have raised concerns about living next to electrical substations?” [67]



**We strongly recommend that a thorough independent health survey of wireless transfer be undertaken, especially for applications involving prosthetics and other body contact applications that will entail lifelong exposures.**

## **SAR Definition and Measurement and reliance on the Standardized Anthropomorphic Mannequin (SAM)**

### **History of Exposure Testing, Guidelines, and Standard-Setting (adapted from Gandhi et al., 2012 [68] previously submitted to FCC by EHT)**

In September 1982 the American National Standards Institute (ANSI) published the first dosimetry exposure standard to electromagnetic fields between 300 kHz to 100 GHz. This document proposed 4 W/kg as the limit of absorption under which irreversible damage may occur from RF heating of flesh. A 10 fold safety limit was then arbitrarily imposed for human whole body exposure of 0.4 W/kg averaged over 6 min, and a 20-fold greater spatial peak SAR exposure over any 1 gram of tissue of 8 W/kg averaged over 6 min. As ANSI did not feel competent to judge biological and medical implications of exposure they passed the baton to the Institute of Electrical and Electronic Engineers (IEEE), a body not noted for its medical expertise. This standard was adopted and revised by the IEEE in 1991 [69], to allow whole body average SAR exposure to 0.08 W/kg averaged over 30 min and the spatial peak SAR for any 1 gram of tissue to 1.6 W/kg averaged over 30 min for the general population, with workers permitted to have the same exposures in one-fifth the time, i.e., 6 minutes. With little or no change this standard has remained to this day. It was officially adopted by the FCC in 1996. The guidelines for how to measure the compliance to this standard was standardized in 1998 by the international commission on Non-Ionizing Radiation Protection (ICNIRP) in 1998 [70] and finally approved by the FCC in 2001. It is surprising that public health research has never featured in the adoption of the principal tool for human exposure safety until the National Toxicology Program study of 2017.

The FCC exposure limits were, and remain, identical to the 1991 IEEE standard. The FCC SAR adopted values were: (1) For occupational exposures, “0.4 W/kg as averaged over the whole-body and spatial peak SAR not exceeding 8 W/kg as averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube). Exceptions are the hands, wrists, feet, and ankles where the spatial peak SAR shall not exceed 20 W/kg, as averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) [averaged over 6 minutes].” (2) For the general population exposures, “0.08 W/kg as averaged over the whole body and spatial peak SAR not exceeding 1.6 W/kg as averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube). Exceptions are the hands, wrists, feet and ankles where the spatial peak SAR shall not exceed 4 W/kg, as averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) [averaged over 30 minutes].”

Finally in 2001 the FCC established a standardized cell phone SAR certification process was available (the SAM cell phone certification process). However, the FCC continued to offer the alternative computer simulation certification process [68] .

The FCC definition of SAR and its measurement remain unchanged based on assumption that there are no effects in addition to thermal impacts and that the adult head and body phantom of the Standard Anthropomorphic Mannequin (SAM) are protective of children of all ages to adulthood. We should note that SAM is based on the 98th percentile of military recruits in 1988, weighing about 220 pounds with a 12-pound head. While the FCC safety standards apply to all users' body sizes (from small children to large adults), the actual testing model is based upon a 6'2", 220 lbs. large adult male. According to a 2011 study [68], SAM represents only the largest 3% of cell phone users.

The continuation of point 7 of the docket states as follows:

*"7. ....Accordingly, there is no reason to expect that thermal effects will effectively change at the increasingly higher frequencies. Accordingly, the Commission proposes to extend the same constant exposure limits that presently apply from 6 GHz to 100 GHz up to an upper frequency of 3,000 GHz (3 THz),....."*

This statement of the docket is fundamentally flawed, even in the narrow definition of heating effects, as it ignores two well known EM wave/tissue coupling effects. These are Standing Wave coupling and the inconvenient inhomogeneity of the real human body as compared to the SAM [71]–[74]. We will treat each separately below. Furthermore it ignores a biological reality by assuming that superficial skin exposure to the EM spectrum can be of no biological impact. An example of such is detailed in the section "Other Comments".

While these models may have been useful in the early stages of developing standards, they do not reflect current understanding of neurophysiology and development. Effectively the FCC rejects requests submitted to the docket from multiple parties including the American Academy of Pediatrics (AAP), EHT, Dr. David Carpenter, former Dean of Public Health, University at Albany of the State University of New York, and Director of Public Health Laboratory for the State of New York, Dr. Joel Moskowitz of Berkeley, and others that have documented in submissions to the FCC the multiple ways that children are more susceptible to RF [75]. We call special attention to a September 2019 letter sent to Members of Congress calling for revised standards to protect children, including the Honorables: Anna Eschoo, Edward Markey, Elizabeth Warren, Elijah Cummings, Lamar Alexander, signed by Dr. Jerome Paulson, former Chair of the American Academy of Pediatrics Executive Council on environmental health, pediatrician at Children's National Medical Center in Washington, D.C., and Professor in the Department of Pediatrics at The George Washington University School of Medicine and Health Sciences.

## Standing wave coupling reveals inadequacy of SAM/SAR concept

In paragraph 35, the FCC declares that it will exempt several forms of RF from any testing because of the assumed lack of biological impact:

*"As proposed in the 2013 RF Further Notice, a single RF source will be exempt from routine RF exposure evaluation under any one of three circumstances: 1) the RF source transmits at no more than 1 mW average power; 2) the RF source normally operates between 0.5 cm and 40 cm separation from the body, in the frequency range between 300 MHz and 6 GHz, and transmits at no more than the average power threshold result of the formula we adopt based on localized specific absorption rate (SAR) limits; or 3) for all other transmitters, (a) the RF source transmits at no more than the average power threshold result of the set of formulas we adopt based on the maximum permissible exposure (MPE) limits, and (b) the intended operation is normally separated at a distance from any part of the radiating structure of at least  $\lambda/2\pi$ , where  $\lambda$  is the free-space operating wavelength. These specific exemption criteria are a*

*generally-applicable set of formulas, based on power, distance, and frequency, for all services using fixed, mobile, and portable transmitters.”*

This exemption ignores several facts about frequencies above 6 GHz. At these frequencies, wavelengths can approach the same dimension as critical tissue structures and the conditions for standing waves begin, likely resulting in unacceptable increases in absorption and therefore tissue temperature. Standing waves are created when part of a wave is reflected by the boundary between two different tissue layers (for instance the dermis and underlying fat tissues) constructively interfering with impinging wave form. The condition for this to happen is only that the length of the radiation approaches that of the layer thickness.

The underlying assumption of the SAR standard is that the wavelength of the signal is longer than the spatial dimensions of the volume of interest. In this case the situation is quasi static and heating is by absorption of the signal and this is a function of the signal intensity only. But with higher frequency signals, above 6 GHz, this condition is violated as the wavelengths begin to approach the same size as common biological materials. This can easily be seen in anatomically-based finite-difference time-domain (FDTD) electromagnetic simulations using 3-dimensional microCT scans of several important pollinating insects including the honeybee (*Apis Melliflora*) [76]. The FDTD technique (commonly used in heterogeneous human body models) is implemented in the commercial simulation software Sim4life (ZMT, Zurich, Switzerland) that evaluates absorption of RF-EMFs inside the human body as well as that of the honeybee and other insects as a function of frequency. These French researchers devised several different methods for measuring the propagation of EMFs inside and around the obtained 3D insect phantoms noting that absorption necessarily depends on their dielectric properties: the relative permittivity and conductivity.

They reported that:

“All insects showed a dependence of the absorbed power on the frequency. All insects showed a general increase in absorbed RF power at and above 6 GHz, in comparison to the absorbed RF power below 6 GHz. Our simulations showed that a shift of 10% of the incident power density to frequencies above 6 GHz would lead to an increase in absorbed power between 3–370%”

Further, they cautioned that these conditions were likely to result in severe impairment of insect behavior including their capacity to pollinate or produce honey.

The wave length at 6 GHz is  $\lambda = 5$  cm in air and at 3000 GHz it is  $\lambda = 0.1$  mm. Under all circumstances, the effective wavelength in biological structures is caused by wavelength contraction resulting from passage through material that is more dense than air and is given by  $\lambda/\sqrt{n}$ , where  $n$  is the index of refraction of the tissue. Different tissue structures with different indices of refraction and dielectric constants have been identified reflecting their different densities and water contents (fat/muscle of skin/fat) that present distinct planes of reflection for the impinging signal. Effectively the higher the water content of any object, the greater absorption will take place. Consider that the brains of children contain much more fluid than that of an adult. Further, their skull is less dense and can absorb up to 10 times more RF than an adult. We comment further on this subject below.

Accordingly, as wavelengths approach the dimensions of these structures, portions of the wave are reflected back and forth inside the structure and begin to interfere with each other. If the conditions are correct, standing waves in flesh or tissue begin to appear as electromagnetic waves impinge on one another. This enhanced coupling leads to heightened SAR values and the potential creation of hotspots that can occur within different tissues contained within the head and body. **As a result, the crude homogeneous phantoms favoured by current compliance testing relying on the SAM, sanctioned**

and even dictated by the FCC, cannot provide a realistic approximation of human exposures to these higher frequencies because they do not reflect complex differentiated tissue within the human skull. Numerous commentators to the FCC, including EHT on many different occasions, have documented the fact that FDTD models offer much more accurate estimation of absorption because they rely on heterogeneous models throughout the age and sex range, including one of the pregnant young woman.

This is not the first time that the FCC has been made aware of the inadequacy of the SAR definition for such wavelengths/dimensions. We point out articles by Christ et al. [77], [78], Klemm and Troester [79] and Betzalel et al. [80], [81], amongst others showing clear evidence that 5G frequencies can be absorbed deeply and have biological impacts. To quote from the Thesis of Dr. G. Melia [82];

*“Table 1 shows the frequencies at which the penetration depth of each material is 1 cm in the 5-10 GHz range. Over this range, we may expect EM absorption by the human body to be complicated, with possibly no strong relationship to any one biometric parameter (especially once non-normal and non-planar incidence are introduced), due to the effects of reflections within the body’s outer layers. We should add that the eye remains exquisitely vulnerable to RF as the volume is quite small and it lacks any natural cooling mechanism.”*

Table 1: Frequencies that can penetrate 1 cm into three biological tissues [83]

<i>Dry Skin</i>	<i>5.2 GHz</i>
<i>Infiltrated Fat</i>	<i>9.5 GHz</i>
<i>Muscle</i>	<i>4.7 GHz</i>

Simply put, the layered structure of tissues, especially skin, is going to lead to strong coupling and therefore absorption of RF radiation, far higher than the simplistic models employed by the FCC. Moreover, the eyes will be especially prone to damage. Finally, as others have confirmed, systemic immunological and other impacts can occur even with minimal absorption.

**The current docket does not take such wavelength effects into consideration, rendering their own definition of safety insufficient and their preferred measurement technique inadequate.**

## The inhomogeneous brain and body and homogeneous SAM

Without exception, the dielectric constant of the air--indicating the ease with which any signal can penetrate the air-- is uniformly much lower than that of any living tissue which contains fluid or fat. Thus, the dielectric constant of the air is generally assumed to be 1. The dielectric constant of the brain of a child is estimated to approximate 60, while that of an adult may be 30. Because the child brain contains more fluid and fat it will absorb much more radiation than will an adult, as indicated by modeling carried out by Fernandez et al. [84] and Morris et al. [85]. We should add that ICNIRP and the FCC are disingenuous when noting no differences in exposure to the whole head of an adult and child, when brain exposures are understood to be much more relevant and in need of protection.

Even more problematic is the concept enshrined by SAM that it is appropriate to consider the body phantom as a homogenized, uniform liquid and ignore the differences in electromagnetic properties between skin, bone, fat and flesh, [43], as well as basic anatomic distinctions between men and women,

including the exquisite vulnerability of the testes, pregnant women, infants, toddlers and young children. Detailed studies have documented the folly in doing so [73], [74]. The table below illustrates how important properties - conductivity, density and dielectric permittivity - vary wildly for different tissue types.

*Table 2 The parameters for different tissue types in the human head, taken from Ref [86]: Permittivity  $\epsilon_T$ , Conductivity  $\sigma$  (S/m), Density  $\rho$  (kg/m<sup>3</sup>), Specific heat capacity  $C$  (J/kgC), Thermal conductivity  $K$  (W/mC), Metabolic production ( $W/m^3$ ), Blood flow associated term  $B$  ( $W/m^3C$ )*

Tissue	$\epsilon_T$	$\sigma$	$\rho$	$C$	$K$	$A$	$B$
Blood	59.37	2.044	1058	3840	0.49	0	0
Blood Vessel	43.34	1.066	1040	3553	0.46	1600	9000
Bone (Cancellous)	19.34	0.588	1920	2150	0.30	2510	14120
Bone (Cortical)	11.78	0.275	1990	1650	0.30	0	0
Bone (Marrow)	5.37	0.069	1040	2700	0.22	5020	28230
Brain (Cerebellum)	46.11	1.709	1038	3687	0.57	10040	56490
Brain (Gray Matter)	50.08	1.391	1038	3687	0.57	10040	56490
Brain (White Matter)	37.01	0.915	1038	3600	0.50	2820	15890
Skin	38.87	1.845	1125	3610	0.42	2190	12310

The resulting simulation model of the human head (Figure 1) illustrates the heterogeneous nature of tissues within the human head that cannot be reflected in SAM. It therefore makes little sense to persist in using a simplified SAM to gauge the safety of mobile devices. Furthermore, the simulation results (Figure 2) demonstrate large temperature differentials in the cranium or skull due to EM absorption from a mobile phone, with temperature jumps of over a degree in the skin and cranium bone with either the 6 or 30 minute averaged time for exposure.

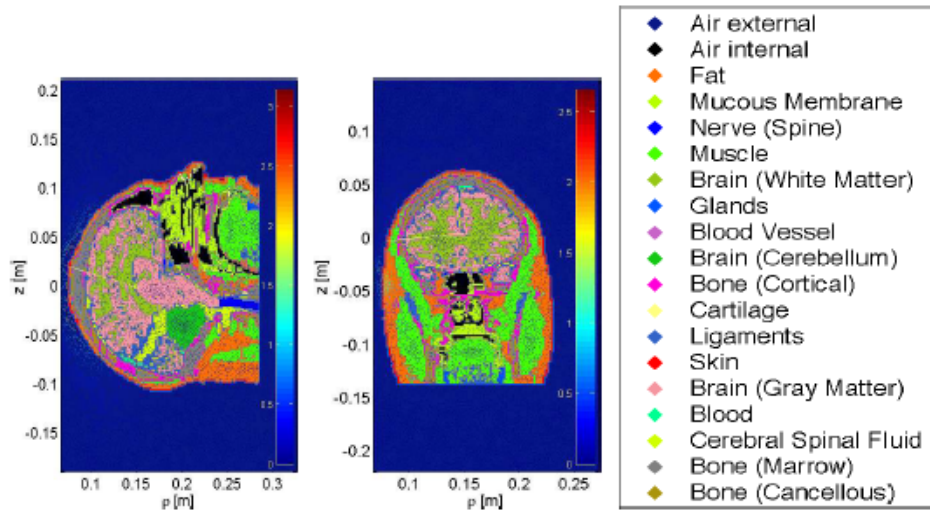


Figure 1 - the distribution of different tissue types in the head by table 2.2. taken from ref. [86]

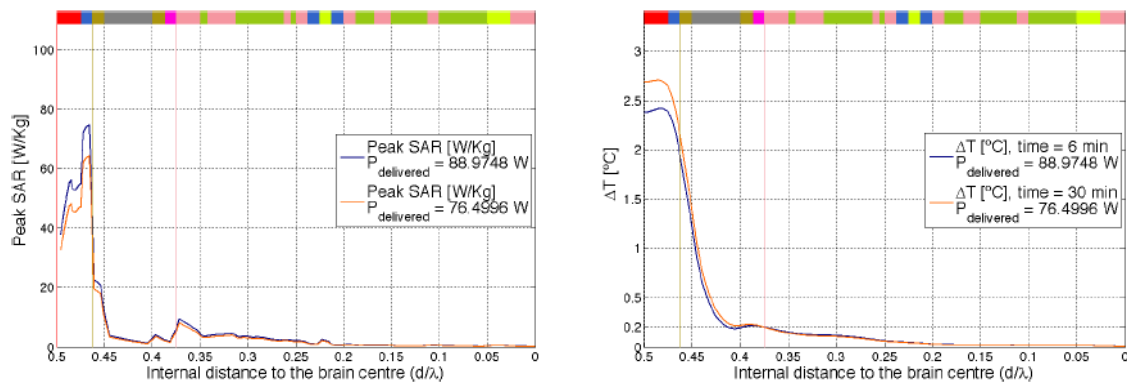


Figure 2 SAR and temperature increase for the cranial setting at 6 and 30 minute exposures. taken from ref. [86]

Further the IEEE and ICNIRP safety guidelines employ a plastic “pinna” (ear) of from 6 to 15 mm in thickness next to the head of SAM for SAR testing of cellular telephones. This contributes to an underestimation of radiation exposures that take place inside the brain that have been amplified and confirmed in testing by ANSES [33] and by independent testing carried out by FCC-certified laboratories for the *Chicago Tribune* [87]. These tests consistently confirm that when phones are evaluated directly next to the body, rather than with a holster allowing up to an inch distance away, the body absorbs up to 11 times more radiation than current outdated thermally-based limits allow. Similar results can be expected for the brain. Reports from Phonegate Alert (<https://www.phonegatealert.org/actualite>) further detail important limitations of current test systems and underlie repeated calls to revise these systems accordingly. Thus, Gandhi reported that:

“Both from measurements and computer modeling that the specific absorption rate (SAR) reduces by 10%–15% for every millimeter separation of the cell phone on account of rapidly diminishing EM fields in the near-field region of the cell phone antenna. This rapid reduction of SAR depending on the antenna and its location on the handset has been shown, both computationally and experimentally, regardless of the phantom model such as a flat phantom suggested for SAR compliance testing of devices in contact with the body, for a sphere phantom, and for head-shaped models used for SAR compliance testing of cell phones. Unfortunately, our observations in the past were based on SARs of only three cell phones. Expecting that the SARs for cell phones may exceed the safety limits for body contact, cell phone manufacturers have started to recommend that the devices can be used at 5–25 mm from the body even though it is difficult to see how to maintain this distance correctly under mobile conditions. The National Agency ANFR of France recently released the cell phone SAR test data for 450 cell phones that measure 10-g SARs reducing by 10%–30% for each millimeter distal placement from the planar body phantom. Their data corroborate our findings that *most cell phones will exceed the safety guidelines when held against the body by factors of 1.6–3.7 times for the European/ICNIRP standard or by factors as high as 11 if 1-g SAR values were to be measured as required by the U.S. FCC.*” [italics added][26]



## **Vulnerability of Children to other medical interventions establishes the need to take special actions to reduce children's exposures to RF**

The docket errs in its assumption that tests developed for mature large adults adequately protect children that contain more fluids, less dense bone, and incomplete myelination, all of which make them more vulnerable to exposures to RF. The docket states:

*“We further decline to revisit our RF exposure policy as it pertains to children. Under IEEE Std 1528-2003—the standard for determining the compliance of devices such as cell phones—the measurement test setup that is used was designed to test for effects on children as well as adults.”*

The IEEE Standard that is referenced above only includes RF between 4 MHz and 10 GHz and importantly does not address the fact that at whatever stage of life they may be exposed, from infancy and toddlerhood, throughout adolescence, children are not merely small adults. Their bodies contain more fluid. Their bones, especially their skull, are less dense. Computer simulations of absorption of continuous wave signals at a single frequency at a time into the head of SAM cannot and do not reliably estimate absorption from simultaneously operating multiple frequencies (typical of a smart phone today) into the different components of the child brain, as previously submitted peer-reviewed publications have made clear. As a result even if RF exposures were identical--and we and others have shown that they are not--the biological impacts can be expected to differ as a result of the differing immune and nervous systems of children.

This IEEE standard relies on the simplified model of the head--essentially an homogenous fluid-holding sphere and body--a pool of uniform liquid, with the intent to provide solely “for the reproducible and conservative measurement of the peak spatial-average SAR (psSAR) ... by radio-frequency (RF) transmitting devices, with a defined measurement uncertainty.” [88]

## **Proposed Peak SAR values and Maximum Allowed Power Density will Result in Unacceptable and Intolerable Thermal Impacts**

The Commission proposes for frequencies above 6 GHz a maximum power density of 4 mW/cm<sup>2</sup> for the general public.

*“9. The proposed general population localized power density value of 4 mW/cm<sup>2</sup> matches the exposure limit specified at 6 GHz in the IEEE Std C95.1–1991 standard referenced in the Commission’s rules. Based on planar models, this standard suggests that a power density of 4 mW/cm<sup>2</sup> just above 6 GHz is consistent with the Commission’s 1-gram SAR limit of 1.6 W/kg at 6 GHz. Also, the thermal perception threshold at frequencies approaching 100 GHz for large areas of exposure is indicated at about 4 mW/cm<sup>2</sup>.”*

Thermal perception is defined as a temperature rise in flesh of less than 0.1 °C. Given the inadequacies of the SAM-based SAR standard which allows an unreasonably large thickness for the ear (“pinna”) and fails to take into account different electrical properties of brain tissue, more realistic simulation studies [89] based on anatomically-modeled 1 mm cubic Voxel models of the head demonstrate that with the current standards one can expect temperature rises 5 to 10 times this level, i.e. well into and well beyond the realm of thermal perception. This proposed level of exposure would result in unacceptably high and

intolerable conditions by allowing prolonged exposures to levels that are relied on for medical devices that are typically used for relatively circumscribed and time-limited periods. (see below)

## SAR values do not adequately depict the biologically disruptive nature of pulsed signals that can lead to permanent tissue damage

The SAR standard refers specifically to averaged values over periods of 6 or 30 minutes estimated for a single frequency at a time and is more suitable to a continuous wave signal (CW) than the pulsed signal trains from multiple operating frequencies of today's modern communication. The belief, and it can be described as a belief as opposed to an established scientific fact, is that there is an equivalence between an averaged power of a rapidly changing pulse train of signals and a CW signal.

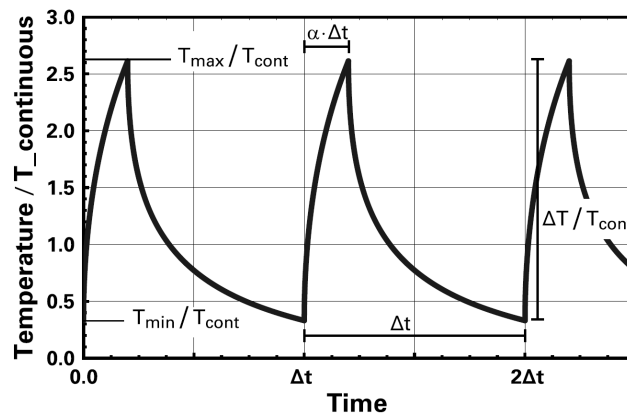


Figure 3 - Taken from [90] Transient temperature oscillations resulting from a pulse train, computed for  $\Delta t = t_1$  and  $\alpha = 20\%$  at an intensity resulting in a temperature increase of 1 K at continuous exposure.  $T_{min}$ : minimum temperature;  $T_{max}$ : maximum temperature;  $T_{cont}$ : temperature at continuous exposure.

By analogy this reasoning would suggest that if a steak is placed on a grill and half the steak is in the pan where it thoroughly cooks, while the other half remains raw and uncooked outside the pan, then the steak can be considered to be cooked on average. Theoretical studies by two of the pre-eminent modelers in the field, Neufeld and Kuster [90] of IT'IS, show significant temperature oscillations from a pulse train in the skin of more than 1 °C for pulses centered around 5 GHz and have led these authors to warn about the need to lower standards for permissible exposures accordingly:

“THE FIFTH generation of wireless communication technology (5G) promises to facilitate transmission at data rates up to a factor of 100 times higher than 4G. For that purpose, higher frequencies (including millimeter-wave bands), broadband modulation schemes, and thus **faster signals with steeper rise and fall times will be employed**, potentially in combination with pulsed operation for time domain multiple access.

5G is designed as a ubiquitous communication system spanning applications such as high-bandwidth mobile data and telephony, real-time machine-to-machine communication (e.g., autonomous mobility), and the Internet of Things (IoT). *Exposure to radio-frequency electromagnetic microwave radiation (RF-EMR) from wireless devices to large radar installations and medical equipment can result in*

*increases in body core temperature or cause localized temperature rises, with the potential for adverse health effects.” [italics added]*

As these influential authors advised:

***“The results also show that the peak-to-average ratio of 1,000 tolerated by the International Council on Non-Ionizing Radiation Protection guidelines may lead to permanent tissue damage after even short exposures, highlighting the importance of revisiting existing exposure guidelines.”***

**We feel that the FCC would do well to heed this advice.**

Kuster and Neufeld relied on a FDA validated model of tissue damage, the CEM43, with an experimental data based damage threshold for human skin of 10 hours. They employed respective safety factors of 10 and 50 in examining thermal and tissue damage models for homogenous skin and modeled temperature changes that can be expected to occur under currently allowed conditions of exposure to RF that can be expected to take place with the implementation of 5G, along with 3G and 4G. They found that for a very low peak-to-average ratio of 100 ( $\alpha \geq 0.01$ ), humans can be expected to tolerate only 30 seconds of exposure before experiencing unpleasant sensations of heat. The main factor underlying the biological impacts of pulsed signals is the disparity between the time width of the EM pulse and the time constant for heat dissipation in the skin, approximately 1000 greater than the pulse width. What this means is that while tissue may be able to absorb the energy of the EM pulse efficiently, it is a lot less efficient at getting rid of the same energy as heat. Therefore the tissue cannot reach a state whereby the energy deposited by an EM wave is dissipated. The resulting buildup of heat translates to a significant temperature change. In the jargon of science, it is a result of a thermal linear response of an electromagnetic impulse. (This situation is akin to a child sitting on a swing that is gently moving and being slowly pushed to and fro. If that same child is stationary on the swing and suddenly receives repeated short and sharp slaps on the back, the swing will barely move, but the energy of the blows will be felt by the child!!)

These results about thermal coupling within tissue have been revised upwards recently [48], [49] and have indicated the need to change ICNIRP guidelines to protect public health.

This rather basic fact of impact and response, understood in physics, is entirely missed by the FCC docket. Indeed, there is no consideration of the erratic pulsation nature of modern communications and the profound biological impact such signaling can have. This significant omission is evident when studying the FCC standards for determining the peak spatial-average SAR [38]–[40]. Effectively the agency ignores the fact that peak pulses, repeatedly taking place over nanoseconds through cellular phone calls, or when apps are constantly updating and downloading, can be far more biologically important than values averaged over a period of 6 or 30 minutes. In fact, where RF averaging is carried out over half an hour this effectively smoothes out any impacts of the thousands of short, episodic peaks that do occur.

**Thus, there is strong scientific evidence in literature showing that in experiments where pulsed signal is used these signals induce biological effects that are different from those produced through continuous wave signals.** Below is an example from a neutral research database, which indicates the important effect of pulsing and the additional importance of using real mobile device -exposure in laboratory experiments [93]–[95]. Effectively greater biological responses occur when studies are able to employ real-world exposures.

# Simulated Mobile Phone Signals in Experiments Do Not Reliably Approximate Biological Impacts of Real-world Mobile Phone Signals

Table 2.2 Number of bio-effect Mobile phone studies with Signal Type and Wave- form [37]

Research Categories	Real Mobile Phone used in Experiments			Simulated Mobile Phone Signals used in Experiments					
Wave form	Pulsed			Pulsed			Continuous		
Outcome	#Effect	#No Effect	#Uncertain Effect	#Effect	#No Effect	#Uncertain Effect	#Effect	#No Effect	#Uncertain Effect
<i>in vivo</i>	120	18	11	69	49	8	6	4	0
<i>in vitro</i>	28	8	1	60	63	7	10	17	2

## Averaging areas for higher frequencies do not Reflect Real-world Properties

When defining appropriate averaging areas, FCC should look at how relatively low power density (average) and SAR levels of RF can cause oxidative stress--as well-established and validated marker of degenerative diseases. In their review of 100 studies, Yakymenko et al. [42] nicely illustrate how these low levels of RF can affect cells (in vitro) and animals (in vivo). Below is a summary of in vitro studies which indicate that both pulsed and continuous wave RF can have impacts, although it appears that the former generally are more impactful[23]

Table 2 - Publications reporting positive findings on oxidative stress form RFR in-vitro [39]

Reference	Biological system exposed	RFR exposure	Statistically significant effects reported*
(Agarwal et al., 2009)	Human spermatozoa	Cell phone RFR, in talk mode, for 1 h	Increase in reactive oxygen species (ROS) level, decrease in sperm motility and viability.
(Campisi et al., 2010)	Rat astroglial cells	900 MHz (continuous or modulated), electric field 10 V/m, for 5; 10; 20 min	Increase in ROS levels and DNA fragmentation after exposure to modulated RFR for 20 min.
(De Iuliis et al., 2009) (Friedman et al., 2007)	Human spermatozoa HeLa membranes	1.8 GHz, SAR = 0.4–27.5 W/kg 875 MHz, 200 $\mu$ W/cm <sup>2</sup> , for 5 and 10 min	Increased amounts of ROS. Increased NADH oxidase activity.
(Hou et al., 2014)	Mouse embryonic fibroblasts (NIH/3T3)	1800-MHz GSM-talk mode RFR, SAR = 2 W/kg, intermittent exposure (5 min on/10 min off) for 0.5–8 h	Increased intracellular ROS levels.
(Kahya et al., 2014)	Cancer cell cultures	900 MHz RFR, SAR = 0.36 W/kg, for 1 h	Induced apoptosis effects through oxidative stress, selenium counteracted the effects of RFR exposure.
(Lantow et al., 2006a)	Human blood cells	Continuous wave or GSM signal, SAR = 2 W/kg, for 30 or 45 min of continuous or 5 min ON, 5 min OFF	After continuous or intermittent GSM signal a different ROS production was detected in human monocytes compared to sham.
(Lantow et al., 2006b)	Human Mono Mac 6 and K562 cells	Continuous wave, GSM speaking only, GSM hearing only, GSM talk, SARs of 0.5, 1.0, 1.5 and 2.0 W/kg.	The GSM-DTX signal at 2 W/kg produced difference in free radical production compared to sham.
(Liu et al., 2013b)	GC-2 cells	1800 MHz, SAR = 1; 2 W/kg, 5 min ON, 10 min OFF for 24 h	In the 2 W/kg exposed cultures, the level of ROS was increased.
(Lu et al., 2012)	Human blood mononuclear cells	900 MHz, SAR = 0.4 W/kg, for 1–8 h	The increased level of apoptosis induced through the mitochondrial pathway and mediated by activating ROS and caspase-3.

When looking at these studies, it is easy to notice that in several, oxidative stress is reported to appear after a few hours exposure and exposure levels are often below existing FCC guidelines. Pulsed signals appear especially biologically active in both human and animal cell cultures, with oxidative stress leading to inflammation and disease, as Yakymenko et al. [42] illustrate above.

## The Skin as the largest organ

### **Medical uses and side-effects of nonthermal levels of EMF spectrum as part of phototherapy for newborn jaundice demonstrates that superficial skin absorption has systemic biological effects**

The docket assumes that superficial skin exposure can be of no biological impact. This flies in the face of long standing medical practice that employs part of the EMF spectrum to treat a variety of serious diseases relying solely on phototherapy--the application of light to the skin surface. The docket states at paragraph 126:

*“however, we do not feel it is appropriate to relax our limits at higher frequencies for exposure from consumer communication devices, considering the already minimal skin depth at 100 GHz. Accordingly, we propose to extend our existing limits to 3,000 GHz (3 THz) to stay ahead of the possibility of technologies being introduced that are only nascent or unknown today.”*

**This FCC statement misunderstands basic biology and the fact that skin exposures can affect multiple organs.** Thus, the longstanding treatment of the bodies of newborn jaundice with nontherma levels of blue-light (400 nanometers) is based on the well-known capacity of skin to send exposed blood cells through the liver which hydroxylates vitamin D to form 25-(OH) vitamin D (25-OHD) and to the kidneys to form the active metabolite 1,25(OH) 2 vitamin D. This well established form of phototherapy is based on the fact that blue light is absorbed superficially by the skin and the capillaries of the baby, enabling these internal organs to change the bilirubin in the blood. Typically this employs a 430 to 490nm light emitting diode (LED) bulb in an overhead lamp (at a distance no greater than 8 cm).

During phototherapy, the newborn must be completely covered to avoid permanent damage to the retina. In fact, because health care professionals working with these babies report nausea, disturbances of their own vision, and other side effects from their own exposures to this part of the EMF spectrum, they take precautions to minimize exposures. While the mechanisms for eye damage are still being elucidated, they include severe damage to the retina [96], [97] termed light-induced damage. Three distinct mechanisms have been identified: photomechanical, photothermal, and photochemical. Photomechanical damage occurs from the sudden increase in energy captured by the RPE, which may lead to permanent photoreceptor damage of rods and cones. This type of damage depends entirely on the amount of energy absorbed and not on the spectral composition. In contrast, photothermal damage arises when the retina and the RPE are exposed to pulsed, brief intense (100 ms to 10 s) light that induce a significant increase in the temperature of these tissues [96], [97].

The more common type of retinal/RPE damage is photochemical, that takes place with either short, intense exposures or with longer chronic exposures, either one of which results in permanent damage

to vision from non-thermal exposure. These phenomena are still being investigated and are believed to involve the increased production of reactive oxygen species (ROS) which lead to oxidative damage. Moreover, when lipofuscin [98]--the brown yellow pigment that accumulates with age in the eye and elsewhere-- absorbs blue light, the material becomes phototoxic, which can lead to further damage to vision [99].

## **The Vulnerability of Children**

A five-year-old's brain, healthy or otherwise, is encased in a thinner skull and contains more fluid than an adult brain. The American Academy of Pediatrics cautions that children need more real face-time than screen time—more laps than apps—and the group has written to the FCC supporting the need to revamp standards to recognize the growing use of these devices by infants and toddlers. Most disconcerting are findings from Nesrin Seyhan, the NATO-supported founding chairman of the Biophysics Department at Gazi University in Ankara, Turkey, whose controlled studies show that prenatally exposed rats and rabbits have fewer brain cells—and those that survive sustain more damage to their brains, livers, reproductive systems and eyes. Recent reports from Yale University's chief of obstetrics and gynecology, Hugh Taylor, found that prenatal exposure significantly increased hyperactive behavior in offspring and altered brain chemistry. Other research carried out by renowned National Institute of Drug Abuse Director Nora Volkow, MD, PhD, finds that just 50 minutes of exposure to cell phone radiation in adult males directly alters the production of glucose— the brain's main fuel [100]. Experimental work completed by American, Australian, Greek, and Turkish teams working with experts in male reproductive health has reported that cell phone-radiation-exposed human sperm die three times faster, swim significantly more poorly, become more deformed, and develop significantly more damage to sperm DNA [101]–[105]. Peer-reviewed publications on all these findings have been previously submitted to the FCC, with several of the researchers named here meeting directly with FCC representatives and with the Interagency Work Group on RF from 2013-18.

## **Human Skin as the largest Organ of the body is ignored**

The FCC proposal fails to understand that the first 2 mm of the skin consists of the integumentary system that include multiple layers of cells and tissues with important immunological, neurological and other functions and that slight immediate penetration can produce profound systemic impacts. Thus, the FCC states at paragraph 126:

*“We are unaware of any reason the limits should be different above 100 GHz than across the already existing wide frequency range. As the difference in body penetration further diminishes towards zero, there is no apparent reason to expect that thermal effects will effectively change in the increasingly higher frequencies. Accordingly, we propose to extend the same constant exposure limits that presently apply from 6 GHz to 100 GHz up to an upper frequency of 3,000 GHz (3 THz), which is considered to be the upper bound of existing radio frequency bands. Starting at 300 GHz or a wavelength of 1,000 micrometers (μm), standards have been developed for lasers primarily for application in industrial settings. In an effort by standards bodies to match the laser standards, RF limits have been increased at millimeter wave frequencies; however, we do not feel it is appropriate to relax our limits at higher frequencies for exposure from consumer communication devices, considering the already minimal skin depth at 100 GHz. Accordingly, we propose to extend our existing limits to 3,000 GHz (3 THz) to stay ahead of the possibility of technologies being introduced that are only nascent or unknown today.”*



The docket assumes that the skin chiefly functions as a barrier or envelope and remains biologically inert. It has been pointed out that in the frequency range supported by this docket most of the signal will not penetrate the body, but will be absorbed in the skin (point 7 of this docket) [17]. However, while absorption may be superficial, it is not inconsequential. Thus, it is increasingly recognized that the skin is not simply a barrier between a messy interior and harsh exterior, but is itself a major organ of the body. Recent results have suggested that the skin plays a significant and pivotal role in the immune system of the body. Furthermore, it is understood that in the frequency region of interest the modality of electromagnetic coupling of signals to skin is complex and efficient, because of the layered nature of skin and structures like the sweat duct [80], [81], [106], [107]. **While millimeter waves may not be absorbed beyond 2 mm into the skin, that distance is sufficient to induce biological impacts given the complex array of immune and other functions that take place within the epidermis as indicated in Figure 2 [65].**

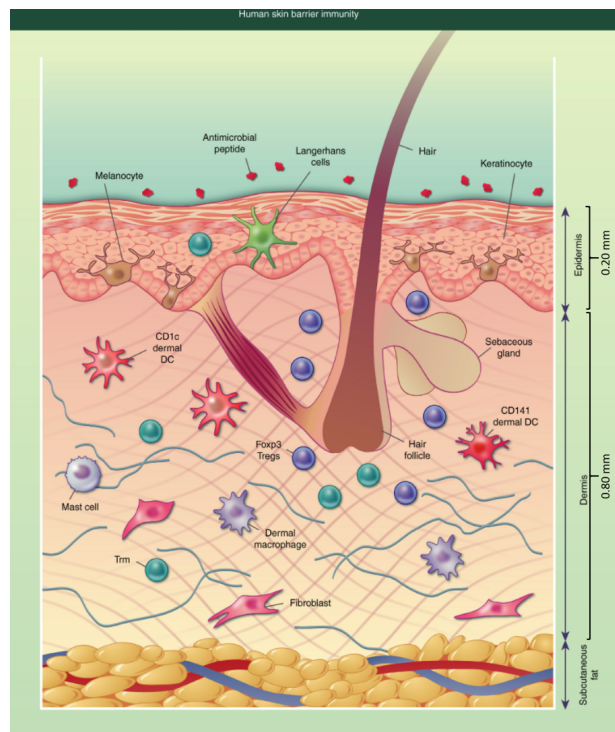


Figure 2. Diagrammatic representation of human skin barrier immunity. The surface of the skin is covered in antimicrobial peptides and lipids, some of which originate from the sebaceous gland located near the hair follicle. The epidermis consists of keratinocytes forming stratified corneum, with melanocytes interspersed. Langerhans cells and T resident memory cells (Trm) can also be found in the epidermis. It is approximately 0.2 mm thick. The dermis (approximately 0.8 mm thick) has a more diverse collection of cells including structural cells such as fibroblasts, and immune cells such as dermal dendritic cells (DCs) and macrophages, CD4+ and CD8+ Trm, mast cells and Foxp3+ T regulatory cells (Tregs), which are often located near the hair follicle. The final layer of the skin is the subcutaneous fat, which is primarily composed of adipocytes.

We note that several recent investigators have detailed the mechanisms through which skin exposures can have systemic effects on the immune system and its tertiary components. For instance:

Kabashima et al. state “Upon inflammation, various immune cells pass through, reside in or are recruited to the skin to orchestrate diverse cutaneous immune responses. To achieve this, immune cells interact with each other and even communicate with non-immune cells, including peripheral nerves and the microbiota. Immunologically important anatomical sites, such as skin appendages (for example, hair follicles and sweat glands) or postcapillary venules, act as special portal sites for immune cells and for establishing

tertiary lymphoid structures, including inducible skin-associated lymphoid tissue.” [108] For more than 3 decades [109], scientists have appreciated that although the skin lacks direct access to the blood or lymphatic circulation, it contains a number of immune-competent cells and can be considered a part of the immune system, governing responses to infections or other potentially threatening agents. These cells include: Langerhans cells, the macrophage-like antigen-presenting cells of the epidermis; keratinocytes, epithelial cells with immune properties; dendritic epidermal T lymphocytes, resident cells that may serve as a primitive T-cell immune surveillance system; epidermotropic lymphocytes, migrants from vessels in the dermis; and melanocytes, epidermal pigment cells with immune properties.

Moreover, it is puzzling to see that the current FCC proposal does not recognize the special vulnerability of the eye to RF, especially the frequencies that will be used in 5G. The skin over the eye is in fact permeable by millimeter waves because it is the thinnest on the body (half a millimeter). In contrast, skin is thickest on the palms of the hands and soles of the feet (1.5 millimeters).

Given the evidence described above, the long term effects of heightened absorption in the skin of 5G and other RF signals cannot be ignored by the FCC. Rates of growth of melanocytes or other precancerous lesions of the skin could certainly be accelerated through exposures to 5G or other RF frequencies, which could also have important immunological effects. Moreover it is understood that in addition to thermoregulation, the skin affects a cascade of responses that are subject to numerous changes with age, as indicated in this figure below.

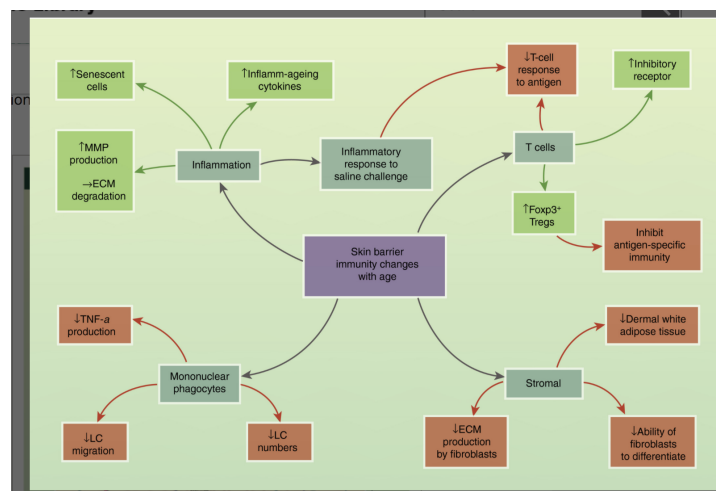


Figure 3 - Skin barrier immunity changes with age. Schematic showing the effect of age on skin-resident populations. Negative/inhibitory effects are shown in red and positive/enhancing effects are shown in green. ECM, extracellular matrix; LC, Langerhans cell; MMP, matrix metalloproteinases; Treg, T regulatory cells

## Millimeter wave medical devices have an effect on internal organs, not just skin

Medical applications of millimeter waves (MMW) utilize a frequency range 42 -100 GHz. This technology (millimeter wave therapy) has been developed within the last 50 years and several reviews [110], [111] show that short exposures of skin in certain specific spots with MMW creates a strong beneficial effect in internal organs (like lung and heart). However, if these spots on skin are irradiated longer periods of time the effect turns harmful [112]. Manufacturers of these medical devices even warn

about using MMW treatments longer than 2 hours per day. From this perspective, running a 5G cell tower 24/7 at similar frequency range as medical MMW devices can be deemed a health hazard insofar as it deviates from MMW medical device manufacturers' safety instructions. Therefore, chronic exposure of MMW frequencies should be tested in chronic exposure set-up using above mentioned frequencies before allowing 5G cell towers, micro cells, end-gadgets and IoT-devices to operate 24/7 in MMW-range.

## **Association of sunlight with Serum Vitamin D levels also indicates that skin exposure affects overall health**

It is well known that those living in sunnier climates tend to have higher levels of serum Vitamin D [113]. In fact, Scandinavian countries fortify their foods with Vitamin D in an effort to combat problems created by their lack of sunlight in the winter. The skin plays a major role in the process of Vitamin D production which takes place through the liver and kidneys as a result of superficial exposure to ultraviolet radiation B that affects systemic production of serum levels. A growing number of diseases are linked with Vitamin D deficiency, including breast cancer, multiple sclerosis, overall mortality, cardiovascular disease, depression and even schizophrenia. Seasonal affective disorder (SAD) has long been recognized to respond to exposures to artificial sunlight that affect major neurotransmitters involved in depression.

## **Many National Responses to Current Safety Standards are more stringent than ICNIRP**

The FCC proposal does not address the fact that other nations have also proposed more stringent approaches to RF especially regarding children [109]. These include:

- **Russia** - The Russian Ministry of Health and the Russian National Committee for Protection Against Non-ionizing Radiation which have just released new recommendations for children now moving to online learning at home on computers. They recommend limiting overall screen time and using wired rather than Wi-Fi. They also warn against using smartphones for educational purposes.
- The exposure limits in Russia, China, Switzerland and Italy are 100 times lower than those proposed by the FCC [17].
- **France** - ANSES has continued to carry out studies of phones in the real world under real world exposures that simulate phones stored in the pocket or on the body. France has banned Wi-Fi in kindergarten and restricts Wi-Fi in school by having the wireless off as the default setting. Teachers have wired (not wireless) computers for internet access. The country launched public health initiatives on how to reduce cell phone radiation exposure years ago.
- **Israel** - They have banned Wi-Fi in nursery schools, restricted Wi-Fi in elementary schools, banned cell phones in classrooms and have a national agency educating citizens on how to reduce cell phone radiation. In 2016, the mayor of Haifa called for wired networks in lieu of wireless in schools.

- **Cyprus** - They have also removed Wi-Fi from elementary classrooms and have a strong public awareness campaign educating parents, teenagers and pregnant women.
- **Belgium** - Banned cell phones manufactured for young children.
- **Italy** - Mayors of several Northern cities as well as some of the Districts of Rome have long called for wired networks to replace Wi-Fi networks in schools in cities such as Borgofranco d'Ivrea, Italy.
- **French Polynesia** - they have also removed Wi-Fi from nursery schools and like Cyprus, launched a major public health campaign.

## Other Comments regarding lack of specificity of what 5G constitutes

**We take exception to the FCC refusal to provide for routine monitoring of emissions from cellphone towers, including their maximum allowed effective radiated power, minimal vertical and horizontal distance permitted.** We note that other nations have adopted such monitoring and, when merited, taken steps to remove or reduce exposures

At paragraph 108, the agency declares:

*“RF Check suggests that the Commission recognize that licensees alone cannot ensure compliance and that a comprehensive, uniform solution that involves all parties is necessary. RF Check proposes the creation of a database in which transmitting antennas are registered and their exposure areas calculated, with the antenna and exposure areas visually depicted. This database would be accessed and viewed by a worker at any worksite via smartphone.”*

**We agree with RF Check that there should be a publicly accessible database with regularly monitored RF levels showing both peak and average SAR, with the former reflecting shortest averaging times.** Evidence is clear that repeated exposures to changing modulated peaks in exposure to weak RF can have major impacts on health. Absent access to real-time monitoring, it will not be possible to evaluate public health and environmental impacts. The assumption that such exposure has no effect has led to a policy where there are no measurements widely available to study whether or not such an effect is occurring.

We note with interest that Israel [11] among other nations has a policy of regular monitoring of cell tower emissions that can be accessed online. The public can access the position of every cell tower in Israel with an interactive map that shows the area of coverage and where signals will be strongest. Of course, it is important with such a system to include power wattage that can be monitored as well. We believe it is critical to institute averaging periods that correspond to potential biological impacts. Thus, peak measurements are more important than for instance a 24 hr average, with the latter being meaningless. It will be important to report peak values as well as other measures.

Importantly, 5G is itself a phenomenon that has not been standardized as to nomenclature or frequencies, referring generally to frequencies above 5 GHz and that can range up to 100 GHz. For the new 5G networks to function completely, any new antennas will have to incorporate 4G and 3G signals along with millimeter wave frequencies [114]. While these earlier technologies currently power most devices operating in the world today, they also have been found to be carcinogenic and to damage DNA, according to the NTP [52] and the Ramazzini Institute [115], among others. Because millimeter wave frequencies cannot travel as far nor can they penetrate buildings or trees, antennas will have to be placed close to human habitation. Effectively these 5G enabled antennas will bring 3G and 4G signals previously reserved for tall towers and more remote locations into closer human contact. This has led more than 370 scientists [116] to call for a moratorium on 5G until safety studies can be carried out and

biologically based standards can be developed to promote reasonable approaches to public health and safety. A similar call by the scientific community in Australia is calling for the same [117].

## The U.S. Navy and NOAA object to 5G interference with astronomy and meteorology from 20,000+ approved new satellites

As we pointed out in our introduction, serious objections have been filed with the FCC concerning the space-based potential for 5G frequencies, as planned and encouraged, that will disrupt weather forecast and the earth observation satellites. According to directors at National Aeronautics and Space Agency (NASA), National Oceanic and Atmospheric Administration (NOAA), and the U.S. Navy, the FCC policies to assist 5G in flourishing in space could jeopardize the collection of vital information for weather prediction and astronomy, including the tracking of satellites [118], [119]. Commercial companies such as Space X and Amazon intend to launch up to 20,000 more satellites for a space-based 5G system working in the 24 GHz range.

Currently there are about 5,000 satellites in circulation, about half of which are ‘junk’, according to several resources [120]. Transmission of information from satellites, weather balloons, ocean buoys, weather radars and other technologies is conveyed by these satellites currently. Thus, if the extra 20,000 5G satellites that are envisioned by Space X and Amazon were actually launched, the transmission of information from such meteorological apparatus will suffer from considerable interference that would impact the accuracy of the forecast in relation to the observations, as measured by the “forecast skill”. In fact, such launching should never occur without a proper assessment of the impact it might have in the “forecast skill”, as noticed by Dr. Jordan Gerth in a letter published by The Washington Post, dated Feb. 28, [114].

Another, important aspect in this deployment is the fact that modern weather analysis relies on the profiling of atmospheric moisture, either by space-based satellites or by ground based polarization radiometers (for example those supplied by Radiometer Physics GmbH. [121]) as these have been replacing weather balloons. These devices operate, typically, in a frequency range from the ~23 GHz to ~90 GHz, and they are essentially passive instruments that use the electromagnetic emission of certain elements at characteristic frequency range in the atmosphere to infer the mentioned atmospheric profiles. In particular, the water vapour line present in the absorption spectrum of the atmosphere at 23.8 GHz will suffer considerable interference of the noise created by the proposed FCC deployment. Thus, it would render atmospheric profiling very difficult, if not impossible. Considering that those profiles are indispensable for the production of meteorological forecasts, it is expected that, once again, this satellite deployment would impact the “forecast skill”.

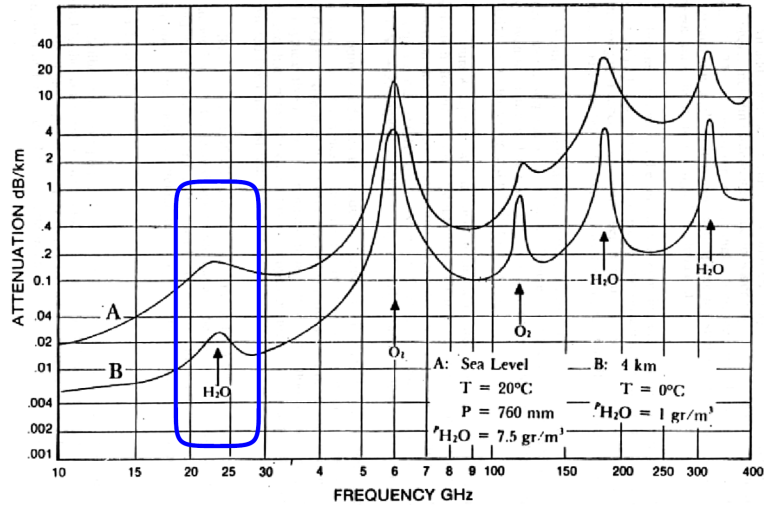


Figure 4 - The Atmospheric extinction coefficient (black line) as a function of frequency. line marked A is measured at sea level and the line B is measured at 4 km. The critical water vapour line is marked at 23.8 GHz by blue rectangle. Sampling of the critical water vapour line at 23.8 GHz would be seriously disrupted by the deployment of LEO 5G satellites using the 24 GHz band for transmission. (taken from the FCC [122])

Here we should note that the FCC has overstepped its competence in rejecting these concerns from these science-based agencies and giving priority to economic development of 5G systems over serious issues raised regarding how the planned satellites would impair the capacity to carry out reliable meteorological forecasts as well as astronomical observations critical to space missions. Please, consider that meteorological forecasts are crucial for activities that go on from primary sectors such as agriculture and fishing, renewable energy to navigation, aviation and security. In proposing policies that would damage weather prediction and astronomical observation, the FCC has not taken into account the possible consequences to food and energy chain, energy supply, etc., that could result in major disruptions in the economy worldwide.

The question then boils down to: “Are these satellites so important to our society that we could risk deployment without a proper assessment of the impact in the “forecast skill” and all its consequences?”

A final remark on this point is that using high-frequencies, especially near the frequency lines shown in Figure 4 to communicate with such a dense network of satellites, would mean that a substantial amount of the signal may be absorbed by the atmospheric water. This fact alone would render this deployment unacceptable and would have two effects that required the FCC attentions: 1) communication will be dramatically inefficient (an educated guess would give a figure of around 90 % of the signal lost); 2) the power absorbed by the atmosphere will tend to slightly increase its temperature, and as the atmosphere is a complex dynamic system, there is no way to understand what impact that heating may have on climate.

The FCC is referred to the mentioned article to complement these comments: The Washington Post published a letter, dated Feb. 28, [119] from the Commerce Secretary Wilbur Ross and NASA Administrator Jim Bridenstine urging the FCC to remove a policy paper that, to quote the letter, “would have a significant negative impact on the transmission of critical Earth science data — an American taxpayer investment spanning decades and billions of dollars with data supporting public safety, natural disaster and weather forecasting.”



The letter said the FCC posted the proposal when “there was no consensus in the interagency on this topic.”

It requested the FCC take down the proposal “immediately” ahead of a scheduled meeting convened by NASA “to continue the long-standing interagency reconciliation process on this important topic.”

On 8th March [123], the FCC replied to the letter and summarily rejected the request. It claimed that it had already “engaged extensively” with Commerce, NOAA and NASA, and that matters had been settled by the State Department, the appointed “arbiter.” This is an astonishing usurpation of scientific competence and authority by an agency that has no expertise in either weather prediction or astronomy. It is tempting to ask if you would want an FCC official to be commanding Space Force or SpaceX rockets. Moreover, having the State Department rule over the matter seems ill-advised. While the gist of our comments deal with serious health and environmental concerns, issues of meteorology and astronomy merit the most serious concern, especially given the potential for irreversible damage to systems that have taken decades and billions of dollars to build.

## Suggested Steps

The FCC has failed to take full cognizance of peer-reviewed published scientific evidence submitted to it regarding several other relevant dockets (see Appendix 1) and has also failed to duly consider that other national governments and expert groups have developed protective policies and standards based on the view that pulsed signals are much more biologically active than continuous signals and on the understanding that children and pregnant women require greater protection than others. Biologically based approaches should be developed that seek to achieve exposures that are as low as technically feasible, similar to those adopted for water contaminants at levels deemed As Low as Reasonably Achievable (ALARA).

Originally developed for radiation safety in the 1980s, ALARA [107] has since been advanced by EHT, ORSAA and others as a way to encourage technology to employ hardware and software to achieve the lowest radiation levels necessary for operation.

The outdated and inadequate SAR and SAM standards should be discarded immediately in favour of measures of radiative ambient power density. The measure for how high these should be governed by the ALARA principle described below.

We also note that for years anatomically-based, highly-detailed whole-body models of humans throughout the age range including models of specific major organs, termed the Virtual Family (VF), have been employed to assess potential medical and surgical devices. Carried out in collaboration between the U.S. Food and Drug Administration (FDA), the Foundation for Research on Information Technologies in Society (IT'IS Foundation, Zürich, Switzerland), Schmid & Partner Engineering AG (SPEAG, Zurich, Switzerland), the Hospital of the Friedrich-Alexander-University, Erlangen, Germany, and Siemens Medical Solutions, Erlangen, Germany, the VF project was developed from MRI models of healthy volunteers. Swiss researchers have refined this further with ZMT Zurich MedTech AG (ZMT, Zurich, Switzerland) and the IT'IS Foundation have sponsored the release of VF 2.0 and 3.0 models.

The FDA website depicts the VF models as follows [124] : “VF models are used for electromagnetic, thermal, acoustic, and computational fluid dynamics (CFD) simulations. Examples of applications of electromagnetic and thermal simulations are the assessment of the safety of active and passive medical implants in an MRI environment and the evaluation of the safety and efficacy of ablation devices. Electromagnetic and thermal simulations have been performed on the entire set of VF models and

additional models of children to calculate the whole-body averaged and local specific absorption rate (SAR) during exposure to 1.5 and 3T whole-body MRI coils. These electromagnetic and thermal simulations have also allowed the evaluation of the safety of multi-channel transmit radio frequency whole-body MRI coils. An example of application of electromagnetic and CFD simulations is the assessment of the applicability of the magneto-hemodynamic effect as a biomarker for cardiac output<sup>6</sup>. Acoustic simulations have been performed to assess the impact of the human anatomy on the focus location, shape, and intensity of ultrasound waves during focused ultrasound treatment<sup>7</sup>. As of the end of 2014, the VF was used in more than 120 medical device submissions to FDA and was cited more than 180 times in peer-reviewed literature.”

We ask the agency to ponder this: *If VF models are used for electromagnetic, thermal, acoustic, and computational fluid dynamics (CFD) simulations, why cannot these same models be used to evaluate biological absorption and impacts of RF from cell phones and other wireless devices and set standards to reduce that exposure to the lowest feasible levels?*

EHT, along with other public health experts, have consistently called for biologically based standards that would rest on ALARA. This approach would approve those technologies that show clear evidence of limiting exposures through innovations in hardware (such as antenna design) as well as innovations in operating systems (such as default frequency of updating and downloading, and automatically going to sleep mode when in various states of relative inactivity or as sensed by accelerometers--that automatically sense when a device is next to a human body).

Although there is a dearth of research into what are truly acceptable levels of ambient power density for the frequencies of interest below which there appears to be little or no biological impact, the authors note important research by Zothansiam et al. [46] . This research documents and relates DNA damage and antioxidant status in populations living in the immediate vicinity (less than 80 m) of cell phone towers compared to those, a control population, living far from the same towers (more than 300 m). **This study, professionally and thoroughly done, shows that for ambient power densities of 0.014 - 0.065 mW/m<sup>2</sup>, measured for the control population, the traces of such biological damage are greatly reduced, compared to the exposed population. As a start for an ALARA standard one could consider this power density range for not just ambient exposure, but as an acceptable level of device exposure.**

Further, we wholeheartedly agree with the AAP and other experts in pediatric neurology [125] from many nations that young children should not routinely be exposed to these devices or expected to use them for educational purposes.

As pointed out in a recent review on the physiological effect of millimeter waves on human skin [126], there have only been 99 studies covering the proposed frequency band for 5G. In short there is an urgent need for independent research.

In that regard, the FCC should undertake a major public educational campaign with the industry to make information about current protocols including distances from the body that phones and tablets are tested broadly known. Further, efforts should be launched to promote wired access in schools and homes and to encourage young parents to always download information from wireless devices and put devices on airplane mode before handing them to children. Prompted by the lawsuit from the University of California Berkeley, Environmental Law Clinic and Dr. Joel Moskowitz of UC Berkeley, the State of California attempted to provide a broad educational program to promote awareness of the reasons why and methods how to reduce exposures to wireless radiation. First proposed in 2009, based on guidance developed by the University of Pittsburgh Cancer Institute Center for Environmental Oncology, the

program included a major educational program to staff and their families. After some 27 revisions, the final program released by California's Health Department was substantially watered down but does include guidance about why and how to reduce wireless radiation, especially for children, pregnant women and those with pre-existing conditions [127].

We hope that the States will also partner with industry to expand efforts to promote better public, employer and worker understanding of the need to reduce exposures to wireless radiation. We note that, for more than two decades, no major secondary insurer will provide coverage for any health or environmental damages from cell phones or other wireless radiation. In several European nations, harmed individuals have succeeded in obtaining major financial damages from their former employers for having required them to use phones as part of their work [28], [128]. As such lawsuits mount, they may also add to the pressure for reform. **As the weight of litigation mounts, the question will be asked: why has regulation ignored the warnings of science ?**

## Conclusion

The FCC proposed changes in rules regarding human exposure to RF/EMF fail to acknowledge the state of the art of the published peer-reviewed science, developments of more stringent standards by other nations, and relies on outdated assumptions and methods for testing phones and other wireless devices. Further the proposal ignores more than 60 peer-reviewed submissions from EHT-associated scientists and several hundreds from others from a number of experts that have long worked in the field, including A. Blake Levitt, the scientists of the ORSAA, Phonegate Alert, The *Bioinitiative Report*, Environmental Grassroots and many others. Since 2013, the agency itself has had less than 1 full time equivalent staff member assigned to the duty of reviewing this and related dockets. Further, the agency has never conducted a systematic inventory of the materials submitted since from 2013-to the end of 2019 when indication of this action was first given, has not tasked consultants with carrying out a thorough review of the submitted material and currently has an unworkable database of all the records submitted thus far, despite its obligation to maintain a transparent indication of relevant efforts undertaken regarding this proposal.

Moreover, the agency is out of touch with the substantial body of scientists and other government experts that concur that there is serious evidence of nonthermal effects in animals and humans, including the capacity of current levels of radiation from cellphone and other wireless radiation to cause multiple forms of cancer, damage DNA, impair reproduction, interfere with sleep and memory, disturb production of melatonin, affect cardiac function, affect the nervous system, and a number of other serious neurological and developmental impacts.

We recommend a halt to the roll-out of the fifth generation, 5G, for telecommunication and for the expansion of wireless networks until hazards for human health and the environment of these new frequencies and the densification of networks have been fully investigated by scientists independent from industry. 5G paired with densification of 4G antennas will substantially increase environmental exposure to radiofrequency electromagnetic fields. We also recommend federally developed safety limits based on empirical scientific studies that have thoroughly investigated long term effects to humans, animals, insects, trees and the environment. Federal safety limits should be based on adequate data from animal and human research, not based on assumptions.

In 2014, the Safra Center for Ethics of Harvard Law School issued a report that may explain why the FCC has been so lax in its review of this serious matter affecting every man, woman and child in this nation and around the world. The report by Norman Alster for the Center concluded that the FCC is a captured

agency, noting that its leaders have regularly been recruited from and returned to the industry that it regulates with little capacity for independent review and evaluation. Indeed the technical demands of the issues with which the FCC must regularly grapple mean that few are trained or equipped to comprehend the complexities of the numerous issues with which the agency is charged. The systematic shrinking of federal funds for research on this topic, fueled in large part by lobbying from one of the most profitable industries in the world--the telecom industry-- also speaks legions about why the government has consistently failed to ask important questions regarding the biological and environmental reverberations of this growing technology and provide the means to find their answers. As an old proverb runs--if you don't want to know, don't ask.

We urge the FCC to ask the hard questions that it cannot answer at this time. What are the impacts on public health and the environment of the unprecedented expansion of this industry? What will be the ERP from 5G enabled antennas that will include 3G and 4G operating antennas that can be installed within yards of residences around the nation? What are the consequences for future workforce development of producing young children that can and are encouraged to swipe before they talk or walk? What are the social and emotional consequences of encouraging children to rely on computers, rather than learn how to work as teams to solve problems? What are the repercussions of encouraging digital devices to serve as intermediaries between young parents and their children? Fundamentally, do we have evidence of the safety of wireless radiation?

We are chiefly concerned about public health and the environment. We concur with the AAP that young children are at highest risk from medical and behavioral problems. We also raise a warning flag, appreciating that if 5G does further impair honeybees and 2,000 other pollinators, then agriculture itself is at risk. Others have documented that trees and agriculture are directly vulnerable to this radiation .

The burden of proof the agency is demanding of us appears to be inherently unreasonable. We are asked to prove that the ear should not be treated like the hand or foot. We are asked to show why children should not be considered simply small adults? Effectively, the only proof of harm that would be deemed sufficient in this record would be that created by those who have directly incurred damage to their own health, literally become the bodies of evidence through their documented suffering as a result of EMF exposures.

We urge that the agency revise its approach to evaluating cellphones and other wireless devices to take into account the body of peer-reviewed scientific evidence in EMF-Portal [23]and ORSAA [34] At this point, evidence has accumulated of serious health impacts in children, in men of reproductive age, as well as a growing body of experimental studies showing clear evidence that cellphone and other wireless radiation can damage memory, learning, behavior, and the capacity of men to father healthy families if they chose to do so. Therefore, the rules for evaluating human exposure should be changed to a biologically-based standard that will be developed in consultation with other national health and communication experts. Until that is accomplished, we advise adoption of the concept of ALARA, in parallel with the positions taken by a number of other expert groups.

## Appendix I: List of EHT submissions to prior relevant dockets

**All Links hereby incorporated by reference.**

Date Received	Proceeding ID	FCC Upload Filing URL	Name of EHT affiliated Filer(s)	Total Page Count
9/13/19	13-39,13-84,03-137	<a href="#">10913927726988</a>	Environmental Health Trust	29
9/13/19	13-39,13-84,03-137	<a href="#">1091340619273</a>	Environmental Health Trust	51
9/13/19	13-39,13-84,03-137	<a href="#">10913296696567</a>	Environmental Health Trust	34
9/13/19	13-39,13-84,03-137	<a href="#">109131837001830</a>	Environmental Health Trust	33
9/13/19	13-39,13-84,03-137	<a href="#">1091314126731</a>	Environmental Health Trust	21
9/13/19	13-39,13-84,03-137	<a href="#">10913128473042</a>	Environmental Health Trust	26
9/13/19	13-39,13-84,03-137	<a href="#">10913119016386</a>	Environmental Health Trust	25
9/13/19	13-39,13-84,03-137	<a href="#">109130755017293</a>	Environmental Health Trust	27
6/17/19	19-71	<a href="#">1061728670863</a>	Environmental Health Trust	35
6/17/19	19-71	<a href="#">10617092931536</a>	Environmental Health Trust	13
6/3/19	19-71,19-36	<a href="#">10603967407328</a>	Environmental Health Trust	35
4/29/19	13-84,03-137	<a href="#">10429038011618</a>	Environmental Health Trust	6

4/29/19	13-84,03-137	<a href="#">10429016089243</a>	Environmental Health Trust	44
12/10/18	13-84,03-137	<a href="#">1210030663890</a>	Environmental Health Trust	47
10/1/18	13-84,03-137	<a href="#">1001332406626</a>	Environmental Health Trust	55
7/18/18	17-79	<a href="#">1071877199353</a>	Environmental Health Trust	1
5/31/18	17-79	<a href="#">10531586230040</a>	Environmental Health Trust	115
9/6/17	13-84,03-137	<a href="#">1090617265110</a>	Environmental Health Trust	1
9/6/17	13-84,03-137	<a href="#">10906049223245</a>	Environmental Health Trust	17
9/6/17	13-84,03-137	<a href="#">10906001218058</a>	Environmental Health Trust	57
7/11/17	17-79,15-180,17-84,13-84,03-137	<a href="#">10711815002508</a>	Environmental Health Trust	191
6/29/17	17-79,15-180,13-84,03-137	<a href="#">106292067109730</a>	Environmental Health Trust	14
6/7/17	17-79,13-84,15-180	<a href="#">10607967426295</a>	Environmental Health Trust	46
6/7/17	17-79,15-180,13-84	<a href="#">106070048305926</a>	Environmental Health Trust	134
2/20/17	16-421	<a href="#">102200773116598</a>	Environmental Health Trust	787
7/18/16	13-84,03-137	<a href="#">10718080685516</a>	Environmental Health Trust	59



7/11/16	14-177,15-256,10-112,97-95,13-84	<a href="#">10709642227609</a>	Environmental Health Trust	1397
7/7/16	13-84,03-137	<a href="#">10707225417557</a>	Environmental Health Trust	897
7/7/16	13-84,03-137	<a href="#">1070786836035</a>	Environmental Health Trust	597
7/7/16	13-84,03-137	<a href="#">1070795887708</a>	Environmental Health Trust	997
7/7/16	13-84,03-137	<a href="#">10707304111787</a>	Environmental Health Trust	152
7/7/16	13-84,03-137	<a href="#">10707243848074</a>	Environmental Health Trust	523
6/13/16	03-137	<a href="#">60002004449</a>	Environmental Health Trust	7
6/13/16	13-84	<a href="#">60002004448</a>	Environmental Health Trust	7
2/7/13	13-84	<a href="#">6017339199</a>	Toni Stein on behalf of Environmental Health Trust PART 1	4
2/7/13	13-84	<a href="#">6017339198</a>	Toni Stein on behalf of Environmental Health Trust PART 1	11
2/7/13	13-84	<a href="#">6017339197</a>	Toni Stein on behalf of Environmental Health Trust PART 1	11
2/7/13	13-84	<a href="#">6017339196</a>	Toni Stein on behalf of Environmental Health Trust PART 1	37
2/7/13	13-84	<a href="#">6017339194</a>	Toni Stein on behalf of Environmental Health Trust PART 1	4

2/7/13	03-137	<a href="#">6017162987</a>	Toni Stein on behalf of Environmental Health Trust PART 1	4
2/7/13	03-137	<a href="#">6017162984</a>	Toni Stein on behalf of Environmental Health Trust PART 1	11
2/7/13	12-357	<a href="#">6017162980</a>	Toni Stein on behalf of Environmental Health Trust PART 1	11
2/7/13	03-137	<a href="#">6017162979</a>	Toni Stein on behalf of Environmental Health Trust PART 1	11
2/7/13	03-137	<a href="#">6017162978</a>	Toni Stein on behalf of Environmental Health Trust PART 1	37
2/7/13	12-357	<a href="#">6017162977</a>	Toni Stein on behalf of Environmental Health Trust PART 1	37
2/7/13	03-137	<a href="#">6017162954</a>	Toni Stein on behalf of Environmental Health Trust PART 1	4
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2/7/13	12-357	<a href="#">6017162982</a>	Toni Stein on behalf of Environmental Health Trust PART 1	-
2/7/13	13-84	<a href="#">6017339193</a>	Toni Stein on behalf of Environmental Health Trust	17
2/7/13	03-137	<a href="#">6017162862</a>	Toni Stein on behalf of Environmental Health Trust	17

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2/7/13	13-84	<a href="#">6017339176</a>	Toni Stein on behalf of Environmental Health Trust	23
2/7/13	12-357	<a href="#">6017162736</a>	Toni Stein on behalf of Environmental Health Trust	8
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9/16/13	13-84	<a href="#">6017467408</a>	Devra Lee Davis PhD MPH	66
2/4/13	13-84	<a href="#">6017338973</a>	Devra Davis	36
2/4/13	03-137	<a href="#">6017161777</a>	Devra Davis	36
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11/18/13	13-84	<a href="#">6017477112</a>	L. Lloyd Morgan	87
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6/1/20	19-226	<a href="#">10531821017710</a>	Theodora Scarato	43
6/1/20	19-226	<a href="#">10531002724083</a>	Theodora Scarato	110
4/17/18	13-84	<a href="#">10417871820142</a>	Theodora Scarato	135
4/17/18	13-84	<a href="#">10417078206082</a>	Theodora Scarato	34
12/20/16	16-399	<a href="#">122037800466</a>	Theodora Scarato	1122
12/20/16	16-1	<a href="#">12201878924630</a>	Theodora Scarato	-
9/3/13	13-84	<a href="#">6017465938</a>	Theodora Scarato	12
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2/5/13	03-137	<a href="#">6017162275</a>	Theodora Scarato	1
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5/14/20	19-226	<a href="#">1051420599254</a>	Ronald L. Melnick	10
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6/18/19	19-71	<a href="#">1061840066469</a>	angela tsiang	8
6/18/19	19-71	<a href="#">106181427814865</a>	Angela Tsiang	-
9/26/16	14-177,15-256,RM-11664,10-112,97-95,13-84	<a href="#">109262631324881</a>	Angela Tsiang	-
7/14/16	10-112	<a href="#">1071463140829</a>	Angela Tsiang	10
7/14/16	15-256	<a href="#">107140608225937</a>	Angela Tsiang	10
7/14/16	97-95	<a href="#">1071422961888</a>	Angela Tsiang	10

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8/11/17	17-108	<a href="#">191082283432884</a>	Jeromy Johnson	-
5/8/17	17-108	<a href="#">10508181876483</a>	Jeromy Johnson	-
4/26/16	14-28	<a href="#">60001671669</a>	Jeromy Johnson	-
3/5/13	13-84	<a href="#">6017339270</a>	Jeromy Johnson	1
3/5/13	12-357	<a href="#">6017166856</a>	Jeromy Johnson	1
3/5/13	03-137	<a href="#">6017166844</a>	Jeromy Johnson	1
6/21/12	09-182	<a href="#">6017075356</a>	Jeromy Johnson	-
6/21/12	09-182	<a href="#">6017075328</a>	Jeromy Johnson	-
6/21/12	09-182	<a href="#">6017075312</a>	Jeromy Johnson	-
6/21/12	09-182	<a href="#">6017075305</a>	Jeromy Johnson	-
6/21/12	09-182	<a href="#">6017075267</a>	Jeromy Johnson	-

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2/3/14	11-59	<a href="#">6017587307</a>	The EMR Policy Institute	6
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9/3/13	03-137	<a href="#">6017465387</a>	The EMR Policy Institute	77
9/3/13	13-84	<a href="#">6017465393</a>	The EMR Policy Institute	-
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3/7/13	13-84	<a href="#">6017339320</a>	The EMR Policy Institute	19
3/7/13	12-357	<a href="#">6017167065</a>	The EMR Policy Institute	4
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3/7/13	03-137	<a href="#">6017167063</a>	The EMR Policy Institute	54
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5/23/11	01-92	<a href="#">6016786272</a>	The EMR Policy Institute	17
5/23/11	05-337	<a href="#">6016786271</a>	The EMR Policy Institute	17
5/23/11	07-135	<a href="#">6016786270</a>	The EMR Policy Institute	17
5/23/11	09-51	<a href="#">6016786269</a>	The EMR Policy Institute	17
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4/18/11	96-45	<a href="#">6016376592</a>	The EMR Policy Institute	23
4/18/11	01-92	<a href="#">6016376591</a>	The EMR Policy Institute	23
4/18/11	05-337	<a href="#">6016376590</a>	The EMR Policy Institute	23
4/18/11	07-135	<a href="#">6016376589</a>	The EMR Policy Institute	23
4/18/11	10-90	<a href="#">6016376588</a>	The EMR Policy Institute	23
4/18/11	09-51	<a href="#">6016376572</a>	The EMR Policy Institute	23
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4/18/11	07-135	<a href="#">6016376550</a>	The EMR Policy Institute	172
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4/18/11	09-51	<a href="#">6016376503</a>	The EMR Policy Institute	143
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4/18/11	03-109	<a href="#">6016376490</a>	The EMR Policy Inatitute	48
4/18/11	96-45	<a href="#">6016376489</a>	The EMR Policy Inatitute	48

4/18/11	01-92	<a href="#">6016376488</a>	The EMR Policy Inatitute	48
4/18/11	05-337	<a href="#">6016376487</a>	The EMR Policy Inatitute	48
4/18/11	07-135	<a href="#">6016376486</a>	The EMR Policy Inatitute	48
4/18/11	10-90	<a href="#">6016376485</a>	The EMR Policy Inatitute	48
4/18/11	09-51	<a href="#">6016376471</a>	The EMR Policy Inatitute	48
4/18/11	11-13	<a href="#">6016376296</a>	The EMR Policy Institute	6
4/18/11	03-109	<a href="#">6016376295</a>	The EMR Policy Institute	6
4/18/11	96-45	<a href="#">6016376294</a>	The EMR Policy Institute	6
4/18/11	01-92	<a href="#">6016376293</a>	The EMR Policy Institute	6
4/18/11	05-337	<a href="#">6016376292</a>	The EMR Policy Institute	6
4/18/11	07-135	<a href="#">6016376291</a>	The EMR Policy Institute	6
4/18/11	10-90	<a href="#">6016376290</a>	The EMR Policy Institute	6
4/18/11	09-51	<a href="#">6016376277</a>	The EMR Policy Institute	6
8/16/10	10-120	<a href="#">6015851423</a>	The EMR Policy Institute	13

7/20/09	09-51	<a href="#">6015069759</a>	The EMR Policy Institute	94
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6/8/09	09-51	<a href="#">5515364452</a>	The EMR Policy Institute	374
6/8/09	09-51	<a href="#">5515364342</a>	The EMR Policy Institute	257
9/29/08	08-165	<a href="#">5515320020</a>	The EMR Policy Institute	53
8/8/08	08-95	<a href="#">5515185669</a>	The EMR Policy Institute	67
12/6/06	03-187	<a href="#">5513861747</a>	The EMR Policy Institute	28
12/6/06	06-164	<a href="#">5513861740</a>	The EMR Policy Institute	28
3/6/06	02-353	<a href="#">5513482612</a>	EMR Policy Institute	2
3/6/06	04-356	<a href="#">5513482611</a>	EMR Policy Institute	2
3/6/06	02-353	<a href="#">5513482420</a>	EMR Policy Institute	2
3/6/06	04-356	<a href="#">5513482419</a>	EMR Policy Institute	2
11/18/04	04-356	<a href="#">5512035363</a>	The EMR Policy Institute	6
12/8/03	03-137	<a href="#">5510444038</a>	The EMR Policy Institute	20

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2/12/13	13-84	<a href="#">6017339206</a>	Antoinette Stein	12
2/12/13	12-357	<a href="#">6017163528</a>	Antoinette Stein	12
2/12/13	03-137	<a href="#">6017163527</a>	Antoinette Stein	12
2/7/13	13-84	<a href="#">6017339191</a>	Antoinette Stein	139
2/7/13	13-84	<a href="#">6017339174</a>	Antoinette Stein	8
2/7/13	12-357	<a href="#">6017162760</a>	Antoinette Stein	139
2/7/13	12-357	<a href="#">6017162731</a>	Antoinette Stein	8
2/7/13	03-137	<a href="#">6017162728</a>	Antoinette Stein	8
2/7/13	03-137	<a href="#">6017162761</a>	Antoinette Stein	-

## Appendix 2: Worldwide governmental actions on cell phones and wireless radiation limits

**Please see External Attachment of Appendix 2.**



## Appendix 3: Comparisons of materials reviewed by ICNIRP/FDA, ARPANSA, and ORSAA

The following extract is taken from the ” [124]

**Table 1. Comparison of available Epidemiological studies on wireless technology.**

	FDA Report (Cancer only)	ARPANSA TRS-164 (Cancer only)	ORSAA (Cancer only)	ORSAA Other Health Studies
Demonstrates statistical association in user groups. Effect studies	22	12	37	50
Demonstrates statistical association in user groups. “No Effect” Studies	25	14	27	9
Demonstrates statistical association in user groups. “Uncertain Effect” Studies	11	8	14	9
Total	58	34	78	68

The conclusion is very clear. The selection of papers in the FDA report is inadequate and unrepresentative of the available literature.

This recent review by **Pareja-Peña F et al. 2020**, [126] of the 400 MHz – 3 GHz radiofrequency electromagnetic field influence on brain tumor induction is a much more balanced review.

### ***In-vivo* Animal Studies (Genotoxicity/Carcinogenicity and Tumorigenesis)**

I have reviewed the *in-vivo* animal studies cited in the FDA report and compared these with the ORSAA database records, as follows:

The FDA report reviewed 37 studies and the comparison with the ORSAA database is in **Table 2**. The period used to select studies was from 2008 to 2018 (01/01/2008 to 31/12/2018) as stated in the FDA report.

**Table 2: *In-vivo* animal studies in FDA report versus ORSAA database.**

Study type	FDA Report	ORSAA database
Effect	<b>23</b>	<b>43</b>
No Effect	<b>4</b>	<b>5</b>
Uncertain Effect	<b>8</b>	<b>7</b>
NESS (Dosimetry & Setup studies)	<b>2</b>	<b>Didn't collate</b>
<b>Total</b>	<b>37</b>	<b>55</b>

**It is clear that the FDA report reviewed only about half of the available scientific papers.**

Even with their poor quality review of 37 papers, the trend is clear: the in-vivo experimental animal studies show overwhelming genotoxicity resulting from RF exposures.

Once again, the non-cancer bioeffects are omitted in the FDA review. The bioeffects that need to be considered are listed below in their respective categories. Effects found in any of these categories have the potential for long-term chronic health implications. The glaring question is 'Why has the FDA ignored these subject areas?':

- Altered Electrophysiology
- Altered Enzyme Activity
- Altered Protein Levels
- Audiological Effects
- Autonomic Nervous System Effect
- Cardiovascular Effects
- Cell Membrane Effects
- Cellular Signaling Effect
- Central Nervous System Effects
- Circulatory System Effects
- Dermal Effects
- Gene Expression Changes
- Growth/Development Effects
- Learning Effects
- Mitochondrial Effects
- Neurodegeneration
- Neurological System Effects
- Neurotransmitter Effect
- Ocular Effects
- Pregnancy Effects
- Renal Effects

- Salivary Gland Effects
- Skeletal Effects
- Sleep Effects
- Thyroid Effects

## CONCLUSION

**While the FDA report purports to be a scientific assessment, it falls short in many respects.** I conclude that this is just another political report trying to justify the rollout of further wireless technology. We are rolling out wireless 5G technologies without pre-market health testing and this is an unethical experiment on large population groups and the environment. This is not how a reputable risk management approach works. For example, when considering the health risks of ionising radiation at low doses (below 100 mSv), there are biological effects, but no proven health effects. In this case, the International Commission on Radiological Protection ICRP, apply risk management principles such As Low As Reasonably Achievable (ALARA). This principle means that we do the following:

- design equipment to minimise exposure to users;
- administratively advise users on the safe use of devices;
- use alternative methods of service delivery to limit exposure.

In Health and Safety management, the “Hierarchy of Controls” for dealing with risks are:

1. elimination
2. substitution
3. engineering controls
4. administrative controls
5. personal protective equipment.

These philosophies of protection are completely absent from the rollout of wireless technology. This is even more important because man-made EMF, unlike low dose ionising radiation, is not found in our environment. Life on earth has not biologically evolved with this man-made pulsed EMF. ICNIRP statements that a short-term (6 minute) thermal guideline protects everyone are reckless and negligent.

**The current research on existing wireless technologies tells us clearly that we should be taking an approach that reduces exposure, not one which increases exposure. This recommendation includes environmental levels.**

## European Parliament Reports and Memorandum.

Report | Doc. 12608 | 06 May 2011

[The potential dangers of electromagnetic fields and their effect on the environment](#)

[B. Explanatory memorandum by Mr Huss, rapporteur](#)

*Excerpts from the memorandum regarding ICNIRP*

19. To back up their argument, the experts quoted the scientific assessments carried out by associations such as the International Committee on Non-Ionisation Radiation Protection (ICNIRP), a small private NGO near Munich, or by official organisations: the World

Health Organization, the European Commission and a number of national protection agencies. It appears that these European and national organisations or international bodies have based their thinking on the threshold values and recommendations advocated by the ICNIRP when that private association was set up near Munich at the beginning of the 1990s.

21. The representative of the European Environment Agency in Copenhagen, an official advisory body to the European Union, stressed the importance of the precautionary principle written into the European treaties and accordingly pointed to the need for effective preventive measures to protect human health and avoid painful health issues or scandals of the kind already experienced over asbestos, tobacco smoking, lead and PCBs (polychlorobiphenyls), to name but a few. He presented a convincing analysis of the scientific assessment methods currently used and the different levels of evidence to conclude, on the basis of the "Bioinitiative" scientific report and other more recent studies by the Ramazzini Institute in Bologna, that the indices or levels of proof were sufficient at this stage to prompt action by governments and international bodies.

29. The rapporteur underlines in this context that it is most curious, to say the least, that the applicable official threshold values for limiting the health impact of extremely low frequency electromagnetic fields and high frequency waves were drawn up and proposed to international political institutions (WHO, European Commission, governments) by the ICNIRP, an NGO whose origin and structure are none too clear and which is furthermore suspected of having rather close links with the industries whose expansion is shaped by recommendations for maximum threshold values for the different frequencies of electromagnetic fields.

30. If most governments and safety agencies have merely contented themselves with replicating and adopting the safety recommendations advocated by the ICNIRP, this has essentially been for two reasons: in order not to impede the expansion of these new technologies with their promise of economic growth, technological progress and job creation;

and also because the political decision-makers unfortunately still have little involvement in matters of assessing technological risks for the environment and health.

44. A significant number of top scientists and researchers have banded together in a dedicated international body entitled ICEMS, "International Commission for Electromagnetic Safety", in order to carry out independent research and recommend that the precautionary principle be applied in the matter. In 2006 (Benevento Resolution) and 2008 (Venice Resolution), these scientists published instructive resolutions calling for the adoption of far tougher new safety standards and rules.

45. Scientific studies disclose athermic or biological effects of electromagnetic fields or waves on cells, the nervous system, genetics, etc., which essentially fall into three categories: biological effects influencing the metabolism, sleep, the electrocardiogram profile; effects observed in experimentation on animals or in cell cultures (in vitro); effects emerging from epidemiological studies on prolonged use of mobile telephones or on living near high voltage power lines or base stations of relay antennas.

#### [Serious Safety Concerns about 5G Wireless Deployment in Australia and New Zealand](#)

"Contrary to the ARPANSA claims, when we examined the limited number of studies that investigated effects of mm waves (carrier waves of SG), we found concerning evidence. When we searched for airport screening/radar safety studies we could not find a single Australian/New Zealand investigation. Studies from elsewhere appear to have mostly found evidence of biological impact. For example, a study by researchers at Shiraz University, Iran<sup>27</sup> published in 2013, but later retracted without an expressed reason, reported a high prevalence of neuro-behavioural problems in the occupationally exposed people significantly associated with their time at work. Their test cohort of airport radar personnel exposed to mm waves (14-18 GHz) revealed neurological, behavioural and cognitive problems despite being young ( $33 \pm 6.8$  years). We contacted the authors and they informed us that their publication was retracted due to pressure from the government authorities (that researchers would face litigation unless they withdrew the publication). Their findings were similar to a number of studies that have found adverse health effects in people exposed to radar.<sup>28•30</sup> Neurological problems (such as migraine, headache and dizziness) were found in exposed residential populations around military radar in a study in Cyprus with a dose response (worse closer to the radar towers).<sup>28</sup> However, the authors of this military-funded study attempted to attribute their findings to antenna visibility or aircraft noise without evidence to substantiate this claim and also ignoring a large body of evidence demonstrating that RF-EMR exposure can cause neurological symptoms. Moreover, researchers at University of Washington Medical Center had previously reported an increased risk of testicular cancer in personnel exposed to hand-held police radar units.<sup>29</sup>"

Bandara P, McCredden J, May M, Weller S, Maisch D, Kelly R, Chandler T, Pockett S, Leach V and Wojcik D. [Serious Safety Concerns about 5G Wireless Deployment in Australia and New Zealand](#). Radiation Protection In Australasia 2020; 37(1):47-54.

Research papers with links submitted as reference on industry influence and conflict of interest.

- The International Journal of Oncology published "[World Health Organization, radiofrequency radiation and health – a hard nut to crack \(Review\)](#)" in 2017 detailing conflicts of interest with ICNIRP and the WHO EMF Project, both started with industry support.
- The American Journal of Industrial Medicine published "[Secret ties to industry and conflicting interests in cancer research](#)" in 2006 about industry funding of studies such as the Danish Cohort cell phone studies that are often put forward show no harm.
- Molecular and Clinical Oncology published "[Appeals that matter or not on a moratorium on the deployment of the fifth generation, 5G, for microwave radiation](#)" in 2020 published in details how ICNIRP is referred to as "a private German non-governmental organization. ICNIRP [that] relies on the evaluation only of thermal (heating) effects from RF radiation, thereby excluding a large body of published science demonstrating the detrimental effects caused by non-thermal radiation."
- Environmental Health published [Childhood Brain Tumour Risk and Its Association With Wireless Phones: A Commentary](#) in 2011 about how a study called CEFALO on brain tumor risks for

children using mobile phones” – authored by several ICNIRP scientists- did not provide assurances of safety as prompted by the study authors. In a [2019 letter](#) signed by several expert scientists the misrepresentation of the CEFALO study was deemed to “represent scientific misconduct.”

- Environmental Research published [Extremely low frequency electromagnetic fields and cancer: How source of funding affects results](#)” in 2019 that found almost all government or independent studies find either a statistically significant association between magnetic field exposure and childhood leukemia, or an elevated risk “while almost all industry supported studies fail to find any significant or even suggestive association.”
- Neurological Sciences published [“Mobile phone use and risk of brain tumours: a systematic review of association between study quality, source of funding, and research outcomes.”](#) in 2017 . The review of the literature and meta-analysis of case-control studies found evidence linking mobile phone use and risk of brain tumours especially in long-term users (greater than 10 years) with a significantly positive correlation- higher quality studies show a statistically significant association between mobile phone use and risk of brain tumour. “Even the source of funding was found to affect the quality of results produced by the studies.”

Please also be aware of these investigative reports on industry influence:

- [The Harvard Press Book “Captured Agency: How the Federal Communications Commission is Dominated by the Industries it Presumably Regulates”](#) by Norm Alster documents the financial ties between the US federal government’s Federal communications Commission (FCC) and how, as a result, the wireless industry has bought inordinate access to—and power over—a major US regulatory agency. [Read that here.](#)
- [“The Disinformation Campaign—And Massive Radiation Increase—Behind The 5G Rollout”](#) by Mark Hertsgaard And Mark Dowie in The Nation April 23, 2018
- [War on 5G: Amsterdam Investigation into Scientists Finds Telecom Influence by Jannes van Roermund and Paul Thacker, De Telegraaf \(Amsterdam\), Jun 2, 2020 \(English translation\)](#) on the American Council on Science and Health attacks against Prof. Moskowitz and more.
- 2020, [Is 5G Going to Kill Us](#), The New Republic by Christopher Ketcham “Modern public health calamities, from asbestos to auto safety to leaded gasoline and tobacco, often follow a predictable narrative. Industry dismisses the health risk, government regulators shrug and look away, and a beleaguered minority is left to sound the alarm”  
[“Health and Cellphones: How Wireless Made Us Think Cell Phones Are Safe” Your Call, KALW 91.7FM San Francisco](#) explores “how big wireless companies used the same playbook as big oil and big tobacco to deceive the public” with guests Dr. Devra Davis and Mark Hertsgaard.
- Democracy Now: [How the Wireless Industry Convinced the Public Cellphones Are Safe & Cherry-Picked Research on Risks](#)

Investigate Europe’s Three Part Investigation on 5G

- [5G The Mass Experiment \(Part 1\)](#)
- [How Much is Safe? Finances Effect Research \(Part 2\)](#)
- [Real 5G issues overshadowed by Covid-19 conspiracy theories \( Part 3\)](#)

## Appendix 4: Additional References for Children and Cell Phone Radiation.

American Academy of Pediatrics Official Letters

- [2013 AAP Letter to FCC Commissioner Mignon Clyburn and FDA Commissioner Margaret Hamburg calling for a review of RF guidelines](#)
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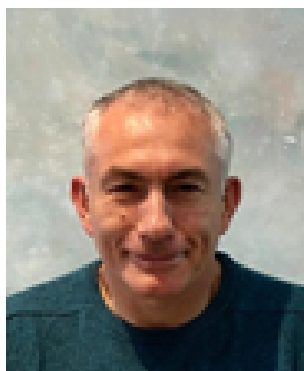
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Devra Davis, PhD, MPH, and Fellow American College of Epidemiology, is the author of more than 220 scientific publications, editor of multiple monographs, and author of 3 popular, award-winning books. Founding President of EHT, she previously served as Founding Executive Director, Board on Environmental Studies and Toxicology, National Academies of Sciences, Engineering and Medicine, Founding Director of the Center for Environmental Oncology, University of Pittsburgh Cancer Institute, Visiting Professor of Medicine, The Hebrew University, Ondokuz Mayıs University, Professor of Epidemiology, Visiting Professor, Sichuan University, and as a U.S. Senate confirmed presidential appointee in public health.



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The ANSES 5G Report should include documentation of the conflicts of interests and history of industry ties of ICNIRP and the WHO EMF Project.

ICNIRP is short for the International Commission for Non-ionizing Radiation Protection. ICNIRP is an invite only, small group of just 14 members that has no oversight. It was founded by scientist Michael Repacholi who was [funneling industry money](#) through a hospital to fund his EMF activities and is now an industry consultant. Repacholi remains an ICNIRP Emeritus Member.

ICNIRP – with its impressive sounding name – is de-facto the standard setting so called “authority” when it comes to answering the question of “what is safe” regarding wireless and powerline frequency extremely low frequency non-ionizing radiation. It does not represent “consensus” as it is made of just 14 people.

“ICNIRP can, and should, be considered as a “private club” where, members of the new Main Commission are selected by the members of the outgoing Main Commission. It is a self-perpetuating and self-promoting German NGO that is not accountable for its actions at all. Nobody controls it. Nobody supervises it. Nobody checks it for conflicts of interests. Nobody checks it for the scientific accuracy. In all what and how ICNIRP does we, the general public, must rely on the self-assurances, from the ICNIRP, that all is in order.” –[Dr. Dariuz Leszczynski on ICNIRP](#)

## ICNIRP Has No Oversight

ICNIRP has up to 14 Commissioners and they only allow in new Commissioners they nominate. It is generally the same group of people for years, shifting positions. For example, Eric Van Rongan started consulting to ICNIRP in 2001, was brought in as Commissioner in 2010, was Chair in 2016, and Vice Chair in 2021. Rodney Croft Joined ICNIRP’s “Biology Standing Committee 2008” and Main

Commission in 2012. Rodney Croft has been ICNIRP Chair since May 2020. Conflicts of Interest (COI) statements do not exist online for those on “Committees” and the COIs now posted for Commissioners only go back a few years which hides the reality that many ICNIRP members have years of industry connected funding, and regularly publish with industry supported authors. Theodora Scarato, Executive Director of EHT has repeatedly [written ICNIRP](#) for clarification on many matters related to transparency and the scientific documentation for their limits and never received a full response to her questions. “The International Commission on Non-Ionizing Radiation Protection (ICNIRP) is a private non-governmental (NGO) organization registered in Munich, Germany. ICNIRP appoints its own members and is closed to transparency. It was started in 1992 with the biophysicist Michael Repacholi as the first chairman, now emeritus member. ICNIRP has published three articles with guidelines on RF-EMF exposure [86, 89, 90]. Only thermal (heating) effects from RF radiation are recognized, thereby excluding all studies showing harmful effects at lower non-thermal intensities. In contrast to ICNIRP, some other expert panels such as European Academy of Environmental Medicine [91], the Bioinitiative group [92], and the Russian Commission for Protection from Non-Ionizing Radiation [93], take into account non-thermal RF effects and suggest much lower guidelines for RF exposure. ICNIRP has managed to get collaborative status with WHO, as discussed previously [88]. The aim is to harmonize the RF-radiation guidelines all over the world. For that purpose ICNIRP has been successful. The guidelines are set to allow very high exposure levels so that the deployment of this technology is not hampered, in favor for industry but at disadvantage to human health and environment. In fact, the ICNIRP guidelines have never been challenged by industry in peer-reviewed articles, which must be taken as a greencard for acceptance by industry.” – [Lost opportunities for cancer prevention: historical evidence on early warnings with emphasis on radiofrequency radiation](#)”

## Investigate Europe Refers to ICNIRP as a “Cartel”

A “close knit” “small circle of insiders who reject alarming research” according to Investigate Europe. As part of a 3 part investigation called, “The 5G Mass Experiment,” Investigate Europe, a team of investigative journalists from the European Union examined the risks of deployment of 5G, and the adequacy of electromagnetic field (EMF) safety guidelines promoted by ICNIRP. Their investigation details how ICNIRP is industry tied and plagued with conflicts of interest. In [“How Much is Safe”](#) Investigate Europe details the incestuous relationship between ICNIRP, the WHO EMF Project and other authoritative groups. “ICNIRP is the de facto standard-setter of radiation safety limits in much of Europe. Still, it is just one out of several scientific groups. The groups, however, are to a remarkable degree staffed by the same experts.”

Of 13 ICNIRP scientists, six are members of at least one other committee. In the WHO group, this applies for six out of seven. Every third researcher in the EU commission that gave radiation advice in 2015 was represented in other groups. The journalists identified a group of fourteen scientists who either helped create, or defend, the EMF exposure guidelines disseminated by ICNIRP, a non- governmental organization (NGO) based in Germany.

[“The ICNIRP Cartel: Who’s Who in the EMF Research World.”](#) an interactive graphic developed by Investigate Europe details the revolving door between ICNIRP the WHO EMF Project.

“ICNIRP scientists argue that the thousands of peer-reviewed studies that have found harmful biologic or health effects from chronic exposure to non-thermal levels of EMF are insufficient to warrant stronger safety guidelines. The journalists argue that the cartel promotes the ICNIRP guidelines by conducting



biased reviews of the scientific literature that minimize health risks from EMF exposure. These reviews have been conducted for the World Health Organization (WHO) and other government agencies. By preserving the ICNIRP EMF exposure guidelines favored by industry, the cartel ensures that the cellular industry will continue to fund health effects research. – Joel M. Moskowitz, Ph.D., Electromagnetic Radiation Safety, February 11, 2019

- [5G The Mass Experiment \(Part 1\)](#)
- [How Much is Safe? Finances Effect Research \(Part 2\)](#)
- [Real 5G issues overshadowed by Covid-19 conspiracy theories \( Part 3\)](#)

Lennart Hardell and Michael Carlberg published [“Health risks from radiofrequency radiation, including 5G, should be assessed by experts with no conflicts of interest”](#) detailing how the independent evaluations of RF radiation health risks are ignored by ICNIRP and other closely connected groups. ” Conflicts of interest and ties to the industry seem to have contributed to the biased reports. The lack of proper unbiased risk evaluation of the 5G technology places populations at risk. Furthermore, there seems to be a cartel of individuals monopolizing evaluation committees, thus reinforcing the no-risk paradigm. We believe that this activity should qualify as scientific misconduct.” Listen to Dr. Hardell describe the conflicts of interest between ICNIRP, the WHO EMF Project and other groups in the [video](#) below from his talk to in Tallinn in June 3, 2019 (kiirusinfo.ee).

## European Parliament Member Report: ICNIRP Under the Influence of Industry

A 2021 [report](#) released by European Members of Parliaments Michèle Rivasi (Europe Écologie) and Dr. Klaus Buchner (Ökologisch-Demokratische Partei) accuses ICNIRP of being under the influence of the telecommunications industry and ignoring the science showing their harmful effects- specifically with how “the scientific debate has been hijacked by corporate interests from the Telecom industry and conflicts of interest.”

“ICNIRP pretends to be scientifically neutral, and free from vested interests of the Telecom industry. We show with this study that this is ‘playing with the truth’ or simply a lie.”

The report written by Hans van Scharen and edited by Tomas Vanheste and Erik Lambert is entitled, [“The International Commission on Non-Ionizing Radiation Protection: Conflicts of Interest, Corporate Capture and the Push for 5G.” \(PDF\)](#)

The report makes several key points:

- “Employed by industry” is not, in itself, sufficient to avoid conflicts of interest. It is also important to ascertain to what extent ICNIRP research activities may be funded by industry.
- It is clear from ICES minutes that ICNIRP worked very closely with IEEE/ICES on the creation of the new RF safety guidelines that were published in March 2020. And this implies that large telecom-companies such as Motorola and others, as well as US military, had a direct influence on the ICNIRP guidelines, which are still the basis for EU-policies in this domain ....
- From the minutes of [a meeting by the IEEE/ICES TC95 working groups](#) at a Motorola headquarters, a few interesting things got clear: ICES-chair Faraone Antonio from ‘Motorola

Solutions' proudly announced that "ICNIRP has delayed finalizing their conclusions to give full consideration of ICES's recommendations".

- The majority of ICNIRP-scientists have done, or are doing, research partly funded by industry.

For example see the [Link to ICNIRP Commission in 2006](#)

Anders Ahlbom : ICNIRP Chair was Anders Ahlbom later thrown out of the WHO IARC EMF Working Group in 2011 for conflicts of interest because – [as Microwave News reports](#) – Ahlbom was found to be a director of his brother's consulting firm, [Gunnar Ahlbom AB](#)-established to help clients on telecom issues, with an emphasis on environmental and energy regulations. Ahlbom failed to mention this sideline in his "[Declaration of Interests](#)" that is required of all those who participate in IARC cancer assessments. By 2014, ICNIRP started posting COI statements [LINK to ICNIRP in 2014](#) but note that there are non posted for Repacholi and the Vice Chair is Maria Feychting, Anders Ahlbom's protégé. As an Interphone study Principal Investigator (PI) she received money from the Mobile Manufacturers Forum and the GSM Association. As a COSMOS study PI she has received funds from TaliaSonera, Ericsson AB, Telenor. As a co-investigator on a childhood leukemia study she received funding from the Electric Power Research Institute (EPRI). She also participated in projects funded by the Swiss Research Foundation on Mobile Communication of Zurich. Among the five founders of this organization are Swisscom (a Swiss telecommunications company, telephony and mobile telephony, and Internet service provider), Orange, Sunrise (a Swiss telecommunications provider based in Zurich), and 3G Mobile (liquidated in 2011). As the way back machine did not save the COI statements we cannot review them.

A brief look at the Scientific expert group [See link to ICNIRP SEG in 2014](#) finds industry tied researchers like Leeka Kheifets who has been funded by Electric Power Research Institute and has participated in projects funded by the Swiss Research Foundation on Mobile Communication de Zurich. Among the five founders of this organization are Swisscom a Swiss telecommunications company, telephony and mobile telephony and Internet service provider; Orange; Sunrise, a Swiss telecommunications provider based in Zurich; and, 3G Mobile, which was liquidated in 2011).

Furthermore the [2014 ICNIRP](#) features Mats-Olof Mattsson who declares on another [Curriculum Vitae](#) that was part of the TeliaSonera (Telecom company) Scientific Advisory Board in 2009, to Andrew Wood who stated in his 2017 ICNIRP COI that he has [in kind support](#) from Telstra in his research department and Marvin Ziskin known to be [funded by industry](#) for his current research.

[5G is testing the limits of trust by](#) Dariusz Leszczynski, Medium, Apr 13, 2021

"For the majority of users of wireless technology, ICNIRP is merely an acronym. They hear that ICNIRP claims to be about science only, void of any influences, be it from the industry or from government radiation regulatory bodies. However, not many users are aware of how ICNIRP operates in practice.

Consider:

1. ICNIRP is a group of about a dozen scientists who claim not to represent anyone else but themselves.
2. ICNIRP claims to be void of any lobbying influence from the industry and from the national radiation protection organizations.
3. Retiring members of ICNIRP are replaced by new members who are selected by current members.
4. ICNIRP's selection criteria, and their justifications for selecting particular new members, are not publicly available. Only ICNIRP members know why a person has been selected to join their group.
5. ICNIRP is not responsible to any entity for the scientific decisions they make.
6. No one has controls over how ICNIRP arrives at their recommended safety guidelines.
7. There is no oversight of ICNIRP's activities by anyone.

8. ICNIRP has no legal responsibility for their scientific opinions.”

and

“However, interestingly and worryingly, ICNIRP Chairman Rodney Croft, Professor of Psychology at the University of Wollongong in Australia, has recently stated in an interview with [“The Feed” on Australian TV on June 16, 2020](#):

“There is no harm associated with 5G”

“Look, it’s very true that the amount of studies that specifically look at 5G are very limited, but from a science perspective that just isn’t relevant”

In summary,

- ICNIRP is an organization that functions without any control or oversight, either scientific or legal.
- There is no control over whether or not telecom industry or national radiation protection organizations are actively lobbying ICNIRP.
- ICNIRP trivializes the lack of research on 5G millimeter-waves and health, as expressed by the ICNIRP Chairman.
- The opinions expressed and decisions made by ICNIRP members are considered not sufficiently science-based by national science groups in several countries, as well as a number of prominent scientists.
- While members of ICNIRP do not have any legal responsibility for their scientific opinions, the telecom industry that uses ICNIRP safety guidelines for their products does have legal responsibility should their devices cause health harm.

In this scientifically and legally complex situation, there is an urgent need to perform an independent validation of the results of ICNIRP’s review of science and of the validity of the ICNIRP safety guidelines.“

–[5G is testing the limits of trust by](#) Dariusz Leszczynski, Medium, Apr 13, 2021

As detailed by Dr. Hardell in his [International Journal of Oncology article](#), the biophysicist Michael Repacholi from Australia was the first chairman of ICNIRP in 1992 and is still Member Emeritus. He also founded the EMF Project of the World Health Organization via industry funds. “Michael Repacholi immediately set up a close collaboration between WHO and ICNIRP (being head of both organizations) inviting the electric, telecom and military industries to meetings. He also arranged for large part of the WHO EMF project to be financed by the telecommunication industry’s lobbying organisations; GSM Association and Mobile Manufacturers Forum, now called Mobile & Wireless Forum (MWF) (51) in addition to WHO, see the International EMF Project, Progress Report June 2005–2006 [IAC Progress Report 2005-2006](#).

“Repacholi acted like a representative for the telecom industry while responsible for the EMF health effects department at the WHO (See <http://microwavenews.com/news/time-stop-who-charade>). Since he left WHO in 2006 he has been involved in industry propaganda video interviews with GSM Association and Hydro Quebec where he clearly speaks in favor of the telecommunications and the power industries, respectively. “

“ICNIRP funding partly comes from government regulatory bodies, such as, for example, the Australian Radiation Protection & Nuclear Safety Agency (ARPANSA). What is actually going on is best described as ‘money laundering’ by the Telecom industry through government (ARPANSA) and onto WHO’s International EMF Project and ICNIRP” – [Oceania Radiofrequency Scientific Advisory Association as quoted in the European Parliament Member Report](#)

The [European Parliament Member Report](#) on ICNIRP details several of the ways that industry money supports ICNIRP and other government authorities. For example, in Australia, not only does a tax on telecommunications companies get earmarked for the funding of the Australian Radiation Protection & Nuclear Safety Agency but [Public Information Requests](#) reveal quite clearly that the Telecom group AMTA is the funder for the research on electromagnetic radiation administered by National Health and Medical Research Council. The [PIAs](#) also reveal that ARPANSA considers itself “part of ICNIRP”. According to the Australian research group ORSAA “the money that the Australian NHMRC receives in order to provide grants for medical research has mostly gone to industry-friendly researchers who have direct links with the wireless industry. For example, the largest recipient of this NHMRC research funds is Prof. Rodney Croft. He has essentially been the head of RF-EMR health research in Australia, despite his questionable qualifications for this health research role.” ORSAA explains how Prof. Croft has received ample direct industry funding in addition to his lucrative NHMRC grants.

The telecommunications company Telstra explains [their funding of ACRBR /ACEBR/ NHMRC/Swinburne University on their website](#), “In 2004, Telstra altered its approach to participate in a consortium of leading Australian research institutions to establish a Centre of Excellence in Radio Frequency (RF) EME Research, known as the Australian Centre for RF Bioeffects Research (ACRBR). This centre was funded by the National Health and Medical Research Council (NHMRC). In 2013 a new Centre of Excellence was established called the Australian Centre for Electromagnetic Bioeffects Research (ACEBR). This centre was refunded again in 2019 for a further five-year period. As part of the ACEBR, our ongoing commitment to EME research is also maintained through joint funding of a state-of-the-art RF laboratory at Swinburne University and provision of mobile telecommunications equipment, to support work on RF dosimetry (measurement).”

Fact: Members of ICNIRP such as Croft have a history of receiving financial support from telecommunications company Telstra for their research. Telstra donates their own staff to some of ICNIRP Commissioner's research [labs](#) (Telstra staff includes [Ray McKenzie](#), [Dr Steve Iskra](#), [Dr Robert McIntosh](#)). Several members of ICNIRP have also received funding from EPRI, the industry consulting arm.

Watch some excerpts from [a 2009 investigation](#) into the issue featuring Rodney Croft, now Chair of ICNIRP.

After years of less than transparent information, and years of telecom funding to scientist Michael Repacholi, information about the current funding of ICNIRP has been somewhat provided. Microwave News covers this issue in his article [“ICNIRP’s Principal Patron: Germany “](#) which details how the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety ([BMU](#)), which is the bureaucratic parent of the Federal Office for Radiation Protection provided 70-80% of ICNIRP support in the last three years. Details of Germany’s support for ICNIRP was provided to Microwave News by the BMU

following an information request. ICNIRP also receives an “in-kind-contribution” from the BMU: “free” office space in the BfS. Microwave News also [reports](#) that among the other agencies that support ICNIRP are: European Union Programme for Employment and Social Innovation “EaSI” (2014–2020), International Radiation Protection Association ([IRPA](#)), Australian Radiation Protection and Nuclear Safety Agency ([ARPANSA](#)) and New Zealand Ministry of Health.

The bottom line is that a small group of industry tied individuals are making decisions on safety limits used across the world.

ORSAA [calls this](#) “pure corruption at a huge cost to public health everywhere. This system of funding and promoting an in-club of industry friendly researchers has kept a small number of people in powerful positions within the WHO, ICNIRP, ARPANSA etc., influencing decision making for most of the world.”

“Sowing doubt is ICNIRP’s business. ..It looks as if ICNIRP is once again used by this industry to enforce its interests, and this time with a method copied from the tobacco industry. By sowing doubt for decades, the tobacco industry succeeded in keeping people unsure about the already certain fact that smoking causes lung cancer. Now the mobile communication industry uses the same tactic, and this with even more dire consequences: the addiction might be comparable, but the number of addicts is by far much higher.” – [How the Mobile Communication Industry Deals with Science as Illustrated by ICNIRP versus NTP](#) by Dr. Franz Adlkofer, Pandora Foundation for independent research

## 2020 France TV Investigation

France Télévisions “5G A Wave of Doubt” was directed by investigative journalist Nicolas Vescovacci and broadcast on France 2 on Thursday, November 12, 2020 investigated the industry ties of members of International Commission on Non-Ionizing Radiation Protection. Currently, the full one hour replay is only available to watch in France, however several video excerpts translated into English are posted online for all viewers in all countries.

- [VIDEO CLIP. 5G: Are we protected by the limit values for exposure to electromagnetic waves? Who fixes them?](#)
- [VIDEO CLIP. 5G: Are electromagnetic waves the cause of cancer among Atos employees?](#)
- [VIDEO CLIP. “Phonégate”: since 2016, a doctor has denounced a general overexposure to cell phone waves](#)
- [FULL VIDEO on France Télévisions 5G A Wave of Doubt- \( in France ONLY\)](#)

VIDEO. 5G: are we protected by the limit values for exposure to electromagnetic waves? Who fixes them?

Below certain exposure limit values, electromagnetic waves are harmless, says the WHO. What are these limit values? Are they enough to protect us? By whom are they fixed? “Further investigation” compiled scientific studies and questioned certain risks of conflicts of interest ..

## SCIENCE, POLITICS, AND GROUPTHINK

Article By James C. Lin in IEEE EXPLORE

April 13th, 2021 [PDF](#)

Lin was formerly in ICNIRP. Her writes:

‘Recently, a privately constituted group, with self-appointed membership, published a set of guidelines for limiting exposure to RF electromagnetic fields in the 100-kHz and 300-GHz frequency range [7]. The proposed guidelines were primarily based on the tissue-heating potentials of RF radiation to elevate animal body temperatures to greater than 1° C. While recognizing that the two aforementioned studies [the NTP and Ramazzini Study that found cancer] used large numbers of animals, best laboratory practice, and animals exposed for the entirety of their lives, the private group preferred to quibble with alleged “chance differences” between treatment conditions and the fact that the measured animal body core temperature changes reached 1° C, implying that a 1° C body core temperature rise is carcinogenic, ignoring the RF exposure. The group then pronounced that, when considered either in isolation or within the context of other animal carcinogenicity research, these findings do not provide evidence that RF radiation is carcinogenic.’

“Furthermore, the group noted that, even though many epidemiological studies of RF radiation associated with mobile phone use and cancer risk had been performed, studies on brain tumors, acoustic neuroma, meningioma, and parotid gland tumors had not provided evidence of an increased cancer risk. It suggested that, although somewhat elevated odds ratios were observed, inconsistencies and limitations, including recall or selection bias, precluded these results from being considered for setting exposure guidelines. The simultaneous penchant to dismiss and criticize positive results and the fondness for and eager acceptance of negative findings are palpable and concerning.” – [James Lin](#)

## ICNIRP INVESTIGATIONS

- The International Journal of Oncology [“World Health Organization, radiofrequency radiation and health – a hard nut to crack \(Review\)”](#)
- Thesis focused on ICNIRP: The Procrustean Approach: [An examination of the manipulation of telecommunications standards by political, military, and industrial vested interests at the expense of public health protection.](#)
- Mulerland blog [ICNIRP – investigative files, articles, papers, documentaries](#)

## MICROWAVE NEWS REPORTS

- [ICNIRP’s Principal Patron: Germany](#)
- [The Lies Must Stop Disband ICNIRP](#)
- [“Critique of the ICNIRP Note of September 4, 2018, Regarding Recent Animal Carcinogenesis Studies,” Ron Melnick, September 12, 2018.](#)

## INVESTIGATE EUROPE ARTICLES

The journalists of Investigate Europe did numerous articles on 5G, ICNIRP and the vested interests.

- [The ICNIRP “Cartel”](#)
- [Dr. Fiorella Belpoggi, Director of Research at the Ramazzini Institute, Italy: A case for caution](#)



- [Eric Van Rongen, of the International Commission on Non-Ionising Radiation Protection: “We need more studies on 5G, but it is not ICNIRP’s task to decide that.”](#)
- [5G: How it works and what it does](#)
- [Dariusz Leszczynski: ‘G’ forces unleashed with unknown effect](#)
- [David Gee, former European Environmental Agency senior adviser: The ‘precautionary principle’ is under-used and should be re-championed](#)
- [How much is safe?](#)
- [5G Health Effects](#)
- [Michael Repacholi, former coordinator of the WHO’s programme on potential conflict of interest in industry funding research](#)
- [Louis Slesin, founder and editor of Microwave News: There are more complicated interactions than the pure thermal ones](#)
- [5G The Mass Experiment \(Part 1\)](#)
- [How Much is Safe? Finances Effect Research \(Part 2\)](#)
- [Real 5G issues overshadowed by Covid-19 conspiracy theories \( Part 3\)](#)

## MICROWAVE NEWS

Louis Slesin of Microwave News has covered ICNIRP for years. Here are some articles to read:

- [Germany Supports ICNIRP](#)
- [Will WHO Kick Its ICNIRP Habit?](#)
- [\*\*The Lies Must Stop Disband ICNIRP: Facts Matter, Now More Than Ever\*\*](#)

### Additional Information

#### Global Secondary Insurance Firms Classify 5G as High Risk

A 2019 Report by Swiss Re Institute<sup>39</sup> classifies 5G mobile networks as an "off-the-leash" risk, meaning a high-impact emerging risk that will affect property and casualty claims in more than three years' time.

The report states:

- "Existing concerns regarding potential negative health effects from electromagnetic fields (EMF) are only likely to increase. An uptick in liability claims could be a potential long-term consequence."
- "As the biological effects of EMF in general and 5G in particular are still being debated, potential claims for health impairments may come with a long latency."

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<sup>39</sup> Swiss Re Institute, [New Emerging Risk Insights](#), 2019



A 5G moratorium should remain in place until adequate data demonstrating safety is provided. We have joined with over 400 scientists calling to halt 5G in the [5G Appeal](#). The current weight of scientific evidence refutes the prominent claim that the deployment of wireless technologies poses no health risks ([Bandara and Carpenter, 2018](#)). Evidence supports the [International EMF Scientist Appeal](#) by 244 scientists from 41 countries who have published on the subject in peer-reviewed literature and collectively petitioned the WHO and the UN for immediate measures to reduce public exposure to artificial electromagnetic fields and radiation.

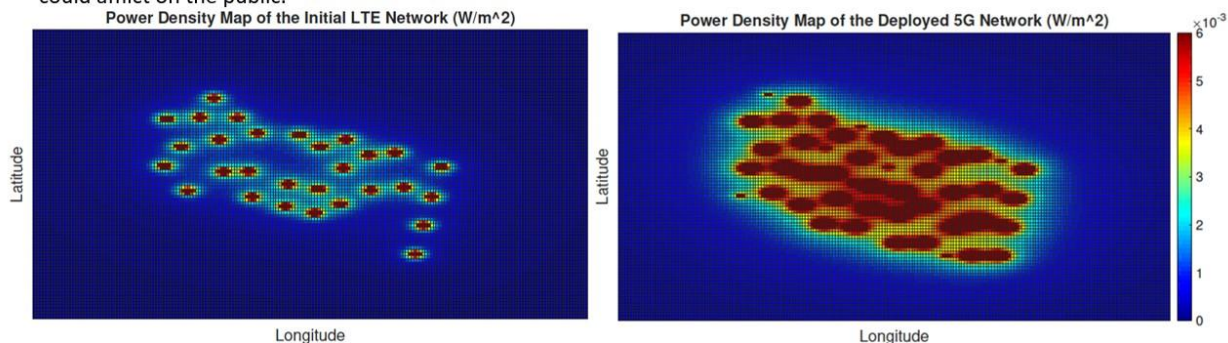
No new frequencies should be deployed until proper testing for long term safety has been completed. The safe alternative is to use wired connectivity for most telecommunications and technology needs. This will reduce the need to increase capacity. We recommend a public awareness program for Europe to educate residents and visitors on how to reduce exposures to radiofrequency radiation. Several countries like Cyprus, French Polynesia and France have large scale public education programs informing residents about the radiation and how to reduce exposure.

A 2020 paper [“Radiation Analysis in a Gradual 5G Network Deployment Strategy.”](#) presented at the IEEE 3rd 5G World Forum documents how engineers found significant increases in levels of radio frequency radiation would result if a mmWave-based 5G network was fully deployed in Austin Texas. The researchers first mapped the pre-existing LTE antennas and then laid out the real world design for the densification of cell towers and signal repeaters which would be needed in the City in order to fully build out a mmWave-based 5G network. The engineers then simulated the RF power densities that would be experienced in the outdoor environments should the 5G mmWave antennas be installed. They found the fully deployed 5G mmWave network would result in significant increases in outdoor RF levels for the City. The researchers conclude that, “This suggests that 5G mobile networks can not yet be classified as safe for the public, and demands serious considerations before using mmWave communications for 5G networks, given the potential harms it could afflict on the public.” The engineers created a heat map to show the increased radiation levels should 5G be fully deployed in Austin Texas.

## 5G mm Wave Deployment Increases Radiofrequency Radiation

"The remarkable increase in radiation levels after integrating 5G infrastructure with the original LTE network can be easily observed through the predominance of the red color in the heat map."

"This suggests that 5G mobile networks can not yet be classified as safe for the public, and demands serious considerations before using mm Wave communications for 5G networks, given the potential harms it could afflict on the public."



A. M. EL-HAJJ AND T. NAOUS, ["RADIATION ANALYSIS IN A GRADUAL 5G NETWORK DEPLOYMENT STRATEGY,"](#) 2020 IEEE 3RD 5G WORLD FORUM (5GWF)

### Documented Impacts to Wildlife and the Environment

The [U.S. Department of the Interior sent a letter](#) in 2014<sup>40</sup> reviewing several research studies showing harm to birds and concluding that "The electromagnetic radiation standards used by the Federal Communications Commission (FCC) continue to be based on thermal heating, a criterion now nearly 30 years out of date and inapplicable today."

A now-retired U.S. Fish and Wildlife Service wildlife biologist, the former lead on telecommunications impacts, Dr. Albert Manville, has [written to the FCC](#) on impacts to birds and on [higher frequencies to be used in 5G](#). Dr. Manville authored numerous [publications](#) detailing research showing harm to birds.<sup>41,42,43</sup> "The race to implement 5G and the push by FCC to approve the related 5G license frequencies to industry are very troubling and downright dangerous."

- ["A review of the ecological effects of RF-EMF"](#) reviewed 113 studies finding RF-EMF had a significant effect on birds, insects, other vertebrates, other organisms, and plants in 70% of the studies ([Cucurachi 2013](#)). Development and reproduction in birds and insects were the most strongly affected. As an example of the several studies on wildlife impacts, a study focusing on RF from antennas found increased sperm abnormalities in mice exposed to RF from GSM antennas ([Otitolaju 2010](#)).

<sup>40</sup> Washington DC, Veenendaal ME. [Department of Interior Letter](#). United States Department of the Interior OFFICE OF THE SECRETARY.

<sup>41</sup> ECFS Filing Detail. <https://www.fcc.gov/ecfs/filing/1060315601199>. Accessed July 8, 2020.

<sup>42</sup> Albert M. Manville Ph.D. Former U.S. Fish and Wildlife Service Senior Biologist. [Memorandum on the Bird and Wildlife Impacts of Non-ionizing Radiation](#). Environmental Health Trust. Accessed July 8, 2020.

<sup>43</sup> Manville AM. *Collisions, Electrocutions, and Next Steps-Manville BIRD STRIKES AND ELECTROCUTIONS AT POWER LINES, COMMUNICATION TOWERS, AND WIND TURBINES: STATE OF THE ART AND STATE OF THE SCIENCE B NEXT STEPS TOWARD MITIGATION I.*; 2002.

- [“Exposure of Insects to Radio-Frequency Electromagnetic Fields from 2 to 120 GHz”](#) published in Scientific Reports is the first study to investigate how insects (including the Western honeybee) absorb the higher frequencies (2 GHz to 120 GHz) to be used in the 4G/5G rollout. The scientific simulations showed increases in absorbed power between 3% to 370% when the insects were exposed to the frequencies. Researchers concluded, “This could lead to changes in insect behaviour, physiology, and morphology over time....”
- Studies on bees have found behavioral effects ([Kumar 2011](#), [Favre 2011](#)), disrupted navigation ([Goldsworthy 2009](#), [Sainudeen 2011](#), [Kimmel et al. 2007](#)), decreasing egg laying rate ([Sharma and Kumar, 2010](#)), and reduced colony strength ([Sharma and Kumar, 2010](#), [Harst et al. 2006](#)).
- Research has also found a high level of damage to trees from antenna radiation. For example, a field monitoring study spanning 9 years involving over 100 trees ([Waldmann-Selsam 2016](#)) found trees sustained more damage on the side of the tree facing the antenna.
- A study on Aspen trees near Lyons, Colorado entitled [“Adverse Influence of Radio Frequency Background on Trembling Aspen Seedlings”](#) published in the *International Journal of Forestry* found adverse effects on growth rate and fall anthocyanin production, concluding that “results of this preliminary experiment indicate that the RF background may be adversely affecting leaf and shoot growth and inhibiting fall production of anthocyanins associated with leaf senescence in Trembling Aspen seedlings. These effects suggest that exposure to the RF background may be an underlying factor in the recent rapid decline of Aspen populations. Further studies are underway to test this hypothesis in a more rigorous way.”<sup>44</sup>
- An analysis of 45 peer-reviewed scientific publications (1996–2016) on changes in plants due to the non-thermal RF-EMF effects from mobile phone radiation entitled [“Weak radiofrequency radiation exposure from mobile phone radiation on plants”](#) concludes, “Our analysis demonstrates that the data from a substantial amount of the studies on RF-EMFs from mobile phones show physiological and/or morphological effects (89.9%,  $p < 0.001$ ). Additionally, our analysis of the results from these reported studies demonstrates that the maize, roselle, pea, fenugreek, duckweeds, tomato, onions and mungbean plants seem to be very sensitive to RF-EMFs. Our findings also suggest that plants seem to be more responsive to certain frequencies....”<sup>45</sup>

## Electromagnetic Fields Can Alter Animal and Insect Orientation

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<sup>44</sup> Katie Haggerty, [“Adverse Influence of Radio Frequency Background on Trembling Aspen Seedlings: Preliminary Observations,”](#) *International Journal of Forestry Research*, vol. 2010, Article ID 836278, 7 pages, 2010. doi.org/10.1155/2010/836278.

<sup>45</sup> Malka N. Halgamuge (2017) [Review: Weak radiofrequency radiation exposure from mobile phone radiation on plants,](#) *Electromagnetic Biology and Medicine*, 36:2, 213-235, DOI: 10.1080/15368378.2016.1220389.

*Science of the Total Environment* published environmental scientist Alforso Balmori's "[Anthropogenic radiofrequency electromagnetic fields as an emerging threat to wildlife orientation](#)," which states, "Current evidence indicates that exposure at levels that are found in the environment (in urban areas and near base stations) may particularly alter the receptor organs to orient in the magnetic field of the earth. These results could have important implications for migratory birds and insects, especially in urban areas, but could also apply to birds and insects in natural and protected areas where there are powerful base station emitters of radio frequencies. Therefore, more research on the effects of electromagnetic radiation in nature is needed to investigate this emerging threat."<sup>46</sup>

Multiple research studies have documented how animals' magnetoreception can be disrupted by external electromagnetic fields, from [mice](#)<sup>47</sup> to [cows](#) to [dogs](#) to [birds](#).<sup>48</sup> Electromagnetic exposure is especially disruptive to migratory birds.<sup>49</sup> Electromagnetic fields have been shown to disrupt the magnetic compass orientation used by birds to navigate.<sup>50,51</sup> Researchers have suggested this disruption of magnetoreception is due to cryptochrome photoreceptors that allow birds to use built-in receptors as a biological compass.

In 2012, the government of India's Ministry of the Environment and Forest issued a [report](#) on the potential impacts of communication towers on wildlife, citing hundreds of research studies that found adverse effects. Recommendations from the Ministry include, "Introduce a law for protection of urban flora and fauna from emerging threats like ERM/EMF as conservation issues in urban areas are different from forested or wildlife habitats."<sup>52</sup>

A [2017 report to UNESCO](#)<sup>53</sup> by botanist Mark Broomhall details the association between increasing amounts of electromagnetic radiation from cellular antennas on the Mt. Nardi tower complex and species disappearance and exodus from the Mt. Nardi area of the Nightcap National Park World Heritage Area during a 15-year period (2000–2015). He estimates "in both volume and species that from 70 to 90% of the wildlife has become rare or has disappeared from the Nightcap National Park within a radius of the Mt. Nardi tower complex. This statement can be

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<sup>46</sup> Alfonso Balmori, [Anthropogenic radiofrequency electromagnetic fields as an emerging threat to wildlife orientation](#), *Science of The Total Environment*, Volumes 518–519, 2015, Pages 58-60, ISSN 0048-9697, doi.org/10.1016/j.scitotenv.2015.02.077.

<sup>47</sup> Malkemper, E.P., et al. "[Magnetoreception in the wood mouse \(Apodemus sylvaticus\): influence of weak frequency-modulated radio frequency fields](#)." *Scientific Reports*, vol. 4, no. 9917, 2015.

<sup>48</sup> Wiltchko Roswitha, Thalau Peter, Gehring Dennis, Nießner Christine, Ritz Thorsten, Wiltchko Wolfgang. [Magnetoreception in birds: the effect of radio-frequency fields](#).12. *Journal of The Royal Society Interface*.

<sup>49</sup> Engels, Svenja, et al. "[Anthropogenic electromagnetic noise disrupts magnetic compass orientation in a migratory bird](#)." *Nature* 509.7500 (2014): 353-356.

<sup>50</sup> Wiltchko, Roswitha, et al. "[Magnetoreception in birds: the effect of radio-frequency fields](#)." *Journal of The Royal Society Interface* 12.103 (2015): 20141103.

<sup>51</sup> Schwarze, S., et al. "[Weak Broadband Electromagnetic Fields are More Disruptive to Magnetic Compass Orientation in a Night-Migratory Songbird \(Erithacus rubecula\) than Strong Narrow-Band Fields](#)." *Front Behav Neurosci*. 10.55 (2016).

<sup>52</sup> Expert Committee, Ministry of Environment and Forest, Government of India, [Report on Possible Impacts of Communication Towers on Wildlife Including Birds and Bees](#), Constituted on 30th August, 2010.

<sup>53</sup> Broomhall, Mark. "[Report detailing the exodus of species from the Mt. Nardi area of the Nightcap National Park World Heritage Area during a 15-year period \(2000-2015\)](#)." United Nations Scientific and Cultural Organization (2017).

summarised with concrete data: 3 bat species once common have become rare or gone, 11 threatened and endangered bird species are gone, 11 migratory bird species are gone, 86 bird species are demonstrating unnatural behaviours, 66 once common bird species are now rare or gone.” The Report concludes, “With these short explanations of events we can appreciate that the effects of this technology and its application on Mt. Nardi over the last fifteen years, affect not only the top of the life chain species but they are devastating the fabric of the continuity of the World Heritage, causing genetic deterioration in an insidious, massive and ever escalating scale. To truly understand what these studies reveal is to stare into the abyss.”

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

### **Radiofrequency radiation exposure is increasing at a rapid pace.**

A [2018 article](#) published in *The Lancet Planetary Health* points to unprecedented increasing RF exposures, and the abstract concludes, “due to the exponential increase in the use of wireless personal communication devices (eg, mobile or cordless phones and WiFi or Bluetooth-enabled devices) and the infrastructure facilitating them, levels of exposure to radiofrequency electromagnetic radiation around the 1 GHz frequency band, which is mostly used for modern wireless communications, have increased from extremely low natural levels by about 1018 times...”([Bandara and Carpenter, 2018](#)).<sup>54</sup>

Another key finding from [Zothansiamia 2017](#) was that homes closer to antennas had measurably higher radiation levels—adding to the documentation that antennas increase RF levels. An [Australian study](#) also found that children in kindergartens with nearby antenna installations had nearly three-and-a-half times higher RF exposures than children with installations further away (more than 300 meters) ([Bhatt 2016](#)).<sup>55</sup>

A 2018 multi-country [study](#) that measured RF in several countries found that cell phone network tower radiation is the dominant contributor to RF exposure in most outdoor areas, exposure in urban areas was higher, and that exposure has drastically increased. As an example, the

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<sup>54</sup> Priyanka Bandara, David O Carpenter, [Planetary electromagnetic pollution: it is time to assess its impact](#), *The Lancet Planetary Health*, Volume 2, Issue 12, 2018, Pages e512-e514, ISSN 2542-5196, doi.org/10.1016/S2542-5196(18)30221-3.

<sup>55</sup> Bhatt, C. R., Redmayne, M., Billah, B., Abramson, M. J., & Benke, G. (2016). [Radiofrequency-electromagnetic field exposures in kindergarten children](#). *Journal Of Exposure Science And Environmental Epidemiology*, 27, 497. Retrieved from <https://doi.org/10.1038/jes.2016.55>.



measurements the researchers [took](#) in Los Angeles, USA was 70 times higher than the US EPA estimate 40 years ago.<sup>56</sup>

### **Telecommunications Companies Warn Their Shareholders**

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

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

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

If a connection between radio frequency emissions and possible negative health effects were established, our operations, costs, or revenues may be materially and adversely affected. We currently do not maintain any significant insurance with respect to these matters.

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

Due to these evaluations and the published scientific evidence, cell phone manufacturers cannot insure against health damages from the radiofrequency radiation emitted by their products and networks. In fact, most insurance plans do not cover electromagnetic fields (EMF) and have very clear “electromagnetic field exclusions.” In order for insurance companies to cover EMF, one often must purchase additional “[Pollution Liability](#)” or “Policy Enhancement” coverage.

According to CFC Underwriting LTD in London, the UK agent for Lloyd's:

The Electromagnetic Fields Exclusion (Exclusion 32) is a General Insurance Exclusion and is applied across the market as standard. The purpose of the exclusion is to exclude

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<sup>56</sup> Sanjay Sagar, Seid M. Adem, Benjamin Struchen, Sarah P. Loughran, Michael E. Brunjes, Lisa Arangua, Mohamed Aqiel Dalvie, Rodney J. Croft, Michael Jerrett, Joel M. Moskowitz, Tony Kuo, Martin Rössli, [Comparison of radiofrequency electromagnetic field exposure levels in different everyday microenvironments in an international context](#), Environment International, Volume 114, 2018, Pages 297-306, ISSN 0160-4120, doi.org/10.1016/j.envint.2018.02.036.

cover for illnesses caused by continuous long-term non-ionising radiation exposure i.e. through mobile phone usage.

Even [AT&T Mobile Insurance](#) excludes loss from “pollutants,” and its policy defines “Pollutants” as “Any solid, liquid, gaseous, or thermal irritant or contaminant including smoke, vapor, soot, fumes, acid, alkalis, chemicals, artificially produced electric fields, magnetic field, electromagnetic field, sound waves, microwaves, and all artificially produced ionizing or non-ionizing radiation and waste” (pg. 4) [AT &T Mobile Insurance Policy, February 2014](#).

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

A [2018 study](#) published in *Annals of Telecommunications* found increased RF-EMF exposure from small cell LTE networks in two urban cities in France and the Netherlands. Researchers measured the RF-EMF from LTE (Long-Term Evolution), MC (macro cells meaning large cell towers), and SC networks (low-powered small cell base stations) and found that the small cell networks increased the radio emissions from base stations (called downlink) by a factor of 7–46 while decreasing the radio emissions from user equipment exposure (called uplink) by a factor of 5–17. So while the devices themselves could emit less radiation, the cell antennas will increase the ambient environmental levels ([Mazloum et al., 2019](#)). This study shows the increased exposures would be involuntary. We can turn our phones off, but we cannot turn off the antennas in the neighborhood. The birds, bees, and trees have no choice.

### **Dr. Hugh Taylor, Chair of Obstetrics at Yale New Haven Medicine and John Wargo, Ph.D.,**

Dr. Taylor’s research on pregnant mice found the offspring had increased hyperactivity, lower memory scores and abnormal development of neurons in the part of the brain linked to ADHD. Since then he has recommended that pregnant women keep phones and wireless devices away from a pregnant women’s abdomen. In his talks he states, “There’s essentially no downside to being cautious and protecting your baby” and presents his research plus additional studies in [2008](#), [2012](#) linking cell phone radiation to behavior problems in children. He is a signatory to the EPA recognised BabySafe Project now signed by hundreds of doctors, educators and scientists which lists ten ways to reduce cell phone radiation exposure.

Dr. Hugh Taylor is chief of obstetrics and gynecology at Yale New Haven Hospital and professor of obstetrics, gynecology and reproductive sciences and of molecular, cellular and development



biology at Yale School of Medicine. Dr. Taylor was elected to the National Academy of Medicine, one of the nation's highest honors in the fields of health and medicine and has been funded by the National Institutes of Health continuously for more than 20 years.

- [Cell phone use in pregnancy may affect offspring's brain](#)
- [BabySafe Project](#) , [PDF of Brochure](#)

John Wargo, Ph.D., professor of Environmental Risk and Policy at Yale University and lead author of the report “[Cell Phones: Technology, Exposures, Health Effects](#)” said, “The scientific evidence is sufficiently robust showing that cellular devices pose significant health risks to children and pregnant women. The weight of the evidence supports stronger precautionary regulation by the federal government. The cellular industry should take immediate steps to reduce emission of electromagnetic radiation (EMR) from phones and avoid marketing their products to children.”

### **California Department of Health Cell Phone Advisory**

The California Department of Public Health (CDPH) Issued guidance on how to reduce exposure to radiofrequency energy from cell phones in December 2017.

“Children’s brains develop through the teenage years and may be more affected by cell phone use,” said Dr. Smith of the California Department of Public Health. “Parents should consider reducing the time their children use cell phones and encourage them to turn the devices off at night.”

- [PDF of California Guidance on Reducing Cell Phone Radiation Exposure](#)
- [CDPH Press Release December 13, 2017](#)

### **Maryland State Commission on Children**

In 2017, the Maryland State Children’s Environmental Health And Protection Advisory Council issued advised local school districts reduce classroom wireless radiation exposures by providing wired—rather than wireless—internet connections and educating students on several steps they can take to reduce exposure to Wi-Fi computers.

- [The Maryland State Children’s Environmental Health and Protection Advisory Council](#)

### **The American Academy of Pediatrics**

The American Academy of Pediatrics is our nation’s largest group of doctors dedicated to the health, safety and well-being of infants, children, adolescents, and young adults.

- [PDF of AAP letters on cell phones and wireless](#)

In 2016, the AAP issued ten cell phone safety tips specifically to reduce exposure to wireless radiation.

- “They’re not toys. They have radiation that is emitted from them and the more we can keep it off the body and use (the phone) in other ways, it will be safer,” said Jennifer A. Lowry, M.D., FAACT, FAAP, chair of the AAP Council on Environmental Health Executive Committee in [a press release](#) after the NTP study findings were released.

The [AAP Healthy Child Web Page on Electromagnetic Fields: A Hazard to Your Health?](#) states:

“Cell Phones: In recent years, concern has increased about exposure to radio frequency electromagnetic radiation emitted from cell phones and phone station antennae. An Egyptian study confirmed concerns that living nearby mobile phone base stations increased the risk for developing: Headaches, Memory problems, Dizziness, Depression, Sleep problems”

### Examples of the Manufacturer's Instructions

Here are some examples of the radiofrequency statement for phones as well as other wireless devices people use every day. If phones are used in positions closer than this manufacturer's stated distance, [research](#) shows the cell phone user could potentially receive excessive cell phone radiation SAR levels which violate the ICNIRP and Federal Communications Commission (FCC) regulatory limits.

<a href="#">Samsung Health and Safety Information</a>	“Body-worn operations are restricted to belt-clips, holsters or similar accessories that have no metallic component in the assembly and must provide at least 1.5cm separation between the device and the user's body.”
<a href="#">iPhone 11 Pro Max</a>	“During testing, iPhone radios are set to their highest transmission levels and placed in positions that simulate uses against the head, with no separation, and when worn or carried against the torso of the body, with 5mm separation.”
<a href="#">Nokia 8110 4G Phone (2019 Manual)</a>	“This device meets RF exposure guidelines when used against the head or when positioned at least 5/8 inch (1.5 centimetres) away from the body. When a carry case, belt clip or other form of device holder is used for body-worn operation, it should not contain metal and should provide at least the above stated separation distance from the body.”

<a href="#"><u>Safety &amp; regulatory information (Pixel &amp; Pixel XL 2016)</u></a>	“Body worn operation: Pixel complies with radio frequency specifications when used near your ear or at a distance of 0.4 in (1.0 cm) from your body. Pixel XL complies with radio frequency specifications when used near your ear or at a distance of 0.4 in (1.0 cm) from your body. Ensure that the device accessories, such as a device case and device holster, are not composed of metal components. Keep the device away from your body to meet the distance requirement.”
<a href="#"><u>Samsung 3G Laptop Manual</u></a>	“Usage precautions during 3G connection : Keep safe distance from pregnant women’s stomach or from lower stomach of teenagers. Body worn operation: Important safety information regarding radiofrequency radiation (RF) exposure. To ensure compliance with RF exposure guidelines the Notebook PC must be used with a minimum of 20.8 cm antenna separation from the body.”
<a href="#"><u>Owlcam Manual with RF Instructions</u></a>	Caution exposure to radiofrequency radiation, to comply with FCC RF exposure compliance requirements for mobile configurations, a separation distance of at least 20 cm must be maintained between the antenna of this device and all persons.”
<a href="#"><u>PlayStation 3</u></a>	“This equipment complies with FCC/IC radiation exposure limits set forth for uncontrolled equipment and meets the FCC radio frequency (RF) Exposure Guidelines in Supplement C to OET65 and RSS-102 of the IC radio frequency (RF) Exposure rules. This equipment should be installed and operated with at least 20 cm (8 in) and more between the radiator and person’s body (excluding extremities: hands, wrists, feet and legs).”
<a href="#"><u>Amazon Echo</u></a>	“Information Regarding Exposure to Radio Frequency Energy...This device should be installed and operated with a minimum distance of 20cm between the radiator and your body. The remote control meets the RF exposure requirement of low power devices under portable operation. Nevertheless, it is advised to use the Products in such a manner that minimizes the potential for human contact during normal operation.”

<a href="#"><u>Panasonic DECT Home Cordless Phone</u></a>	<p>“FCC RF Exposure Warning:</p> <p>To comply with FCC RF exposure requirements, the base unit must be installed and operated 20 cm (8 inches) or more between the product and all person’s body.”</p>
<a href="#"><u>HP Printer</u></a>	<p>“In order to avoid the possibility of exceeding the FCC radio frequency exposure limits, human proximity to the antenna shall not be less than 20 cm (8 inches) during normal operation.”</p>
<a href="#"><u>Apple Watch</u></a>	<p>“During testing, Apple Watch radios are set to their highest transmission levels and placed in positions that simulate use against the head, with 10mm separation, and on the wrist, with no separation. When placing Apple Watch near your face, keep at least 10mm of separation to ensure exposure levels remain at or below the as-tested levels.”</p>
<a href="#"><u>Apple iPod Touch</u></a>	<p>“During testing, iPod radios are set to their highest transmission levels and placed in positions that simulate use near the body, with 5mm separation.</p> <p>To reduce exposure to RF energy, use the supplied headphones or other similar accessories. Carry iPod at least 5mm away from your body to ensure exposure levels remain at or below the as-tested levels.”</p>
<a href="#"><u>Nokia 8110 4G Phone (2019 Manual)</u></a>	<p>“This device meets RF exposure guidelines when used against the head or when positioned at least 5/8 inch (1.5 centimetres) away from the body. When a carry case, belt clip or other form of device holder is used for body-worn operation, it should not contain metal and should provide at least the above stated separation distance from the body.”</p>