ENVIRONMENTAL HEALTH TRUST

To: Joseph Goffman
Principal Deputy Assistant Administrator Performing Delegated Duties of Assistant Administrator, Office of Air and RadiationU.S. Environmental Protection Agency
Office of Radiation and Indoor Air
Radiation Protection Division
1200 Pennsylvania Avenue, NW (MC 6608T)
Washington, DC 20460-0001

February 11, 2023

Questions RE: Radiofrequency Radiation

Dear Director Joseph Goffman,

In a July 8, 2020 letter from Lee Veal, Director of the Radiation Protection Division, it was clarified that the EPA does not have a funded mandate for radiofrequency matters, and the EPA is not aware of any EPA reviews that have been conducted on the topic of trees, birds and bees. It was stated that EPA's last review was in the 1984 document Biological Effects of Radiofrequency Radiation (EPA 600/8-83-026F). The EPA does not currently have a funded mandate for radiofrequency matters.

In light of this response I would appreciate a response to my follow up questions that were sent on April 30, 2019. The letter that is unanswered is attached to this email.

I have reiterated my questions and updated them in this letter.
First are questions in regards to the 2018 changes made to the EPA web pages that host public information on wireless and electromagnetic radiation, we have outlined several inaccurate and misleading facts currently on the EPA webpages and documented industry ties and influence.

The EPA webpages we are referencing in the questions are the following newly posted in 2019 EPA webpages.

- EPA Website: Non-Ionizing Radiation From Wireless Technology
- EPA Webpage: Are there regulations concerning radiation emissions from power lines?
- EPA Webpage: Where can I get information about electromagnetic radiation from smart meters?
- EPA Webpage:Where can I get information about electric and magnetic fields from power lines?
- EPA Webpage: Where can I find information about living near a cell phone tower?
- EPA Webpage: Where can I get information about electromagnetic radiation from cell phones?
- EPA Webpage: Electric and Magnetic Fields from Power Lines

The American people have a right to clear, factual and up to date information on the health issues related to cell phones, wireless and 5G. We write the EPA to ensure transparency for the public.

1. As the EPA stated in their July 8, 2020 letter that the EPA does not have a funded mandate for radiofrequency matters; no research review has been done since the 80s- a review that did not include an understanding of impacts to birds and insects.

Why doesn't the EPA clarify on their website pages that they have not done a review of the health or environmental impacts?

RESPONSE FROM EPA OFFICE OF AIR AND RADIATION

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Washington, DC 20460

March 7, 2023

OFFICE OF AIR AND RADIATION

Theodora Scarato
7100 N. Rachel Way
Teton Village, WY 83025

Dear Ms. Scarato:

Thank you for letter to Joseph Goffman, Principal Deputy Assistant Administrator Performing Delegated Duties of Assistant Administrator, in which you asked questions about radiofrequency radiation. I am the Director the Radiation Protection Division, and I'm replying on his behalf.

As you noted, the U.S. Environmental Protection Agency (EPA) does not have a funded mandate for radiofrequency matters or electromagnetic fields (EMF). EPA does not have dedicated staff to maintain expertise in this area and the Agency is not taking actions on EMF. However, in response to regular public inquiries, the EPA has webpages that feature limited summary information on EMF with links to applicable oversight agencies and basic science information. The answers to your questions about the EPA webpages are below.

1. *Why doesn't the EPA clarify on their website pages that they have not done a review of the health or environmental impacts?*

   Answer: The EPA does not have a funded mandate for radiofrequency matters or electromagnetic fields (EMF), nor does the Agency have dedicated staff to maintain expertise in this area. EPA's RadTown webpage, "Non-Ionizing Radiation From Wireless Technology" (https://www.epa.gov/radtown/non-ionizing-radiation-wireless-technology) states that EPA does not regulate the non-ionizing radiation from wireless technology and does not maintain expertise in this area. The "Radiation Resources from Other Agencies" page (https://www.epa.gov/radiation/radiation-resources-outside-epa) similarly states that EPA does not regulate the non-ionizing radiation emitted by electrical devices such as cell phone and transmitters and provides links to the agencies that do.

2.*Why doesn't the EPA clarify that the current FCC regulations are not based on a review of impacts to birds, bees and trees?* This seems to be quite important clarification as FCC limits are not applicable to wildlife, birds, bees and trees.
See https://www.epa.gov/radiation/where-can-i-find-information-about-cell-phone-safety-concerns

RESPONSE FROM EPA OFFICE OF AIR AND RADIATION

2. *Why doesn't the EPA clarify that the current FCC regulations are not based on a review of impacts to birds, bees and trees?*

   Answer: The Telecommunications Act of 1996 directs the Federal Communications Commissions (FCC) to establish rules regarding radiofrequency exposure as it relates to communications transmitters and devices. The EPA does not have a funded mandate for radiofrequency matters or electromagnetic fields (EMF). The webpage "Where Can I Find Information About Cell Phone Safety Concerns" (https://www.epa.gov/radiation/where-can-i-find-information-about-cell-phone-safety-concerns) directs users to the FCC website for information about their regulations.

3.Why are agencies like the NTP and NIEHS omitted from the fact sheet?
Why doesn't the EPA websites on EMFs link to the National Institute of Environmental Health Sciences website and to the National Toxicology Program webpage on cell phone radiation, both of which host information on the cell phone radiation studies?
I am referring to this page Radiation Resources Outside of EPA | US EPA nd this page Non-Ionizing Radiation From Wireless Technology | US EPA . References are omitted from the EPA webpages despite the fact that the NTP/NIEHS is the only US agency doing any funded research on the issue of non thermal effects of wireless radiation.

> As you are aware, the National Toxicology Program (NTP)/National Institute of Environmental Health Sciences (NIEHS) released their final reports on their $30 million animal study on long-term exposure to wireless radiofrequency electromagnetic (RF-EMF) radiation. They found "clear evidence of carcinogenicity due to the increased malignant schwannomas of the heart in male rats. In addition, the study found statistically significant increases in DNA damage, heart damage, malignant glioma tumors of the brain. The NTP was nominated to perform these carefully controlled large scale animal studies to provide information on health effects from long term exposures. All exposures were at non heating, non thermal levels and yet increased tumors were found, thus the NTP studies provide documentation of a carcinogenic effect at non thermal levels. Similarly, studies by the Ramazzini Institute of RF-EMF at levels below FCC limits found

increases in malignant schwannomas of the heart in exposed rats, corroborating the NTP results (Falcioni, 2018).

Importantly, these animal study findings corroborate published case-control studies in humans which found increases in tumors of the same types—schwannomas and gliomas in people who use cell phones. Several scientists have concluded that there is now sufficient evidence to classify RF-EMF as a human carcinogen (Hardell and Carlberg, 2017, Miller et al., 2018). In addition, a recently published study that finds the ANFR cell phone tests of the French government indicate cell phone radiation can exceed limits up to 11 times when tested in accordance with FCC standards in positions mimicking a phone touching the body. Two published research reviews are calling for caution with 5G as it is "a new form of environmental pollution" which "will contribute to a negative public health outcome" (Di Ciaula 2018, Russell 2018).

RESPONSE FROM EPA OFFICE OF AIR AND RADIATION

3. *Why are agencies like the NTP and NIEHS omitted from the fact sheet?*

   Answer: A link to National Institute of Environmental Health Sciences (NIEHS) website can be found on https://www.epa.gov/radtown/electric-and-magnetic-fields-power-lines and https://www.epa.gov/radiation/radiation-resources-outside-epa. In addition, there is a link to the NIEHS's EMF Q&A pamphlet on https://www.epa.gov/radiation/are-there-regulations-concerning-radiation-emissions-power-lines.

   Although the EPA does not have a funded program for radiofrequency radiation, in response to frequent inquiries from members of the public, our websites have pages with brief summary information linking to the agencies that do regulate it. In providing links and summary information to the public, the EPA relies on summary information from official U.S. government websites, as well as summary information from major scientific organizations like the World Health Organization. Evaluation and posting of the information of academic EMF research is outside of EPA's expertise and outside the summary scope of the information provided on our websites. It is worth noting that the National Toxicology Program website (https://www.niehs.nih.gov/news/newsroom/releases/2018/november1/index.cfm) states "The exposures used in the studies cannot be compared directly to the exposure that humans experience when using a cell phone."

4. Why are references to the World Health Organization International Agency for the Research on Cancer classification of radiofrequency as a Class 2B carcinogen omitted from the new EPA webpages? For example on page Non-Ionizing Radiation From Wireless Technology | US EPA, there is no mention of the classification.

RESPONSE FROM EPA OFFICE OF AIR AND RADIATION

4. *Why are references to the World Health Organization International Agency for the Research on Cancer classification of radiofrequency as a Class 2B carcinogen omitted from the new EPA webpages*?

   Answer: The RadTown webpage, "Non-Ionizing Radiation From Wireless Technology" (https://www.epa.gov/radtown/non-ionizing-radiation-wireless-technology) links to the World Health Organization (WHO) page on mobile telephones (https://www.who.int/en/news-room/fact-sheets/detail/electromagnetic-fields-and-public-health-mobile-phones). This WHO website cites the International Agency for the Research on Cancer classification as "possibly carcinogenic to humans." There is also a link to WHO's page "Electromagnetic Fields" on: https://www.epa.gov/radiation/radiation-resources-outside-epa.

   In addition, there is a link to the WHO page Radiation: "5 G mobile networks and health" on https://www.epa.gov/radiation/where-can-i-get-information-about-electromagnetic-radiation-cell-phones

5. Why does the EPA website link to the FCC which has no health experts on staff? The FCC limits are not designed to protect trees, birds or bees, nor effects from long term exposure? Please explain how the decision was made to send the public to the FCC which clearly states that they are not a health and safety agency and defers to EPA and others for such expertise.
Please read the FCC letter to the EPA regarding its inquiry into FCC limits here.

RESPONSE FROM EPA OFFICE OF AIR AND RADIATION

5. *Why does the EPA website link to the FCC which has no health experts on staff? The FCC limits are not designed to protect trees, birds or bees, nor effects from long term exposure?*
   Answer: The Telecommunications Act of 1996 directs the Federal Communications Commissions (FCC) to establish rules regarding radiofrequency exposure for communications transmitters and devices. The EPA does not have a funded mandate for radiofrequency matters or electromagnetic fields. EPA directs users to the FCC website for information about FCC regulations.

6. Why does the EPA website link to a non US governmental industry loyal group that hosts information by industry consultants- the Health Physics Society?

When the EPA page Non-Ionizing Radiation From Wireless Technology | US EPA was first posted in 2018, it directly linked to an outdated 2010 factsheet written by an individual known to be an industry consultant. Review Kenneth Fosters papers to see that he has repeatedly written papers funded by wireless companies.

Later Health Physics updated their factsheet. See the new factshet posted online here **December 2020. Yes they used the same link**
https://hps.org/documents/Mobile_Telephone_Fact_Sheet_update_May_2010.pdf

RESPONSE FROM EPA OFFICE OF AIR AND RADIATION

6. *Why does the EPA website link to a non US governmental industry loyal group that hosts information by industry consultants- the Health Physics Society?*

   Answer: The EPA has historically linked to the Health Physics Society because it is an independent nonprofit scientific organization, and is not affiliated with any government, industrial organization or private entity.

7.Is it the policy of the US EPA to rely on this organization, Health Physics Society for scientific opinion?
We note the new updated 2020 factsheet does not include research on biological effects but references groups known to be tied to icnirp and industry consultant filled groups.

RESPONSE FROM EPA OFFICE OF AIR AND RADIATION

7. *Is it the policy of the US EPA to rely on this organization, Health Physics Society for scientific opinion?*

   Answer: The EPA has historically linked to the Health Physics Society because it is an independent nonprofit scientific organization, and is not affiliated with any government, industrial organization or private entity. With respect to EPA policy on science, you may find the discussion within the EPA FY2022-FY2026 Strategic Plan to be informative on how programs will use science (https://www.epa.gov/planandbudget/strategicplan), specifically in this section: Cross-Agency Strategy 1: Ensure Scientific Integrity and Science-Based Decision Making.

8. Why does the EPA website have inaccurate information? Can you please correct it.
The EPA website text itself has inaccurate information.

Inaccuracy 1 and 2: Inaccurate information is posted about replication of research on two webpages

On the website pageElectric and Magnetic Fields from Power Lines | US EPA it states“A few studies have connected EMF and health effects, but they have not been able to be repeated.”

On the EPA website page Non-Ionizing Radiation From Wireless Technology | US EPA it states “A few studies have connected RF and health effects, but scientists have not been able to repeat the outcomes”

In fact, regarding radiofrequency wireless, there are replication studies such as a study out of Jacobs University that found a tumor promotion effect Lerchl 2015 and the study out of the Swiss Tropical and Public Health Institute that found memory impairments in teenagers (Foerster 2018).

Equally important, the webpage on powerlines was edited from earlier to now state that the research has not been repeated when in fact the association between magnetic fields and childhood leukemia has been repeatedly replicated, so much so that several countries limit new buildings on area with magnetic fields over 3 to 4 milligauss and/or within 50 feet of high voltage power lines.

See Seomun G, Lee J, Park J (2021) Exposure to extremely low-frequency magnetic fields and childhood cancer: A systematic review and meta-analysis. PLoS ONE 16(5): e0251628. https://doi.org/10.1371/journal.pone.0251628

- A total of 33 studies were identified. Thirty studies with 186,223 participants were included in the meta-analysis. Conclusions: Significant associations were observed between exposure to ELF-MFs and childhood leukemia. Furthermore, a possible dose-response effect was also observed.

Christian Brabant, Anton Geerinck, Charlotte Beaudart, Ezio Tirelli, Christophe Geuzaine, Olivier Bruyère. Exposure to magnetic fields and childhood leukemia: a systematic review and meta-analysis of case-control and cohort studies. Reviews on Environmental Health. Published online March 15, 2022. doi: 10.1515/reveh-2021-0112.

In this letter, we detail the serious inaccuracies with these webpages and have a list of questions for you in regards to the recent website changes. Below is a paragraph that was changed by the EPA and we note that the reference to the vulnerability of children was removed and a statement inaccurately stating there are not replicating studies was added.
Added text is in bold.

Example of changes to the EPA Website text on Wireless Radiation
Some people are concerned about potential health effects, especially on the developing brains and bodies of children added of RF energy from wireless technology. Some studies suggest that heavy long-term use of cellphones could have health effects. **Added** Most studies haven’t found any health effects from cell phone use. A few studies have connected RF and health effects, but scientists have not been able to repeat the outcomes. This means that they are inconclusive. Other studies don't find any

health effects from cell phone use. Scientists continue to study the effects of long-term exposure to low levels of RF.

Example of changes to the [EPA Website on Power Lines and Electromagnetic Fields]
Scientific studies have not clearly shown whether exposure to EMF increases cancer risk. **Added** A few studies have connected EMF and health effects, but they have not been able to be repeated. This means that they are inconclusive. Scientists continue to conduct research on the issue.

RESPONSE FROM EPA OFFICE OF AIR AND RADIATION

8. *Why does the EPA website have inaccurate information? Can you please correct it.*

   Answer: Public health agencies often rely on authoritative consensus scientific reports which consider collections of studies to inform public health action. The EPA does not have a funded mandate for radiofrequency matters or electromagnetic fields (EMF) and defers to other agencies possessing a defined role regarding EMF. The Food and Drug Administration (FDA) shares regulatory responsibilities for cell phones with the Federal Communications Commission (FCC). EPA's website links to the FDA webpage Scientific Evidence for Cell Phone Safety (https://www.fda.gov/radiation-emitting-products/cell-phones/scientific-evidence-cell-phone-safety) which states "To date, there is no consistent or credible scientific evidence of health problems caused by the exposure to radio frequency energy emitted by cell phones."

9. Please explain why the EPA no longer engages in the federal radiofrequency interagency workgroup. It was stated in the 2019 letter that this group has never met. Why was it the EPAs decision not to continue or request continued work in the area.

RESPONSE FROM EPA OFFICE OF AIR AND RADIATION

9. *Please explain why the EPA no longer engages in the federal radiofrequency interagency workgroup.*

   Answer: The Radiofrequency Interagency Work Group (RFIAWG), an informal forum for exchange of information, has not met in more than three years. The group does not meet to set, or advise on, policy, rulemaking or guidance. The EPA does not have a funded mandate for radiofrequency matters and does not have dedicated staff for EMF or maintain expertise in this area.

10. Is the EPA doing any environmental monitoring for RF or magnetic field EMF?

RESPONSE FROM EPA OFFICE OF AIR AND RADIATION

10. Is the EPA doing any environmental monitoring for RF or magnetic field EMF?

Answer: The EPA does not have a funded mandate for radiofrequency matters and does not maintain expertise in this area. EPA is not taking actions on EMF or conducting an EMF or RF monitoring program.

11. The FCC regulates wireless radiation. What US agency regulates extremely low frequency fields such as magnetic fields from power lines. What US agency is monitoring the science to ensure the public is protected in regards to magnetic fields?

RESPONSE FROM EPA OFFICE OF AIR AND RADIATION

11. The FCC regulates wireless radiation. What US agency regulates extremely low frequency fields such as magnetic fields from power lines. What US agency is monitoring the science to ensure the public is protected in regards to magnetic fields?

Answer: There are no federal standards limiting electromagnetic fields from power lines and other similar sources. Some states set standards for electromagnetic fields. You can find information about your state radiation protection programs and contact information at http://www.crcpd.org/map.

The US Department of Labor, Occupational Safety and Health Administration (OSHA) does not have regulations addressing exposures from powerlines. However, the OSHA website does reference consensus standards published by the American National Standards Institute (ANSI), American Conference of Industrial Hygienists (ACGIH), and the International Commission on Non-Ionizing Radiation Protection (ICNIRP) Guidelines. www.osha.gov/elf-radiation/standards
The National Institute of Environmental Health Sciences, which is part of the National Institute of Health published a booklet in 2002 that summarizes the information including a number of these exposure standards (https://www.niehs.nih.gov/health/materials/electric_and_magnetic_fields_associated_with_the_use_of_electric_power_questions_and_answers_english_508.pdf.
Thank you again for contacting us. I hope you find this information helpful.

Sincerely,

Veal, Lee Digitally signed by Veal, Lee Date: 2023.03.07 14:38:49 -05'00'

Lee Ann B. Veal
Director, Radiation Protection Division
Office of Radiation and Indoor Air

Our letter also includes the following:
Appendix I: Documentation of the inaccurate and misleading information on the new EPA webages.
Appendix II: Documentation of EPA website changes
Appendix III: Documentation of EPA reports and letters on cell phone radiation
Appendix IV: Published scientific research on cell phone radiofrequency radiation

Sincerely,

Theodora Scarato
Executive Director
Environmental Health Trust

Appendix I: Documentation of inaccurate and misleading information on the EPA website

False/Misleading #1 " While some studies have shown a correlation between the occurrence of certain adverse health effects and long-term use, a definitive cause and effect relationship has not been established." (Found in Non-Ionizing Radiation From Wireless Technology)

Fact: The US National Toxicology Program studies on radiofrequency radiation found increased cancers and their conclusions in regards to the confidence of the association were as follows:

•Malignant schwannoma in the heart in male rats "clear evidence"
•Malignant glioma in the brain in in male rats "some evidence"
•Tumors in the adrenal medulla of male rats GSM "some evidence"
•Additional findings in rats include: Low birth weight, Cardiomyopathy in the right ventricle in both male and female groups, DNA damage found in specific tissues including the brain.

False/Misleading statement #2 "Most studies haven't found any health effects from cell phone use." (Found in Non-Ionizing Radiation From Wireless Technology)

This statement is made based on no references. In fact, several reviews have found that the majority of research studies have found an effect. For example,

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

- A recent evaluation of 2266 studies (including in-vitro and in-vivo studies in human, animal, and plant experimental systems and population studies) found that most studies (n=1546, 68·2%)

have demonstrated significant biological or health effects associated with exposure to anthropogenic electromagnetic fields.

Cucurachi, C., et al. "A review of the ecological effects of radiofrequency electromagnetic fields (RF-EMF)." Environment International, vol. 51, 2013, pp. 116–40.

- A Review of 113 studies from original peer-reviewed publications. RF-EMF had a significant effect on birds, insects, other vertebrates, other organisms and plants in 70% of the studies. Development and reproduction of birds and insects are the most strongly affected endpoints.

Yakymenko, Igor, et al. "Oxidative mechanisms of biological activity of low-intensity radiofrequency radiation." Electromagnetic Biology and Medicine, vol. 35, no. 2, 2016, pp. 186-202.

- "Among 100 currently available peer-reviewed studies dealing with oxidative effects of low-intensity RFR, in general, 93 confirmed that RFR induces oxidative effects in biological systems….In conclusion, our analysis demonstrates that low-intensity 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."

Anthony B. Miller, L. Lloyd Morgan, Iris Udasin and Devra Lee Davis. "Cancer Epidemiology Update, following the 2011 IARC Evaluation of Radiofrequency Electromagnetic Fields (Monograph 102)" Environmental Research, September 6, 2018.

- Literature review: Based on the evidence reviewed it is our opinion that IARC's current categorization of RFR as a possible human carcinogen (Group 2B) should be upgraded to Carcinogenic to Humans (Group 1).

Pall M., Wi-Fi is an important threat to human health, Environmental Research Volume 164, July 2018, Pages 405-416

- (Review paper) "Repeated Wi-Fi studies show that Wi-Fi causes oxidative stress, sperm/testicular damage, neuropsychiatric effects including EEG changes, apoptosis, cellular DNA damage, endocrine changes, and calcium overload.

There are more studies found in the attached list.

False/Misleading statement #3 "A few studies have connected RF and health effects, but scientists have not been able to repeat the outcomes. This means that they are inconclusive." (Found in Non-Ionizing Radiation From Wireless Technology)

"Few" is an inaccurate description of the amount of studies showing adverse effects.
First, the adjective "few" to describe studies is inaccurate as shown by the research cited earlier such as Bandara 2018 published in The Lancet which states, "A recent evaluation of 2266 studies (including in-vitro and in-vivo studies in human, animal, and plant experimental systems and population studies) found that most studies (n=1546, 68·2%) have demonstrated significant biological or health effects associated with exposure to anthropogenic electromagnetic fields."

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Second, there are replication studies with radiofrequency radiation and with other non-ionizing electromagnetic radiation frequencies that have found adverse effects.

Please see these examples:

1. (Foerster 2018) A prospective cohort study of adolescents' memory performance and individual brain dose of microwave radiation from wireless communication published in Environmental Health Perspectives. This study was a follow up (doubling sample size) and confirms prior results from 2015 study and found higher cumulative RF-EMF brain exposure from mobile phone use over one year was associated with figural memory performance in adolescents.
2. (Lerchl et al. 2015) "Tumor promotion by exposure to radiofrequency electromagnetic fields below exposure limits for humans." published in Biochemical and Biophysical Research Communications was a replication study which states, "We have performed a replication study using higher numbers of animals per group and including two additional exposure levels. We could confirm and extend the originally reported findings. Numbers of tumors of the lungs and livers in exposed animals were significantly higher than in sham-exposed controls. In addition, lymphomas were also found to be significantly elevated by exposure...Since many of the tumor-promoting effects in our study were seen at low to moderate exposure levels (0.04 and 0.4 W/kg SAR), thus well below exposure limits for the users of mobile phones, further studies are warranted to investigate the underlying mechanisms. Our findings may help to understand the repeatedly reported increased incidences of brain tumors in heavy users of mobile phones."
3. (Divan 2012) Divan, H.A, et al. "Cell phone use and behavioural problems in young children."Journal of Epidemiology and Community Health, vol. 66, no. 6, 2012, pp. 524-9. Replicated the 2008 study by Divan, H.A., et al. "Prenatal and postnatal exposure to cell phone use and behavioral problems in children."Epidemiology, vol. 19, no. 4, 2008, pp. 523-9. The 2012 publication states, "Conclusion: The findings of the previous publication were replicated in this separate group of participants demonstrating that cell phone use was associated with behavioural problems at age 7 years in children, and this association was not limited to early users of the technology." It is notable that additional research has also found adverse impacts from prenatal exposure. In 2017, (Birks 2017) the largest study to date to use data on prenatal cell phone use collected from parents in five countries found a link between high prenatal cell phone use and hyperactivity/inattention problems in children.
4. (Li 2017) Li, De-Kun, et al., "Exposure to Magnetic Field Non-Ionizing Radiation and the Risk of Miscarriage: A Prospective Cohort Study", Scientific Reports 7, Article number: 17541 (2017) In 2017, Dr. De Kun Li and his team at Kaiser made international news when they published their second study linking miscarriage to real world non ionizing radiation electromagnetic exposures. Funded by the National Institute of Environmental Health Sciences with 913 women as subjects, Li , who specializes in reproductive and prenatal epidemiology, found that women who were exposed to higher electromagnetic field levels had 2.72 times – an almost 3 times increased -risk of miscarriage. "This study provides evidence from a human population that magnetic field non-ionizing radiation could have adverse biological impacts on human health," Li said in the Kaiser Permanente press release. A note: Dr. Li's research also has found other effects from higher exposures to pregnant women including higher risks for ADHD, asthma and obesity.

In addition to specific replication studies, and in addition to the research on cancer, there are published literature reviews that show the majority of research reviewed for various issues and endpoints, did find effects. For example:

Oxidative Stress

- Igor Yakymenko, et al. "Oxidative mechanisms of biological activity of low-intensity radiofrequency radiation." Electromagnetic Biology and Medicine,2015.
- 93 out of 100 currently available peer-reviewed studies dealing with oxidative effects of low-intensity RFR, confirmed that RFR induces oxidative effects in biological systems. In conclusion, our analysis demonstrates that low-intensity 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.

Impacts to reproduction: Several reviews document impacts to sperm and the reproductive system.

- La Vignera, S., et al. "Effects of the exposure to mobile phones on male reproduction: a review of the literature." Journal of Andrology, vol. 33, no. 3, 2012, pp. 350-56.
- Adams, J., et al. "Effect of mobile telephones on sperm quality: A systematic review and meta-analysis." Environment International,vol. 80, 2014, pp. 106-12.
- Houston B., et al. "The effects of radiofrequency electromagnetic radiation on sperm function." Reproduction, 2016.

Impacts to the thyroid:

- (Asl 2019) Asl JF, Larijani B, Zakerkish M, Rahim F, Shirbandi K, Akbari R. The possible global hazard of cell phone radiation on thyroid cells and hormones: a systematic review of evidences. Environ Sci Pollut Res Int. 2019 May 6. doi: 10.1007/s11356-019-05096-z. This research review on impacts to the thyroid concludes that, "of the 22 included studies, 11 studies reported changes in T3 and T4 levels (six reported a decrease in T3 levels and one reported increase in it); moreover, five found decreased T4 levels and two studies an increased level. In other 10 studies, TSH alteration was reported. Of these, two studies reported a decrease in TSH level and one reported an increase in the hormone levels, while in the remaining studies non-significant changes were reported. Finally, seven studies examined histological changes in the thyroid gland follicles and showed that the volume of these cells was reduced. Based on the evidence discussed above, the reduction in diameter of thyroid follicles is potentially linked with cell phone radiation."
- Impacts to EEG: Wallace J, Selmaoui B. Effect of mobile phone radiofrequency signal on the alpha rhythm of human waking EEG: A review. Environmental Research. Published online May 12, 2019. https://doi.org/10.1016/j.envres.2019.05.016. Overview of 30 total selected studies which investigated the effect of the radiofrequency electromagnetic fields on human waking spontaneous EEG … 47% of studies found a significant modification exclusively of the alpha band, the 30% found a significant modification of the alpha band and other frequency bands (delta, theta, beta and gamma), the 3% (only one study) found

an effect on the gamma and beta band, without any effect on the alpha rhythm, the 20% reported no significant effect on the EEG.

False/Misleading statement #4 “Scientists continue to study the effects of long-term exposure to low-levels of RF energy.” (Found in Non-Ionizing Radiation From Wireless Technology)

This is a statement under a highlighted section entitled “Radiation Facts.” This statement is misleading as it does not provide information on current research findings. This statement should include at a minimum the findings of recent US research on EMF. The two US government funded studies on wireless radiation - the only research funded by the US over the last decade- has found evidence of an effect. The two NIH studies are the NIEHS/NTP study -research on long term effects to animals- and the NIDA Volkow 2011 study on brain glucose metabolism.

Volkow, Nora D., et al. "Effects of cell phone radiofrequency signal exposure on brain glucose metabolism."JAMA, vol. 305, no. 8, 2011, pp. 808-13.

- Conclusions: In healthy participants and compared with no exposure, 50-minute cell phone exposure was associated with increased brain glucose metabolism in the region closest to the antenna. This finding is of unknown clinical significance.

NIEHS Cell Phone Radiofrequency Radiation Studies Major findings:

- Clear evidence of tumors in the hearts of male rats. The tumors were malignant schwannomas.
- Some evidence of tumors in the brains of male rats. The tumors were malignant gliomas.
- Some evidence of tumors in the adrenal glands of male rats. The tumors were benign, malignant, or complex combined pheochromocytoma.”
- In addition- Increased right ventricular cardiomyopathy in the heart was found in the exposed rat groups. In the heart of rats at the end of the 2-year studies, there were also significantly increased incidences of right ventricle cardiomyopathy in 3 and 6 W/kg males and females.
- Positive Findings for Genetic Toxicity DNA Damage after 14 Weeks
    - CDMA Rats: Positive in hippocampus (males); equivocal in frontal cortex (males); page 15 final report
    - Mice GSM Positive in frontal cortex (males);
    - Mice CDMA: Positive in frontal cortex (males) and leukocytes (females);

False/Misleading information #5 The list of references on every single EPA EMF page in regards to RF or EMF omits the National Institutes of Health National Toxicology Program Study on Cell Phone Radiation.

This page Non-Ionizing Radiation From Wireless Technology for example, has a list of references to US agencies such as the FCC and NCI but not the NIH, nor the NTP nor the NIEHS pages that detail the findings of the largest most expensive study ever done on cell phone radiation.

The EPA webpage Where can I get information about electromagnetic radiation from cell phones? only references back to the FCC.

These EPA pages and the others on wireless EMF should provide links to the NIEHS Webpage on Cell Phones or the NTP page on cell phones.

False/Misleading information #6 The list of references on EPA's page the Non-Ionizing Radiation From Wireless Technology links to an industry connected non government group called the Health Physics Society (HPA) and the EPA references also link to the HPA Mobile Telephone Fact sheet(PDF) written by a known industry consultant. In addition this factsheet is outdated as it is from 2009/2010. However, as these references are on the EPA page we do expect the public will click on it to get facts on mobile phones.

Although the Health Physics Society states, "The Society is chartered in the United States as an independent nonprofit scientific organization, and is not affiliated with any government, industrial organization or private entity," the Society is clearly made up of people who are industry connected and web pages linked to are written by individuals known to be consultants to the wireless industry so there do seem to be strong ties to industry.

The critical questions are How did the EPA decide to place this industry connected information on their public information webpage?
Is this HPA opinion now US EPA opinion or policy?
What EPA subject matter experts were involved in deciding to put forward outdated industry connected information that downplays the human health impacts?
Why was this material chosen rather than the US government's own NTP information?

False/Misleading information #7 The references on the page Non-Ionizing Radiation From Wireless Technology has a section entitled The World Health Organization but only links to the (WHO) EMF Project Factsheet on electromagnetic fields, public health and cell phones which is outdated, industry connected. Why doesn't the EPA reference the World Health Organization International Agency for the Research on Cancer, monograph or press release classifying radiofrequency mobile phone radiation and wireless radiation as a Class 2 B possible carcinogen. The EPA website should link to the monograph by the WHO/IARC.

Note: It is important to note that the World Health Organization International Agency for the Research on Cancer (WHO/IARC)is a different entity than the World Health Organization EMF Project. The WHO EMF Project was started with industry money and has been criticized for lack of transparency and deep roots to industry. See documentation on industry funding at Maish 2006 Microwave News 2006, and The Nation article 2018.

"Repacholi arranged for the industry money to be sent to the Royal Adelaide Hospital in Australia, where he used to work. The funds were then transferred to the WHO. Seven years ago, Norm Sandler, a Motorola spokesman, told us that, "This is the process for all the supporters of the WHO program." At the

time, Motorola was sending Repacholi $50,000 each year. That money is now bundled with other industry contributions and sent to Australia by the Mobile Manufacturers Forum (MMF), which gives the project $150,000 a year." -Microwave News 2006

The WHO EMF Cell Phone Fact Sheet that the EPA site links to Electromagnetic fields and public health: mobile telephones and their base stations is clearly outdated in several ways. Most blatantly, it does not provide a link to the IARC Classification and links to an outdated 2010 Press release Interphone study on mobile phone use and brain cancer risk, rather than the most current Interphone studies and rather than the WHO/IARC press release (The 2011 Press Release by the WHO IARC) on the issue. The WHO EMF Project will not share as to who or what scientists write their cell phone/wireless factsheets. EHT has repeatedly written dr. Deventer on this issue and she does not respond. A documentary" Microwave Science and Lies" captures a moment where Dr. Deventer of the WHO EMF Project is asked about who wrote the factsheet but refuses to respond to the question. However Michael Repacholi states in a talk (watch it here) he gave that he "worked hard getting the factsheets as clear" as he could make them. See also Michael Repacholi interviewed by GSMA (Industry organization) in a three part GSMA series.

In contrast to the WHO EMF Project, the WHO IARC is an independent scientific group of experts vetted for conflicts of interest among members. For more information on the industry loyal WHO EMF Project and conflicts of interest please read the published research paper in the International Journal of Oncology entitled "World Health Organization, radiofrequency radiation and health - a hard nut to crack (Review)."

False/Misleading information #8 Almost all of the new EPA web pages now simply link directly to the FCC webpages as if the FCC can provide health information on wireless electromagnetic fields despite the fact that the FCC is not a health agency and the fact that FCC Commissioners are former industry executives or lawyers.

- The FCC is intertwined with industry. According to the Harvard Book "Captured Agency: How the Federal Communications Commission is Dominated by the Industries it Presumably Regulates" the FCC is a "captured agency" and has no scientists, medical or public health experts on staff. Several FCC commissioners are former industry executives and according to Captured Agency, the wireless industry has bought inordinate access to—and power over the FCC—a major US regulatory agency. Even the FCC states that they are not a health and safety agency so they are not the appropriate site for health information on wireless radiation. It is notable that the EPA sites link to the FCC yet not the NIEHS/NTP websites.
- The FCC limits are outdated not taking action despite US government recommendations. The 2012: Government Accountability Office (GAO) Report: "Exposure and Testing Requirements for Mobile Phones Should Be Reassessed." calls on the FCC to "formally reassess and, if appropriate, change its current RF energy (microwave) exposure limit and mobile phone testing requirements related to likely usage configurations, particularly when phones are held against the body," because without such a reassessment, the "FCC cannot ensure it is using a limit that reflects the latest research on RF energy exposure."

- In response to the 2012 GAO Report, the FCC opened a proceeding to explore whether it should modify its radiofrequency exposure standards. The FCC noted, "we specifically seek comment as to whether our current limits are appropriate as they relate to device use by children."
- Federal Register Reassessment of Exposure to Radiofrequency Electromagnetic Fields Limits and Policies

To date, the FCC has failed to act. Over 900 comments have been filed since FCC opened this docket, but no US health agency has submitted any opinion or scientific documentation to either docket.

- ET Docket No. 13-84 Reassessment of FCC Radiofrequency Exposure Limits
- ET Docket No. 03-137 Proposed Changes in the Commission's Rules Regarding Human Exposure to Radiofrequency Electromagnetic Fields

In 2018: GAO Lists Status of Their Recommendations to Reassess RF Limits as "Closed - Not Implemented"

- As the FCC has not acted to reassess, the GAO issued this statement in 2018: "Despite many years of consideration, FCC still has no specific plans to take any actions that would satisfy our recommendations. Accordingly, we are closing the recommendations as not implemented."

Regarding the page Electric and Magnetic Fields from Power Lines

False/Misleading information #9 The statement that "A few studies have connected EMF and health effects, but they have not been able to be repeated" is inaccurate as substantial repeated research over the last few decades has found an association between childhood leukemia and magnetic fields at 3 to 4 milligauss (mG). This is why several countries have laws that ensure homes are not built in areas with magnetic fields above 3 or 4 mG.

Childhood leukemia is a health effect.

In 2001, the International Agency for Research on Cancer (IARC), a subsidiary of the World Health Organization, classified ELF magnetic fields as possibly carcinogenic based on studies that show an increased risk of childhood leukemia for chronic exposures above 4 mG (0.4 μT).

- Press Release: "International Agency for the Research on Cancer finds limited evidence that residential magnetic fields increase risks of childhood leukemia" (2001)
- Monograph: "VOLUME 80 NON-IONIZING RADIATION, PART 1: STATIC AND EXTREMELY LOW-FREQUENCY (ELF) ELECTRIC AND MAGNETIC FIELDS International Agency for Research on Cancer of the World Health Organization, (2002)

Since that date, the evidence linking ELF to childhood leukemia has been repeatedly replicated in study after study.

- In 2007 World Health Organization, Environmental Health Criteria 238. Extremely low frequency fields. World Health Organization, Geneva, Switzerland documented repeated scientific evidence demonstrating a consistent pattern of an increased risk of childhood leukaemia to levels above 3 to 4 mG.

- In a 2008 article "Risk Factors for Childhood Leukemia" the International Workshop of WHO/ICNIRP/BfS confirmed that "a consistent pattern of a two-fold increase in childhood leukemia is observed in epidemiological studies associated with average exposure to residential low-frequency magnetic fields above 0.3-0.4 μT [3-4 mG]."
- In the two published large scale animal studies "Carcinogenic Synergism of S-50 Hz MF Plus Formaldehyde in Rats" (2016) and "Life-span exposure to sinusoidal-50 Hz magnetic field and acute low-dose γ radiation induce carcinogenic effects in Sprague-Dawley rats" (2016) the ELF exposed rats had statistically significant increased incidence of several type of malignant tumors in several of the exposed groups. For example, in the study where rats received a single low-dose of gamma radiation early in life and then were exposed to magnetic fields for their entire lifetime, the developed higher than expected rates of three different types of cancer: breast cancer, leukemia/lymphoma, and an extremely rare tumor called malignant schwannoma of the heart. These two large scale studies both find ELF protoes tumors in carcinogen exposed rats.
- In the 2015 final report of the multicenter European research project ARIMMORA commissioned by the European Union looked specifically at childhood leukemia and magnetic fields and stage that "The association has been consistently observed in more than 20 population studies since the 2001 classification." The researchers recommend that "the current concept of 'prudent avoidance' should be encouraged and reinforced. … regarding the risk of childhood leukaemia from ELF-MF exposure might include deciding to locate newly built child care centres, kindergartens, and schools at sufficient distance from high voltage power lines …"
- In addition to childhood leukemia, research has repeatedly found other effects. A 2014 published meta-analysis of sixteen research reports of case-control studies which were published from 2000 to 2007 found a repeated association between exposure to ELF EMF and Breast Cancer (Zhao 2014). Replicated research also has found a higher risk of miscarriage in pregnant women exposed to magnetic fields (Li 2017).

False/Misleading information #9 Regarding the page EPA Webpage Are there regulations concerning radiation emissions from power lines?, the resources presented are well outdated and do not reflect the breadth of EPA research on the issue of magnetic fields and powerlines.

The webpage states, "Along with more information on EMFs, the National Institute of Environmental Health Sciences' EMF Q&A pamphlet (PDF) (65 pp, 11.45 MB, About PDF) provides information about state standards." yet this is to a 2002 brochure which is almost two decades old?
Perhaps more critical information for the US public is the fact not only that the US has failed to issue safety limits for magnetic fields but that the EPA researched this issue for decades and has multiple reports documenting biological effects from EMFs. Why are these EPA reports omitted from EPA webpages? See some examples here.

- 1990 EPA Evaluation of the Potential Carcinogenicity of Electromagnetic Fields (Draft Report) When this report was first drafted, the team recommended that power-frequency EMFs should be classified as "probable human carcinogens" and that RF/MW radiation be considered a "possible human carcinogen." However, this review remains a "Draft only" as it was never finalized. The

Report was prepared to review and evaluate the available literature on the potential carcinogenicity of electromagnetic fields. With respect to human epidemiologic studies, the EPA found of the strongest link between exposure to 60 HZ magnetic field and human cancer. Consistent modest elevations of cancer risk for leukemia, cancer of the central nervous system and lymphoma were found in children whose exposure to magnetic fields was estimated at two MG or higher. These studies estimate a potential 1.5 to 3 increase in cancer risk from elevated magnetic field exposure as defined by wiring codes.

Note: The EPA has only placed online part of this draft report that was ultimately NEVER issued. The first draft concluded that power-frequency EMFs should be classified as "probable human carcinogens." According to Microwave News, "A team led by Dr. Robert McGaughy had recommended that power-frequency EMFs should be classified as "probable human carcinogens" and that RF/MW radiation be considered a "possible human carcinogen." These conclusions were leaked to Microwave News and were later broadcast around the world (see MWN, M/J90). Read it here https://microwavenews.com/news/backissues/m-j90issue.pdf

- 1985 EPA Report Biological influences of low-frequency sinusoidal electromagnetic signals alone and superimposed on RF carrier waves by Carl Blackman, F. Research Triangle Park, N.C., Health Effects Research Laboratory, U.S. Environmental Protection Agency, Biological influences of low-frequency sinusoidal electromagnetic signals alone and superimposed on RF carrier waves
- 1983 The EPA publishes Biological Effects Of RadioFrequency Radiation. "The objective of this report was to summarize and evaluate the existing database for use in developing RF radiation exposure guidance for the general public. The frequency range covered in this document is .5 MHz to 100 GHz. The existing database provides sufficient evidence about the relation between RF radiation exposure and biological effects to commit development of exposure limits to protect the health of the general public. It has been concluded from this review that biological effects occur at SAR up to about 1 W/kg some of them may be significant under certain environmental conditions." Read the Biological Effects Of RadioFrequency Radiation. EPA Document online, PDF, Read the 1983 Project summary of the EPA Bioeffects research here.

- 1981: EPA Report: Index of Publications on Biological Effects of Electromagnetic Radiation. This publication produced by the EPA Health Effects Research Laboratory compiles literature on the Bioeffects of EMFs 0-100 GHz. Read the Index of Publications on Biological Effects of Electromagnetic Radiation.

In conclusion, it is inaccurate for the EPA to state that research has not been replicated. The webpage should state that replication studies have found associations with childhood leukemia,

False Misleading Information #10. The omission of US Government Reports, Congressional hearings, Statements by other federal agencies or even letters written by its own expert EPA staff on the health issues related to wireless and electromagnetic radiation.

For example:

- 1999: Federal Radio -Frequency Interagency Workgroup (RFIW) Letter to Richard Tell Chair, IEEE SCC28 (SC4) Risk Assessment Work Group from the Radiofrequency Radiation Interagency Work Group on Critical Concerns About RF guidelines. In this letter, members of the RFIW identity several critical issues with the RF exposure guidelines. Their concerns include the need for a biological basis for SAR limit and they point out that the limits for brain and bone marrow should be lower than those from muscles and fat as tissues are not equally sensitive. They question the selection criteria for the adverse effect and state there is extensive data on acute effects but that the lower-level non-thermal chronic exposure effects may be very different and chronic effects need to be accounted for. They state the uncertainties in the data should be addressed. "These studies have resulted in concern that exposure guidelines based on thermal effects, and using information and concepts (time-averaged dosimetry, uncertainty factors) that mask any differences between intensity-modulated RF radiation exposure and CW exposure, do not directly address public exposures, and therefore may not adequately protect the public."
- 2002: EPA Norbert Hankin Letter on FCC guidelines: "Federal health and safety agencies have not yet developed policies concerning possible risk from long term, non thermal exposures." Current FCC human exposure limits "are thermally based, and do not apply to chronic, nonthermal exposure situations" and adequate scientific evaluations of the full impact on sensitive populations such as children, pregnant women and the elderly has yet to be completed.
- 2003 Interagency Radio Frequency Workgroup's Letter to CK Chou on RF Exposures: EPA's Norbert Hankin penned the federal RFIWG's second letter on concerns about RF human exposure guidelines with three additional issues.; the sensitivity of different tissues to temperature; that a relaxation of standards will allow for higher exposures; and that the pinna- or ear- is being considered an extremity and will be allowed far higher RF limits without considerations of different body sizes. To our knowledge neither the 2003 or 1999 letter were ever responded to.
- 2008: Congressional Hearing "Health Effects of Cell Phone Use" US House Oversight and Government Reform Subcommittee on Domestic Policy
- 2008 Report by the National Academies of Sciences: The Identification of Research Needs Relating to Potential Biological or Adverse Health Effects of Wireless Communications Devices" This Report reviewed the research needs and gaps and called for the critical need to increase our understanding of any potential adverse effects of long term chronic exposure to RF/microwave energy on children and pregnant woman. "
- 2009: Senate Appropriations Committee Hearing "Health Effects of Cell Phone Use"
- 2009, The President's Cancer Panel Presented on Cell Phone Radiation This meeting was the last in the President's Cancer Panel's 2008/2009 series, Environmental Factors in Cancer and was focused on radiation exposures as they relate to cancer risk. Presenters included Dr. Martha Linet, Chief of the Radiation Epidemiology Branch of the National Cancer Institute, and Dr. David Carpenter, Director of the Institute for Health and the Environment as well as Professor of Environmental Health Sciences within the School of Public Health at the University at Albany. "The evidence for a direct relationship between power line frequency EMFs and cancer is very strong. The lack of a specific mechanism is not a good reason to ignore this evidence." "The United States needs to take a stand in issuing warnings about the use of cell phones, especially by children. Other countries have taken a precautionary approach with this issue and are basing their warnings on the same science available in the U.S." PRESIDENT'S CANCER PANEL

MEETING SUMMARY, ENVIRONMENTAL FACTORS IN CANCER. Dr Carpenter's testimony to the President's panel was published in Reviews in Environmental Health 2009.

- 2014: U.S. Department of the Interior Letter to the National Telecommunications and Information Administration "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".

False Misleading Information #11. The reference to FCC limits and the omission of the fact that the EPA was in development of federally developed safety limits in regards to radiofrequency radiation and was defunded from performing research and issuing the safety limits.

The EPA states on Where can I get information about electromagnetic radiation from cell phones? "The Federal Communications Commission (FCC) has adopted exposure limits to RF energy with which all cell phones legally sold in the United States must comply" but omits that the EPA itself was developing federal safety limits.

The EPA also states on Non-Ionizing Radiation From Wireless Technology, "In the United States, the FCC sets safety guidelines that limit RF energy exposure. They license transmitters and facilities that generate RF energy. The FCC has adopted exposure limits for RF energy. All hand-held wireless devices sold in the United States must comply with these limits." Here again, the EPA omits that the EPA itself was developing federal safety limits.

The EPA states on Where can I find information about living near a cell phone tower? "The Federal Communications Commission (FCC) regulates systems such as cell phone towers. Exposure levels from cell phone towers must comply with the FCC's radiofrequency (RF) radiation exposure guidelines, which were developed to protect the public from RF-related health risks." Here again, the EPA omits that the EPA itself was developing federal safety limits and was defunded.

Please see documentation of the EPA research and ultimately the defunding in the following documents. See also Microwave News articles such as" EPA To Assess Health Impacts of Weak, Modulated RF/MW Radiation"

EPA Briefing To the FCC and NTIA on EPA "Development of RF/MW Radiation Guideline

- In this powerpoint presentation, the EPA briefs the FCC and NTIA about their progress in developing human exposure guidelines- that consider both thermal AND nonthermal effects for microwave radiation. The EPA was in a two phase process. First they were setting "interim RF radiation guidelines" which "did not account for modulation, chronic exposure or non thermal effects." Then they were going to focus on "modulated and nonthermal exposures" in Phase 2 by convening national experts. A year later, the EPA was defunded from RF work and standards were never set.

1995 EPA Letter to the FCC on Near Completion of EMF Guidelines

- The EPA updated the FCC on their progress in developing safety standards to cover thermal and non-thermal effects in this letter stating, "The guidelines are substantially complete and are beginning to enter the review phase… Issuance of the final guidelines that should be in early 1996 last year, selected federal agencies including the FCC formed an radiofrequency interagency workgroup to coordinate radiofrequency issues among federal agencies, providing the technical input to these guidelines and to act as a sounding board to assess a general approach employed in the guidelines.

US Science Advisory Board (SAB) Recommendation to the EPA To Develop RF Guidelines, August 25, 1994

- In this letter, the Science Advisor Board recommends that the EPA develop radiation protection guidance to protect the public. The report contains a 1983 letter from FCC Chairman Mark Fowler to the EPA Administrator Kathleen Bennett which states, "We believe that a definitive federal standard is imperative. Therefore we would like to make clear our support for your guidance development. We encourage the EPA to complete this process as expeditiously as possible so that her uniform federal standard will be available for use by the FCC and other affected agencies." Page 14 has a list of "Significant events in EPA RF Radiation Guidance Program"

Appendix II: History of EPA Web Pages on Non ionizing Radiation
New EPA Webpages as of May 1, 2019, the writing of this letter
Non-Ionizing Radiation From Wireless Technology
Where can I find information about cell phone safety concerns?
Where can I get information about electromagnetic radiation from cell phones?
Where can I find information about living near a cell phone tower?
Are there regulations concerning radiation emissions from power lines?
Where can I get information about electromagnetic radiation from smart meters?
Where can I get information about electric and magnetic fields from power lines?
Non-Ionizing Radiation Used in Microwave Ovens

EPA Webpages on the website November 15 2018 (from about May 2014)
EPA Webpage on Radiation (links to the Factsheets below)
EPA Fact Sheet Non-Ionizing Radiation From Wireless Technology
EPA Fact Sheet on Electric and Magnetic Fields (dated August 2014 but online until 2018)

EPA webpage online before April 2014
EPA Webpage on Wireless Technology
PDF Wireless Technology EPA Fact Sheet (Online from April 2006 to 2014)
EPA Webpage on Electric and Magnetic Fields

Appendix III: EPA Reports and Letters

Letter from George P. Brozowski | Regional Health Physicist | US EPA, September 23, 2014

- "The standards are intended to prevent adverse health effects that may be associated with tissue heating, but are not intended to address low intensity (nonthermal), longterm (chronic) exposures.Investigation as to whether there may be effects from exposures too low to cause heating is continuing."

2003 Interagency Radio Frequency Workgroup's Letter on EPA letterhead from EPA's Norbert Hankin to CK Chou (then Chief Scientist for Motorola) on problems with RF Exposure Limits.

- EPA's Norbert Hankin penned this letter on concerns about RF human exposure guidelines with three additional issues.; the sensitivity of different tissues to temperature; that a relaxation of standards will allow for higher exposures; and that the pinna- or ear- is being considered an extremity and will be allowed far higher RF limits without considerations of different body sizes.

Letter from EPA Norbert Hankin on RF Exposure Limits not addressing long term exposures and biological effects, July 6, 2002

- "Federal health and safety agencies have not yet developed policies concerning possible risk from long term, non thermal exposures." "The generalization by many that the guidelines protect human beings from harm by any or all mechanisms is not justified."

Federal Radio -Frequency Interagency Workgroup (RFIW) Letter to Richard Tell, June 1999

- In this letter, members of the RFIW including EPA staff identity several critical issues with the RF exposure guidelines. Their concerns include the need for a biological basis for SAR limit and they point out that the limits for brain and bone marrow should be lower than those from muscles and fat as tissues are not equally sensitive. They question the selection criteria for the adverse effect and state there is extensive data on acute effects but that the lower-level non-thermal chronic exposure effects may be very different and chronic effects need to be accounted for. They state the uncertainties in the data should be addressed.
- "These studies have resulted in concern that exposure guidelines based on thermal effects, and using information and concepts (time-averaged dosimetry, uncertainty factors) that mask any differences between intensity-modulated RF radiation exposure and CW exposure, do not directly address public exposures, and therefore may not adequately protect the public."

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Biological Effects Of RadioFrequency Radiation, EPA Report 1983
Project summary of the EPA Bioeffects research 1983

Appendix IV: Sampling of Research on the health effects of radiofrequency radiation

Anthony B. Miller, L. Lloyd Morgan, Iris Udasin and Devra Lee Davis. "Cancer Epidemiology Update, following the 2011 IARC Evaluation of Radiofrequency Electromagnetic Fields (Monograph 102)" Environmental Research, September 6, 2018.

National Toxicology Program (NTP) Carcinogenesis Studies of Cell Phone Radiofrequency Radiation, Final Reports

Houston, B.J., et al. "The effects of radiofrequency electromagnetic radiation on sperm function."Reproduction, vol. 152, no. 2, 2016, pp. R263-76.

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

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Hardell, Lennart and Michael Carlberg. "Mobile phone and cordless phone use and the risk for glioma–Analysis of pooled case-control studies in Sweden, 1997–2003 and 2007–2009."Pathophysiology, vol. 22, no. 1, 2015, pp. 1-13.

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Cardis, Elisabeth, et al."Risk of brain tumours in relation to estimated RF dose from mobile phones: results from five Interphone countries."Occupational and Environmental Medicine, vol. 68, no. 9, 2011, pp. 631-40.

Moon et al. “Association between vestibular schwannomas and mobile phone use.”Tumour Biology, vol. 35, no. 1, 2014, pp. 581-7 .

Benson, V.S., et al. “Mobile phone use and risk of brain neoplasms and other cancers: prospective study.” International Journal of Epidemiology, vol. 42, no. 3, 2013, pp. 792-802.

Hardell, et al. “Pooled analysis of case-control studies on acoustic neuroma diagnosed 1997-2003 and 2007-2009 and use of mobile and cordless phones.”International Journal of Oncology, vol. 43, no. 4, 2013, pp. 1036-44.

Hardell, L., M. Carlberg and Mild K. Hansson. “Use of mobile phones and cordless phones is associated with increased risk for glioma and acoustic neuroma.”Pathophysiology, vol. 20, no. 2, 2012, pp. 85-110.

Interphone Study Group.“Acoustic neuroma risk in relation to mobile telephone use: results of the INTERPHONE international case-control study.”Cancer Epidemiology, vol. 35, no. 5, 2011, pp. e.

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Kim, Ju Hwan, et al. "Long-term exposure to 835 MHz RF-EMF induces hyperactivity, autophagy and demyelination in the cortical neurons of mice." Scientific Reports, vol. 7, 2017.

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Washington, DC 20460

March 7, 2023

OFFICE OF
AIR AND
RADIATION

Theodora Scarato
7100 N. Rachel Way
Teton Village, WY 83025

Dear Ms. Scarato:

Thank you for letter to Joseph Goffman, Principal Deputy Assistant Administrator Performing Delegated Duties of Assistant Administrator, in which you asked questions about radiofrequency radiation. I am the Director the Radiation Protection Division, and I'm replying on his behalf.

As you noted, the U.S. Environmental Protection Agency (EPA) does not have a funded mandate for radiofrequency matters or electromagnetic fields (EMF). EPA does not have dedicated staff to maintain expertise in this area and the Agency is not taking actions on EMF. However, in response to regular public inquiries, the EPA has webpages that feature limited summary information on EMF with links to applicable oversight agencies and basic science information. The answers to your questions about the EPA webpages are below.

1. *Why doesn't the EPA clarify on their website pages that they have not done a review of the health or environmental impacts?*

   Answer: The EPA does not have a funded mandate for radiofrequency matters or electromagnetic fields (EMF), nor does the Agency have dedicated staff to maintain expertise in this area. EPA's RadTown webpage, "Non-Ionizing Radiation From Wireless Technology" (https://www.epa.gov/radtown/non-ionizing-radiation-wireless-technology) states that EPA does not regulate the non-ionizing radiation from wireless technology and does not maintain expertise in this area. The "Radiation Resources from Other Agencies" page (https://www.epa.gov/radiation/radiation-resources-outside-epa) similarly states that EPA does not regulate the non-ionizing radiation emitted by electrical devices such as cell phone and transmitters and provides links to the agencies that do.

2. *Why doesn't the EPA clarify that the current FCC regulations are not based on a review of impacts to birds, bees and trees?*

   Answer: The Telecommunications Act of 1996 directs the Federal Communications Commissions (FCC) to establish rules regarding radiofrequency exposure as it relates to communications transmitters and devices. The EPA does not have a funded mandate for radiofrequency matters or electromagnetic fields (EMF). The webpage "Where Can I Find Information About Cell Phone Safety Concerns" (https://www.epa.gov/radiation/where-can-i-find-information-about-cell-phone-safety-concerns) directs users to the FCC website for information about their regulations.

3. *Why are agencies like the NTP and NIEHS omitted from the fact sheet?*

   Answer: A link to National Institute of Environmental Health Sciences (NIEHS) website can be found on https://www.epa.gov/radtown/electric-and-magnetic-fields-power-lines and https://www.epa.gov/radiation/radiation-resources-outside-epa. In addition, there is a link to the NIEHS's EMF Q&A pamphlet on https://www.epa.gov/radiation/are-there-regulations-concerning-radiation-emissions-power-lines.

   Although the EPA does not have a funded program for radiofrequency radiation, in response to frequent inquiries from members of the public, our websites have pages with brief summary information linking to the agencies that do regulate it. In providing links and summary information to the public, the EPA relies on summary information from official U.S. government websites, as well as summary information from major scientific organizations like the World Health Organization. Evaluation and posting of the information of academic EMF research is outside of EPA's expertise and outside the summary scope of the information provided on our websites. It is worth noting that the National Toxicology Program website (https://www.niehs.nih.gov/news/newsroom/releases/2018/november1/index.cfm) states "The exposures used in the studies cannot be compared directly to the exposure that humans experience when using a cell phone."

4. *Why are references to the World Health Organization International Agency for the Research on Cancer classification of radiofrequency as a Class 2B carcinogen omitted from the new EPA webpages*?

   Answer: The RadTown webpage, "Non-Ionizing Radiation From Wireless Technology" (https://www.epa.gov/radtown/non-ionizing-radiation-wireless-technology) links to the World Health Organization (WHO) page on mobile telephones (https://www.who.int/en/news-room/fact-sheets/detail/electromagnetic-fields-and-public-health-mobile-phones). This WHO website cites the International Agency for the Research on Cancer classification as "possibly carcinogenic to humans." There is also a link to WHO's page "Electromagnetic Fields" on: https://www.epa.gov/radiation/radiation-resources-outside-epa.

   In addition, there is a link to the WHO page Radiation: "5 G mobile networks and health" on https://www.epa.gov/radiation/where-can-i-get-information-about-electromagnetic-radiation-cell-phones

5. *Why does the EPA website link to the FCC which has no health experts on staff? The FCC limits are not designed to protect trees, birds or bees, nor effects from long term exposure?*
   Answer: The Telecommunications Act of 1996 directs the Federal Communications Commissions (FCC) to establish rules regarding radiofrequency exposure for communications transmitters and devices. The EPA does not have a funded mandate for radiofrequency matters or electromagnetic fields. EPA directs users to the FCC website for information about FCC regulations.

6. *Why does the EPA website link to a non US governmental industry loyal group that hosts information by industry consultants- the Health Physics Society?*

   Answer: The EPA has historically linked to the Health Physics Society because it is an independent nonprofit scientific organization, and is not affiliated with any government, industrial organization or private entity.

7. *Is it the policy of the US EPA to rely on this organization, Health Physics Society for scientific opinion?*

   Answer: The EPA has historically linked to the Health Physics Society because it is an independent nonprofit scientific organization, and is not affiliated with any government, industrial organization or private entity. With respect to EPA policy on science, you may find the discussion within the EPA FY2022-FY2026 Strategic Plan to be informative on how programs will use science (https://www.epa.gov/planandbudget/strategicplan), specifically in this section: Cross-Agency Strategy 1: Ensure Scientific Integrity and Science-Based Decision Making.

8. *Why does the EPA website have inaccurate information? Can you please correct it.*

   Answer: Public health agencies often rely on authoritative consensus scientific reports which consider collections of studies to inform public health action. The EPA does not have a funded mandate for radiofrequency matters or electromagnetic fields (EMF) and defers to other agencies possessing a defined role regarding EMF. The Food and Drug Administration (FDA) shares regulatory responsibilities for cell phones with the Federal Communications Commission (FCC). EPA's website links to the FDA webpage Scientific Evidence for Cell Phone Safety (https://www.fda.gov/radiation-emitting-products/cell-phones/scientific-evidence-cell-phone-safety) which states "To date, there is no consistent or credible scientific evidence of health problems caused by the exposure to radio frequency energy emitted by cell phones."

9. *Please explain why the EPA no longer engages in the federal radiofrequency interagency workgroup.*

   Answer: The Radiofrequency Interagency Work Group (RFIAWG), an informal forum for exchange of information, has not met in more than three years. The group does not meet to set, or advise on, policy, rulemaking or guidance. The EPA does not have a funded mandate for radiofrequency matters and does not have dedicated staff for EMF or maintain expertise in this area.

10. *Is the EPA doing any environmental monitoring for RF or magnetic field EMF?*

    Answer: The EPA does not have a funded mandate for radiofrequency matters and does not maintain expertise in this area. EPA is not taking actions on EMF or conducting an EMF or RF monitoring program.

11. *The FCC regulates wireless radiation. What US agency regulates extremely low frequency fields such as magnetic fields from power lines. What US agency is monitoring the science to ensure the public is protected in regards to magnetic fields?*

Answer: There are no federal standards limiting electromagnetic fields from power lines and other similar sources. Some states set standards for electromagnetic fields. You can find information about your state radiation protection programs and contact information at http://www.crcpd.org/map.

The US Department of Labor, Occupational Safety and Health Administration (OSHA) does not have regulations addressing exposures from powerlines. However, the OSHA website does reference consensus standards published by the American National Standards Institute (ANSI), American Conference of Industrial Hygienists (ACGIH), and the International Commission on Non-Ionizing Radiation Protection (ICNIRP) Guidelines. www.osha.gov/elf-radiation/standards
The National Institute of Environmental Health Sciences, which is part of the National Institute of Health published a booklet in 2002 that summarizes the information including a number of these exposure standards (https://www.niehs.nih.gov/health/materials/electric_and_magnetic_fields_associated_with_the_use_of_electric_power_questions_and_answers_english_508.pdf.
Thank you again for contacting us. I hope you find this information helpful.

Sincerely,

Lee Ann B. Veal
Director, Radiation Protection Division
Office of Radiation and Indoor Air

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To: Joseph Goffman
Principal Deputy Assistant Administrator Performing Delegated Duties of Assistant Administrator, Office of Air and RadiationU.S. Environmental Protection Agency
Office of Radiation and Indoor Air
Radiation Protection Division
1200 Pennsylvania Avenue, NW (MC 6608T)
Washington, DC 20460-0001

February 11, 2023

Questions RE: Radiofrequency Radiation

Dear Director Joseph Goffman,

In a July 8, 2020 letter from Lee Veal, Director of the Radiation Protection Division, it was clarified that the EPA does not have a funded mandate for radiofrequency matters, and the EPA is not aware of any EPA reviews that have been conducted on the topic of trees, birds and bees. It was stated that EPA's last review was in the 1984 document Biological Effects of Radiofrequency Radiation (EPA 600/8-83-026F). The EPA does not currently have a funded mandate for radiofrequency matters.

In light of this response I would appreciate a response to my follow up questions that were sent on April 30, 2019. The letter that is unanswered is attached to this email.

I have reiterated my questions and updated them in this letter.
First are questions in regards to the 2018 changes made to the EPA web pages that host public information on wireless and electromagnetic radiation, we have outlined several inaccurate and misleading facts currently on the EPA webpages and documented industry ties and influence.

The EPA webpages we are referencing in the questions are the following newly posted in 2019 EPA webpages.

- EPA Website: Non-Ionizing Radiation From Wireless Technology
- EPA Webpage: Are there regulations concerning radiation emissions from power lines?
- EPA Webpage: Where can I get information about electromagnetic radiation from smart meters?
- EPA Webpage:Where can I get information about electric and magnetic fields from power lines?
- EPA Webpage: Where can I find information about living near a cell phone tower?
- EPA Webpage: Where can I get information about electromagnetic radiation from cell phones?
- EPA Webpage: Electric and Magnetic Fields from Power Lines

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The American people have a right to clear, factual and up to date information on the health issues related to cell phones, wireless and 5G. We write the EPA to ensure transparency for the public.

1. As the EPA stated in their July 8, 2020 letter that the EPA does not have a funded mandate for radiofrequency matters; no research review has been done since the 80s- a review that did not include an understanding of impacts to birds and insects.

Why doesn't the EPA clarify on their website pages that they have not done a review of the health or environmental impacts?

2.*Why doesn't the EPA clarify that the current FCC regulations are not based on a review of impacts to birds, bees and trees?* This seems to be quite important clarification as FCC limits are not applicable to wildlife, birds, bees and trees.
See https://www.epa.gov/radiation/where-can-i-find-information-about-cell-phone-safety-concerns

3.Why are agencies like the NTP and NIEHS omitted from the fact sheet?
Why doesn't the EPA websites on EMFs link to the National Institute of Environmental Health Sciences website and to the National Toxicology Program webpage on cell phone radiation, both of which host information on the cell phone radiation studies?
I am referring to this page Radiation Resources Outside of EPA | US EPA nd this page Non-Ionizing Radiation From Wireless Technology | US EPA . References are omitted from the EPA webpages despite the fact that the NTP/NIEHS is the only US agency doing any funded research on the issue of non thermal effects of wireless radiation.

> As you are aware, the National Toxicology Program (NTP)/National Institute of Environmental Health Sciences (NIEHS) released their final reports on their $30 million animal study on long-term exposure to wireless radiofrequency electromagnetic (RF-EMF) radiation. They found "clear evidence of carcinogenicity due to the increased malignant schwannomas of the heart in male rats. In addition, the study found statistically significant increases in DNA damage, heart damage, malignant glioma tumors of the brain. The NTP was nominated to perform these carefully controlled large scale animal studies to provide information on health effects from long term exposures. All exposures were at non heating, non thermal levels and yet increased tumors were found, thus the NTP studies provide documentation of a carcinogenic effect at non thermal levels. Similarly, studies by the Ramazzini Institute of RF-EMF at levels below FCC limits found increases in malignant schwannomas of the heart in exposed rats, corroborating the NTP results (Falcioni, 2018).
>
> Importantly, these animal study findings corroborate published case-control studies in humans which found increases in tumors of the same types—schwannomas and gliomas in people who use cell phones. Several scientists have concluded that there is now sufficient evidence to classify RF-EMF as a human carcinogen (Hardell and Carlberg, 2017, Miller et al., 2018). In addition, a recently published study that finds the

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ANFR cell phone tests of the French government indicate cell phone radiation can exceed limits up to 11 times when tested in accordance with FCC standards in positions mimicking a phone touching the body. Two published research reviews are calling for caution with 5G as it is "a new form of environmental pollution" which "will contribute to a negative public health outcome" (Di Ciaula 2018, Russell 2018).

4. Why are references to the World Health Organization International Agency for the Research on Cancer classification of radiofrequency as a Class 2B carcinogen omitted from the new EPA webpages? For example on page Non-Ionizing Radiation From Wireless Technology | US EPA, there is no mention of the classification.

5. Why does the EPA website link to the FCC which has no health experts on staff? The FCC limits are not designed to protect trees, birds or bees, nor effects from long term exposure? Please explain how the decision was made to send the public to the FCC which clearly states that they are not a health and safety agency and defers to EPA and others for such expertise.
Please read the FCC letter to the EPA regarding its inquiry into FCC limits here.

6. Why does the EPA website link to a non US governmental industry loyal group that hosts information by industry consultants- the Health Physics Society?

When the EPA page Non-Ionizing Radiation From Wireless Technology | US EPA was first posted in 2018, it directly linked to an outdated 2010 factsheet written by an individual known to be an industry consultant. Review Kenneth Fosters papers to see that he has repeatedly written papers funded by wireless companies.
Later Health Physics updated their factsheet. See the new factshet posted online here **December 2020. Yes they used the same link**
https://hps.org/documents/Mobile_Telephone_Fact_Sheet_update_May_2010.pdf

7.Is it the policy of the US EPA to rely on this organization, Health Physics Society for scientific opinion?
We note the new updated 2020 factsheet does not include research on biological effects but references groups known to be tied to icnirp and industry consultant filled groups.

8. Why does the EPA website have inaccurate information? Can you please correct it.
The EPA website text itself has inaccurate information.

Inaccuracy 1 and 2: Inaccurate information is posted about replication of research on two webpages

On the website pageElectric and Magnetic Fields from Power Lines | US EPA it states"A few studies have connected EMF and health effects, but they have not been able to be repeated."

On the EPA website page Non-Ionizing Radiation From Wireless Technology | US EPA it states "A few studies have connected RF and health effects, but scientists have not been able to repeat the outcomes"

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In fact, regarding radiofrequency wireless, there are replication studies such as a study out of Jacobs University that found a tumor promotion effect Lerchl 2015 and the study out of the Swiss Tropical and Public Health Institute that found memory impairments in teenagers (Foerster 2018).

Equally important, the webpage on powerlines was edited from earlier to now state that the research has not been repeated when in fact the association between magnetic fields and childhood leukemia has been repeatedly replicated, so much so that several countries limit new buildings on area with magnetic fields over 3 to 4 milligauss and/or within 50 feet of high voltage power lines.

See Seomun G, Lee J, Park J (2021) Exposure to extremely low-frequency magnetic fields and childhood cancer: A systematic review and meta-analysis. PLoS ONE 16(5): e0251628. https://doi.org/10.1371/journal.pone.0251628

- A total of 33 studies were identified. Thirty studies with 186,223 participants were included in the meta-analysis. Conclusions: Significant associations were observed between exposure to ELF-MFs and childhood leukemia. Furthermore, a possible dose-response effect was also observed.

Christian Brabant, Anton Geerinck, Charlotte Beaudart, Ezio Tirelli, Christophe Geuzaine, Olivier Bruyère. Exposure to magnetic fields and childhood leukemia: a systematic review and meta-analysis of case-control and cohort studies. Reviews on Environmental Health. Published online March 15, 2022. doi: 10.1515/reveh-2021-0112.

In this letter, we detail the serious inaccuracies with these webpages and have a list of questions for you in regards to the recent website changes. Below is a paragraph that was changed by the EPA and we note that the reference to the vulnerability of children was removed and a statement inaccurately stating there are not replicating studies was added.
Added text is in bold.

Example of changes to the EPA Website text on Wireless Radiation
Some people are concerned about potential health effects, especially on the developing brains and bodies of children added of RF energy from wireless technology. Some studies suggest that heavy long-term use of cellphones could have health effects. **Added** Most studies haven't found any health effects from cell phone use. A few studies have connected RF and health effects, but scientists have not been able to repeat the outcomes. This means that they are inconclusive. Other studies don't find any health effects from cell phone use. Scientists continue to study the effects of long-term exposure to low levels of RF.

Example of changes to the EPA Website on Power Lines and Electromagnetic Fields
Scientific studies experiments have not clearly shown whether exposure to EMF increases cancer risk. **Added** A few studies have connected EMF and health effects, but they have not been able to be repeated. This means that they are inconclusive. Scientists continue to conduct research on the issue.

9. Please explain why the EPA no longer engages in the federal radiofrequency interagency workgroup. It was stated in the 2019 letter that this group has never met. Why was it the EPAs decision not to continue or request continued work in the area.

10. Is the EPA doing any environmental monitoring for RF or magnetic field EMF?

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11. The FCC regulates wireless radiation. What US agency regulates extremely low frequency fields such as magnetic fields from power lines. What USagency is monitoring the science to ensure the public is protected in regards to magnetic fields?

Our letter also includes the following:
Appendix I: Documentation of the inaccurate and misleading information on the new EPA webages.
Appendix II: Documentation of EPA website changes
Appendix III: Documentation of EPA reports and letters on cell phone radiation
Appendix IV: Published scientific research on cell phone radiofrequency radiation

Sincerely,

Theodora Scarato
Executive Director, Environmental Health Trust

Appendix I: Documentation of inaccurate and misleading information on the EPA website

False/Misleading #1 " While some studies have shown a correlation between the occurrence of certain adverse health effects and long-term use, a definitive cause and effect relationship has not been established." (Found in Non-Ionizing Radiation From Wireless Technology)

Fact: The US National Toxicology Program studies on radiofrequency radiation found increased cancers and their conclusions in regards to the confidence of the association were as follows:

•Malignant schwannoma in the heart in male rats "clear evidence"
•Malignant glioma in the brain in in male rats "some evidence"
•Tumors in the adrenal medulla of male rats GSM "some evidence"
•Additional findings in rats include: Low birth weight, Cardiomyopathy in the right ventricle in both male and female groups, DNA damage found in specific tissues including the brain.

False/Misleading statement #2 "Most studies haven't found any health effects from cell phone use." (Found in Non-Ionizing Radiation From Wireless Technology)

This statement is made based on no references. In fact, several reviews have found that the majority of research studies have found an effect. For example,

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

- A recent evaluation of 2266 studies (including in-vitro and in-vivo studies in human, animal, and plant experimental systems and population studies) found that most studies (n=1546, 68·2%) have demonstrated significant biological or health effects associated with exposure to anthropogenic electromagnetic fields.

Cucurachi, C., et al. "A review of the ecological effects of radiofrequency electromagnetic fields (RF-EMF)." Environment International, vol. 51, 2013, pp. 116–40.

- A Review of 113 studies from original peer-reviewed publications. RF-EMF had a significant effect on birds, insects, other vertebrates, other organisms and plants in 70% of the studies. Development and reproduction of birds and insects are the most strongly affected endpoints.

Yakymenko, Igor, et al. "Oxidative mechanisms of biological activity of low-intensity radiofrequency radiation." Electromagnetic Biology and Medicine, vol. 35, no. 2, 2016, pp. 186-202.

- "Among 100 currently available peer-reviewed studies dealing with oxidative effects of low-intensity RFR, in general, 93 confirmed that RFR induces oxidative effects in biological systems….In conclusion, our analysis demonstrates that low-intensity 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."

Anthony B. Miller, L. Lloyd Morgan, Iris Udasin and Devra Lee Davis. "Cancer Epidemiology Update, following the 2011 IARC Evaluation of Radiofrequency Electromagnetic Fields (Monograph 102)" Environmental Research, September 6, 2018.

- Literature review: Based on the evidence reviewed it is our opinion that IARC's current categorization of RFR as a possible human carcinogen (Group 2B) should be upgraded to Carcinogenic to Humans (Group 1).

Pall M., Wi-Fi is an important threat to human health, Environmental Research Volume 164, July 2018, Pages 405-416

- (Review paper) "Repeated Wi-Fi studies show that Wi-Fi causes oxidative stress, sperm/testicular damage, neuropsychiatric effects including EEG changes, apoptosis, cellular DNA damage, endocrine changes, and calcium overload.

There are more studies found in the attached list.

False/Misleading statement #3 "A few studies have connected RF and health effects, but scientists have not been able to repeat the outcomes. This means that they are inconclusive." (Found in Non-Ionizing Radiation From Wireless Technology)

"Few" is an inaccurate description of the amount of studies showing adverse effects.
First, the adjective "few" to describe studies is inaccurate as shown by the research cited earlier such as Bandara 2018 published in The Lancet which states, "A recent evaluation of 2266 studies (including in-vitro and in-vivo studies in human, animal, and plant experimental systems and population studies) found that most studies (n=1546,

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68·2%) have demonstrated significant biological or health effects associated with exposure to anthropogenic electromagnetic fields."

.

Second, there are replication studies with radiofrequency radiation and with other non-ionizing electromagnetic radiation frequencies that have found adverse effects.

Please see these examples:

1. (Foerster 2018) A prospective cohort study of adolescents' memory performance and individual brain dose of microwave radiation from wireless communication published in Environmental Health Perspectives. This study was a follow up (doubling sample size) and confirms prior results from 2015 study and found higher cumulative RF-EMF brain exposure from mobile phone use over one year was associated with figural memory performance in adolescents.
2. (Lerchl et al. 2015) "Tumor promotion by exposure to radiofrequency electromagnetic fields below exposure limits for humans." published in Biochemical and Biophysical Research Communications was a replication study which states, "We have performed a replication study using higher numbers of animals per group and including two additional exposure levels. We could confirm and extend the originally reported findings. Numbers of tumors of the lungs and livers in exposed animals were significantly higher than in sham-exposed controls. In addition, lymphomas were also found to be significantly elevated by exposure...Since many of the tumor-promoting effects in our study were seen at low to moderate exposure levels (0.04 and 0.4 W/kg SAR), thus well below exposure limits for the users of mobile phones, further studies are warranted to investigate the underlying mechanisms. Our findings may help to understand the repeatedly reported increased incidences of brain tumors in heavy users of mobile phones."
3. (Divan 2012) Divan, H.A, et al. "Cell phone use and behavioural problems in young children."Journal of Epidemiology and Community Health, vol. 66, no. 6, 2012, pp. 524-9. Replicated the 2008 study by Divan, H.A., et al. "Prenatal and postnatal exposure to cell phone use and behavioral problems in children."Epidemiology, vol. 19, no. 4, 2008, pp. 523-9. The 2012 publication states, "Conclusion: The findings of the previous publication were replicated in this separate group of participants demonstrating that cell phone use was associated with behavioural problems at age 7 years in children, and this association was not limited to early users of the technology." It is notable that additional research has also found adverse impacts from prenatal exposure. In 2017, (Birks 2017) the largest study to date to use data on prenatal cell phone use collected from parents in five countries found a link between high prenatal cell phone use and hyperactivity/inattention problems in children.
4. (Li 2017) Li, De-Kun, et al., "Exposure to Magnetic Field Non-Ionizing Radiation and the Risk of Miscarriage: A Prospective Cohort Study", Scientific Reports 7, Article number: 17541 (2017) In 2017, Dr. De Kun Li and his team at Kaiser made international news when they published their second study linking miscarriage to real world non ionizing radiation electromagnetic exposures. Funded by the National Institute of Environmental Health Sciences with 913 women as subjects, Li , who specializes in reproductive and prenatal epidemiology, found that women who were exposed to higher electromagnetic field levels had 2.72 times – an almost 3 times increased -risk of miscarriage. "This study provides evidence from a human population that magnetic field non-ionizing radiation could have adverse biological impacts on human health," Li said in the Kaiser Permanente press release. A note: Dr. Li's research also has found other effects from higher exposures to pregnant women including higher risks for ADHD, asthma and obesity.

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In addition to specific replication studies, and in addition to the research on cancer, there are published literature reviews that show the majority of research reviewed for various issues and endpoints, did find effects. For example:

Oxidative Stress

- Igor Yakymenko, et al. "Oxidative mechanisms of biological activity of low-intensity radiofrequency radiation." Electromagnetic Biology and Medicine,2015.
- 93 out of 100 currently available peer-reviewed studies dealing with oxidative effects of low-intensity RFR, confirmed that RFR induces oxidative effects in biological systems. In conclusion, our analysis demonstrates that low-intensity 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.

Impacts to reproduction: Several reviews document impacts to sperm and the reproductive system.

- La Vignera, S., et al. "Effects of the exposure to mobile phones on male reproduction: a review of the literature." Journal of Andrology, vol. 33, no. 3, 2012, pp. 350-56.
- Adams, J., et al. "Effect of mobile telephones on sperm quality: A systematic review and meta-analysis." Environment International,vol. 80, 2014, pp. 106-12.
- Houston B., et al. "The effects of radiofrequency electromagnetic radiation on sperm function." Reproduction, 2016.

Impacts to the thyroid:

- (Asl 2019) Asl JF, Larijani B, Zakerkish M, Rahim F, Shirbandi K, Akbari R. The possible global hazard of cell phone radiation on thyroid cells and hormones: a systematic review of evidences. Environ Sci Pollut Res Int. 2019 May 6. doi: 10.1007/s11356-019-05096-z. This research review on impacts to the thyroid concludes that, "of the 22 included studies, 11 studies reported changes in T3 and T4 levels (six reported a decrease in T3 levels and one reported increase in it); moreover, five found decreased T4 levels and two studies an increased level. In other 10 studies, TSH alteration was reported. Of these, two studies reported a decrease in TSH level and one reported an increase in the hormone levels, while in the remaining studies non-significant changes were reported. Finally, seven studies examined histological changes in the thyroid gland follicles and showed that the volume of these cells was reduced. Based on the evidence discussed above, the reduction in diameter of thyroid follicles is potentially linked with cell phone radiation."
- Impacts to EEG: Wallace J, Selmaoui B. Effect of mobile phone radiofrequency signal on the alpha rhythm of human waking EEG: A review. Environmental Research. Published online May 12, 2019. https://doi.org/10.1016/j.envres.2019.05.016. Overview of 30 total selected studies which investigated the effect of the radiofrequency electromagnetic fields on human waking spontaneous EEG … 47% of studies found a significant modification exclusively of the alpha band, the 30% found a significant modification of the alpha band and other frequency bands (delta, theta, beta and gamma), the 3% (only one study) found an effect on the gamma and beta band, without any effect on the alpha rhythm, the 20% reported no significant effect on the EEG.

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False/Misleading statement #4 "Scientists continue to study the effects of long-term exposure to low-levels of RF energy." (Found in Non-Ionizing Radiation From Wireless Technology)

This is a statement under a highlighted section entitled "Radiation Facts." This statement is misleading as it does not provide information on current research findings. This statement should include at a minimum the findings of recent US research on EMF. The two US government funded studies on wireless radiation - the only research funded by the US over the last decade- has found evidence of an effect. The two NIH studies are the NIEHS/NTP study -research on long term effects to animals- and the NIDA Volkow 2011 study on brain glucose metabolism.

Volkow, Nora D., et al. "Effects of cell phone radiofrequency signal exposure on brain glucose metabolism."JAMA, vol. 305, no. 8, 2011, pp. 808-13.

- Conclusions: In healthy participants and compared with no exposure, 50-minute cell phone exposure was associated with increased brain glucose metabolism in the region closest to the antenna. This finding is of unknown clinical significance.

NIEHS Cell Phone Radiofrequency Radiation Studies Major findings:

- Clear evidence of tumors in the hearts of male rats. The tumors were malignant schwannomas.
- Some evidence of tumors in the brains of male rats. The tumors were malignant gliomas.
- Some evidence of tumors in the adrenal glands of male rats. The tumors were benign, malignant, or complex combined pheochromocytoma."
- In addition- Increased right ventricular cardiomyopathy in the heart was found in the exposed rat groups. In the heart of rats at the end of the 2-year studies, there were also significantly increased incidences of right ventricle cardiomyopathy in 3 and 6 W/kg males and females.
- Positive Findings for Genetic Toxicity DNA Damage after 14 Weeks
    - CDMA Rats: Positive in hippocampus (males); equivocal in frontal cortex (males); page 15 final report
    - Mice GSM Positive in frontal cortex (males);
    - Mice CDMA: Positive in frontal cortex (males) and leukocytes (females);

False/Misleading information #5 The list of references on every single EPA EMF page in regards to RF or EMF omits the National Institutes of Health National Toxicology Program Study on Cell Phone Radiation.

This page Non-Ionizing Radiation From Wireless Technology for example, has a list of references to US agencies such as the FCC and NCI but not the NIH, nor the NTP nor the NIEHS pages that detail the findings of the largest most expensive study ever done on cell phone radiation.

The EPA webpage Where can I get information about electromagnetic radiation from cell phones? only references back to the FCC.

These EPA pages and the others on wireless EMF should provide links to the NIEHS Webpage on Cell Phones or the NTP page on cell phones.

False/Misleading information #6 The list of references on EPA's page the Non-Ionizing Radiation From Wireless Technology links to an industry connected non government group called the Health Physics Society (HPA) and the

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EPA references also link to the HPA Mobile Telephone Fact sheet(PDF) written by a known industry consultant. In addition this factsheet is outdated as it is from 2009/2010. However, as these references are on the EPA page we do expect the public will click on it to get facts on mobile phones.

Although the Health Physics Society states, "The Society is chartered in the United States as an independent nonprofit scientific organization, and is not affiliated with any government, industrial organization or private entity," the Society is clearly made up of people who are industry connected and web pages linked to are written by individuals known to be consultants to the wireless industry so there do seem to be strong ties to industry.

The critical questions are How did the EPA decide to place this industry connected information on their public information webpage?
Is this HPA opinion now US EPA opinion or policy?
What EPA subject matter experts were involved in deciding to put forward outdated industry connected information that downplays the human health impacts?
Why was this material chosen rather than the US government's own NTP information?

False/Misleading information #7 The references on the page Non-Ionizing Radiation From Wireless Technology has a section entitled The World Health Organization but only links to the (WHO) EMF Project Factsheet on electromagnetic fields, public health and cell phones which is outdated, industry connected. Why doesn't the EPA reference the World Health Organization International Agency for the Research on Cancer, monograph or press release classifying radiofrequency mobile phone radiation and wireless radiation as a Class 2 B possible carcinogen. The EPA website should link to the monograph by the WHO/IARC.

Note: It is important to note that the World Health Organization International Agency for the Research on Cancer (WHO/IARC)is a different entity than the World Health Organization EMF Project. The WHO EMF Project was started with industry money and has been criticized for lack of transparency and deep roots to industry. See documentation on industry funding at Maish 2006 Microwave News 2006, and The Nation article 2018.

"Repacholi arranged for the industry money to be sent to the Royal Adelaide Hospital in Australia, where he used to work. The funds were then transferred to the WHO. Seven years ago, Norm Sandler, a Motorola spokesman, told us that, "This is the process for all the supporters of the WHO program." At the time, Motorola was sending Repacholi $50,000 each year. That money is now bundled with other industry contributions and sent to Australia by the Mobile Manufacturers Forum (MMF), which gives the project $150,000 a year." -Microwave News 2006

The WHO EMF Cell Phone Fact Sheet that the EPA site links to Electromagnetic fields and public health: mobile telephones and their base stations is clearly outdated in several ways. Most blatantly, it does not provide a link to the IARC Classification and links to an outdated 2010 Press release Interphone study on mobile phone use and brain cancer risk, rather than the most current Interphone studies and rather than the WHO/IARC press release (The 2011 Press Release by the WHO IARC) on the issue. The WHO EMF Project will not share as to who or what scientists write their cell phone/wireless factsheets. EHT has repeatedly written dr. Deventer on this issue and she does not respond. A documentary" Microwave Science and Lies" captures a moment where Dr. Deventer of the WHO EMF Project is asked about who wrote the factsheet but refuses to respond to the question. However Michael Repacholi states in a talk (watch it here) he gave that he "worked hard getting the factsheets as clear" as he

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could make them. See also Michael Repacholi interviewed by GSMA (Industry organization) in a three part GSMA series.

In contrast to the WHO EMF Project, the WHO IARC is an independent scientific group of experts vetted for conflicts of interest among members. For more information on the industry loyal WHO EMF Project and conflicts of interest please read the published research paper in the International Journal of Oncology entitled "World Health Organization, radiofrequency radiation and health - a hard nut to crack (Review)."

False/Misleading information #8 Almost all of the new EPA web pages now simply link directly to the FCC webpages as if the FCC can provide health information on wireless electromagnetic fields despite the fact that the FCC is not a health agency and the fact that FCC Commissioners are former industry executives or lawyers.

- The FCC is intertwined with industry. According to the Harvard Book "Captured Agency: How the Federal Communications Commission is Dominated by the Industries it Presumably Regulates" the FCC is a "captured agency" and has no scientists, medical or public health experts on staff. Several FCC commissioners are former industry executives and according to Captured Agency, the wireless industry has bought inordinate access to—and power over the FCC—a major US regulatory agency. Even the FCC states that they are not a health and safety agency so they are not the appropriate site for health information on wireless radiation. It is notable that the EPA sites link to the FCC yet not the NIEHS/NTP websites.
- The FCC limits are outdated not taking action despite US government recommendations. The 2012: Government Accountability Office (GAO) Report: "Exposure and Testing Requirements for Mobile Phones Should Be Reassessed." calls on the FCC to "formally reassess and, if appropriate, change its current RF energy (microwave) exposure limit and mobile phone testing requirements related to likely usage configurations, particularly when phones are held against the body," because without such a reassessment, the "FCC cannot ensure it is using a limit that reflects the latest research on RF energy exposure."
- In response to the 2012 GAO Report, the FCC opened a proceeding to explore whether it should modify its radiofrequency exposure standards. The FCC noted, "we specifically seek comment as to whether our current limits are appropriate as they relate to device use by children."
- Federal Register Reassessment of Exposure to Radiofrequency Electromagnetic Fields Limits and Policies

To date, the FCC has failed to act. Over 900 comments have been filed since FCC opened this docket, but no US health agency has submitted any opinion or scientific documentation to either docket.

- ET Docket No. 13-84 Reassessment of FCC Radiofrequency Exposure Limits
- ET Docket No. 03-137 Proposed Changes in the Commission's Rules Regarding Human Exposure to Radiofrequency Electromagnetic Fields

In 2018: GAO Lists Status of Their Recommendations to Reassess RF Limits as "Closed - Not Implemented"

- As the FCC has not acted to reassess, the GAO issued this statement in 2018: "Despite many years of consideration, FCC still has no specific plans to take any actions that would satisfy our recommendations. Accordingly, we are closing the recommendations as not implemented."

Regarding the page Electric and Magnetic Fields from Power Lines

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False/Misleading information #9 The statement that "A few studies have connected EMF and health effects, but they have not been able to be repeated" is inaccurate as substantial repeated research over the last few decades has found an association between childhood leukemia and magnetic fields at 3 to 4 milligauss (mG). This is why several countries have laws that ensure homes are not built in areas with magnetic fields above 3 or 4 mG.

Childhood leukemia is a health effect.

In 2001, the International Agency for Research on Cancer (IARC), a subsidiary of the World Health Organization, classified ELF magnetic fields as possibly carcinogenic based on studies that show an increased risk of childhood leukemia for chronic exposures above 4 mG (0.4 μT).

- Press Release: "International Agency for the Research on Cancer finds limited evidence that residential magnetic fields increase risks of childhood leukemia" (2001)
- Monograph: "VOLUME 80 NON-IONIZING RADIATION, PART 1: STATIC AND EXTREMELY LOW-FREQUENCY (ELF) ELECTRIC AND MAGNETIC FIELDS International Agency for Research on Cancer of the World Health Organization, (2002)

Since that date, the evidence linking ELF to childhood leukemia has been repeatedly replicated in study after study.

- In 2007 World Health Organization, Environmental Health Criteria 238. Extremely low frequency fields. World Health Organization, Geneva, Switzerland documented repeated scientific evidence demonstrating a consistent pattern of an increased risk of childhood leukaemia to levels above 3 to 4 mG.
- In a 2008 article "Risk Factors for Childhood Leukemia" the International Workshop of WHO/ICNIRP/BfS confirmed that "a consistent pattern of a two-fold increase in childhood leukemia is observed in epidemiological studies associated with average exposure to residential low-frequency magnetic fields above 0.3-0.4 μT [3-4 mG]."
- In the two published large scale animal studies "Carcinogenic Synergism of S-50 Hz MF Plus Formaldehyde in Rats" (2016) and "Life-span exposure to sinusoidal-50 Hz magnetic field and acute low-dose γ radiation induce carcinogenic effects in Sprague-Dawley rats" (2016) the ELF exposed rats had statistically significant increased incidence of several type of malignant tumors in several of the exposed groups. For example, in the study where rats received a single low-dose of gamma radiation early in life and then were exposed to magnetic fields for their entire lifetime, the developed higher than expected rates of three different types of cancer: breast cancer, leukemia/lymphoma, and an extremely rare tumor called malignant schwannoma of the heart. These two large scale studies both find ELF protoes tumors in carcinogen exposed rats.
- In the 2015 final report of the multicenter European research project ARIMMORA commissioned by the European Union looked specifically at childhood leukemia and magnetic fields and stage that "The association has been consistently observed in more than 20 population studies since the 2001 classification." The researchers recommend that "the current concept of 'prudent avoidance' should be encouraged and reinforced. … regarding the risk of childhood leukaemia from ELF-MF exposure might include deciding to locate newly built child care centres, kindergartens, and schools at sufficient distance from high voltage power lines …"
- In addition to childhood leukemia, research has repeatedly found other effects. A 2014 published meta-analysis of sixteen research reports of case-control studies which were published from 2000 to 2007 found a repeated association between exposure to ELF EMF and Breast Cancer (Zhao 2014). Replicated

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research also has found a higher risk of miscarriage in pregnant women exposed to magnetic fields (Li 2017).

False/Misleading information #9 Regarding the page EPA Webpage Are there regulations concerning radiation emissions from power lines?, the resources presented are well outdated and do not reflect the breadth of EPA research on the issue of magnetic fields and powerlines.

The webpage states, "Along with more information on EMFs, the National Institute of Environmental Health Sciences' EMF Q&A pamphlet (PDF) (65 pp, 11.45 MB, About PDF) provides information about state standards." yet this is to a 2002 brochure which is almost two decades old?
Perhaps more critical information for the US public is the fact not only that the US has failed to issue safety limits for magnetic fields but that the EPA researched this issue for decades and has multiple reports documenting biological effects from EMFs. Why are these EPA reports omitted from EPA webpages? See some examples here.

- 1990 EPA Evaluation of the Potential Carcinogenicity of Electromagnetic Fields (Draft Report) When this report was first drafted, the team recommended that power-frequency EMFs should be classified as "probable human carcinogens" and that RF/MW radiation be considered a "possible human carcinogen." However, this review remains a "Draft only" as it was never finalized. The Report was prepared to review and evaluate the available literature on the potential carcinogenicity of electromagnetic fields. With respect to human epidemiologic studies, the EPA found of the strongest link between exposure to 60 HZ magnetic field and human cancer. Consistent modest elevations of cancer risk for leukemia, cancer of the central nervous system and lymphoma were found in children whose exposure to magnetic fields was estimated at two MG or higher. These studies estimate a potential 1.5 to 3 increase in cancer risk from elevated magnetic field exposure as defined by wiring codes.

Note: The EPA has only placed online part of this draft report that was ultimately NEVER issued. The first draft concluded that power-frequency EMFs should be classified as "probable human carcinogens." According to Microwave News, "A team led by Dr. Robert McGaughy had recommended that power-frequency EMFs should be classified as "probable human carcinogens" and that RF/MW radiation be considered a "possible human carcinogen." These conclusions were leaked to Microwave News and were later broadcast around the world (see MWN, M/J90). Read it here https://microwavenews.com/news/backissues/m-j90issue.pdf

- 1985 EPA Report Biological influences of low-frequency sinusoidal electromagnetic signals alone and superimposed on RF carrier waves by Carl Blackman, F. Research Triangle Park, N.C., Health Effects Research Laboratory, U.S. Environmental Protection Agency, Biological influences of low-frequency sinusoidal electromagnetic signals alone and superimposed on RF carrier waves
- 1983 The EPA publishes Biological Effects Of RadioFrequency Radiation. "The objective of this report was to summarize and evaluate the existing database for use in developing RF radiation exposure guidance for the general public. The frequency range covered in this document is .5 MHz to 100 GHz. The existing database provides sufficient evidence about the relation between RF radiation exposure and biological effects to commit development of exposure limits to protect the health of the general public. It has been concluded from this review that biological effects occur at SAR up to about 1 W/kg some of them may be significant under certain environmental conditions." Read the Biological Effects Of RadioFrequency Radiation. EPA Document online, PDF, Read the 1983 Project summary of the EPA Bioeffects research here.

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- 1981: EPA Report: Index of Publications on Biological Effects of Electromagnetic Radiation. This publication produced by the EPA Health Effects Research Laboratory compiles literature on the Bioeffects of EMFs 0-100 GHz. Read the Index of Publications on Biological Effects of Electromagnetic Radiation.

In conclusion, it is inaccurate for the EPA to state that research has not been replicated. The webpage should state that replication studies have found associations with childhood leukemia,

False Misleading Information #10. The omission of US Government Reports, Congressional hearings, Statements by other federal agencies or even letters written by its own expert EPA staff on the health issues related to wireless and electromagnetic radiation.

For example:

- 1999: Federal Radio -Frequency Interagency Workgroup (RFIW) Letter to Richard Tell Chair, IEEE SCC28 (SC4) Risk Assessment Work Group from the Radiofrequency Radiation Interagency Work Group on Critical Concerns About RF guidelines. In this letter, members of the RFIW identity several critical issues with the RF exposure guidelines. Their concerns include the need for a biological basis for SAR limit and they point out that the limits for brain and bone marrow should be lower than those from muscles and fat as tissues are not equally sensitive. They question the selection criteria for the adverse effect and state there is extensive data on acute effects but that the lower-level non-thermal chronic exposure effects may be very different and chronic effects need to be accounted for. They state the uncertainties in the data should be addressed. "These studies have resulted in concern that exposure guidelines based on thermal effects, and using information and concepts (time-averaged dosimetry, uncertainty factors) that mask any differences between intensity-modulated RF radiation exposure and CW exposure, do not directly address public exposures, and therefore may not adequately protect the public."
- 2002: EPA Norbert Hankin Letter on FCC guidelines: "Federal health and safety agencies have not yet developed policies concerning possible risk from long term, non thermal exposures." Current FCC human exposure limits "are thermally based, and do not apply to chronic, nonthermal exposure situations" and adequate scientific evaluations of the full impact on sensitive populations such as children, pregnant women and the elderly has yet to be completed.
- 2003 Interagency Radio Frequency Workgroup's Letter to CK Chou on RF Exposures: EPA's Norbert Hankin penned the federal RFIWG's second letter on concerns about RF human exposure guidelines with three additional issues.; the sensitivity of different tissues to temperature; that a relaxation of standards will allow for higher exposures; and that the pinna- or ear- is being considered an extremity and will be allowed far higher RF limits without considerations of different body sizes. To our knowledge neither the 2003 or 1999 letter were ever responded to.
- 2008: Congressional Hearing "Health Effects of Cell Phone Use" US House Oversight and Government Reform Subcommittee on Domestic Policy
- 2008 Report by the National Academies of Sciences: The Identification of Research Needs Relating to Potential Biological or Adverse Health Effects of Wireless Communications Devices" This Report reviewed the research needs and gaps and called for the critical need to increase our understanding of any potential adverse effects of long term chronic exposure to RF/microwave energy on children and pregnant woman. "
- 2009: Senate Appropriations Committee Hearing "Health Effects of Cell Phone Use"

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- 2009, The President's Cancer Panel Presented on Cell Phone Radiation This meeting was the last in the President's Cancer Panel's 2008/2009 series, Environmental Factors in Cancer and was focused on radiation exposures as they relate to cancer risk. Presenters included Dr. Martha Linet, Chief of the Radiation Epidemiology Branch of the National Cancer Institute, and Dr. David Carpenter, Director of the Institute for Health and the Environment as well as Professor of Environmental Health Sciences within the School of Public Health at the University at Albany. "The evidence for a direct relationship between power line frequency EMFs and cancer is very strong. The lack of a specific mechanism is not a good reason to ignore this evidence." "The United States needs to take a stand in issuing warnings about the use of cell phones, especially by children. Other countries have taken a precautionary approach with this issue and are basing their warnings on the same science available in the U.S." PRESIDENT'S CANCER PANEL MEETING SUMMARY, ENVIRONMENTAL FACTORS IN CANCER. Dr Carpenter's testimony to the President's panel was published in Reviews in Environmental Health 2009.
- 2014: U.S. Department of the Interior Letter to the National Telecommunications and Information Administration "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".

False Misleading Information #11. The reference to FCC limits and the omission of the fact that the EPA was in development of federally developed safety limits in regards to radiofrequency radiation and was defunded from performing research and issuing the safety limits.

The EPA states on Where can I get information about electromagnetic radiation from cell phones? "The Federal Communications Commission (FCC) has adopted exposure limits to RF energy with which all cell phones legally sold in the United States must comply" but omits that the EPA itself was developing federal safety limits.

The EPA also states on Non-Ionizing Radiation From Wireless Technology, "In the United States, the FCC sets safety guidelines that limit RF energy exposure. They license transmitters and facilities that generate RF energy. The FCC has adopted exposure limits for RF energy. All hand-held wireless devices sold in the United States must comply with these limits." Here again, the EPA omits that the EPA itself was developing federal safety limits.

The EPA states on Where can I find information about living near a cell phone tower? "The Federal Communications Commission (FCC) regulates systems such as cell phone towers. Exposure levels from cell phone towers must comply with the FCC's radiofrequency (RF) radiation exposure guidelines, which were developed to protect the public from RF-related health risks." Here again, the EPA omits that the EPA itself was developing federal safety limits and was defunded.

Please see documentation of the EPA research and ultimately the defunding in the following documents. See also Microwave News articles such as" EPA To Assess Health Impacts of Weak, Modulated RF/MW Radiation"

EPA Briefing To the FCC and NTIA on EPA "Development of RF/MW Radiation Guideline

- In this powerpoint presentation, the EPA briefs the FCC and NTIA about their progress in developing human exposure guidelines- that consider both thermal AND nonthermal effects for microwave radiation. The EPA was in a two phase process. First they were setting "interim RF radiation guidelines" which "did

not account for modulation, chronic exposure or non thermal effects." Then they were going to focus on "modulated and nonthermal exposures" in Phase 2 by convening national experts. A year later, the EPA was defunded from RF work and standards were never set.

1995 EPA Letter to the FCC on Near Completion of EMF Guidelines

- The EPA updated the FCC on their progress in developing safety standards to cover thermal and non-thermal effects in this letter stating, "The guidelines are substantially complete and are beginning to enter the review phase… Issuance of the final guidelines that should be in early 1996 last year, selected federal agencies including the FCC formed an radiofrequency interagency workgroup to coordinate radiofrequency issues among federal agencies, providing the technical input to these guidelines and to act as a sounding board to assess a general approach employed in the guidelines.

US Science Advisory Board (SAB) Recommendation to the EPA To Develop RF Guidelines, August 25, 1994

- In this letter, the Science Advisor Board recommends that the EPA develop radiation protection guidance to protect the public. The report contains a 1983 letter from FCC Chairman Mark Fowler to the EPA Administrator Kathleen Bennett which states, "We believe that a definitive federal standard is imperative. Therefore we would like to make clear our support for your guidance development. We encourage the EPA to complete this process as expeditiously as possible so that her uniform federal standard will be available for use by the FCC and other affected agencies." Page 14 has a list of "Significant events in EPA RF Radiation Guidance Program"

Appendix II: History of EPA Web Pages on Non ionizing Radiation

New EPA Webpages as of May 1, 2019, the writing of this letter

Non-Ionizing Radiation From Wireless Technology
Where can I find information about cell phone safety concerns?
Where can I get information about electromagnetic radiation from cell phones?
Where can I find information about living near a cell phone tower?
Are there regulations concerning radiation emissions from power lines?
Where can I get information about electromagnetic radiation from smart meters?
Where can I get information about electric and magnetic fields from power lines?
Non-Ionizing Radiation Used in Microwave Ovens

EPA Webpages on the website November 15 2018 (from about May 2014)

EPA Webpage on Radiation (links to the Factsheets below)
EPA Fact Sheet Non-Ionizing Radiation From Wireless Technology
EPA Fact Sheet on Electric and Magnetic Fields (dated August 2014 but online until 2018)

EPA webpage online before April 2014

EPA Webpage on Wireless Technology
PDF Wireless Technology EPA Fact Sheet (Online from April 2006 to 2014)
EPA Webpage on Electric and Magnetic Fields

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Appendix III: EPA Reports and Letters

Letter from George P. Brozowski | Regional Health Physicist | US EPA, September 23, 2014

- "The standards are intended to prevent adverse health effects that may be associated with tissue heating, but are not intended to address low intensity (nonthermal), longterm (chronic) exposures.Investigation as to whether there may be effects from exposures too low to cause heating is continuing."

2003 Interagency Radio Frequency Workgroup's Letter on EPA letterhead from EPA's Norbert Hankin to CK Chou (then Chief Scientist for Motorola) on problems with RF Exposure Limits.

- EPA's Norbert Hankin penned this letter on concerns about RF human exposure guidelines with three additional issues.; the sensitivity of different tissues to temperature; that a relaxation of standards will allow for higher exposures; and that the pinna- or ear- is being considered an extremity and will be allowed far higher RF limits without considerations of different body sizes.

Letter from EPA Norbert Hankin on RF Exposure Limits not addressing long term exposures and biological effects, July 6, 2002

- "Federal health and safety agencies have not yet developed policies concerning possible risk from long term, non thermal exposures." "The generalization by many that the guidelines protect human beings from harm by any or all mechanisms is not justified."

Federal Radio -Frequency Interagency Workgroup (RFIW) Letter to Richard Tell, June 1999

- In this letter, members of the RFIW including EPA staff identity several critical issues with the RF exposure guidelines. Their concerns include the need for a biological basis for SAR limit and they point out that the limits for brain and bone marrow should be lower than those from muscles and fat as tissues are not equally sensitive. They question the selection criteria for the adverse effect and state there is extensive data on acute effects but that the lower-level non-thermal chronic exposure effects may be very different and chronic effects need to be accounted for. They state the uncertainties in the data should be addressed.
- "These studies have resulted in concern that exposure guidelines based on thermal effects, and using information and concepts (time-averaged dosimetry, uncertainty factors) that mask any differences between intensity-modulated RF radiation exposure and CW exposure, do not directly address public exposures, and therefore may not adequately protect the public."

EPA Briefing To the FCC and NTIA on EPA "Development of RF/MW Radiation Guideline

- In this powerpoint presentation, the EPA briefs the FCC and NTIA about their progress in developing human exposure guidelines- that consider both thermal AND nonthermal effects for microwave radiation. The EPA was in a two phase process. First they were setting "interim RF radiation guidelines" which "did not account for modulation, chronic exposure or non thermal effects." Then they were going to focus on "modulated and nonthermal exposures" in Phase 2 by convening national experts. A year later, the EPA was defunded from RF work and standards were never set.

1995 EPA Letter to the FCC on Near Completion of EMF Guidelines

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- The EPA updated the FCC on their progress in developing safety standards to cover thermal and non-thermal effects in this letter stating, "The guidelines are substantially complete and are beginning to enter the review phase… Issuance of the final guidelines that should be in early 1996 last year, selected federal agencies including the FCC formed an radiofrequency interagency workgroup to coordinate radiofrequency issues among federal agencies, providing the technical input to these guidelines and to act as a sounding board to assess a general approach employed in the guidelines.

US Science Advisory Board (SAB) Recommendation to the EPA To Develop RF Guidelines, August 25, 1994

- In this letter, the Science Advisor Board recommends that the EPA develop radiation protection guidance to protect the public. The report contains a 1983 letter from FCC Chairman Mark Fowler to the EPA Administrator Kathleen Bennett which states, "We believe that a definitive federal standard is imperative. Therefore we would like to make clear our support for your guidance development. We encourage the EPA to complete this process as expeditiously as possible so that her uniform federal standard will be available for use by the FCC and other affected agencies." Page 14 has a list of "Significant events in EPA RF Radiation Guidance Program"

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