

To: Portland Public Schools
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RE: Cell towers and Wireless Technology in Schools

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Dear Portland School Board:

I am a physician who has studied toxins in the environment for over 25 years and worked with my local Santa Clara County Medical Association and the California Medical Association to set public health policy. While fighting a proposal to place a cell tower on my daughter's middle school 10 years ago I began learning about the toxic effects of radiofrequency radiation on humans and the environment. I found it is similar to pesticides and chemicals in having a common biological mechanism of toxicity to cells, i.e. oxidation (93 studies). Radiofrequency radiation (RFR) has since then been a focal point for me in toxics research.

It has become apparent that there are a host of other serious concerns related to the use of digital technology in schools including distraction, addiction, inability to memorize, impatience among students and teachers, poor learning, privacy, cyberbullying, cybersecurity, cost, and increasing contribution to global climate change due to energy consumption of data transfer and storage.

Having a safe and healthy environment that promotes learning is essential for the performance and success of students. Positive outcomes in health and education have far reaching benefits and conversely negative outcomes affect all future generations and our society at large. **Wireless technology in particular poses a clear threat to the health and wellbeing of students and it's use in schools must be reconsidered.** The current FCC limits are obsolete and need to be reevaluated. Until we have meaningful public health policy with monitoring in place that is protective of human health with long term exposure, it is up to

individual school districts to take action to safeguard students and others who work in the school district.

This letter will focus on recent scientific evidence of harm from wireless radiation and provide recommendations to reduce radiofrequency radiation exposures in classrooms and thus reduce risk of harm.

Industry

Industry heavily promotes the rapid adoption of new wireless and digital technologies in schools as necessary to keep up. They profit from the data collected as well as the selling of devices. The powerful telecommunications associations and the FCC, now run by insider executives from the telecommunications industry, will dismiss, discredit and deride current research and researchers, while demanding more research. These are classic tobacco tactics well known and described in “Doubt is There Product” by Davis Michaels. The pesticide industry and the chemical industry have used the same tactics to promote their products which are now legacy pollutants in soil, streams and our bodies. Much research has already been done and more can always be done, however, at this point waiting for more research does not protect students, it only kicks the toxin filled can farther into the future.

Note that wireless = microwave = non-ionizing = electromagnetic radiation = Electromagnetic frequency = radiofrequency radiation = EMR = EMF = RFR.

Wireless Technology: New Concerns

In the last 10 years digital and wireless technology in schools have become a dominant part of education and for many teachers, indispensable. While educators and parents have identified addiction and behavior issues with the overuse of digital technology, there are relevant questions that remain about the educational value of digital technology versus book learning, as well as adverse eye effects from prolonged exposure to blue light from digital screens and back pain from poor posture. Researchers are also increasingly concerned with cognitive, learning and health impacts from the continuous long term exposure to radiofrequency radiation (RFR) emissions from wireless devices as well as cell towers in the school environment.

In the last 10 years, as technology use has mushroomed, physicians and scientists, have learned about the abundance of basic scientific research, epidemiologic studies and case control studies showing adverse effects of wireless technology on

our cellular biological processes. The mechanism is similar to other toxic exposures with oxidation being a common point of injury to cell membranes, proteins, DNA, sperm, stem cells, embryos and mitochondria (our cellular energy power plants). **Radiofrequency radiation (RFR) is an environmental toxin which like many other toxins is inadequately studied, monitored or regulated.** Because one cannot feel it, see it or hear it RFR is among the many other toxic exposures silently and slowly affecting our basic biology, genetic structures and that of our environment. This causes a silent decline in our health and that of the environment. Precaution in use is critical.

Acute Effects

This type of non-ionizing radiation can cause acute effects in 3% to 13 % of people with signs of what is termed microwave illness, aka electrosensitivity or electrohypersensitivity. This syndrome was clearly described decades ago in military literature which reported on servicemen working near radar systems. Symptoms include headache, dizziness, fatigue, irritability, insomnia, heart palpitations, poor concentration, memory loss, nausea. Microwave illness (aka electrohypersensitivity) is recognized by the American Access Board. The symptoms are different in everyone and depend on the health of the individual, genetics and other toxins they have been exposed to.

There may be students who are already experiencing these symptoms but have not identified the association with wireless devices. Several teens in Denmark noted that they felt tired on weekdays when they kept the cell phone on the table next to their head at night but on weekends without the phone they felt better. These curious students set up an experiment at school with cress seeds growing some near the router and others far away. The seeds near the Wi Fi router were stunted and grew abnormally. While not a scientific study their observations have been confirmed in other studies on plants.

A well respected hospice physician in Petaluma California, Dr. Scott Eberle, developed microwave illness after a carbon monoxide poisoning and eloquently wrote about his experience in his local medical association journal. He writes not only about how he identified this condition himself with the help of his colleagues but also his feelings of guilt, isolation and despair. In order to work, he learned how to modify his environment by removing all wireless devices and using a landline.

Others are no so lucky. A healthy, well-adjusted young British girl, Jenny Fry, who felt fatigue and headaches around the white board and other digital technology at

school after Wi Fi was introduced, was not listened to by her school administrators when she described her symptoms of “allergy to Wi Fi”. Unable to deal with the pain and suffering she eventually committed suicide. This is not an isolated story among those electrosensitive who are refugees in this increasingly wireless environment with no safe harbor to live, work or study. Some discount and dismiss these incidents as a psychological problem or hysteria but this is not the case. I know as I have not only read and compiled scientific literature on this subject but have also talked to many of these individuals who are highly educated, emotionally and psychologically well-adjusted and actually want to use wireless technology but like an allergy are unable to, due to severe symptoms.

You may have also heard recently on a CBS 60 minutes episode and in the mainstream media about mysterious “attacks” on U.S. diplomats in China and Cuba, where classic signs of microwave illness were experienced in otherwise healthy, psychologically normal people. Severe symptoms include headaches, fatigue, memory loss and nausea and were accompanied by unusual humming sounds. Experts report this is likely due to high powered microwave radiofrequency radiation directed at them and penetrating the walls of their homes.

Effects of Chronic Long Term Exposure

Studies on long term exposure to low levels of radiofrequency microwave radiation (RFR) far below that of current standards indicate cumulative harm. RFR is listed as a possible carcinogen by IARC. Three robust studies stand out that identify wireless radiation as carcinogenic.

Cancer

The first is the 10 year \$25 million study by the **National Toxicology Program**, a part of the National Institute of Environmental Health Sciences which was published in 2018. The study showed, in the words of the NTP, “**clear evidence of carcinogenicity**” to non-thermal levels of radiation. They found a significant increase in tumors of heart, brain and adrenal medulla. In addition, they had increased cancers above controls for prostate, pancreas, lung and liver. DNA damage was documented. A worrisome finding was that of cardiotoxicity similar to aging hearts in those exposed to RFR.

The 10 year **Ramazzini study** showed similar findings at even lower levels of radiation. **Chou** performed a 5 year, \$5 million Air Force [study](#) on long term exposure to non-ionizing radiation and cancer which was published in 1992 finding long term exposure to low levels of RFR was associated with an increase in

primary malignancies described as “a provocative finding”. These three independent studies along with dozens of other studies show reproducibility of the carcinogenic effects of RFR.

This type of radiation can cause cancer of the internal organs as it passes through and is absorbed by any living organism that contains water.

Cancer Cluster in Schools?

While it is exceedingly difficult to identify or find the cause of a cancer cluster, parents and students in Ripon, California are convinced there is one at their school and caused by a nearby cell tower. They are not only protesting but several are abandoning the small school which now boasts 4 children with rare cancers -2 brain tumors, one kidney cancer and one liver cancer. Investigations of not only the cell tower radiation but also water quality have been initiated. Like a chemical superfund site, cell towers and Wi Fi create a continuous unrelenting radiating toxic environment. As noted above wireless radiation is absorbed in the body and organs and thus can cause broad harm to internal organs. The NTP study as noted above showed significant increase in tumors of the heart, brain and adrenal medulla (which sits just above the kidney).

The Reproductive Organs: Infertility and Miscarriage

Damage to DNA either female or male or to the fetus in critical windows of development can not only cause infertility and miscarriage but also heritable birth defects. RFR has been shown to cause injury to DNA and other metabolic processes. Students place tablets and wireless computers on their laps, radiating sensitive reproductive structures in waiting. The biological effects are silent until these students reach reproductive age and have children. Only then is the harm realized. Recent research demonstrates that RFR is toxic to the fragile reproductive process with a distinct lack of studies showing that this technology is safe for the reproductive organs. Articles include:

- **Sperm Damage:** Over 40 studies-Motility, DNA
- **Ovarian Damage:** 3 studies
- **Embryo Damage:** 5 studies
- **Miscarriage:** Kaiser physician, Dr. De Kun Li, performed an incontrovertible robust prospective study of 913 pregnant women and miscarriage. He showed that the highest levels of everyday EMF exposure were associated with a 3-fold increase in miscarriage.

Cognitive Decline

The Brain:

The brain develops through a complex interactive process of chemical, hormonal and electrical signaling that continues into adulthood. The successful functioning of the brain, and thus the individual, is dependent on appropriate and timely connections of the neural pathways which form the architecture of the brain. In the first few years of life a million new neural connections are formed every second. Harvard scientists underscore that cognitive, emotional, and social functions are the foundation for emerging cognitive abilities. What affects the development of one effects the other.

Toxic stress

It is well known that toxic stress as well as exposure to chemical toxicants during childhood can produce behavior and learning deficits by damaging neurons and disrupting critical connections. It is a domino effect of harm with degeneration of neurons hijacking further development. The mechanisms include oxidation of vital structures.

Wireless Radiation as a Toxic Stress

The brain is considered to be the most sensitive target of microwave radiation as well as chemical toxins. Dozens of basic science studies demonstrate that wireless radiation acts as a neurotoxin through neural inflammation and oxidation, similar to chemicals. This translates into disruption in learning, behavior and cognition. A recent controlled study by **Meo (2018)** showed cognition impairment in students near a school cell tower.

Dysregulation of Hormonal Systems and Cell Towers

Because of concerns with the “scientific uncertainty” of public health impacts of cell tower radiofrequency emissions, Professor **Buchner and Eger** performed a rather novel study over a year and a half in Bavaria in 2004. Hearing that a cell tower was to be placed in their municipality they enlisted volunteers to have their urine tested for levels of adrenaline, noradrenaline, dopamine and phenylethylamine, all stress hormones that cannot be consciously regulated. They found continued dysregulation of the catecholamine system with elevation in the stress hormones adrenaline, noradrenaline with decreases in dopamine and phenylethylamine. Long term dysregulation of the catecholamine system is well known to damage human health. Another study by **Eksander (2012)** demonstrated decreases in ACTH, cortisol, thyroid hormones, prolactin and testosterone with exposure to higher but environmentally relevant levels of radiofrequency radiation over a 3 year period.

Child Development Disrupted by Trauma or Stress

The emerging literature on the neurobiology of child developmental traumatology indicates that chronic stress from childhood trauma of many sorts is mediated through the catecholamine (fight or flight) system. This can have negative enduring effects on brain development. Dysregulation of dopamine as well as adrenaline and noradrenaline are involved. “Exposure to severe stress and trauma in youth can disrupt the regulatory processes of the limbic-hypothalamic-pituitary-adrenal (LHPA) axis across the life span in both animals and humans.” (De Bellis and Zizk 2014) In this way chronic stress can affect normal development of the part of the brain called the hippocampus, the learning and memory center of our brains.

It is worrisome that emerging science indicates that wireless radiation can also cause dysregulation of critical developmental hormone systems.

Effects of RFR on the nervous system seen in studies (92+) include

- **DNA damage**
- **Alteration of neural functioning** (cognition and learning)
- **Decrease in neurotransmitters** (mood altering)
- **Oxidative nerve cell injury** and inflammation
- **Damage to hippocampus** (memory center)
- **Demyelination** (disruption of the protective cells surrounding nerves)

Epidemiologic studies on learning and behavior have shown

- **Speech Delay:** (Ma 2017) American Academy of Pediatrics -30-min increase in screen time led to a 49% increased risk of expressive speech delay.
- **Lower Memory Scores:** (Foerster 2018)-22 Swiss Schools- Decreased memory scores with cumulative phone use
- **ADHD:** (Birks 2017) 83,000 Pairs- 5 countries Denmark, Korea, Netherlands, Norway, Spain- Increased maternal cell phones –more ADHD and emotional problems
- **Neuropsychiatric Effects:** (Pall 2016) 26 + studies- fatigue, headache, nausea- Electrosensitivity (EHS)

Cell Tower Effects on Cognition and Learning

The majority of studies, which have been done internationally, have shown an increase in neurologic symptoms in a percentage of residents living near cell towers. Symptoms vary with the distance from the cell tower. Symptoms include insomnia, headache, heart palpitations, dizziness, poor concentration, and fatigue. A study in Japan (**Shinjo 2014**) showed a decrease in symptoms when the cell tower was removed. There is also a well done study showing blood abnormalities in those living nearest to cell towers (**Zothansiana 2017**). DNA and lipid abnormalities were seen along with reduction in internal antioxidants which provide protection from pollutants. Moreover, **a recent study conducted over 2 years looking at effects of cell towers near two schools by Meo et al (2018) clearly demonstrated cognitive dysfunction in students closest to the higher power cell tower.**

Cancer and Cell Towers

A study by **Wolf and Wolf (2004)** showed a significant increase in cancer in those living within 350 feet of a cell tower. **Eger (2004)** found an increase in new cancer cases within a 10-year period if residents lived within 400 meters of a cell tower. They also found that within 5 years of operation of the transmitting base station the relative risk of cancer development tripled in residents near the cell tower compared to resident living outside the area. **Dode (2011)** performed a 10-year study (1996-2006) examining the distance from cell towers and cancer clusters. He and his colleagues found a significant increase in cancers in those living within 500 meters of the cell tower. They noted “The largest density power was 40.78 $\mu\text{W}/\text{cm}^2$, and the smallest was 0.04 $\mu\text{W}/\text{cm}^2$.” The current guidelines are about 1000 $\mu\text{W}/\text{cm}^2$. They *conclude* **“Measured values stay below Brazilian Federal Law limits that are the same of ICNIRP. The human exposure pattern guidelines are inadequate. More restrictive limits must be adopted urgently.”**

Russian Committee on Non-Ionizing Radiation Protection Predicts Severe Effects on Children and Teens

The Russian Committee on Non-Ionizing Radiation Protection, whose scientists have studied the significant risks of radio frequency radiation for decades, published a report in 2008 with a dire warning for reducing exposures to protect future generations from harm- [Russian National Committee of Non-Ionizing Radiation Protection 2008 Report.](#)

The researchers who contributed to this [report on children and teens](#) provided a sobering discussion about the long term health effects, including cancer, especially in children who are continuously exposed to wireless radio frequency radiation. They state,

"According to the opinion of the Children and Mobile Phones the following Health hazards are likely to be faced by the children mobile phone users in the nearest future: disruption of memory, decline of attention, diminishing learning and cognitive abilities, increased irritability, sleep problems, increase in sensitivity to the stress, increased epileptic readiness.

Expected (possible) remote health risks: brain tumors, tumors of acoustical and vestibular nerves (in the age of 25-30 years), Alzheimer's disease, "got dementia", depressive syndrome, and the other types of degeneration of the nervous structures of the brain (in the age of 50 to 60).

The members of the Russian National Committee on Non-Ionizing Radiation Protection emphasize ultimate urgency to defend children's health from the influence of the EMF of the mobile communication systems. We appeal to the government authorities, to the entire society to pay closest attention to this coming threat and to take adequate measures in order to prevent negative consequences to the future generation's health."

Collaborative for High Performing Schools Recommends Low EMF Environment

In the United States, The Collaborative for High Performing Schools developed criteria and policies for schools to improve student performance through improved building design. This includes reduction of chemicals, low energy use, water reduction, along with a section on Best Practices for Low EMF in 2014. This well researched and well written policy [document](#) includes recommendations as follows:

- Provide wired Local Area Networks (LAN) throughout the school
- Disable wireless transmitters on all Wi Fi enabled devices
- Laptops and notebooks have ethernet port and switch to disable wireless
- Keep computers and tablets away from the body
- Hardwire all phones
- Prohibit cell phones and other personal wireless devices in the classroom
- Prohibit cell phone towers and base stations on school buildings or property
- Run conduits for future fiberoptic connections

Learning Not Improved with Digital Technology

Digital technology may well be oversold by the tech Industry who push digital online learning beginning in kindergarten. While this technology may be beneficial as a "tool", it does not necessarily improve learning, especially in the younger grade levels. The Organization for Economic Co-operation and Development (OCED) study, one of the largest of its kind, looked at differences in learning using

books versus digital technology. They found no improvement in mathematics, science or reading and those who used computers frequently have worse results. Mr Schleicher, the OECD director stated, ““If you look at the best-performing education systems, such as those in East Asia, they've been very cautious about using technology in their classrooms.” He goes on to state,

"One of the most disappointing findings of the report is that the socio-economic divide between students is not narrowed by technology, perhaps even amplified."
<https://www.bbc.com/news/business-34174796>

It is also noteworthy that the developers of digital technology (Steve Jobs, Bill Gates and many others) did not send their children to schools where this “revolutionary” technology was used but instead to Montessori schools where books, pen and paper are used with teachers at the center of learning. They understood the impacts of their technology on social emotional development and deep learning. (See new York Times Series on Digital Technology in Schools)

Schools Banning Cell Towers on School Property

Securing leases for cell towers on school property can be an easy way to bring in thousands of dollars of much needed revenue to schools annually and accommodate carriers wanting to expand their territory. There is an indirect cost that is now being considered, however, and that is the human health cost. These schools, states and countries have banned cell towers near or on school property

- Los Angeles Unified school district
- Mumbai, India

Schools Banning Cell Phones to Improve Test Scores

School districts throughout the world and in the US are now banning cell phone use and possession of cell phones in school classrooms as they are unnecessary and distracting. In France this officially occurred in July 2018 but was in place far longer before the law. In the US Wisconsin school districts have done the same with many schools silently developing policy on this.

Research has consistently found higher levels of learning, better note taking and less distraction without cell phones. **Beland and Murphy** of the London School of Economics in 2015 published the results of their study finding an improvement in test scores when cell phones were banned. The researchers also state that banning cell phones reduces the educational inequalities. A total cell phone ban is necessary for this to work.

Kuznekoff and Titsworth in 2013 examined the impact of mobile phone usage during class lecture on student learning. They found students who were not using their mobile phones wrote down 62% more information in their notes and were able to recall more detailed information from the lecture. They also scored a full letter grade and a half higher on a multiple choice test.

Ward (2017) found that the mere presence of a cell phone reduces available cognitive capacity. They call the smartphone a “brain drain”.

Schools Removing Wireless

Worldwide more schools are removing wireless and switching back to wired connections, especially in the younger grades. Policies have been enacted in Israel, France, Vienna Medical Association, Cyprus Medical Association. Frankfurt Germany hardwired 80% of its schools over a decade ago. Specific schools are listed at Environmental Health Trust below and include Waldorf Schools in Escola, Santa Fe, San Diego, Washington, Maryland, Portland, Burlington, Vermont, Minneapolis Minnesota, as well as schools in Italy, Germany, Denmark, Australia, Belgium, Finland, Spain.

Re-Inventing Wires: The Future of Landlines and Networks

Fiberoptic, cabled and wired connections provide a faster, much safer, more cyber secure and less energy intensive option for connecting to digital learning sources without the harmful electromagnetic radiation. An important white paper discusses the broad advantages of broadband connectivity with cable and fiberoptics. **Re-Inventing Wires: The Future of Landlines and Networks**

Summary

The fundamental role of schools is not just for the educational experience but also to provide a safe and healthy environment in which to do so. The use of wireless technology increasingly demonstrates harm to the health, mental function, behavior, memory and learning of students. While convenient to mature adults and for emergencies this wireless technology provides few benefits to students and poses untold but predictable risks, especially with long term exposures.

Measures to reduce exposures are not complicated nor expensive. In doing so you will be protecting the most vulnerable in the population, our children.

You will also be following the recommendations and policies of the Parliamentary Assembly European Council, the California Department of Public Health, the New Jersey Education Association, Germany’s Federal Office for Radiation Protection, Australian Radiation Protection and Nuclear Safety Agency, France and also the

many other thoughtful and precautionary steps taken by schools throughout the world.

You are entrusted with the safety of our children. Please act responsibly to protect them from this emerging public health crisis. A “wait and see” approach is not precautionary or wise. This strategy sold by industry has led to many lessons clearly not learned about the need for premarket testing and proof of safety prior to commercialization of products or chemicals. Pesticides, asbestos, lead, DDT, arsenic, bisphenol A, flame retardants and the list goes on... We need to set a higher standard for our children that puts precaution over profit.

The Precautionary Principle:

When human activities may lead to morally unacceptable harm that is scientifically plausible but uncertain, actions shall be taken to avoid or diminish that harm.

Let’s use it.

Recommendations to Reduce Wireless Radiation

- 1) Study this issue and look at the research
- 2) Have students research this
- 3) Remove Wireless devices in a phased fashion K-3, 4-8, high school while
- 4) Require wired connections for white boards, laptops, tablets,
- 5) Ban cell phone use at schools as many other public schools in the US
- 6) Ban cell towers on schools
- 7) Secure a fiberoptic network for the school

Sincerely ,
Cindy Russell, MD

“Waiting for high levels of scientific and clinical proof before taking action to prevent well-known risks can lead to very high health and economic costs, as was the case with asbestos, leaded petrol and tobacco.”

— [The European Commission](#)

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