Policy Guidance Regarding Wireless Radiation

Abstract

The Internet of Things offers much in the way of convenience, economic opportunity and efficiency. Depending upon how it is deployed, however, it also offers significant risk to our health, personal privacy, and national security. If we ignore these risks, the consequences include the loss of life and personal liberty. Alternatively, if we sensationalize these risks beyond the confines of reasonable evidence, we risk these very same consequences as no one responsible for public policy will take them seriously. This lack of action by our government will in turn result in significant delays to the implementation of important protections on behalf of our citizens. As such, we need to proceed with measured urgency as plans governing billions of dollars in infrastructure investments are being implemented. If not guided by sound policy regarding the health, personal privacy and national security concerns pertaining to these infrastructure investments, billions more in investments will be needed to rectify the issues that surface as a result of these concerns. This brief is an attempt to provide sound policy guidance regarding wireless radiation that will not only enable us to take advantage of most facets of the Internet of Things but also do so in a responsible manner.

About the Authors

Patrick Colbeck is a Michigan State Senator. Prior to his service in the Michigan Senate, he earned

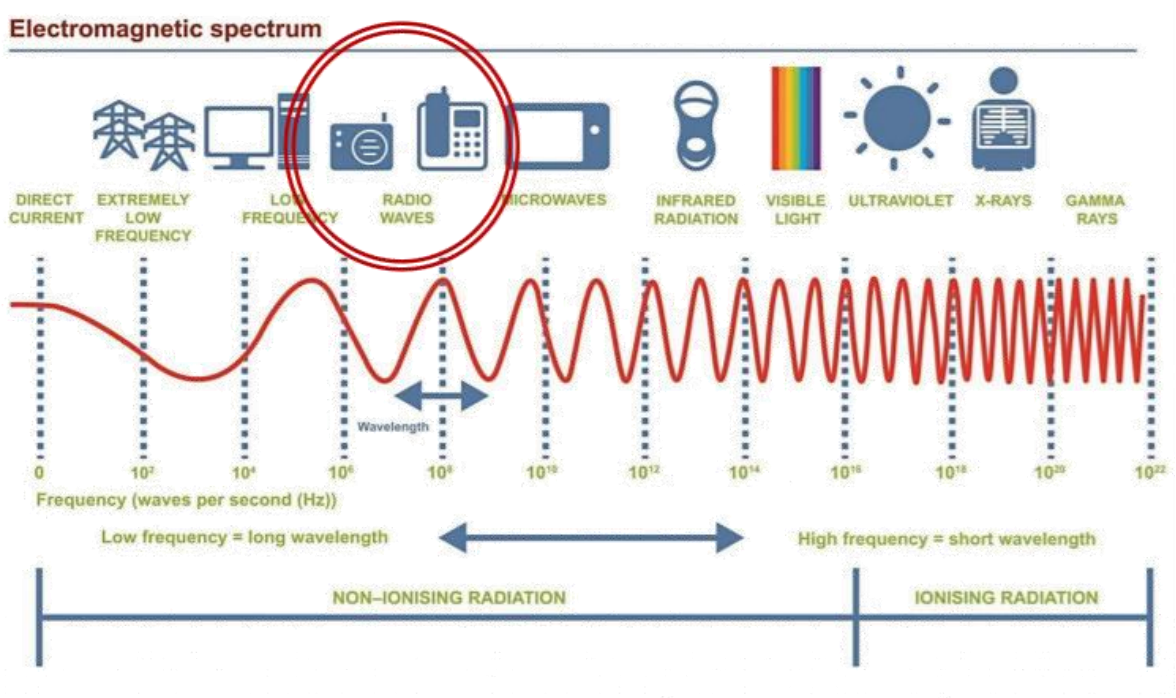


Bachelors and Masters Degrees in Aerospace Engineering from the University of Michigan, graduated with a Life Sciences concentration from the International Space University in Strasbourg, France, and was employed by Boeing as a lead engineer responsible for the design of cabling and environmental control systems within the International Space Station. His wife, Angie Colbeck, MD studied Epidemiology at the University of Michigan's School of Public Health, graduated from the College of Human Medicine at Michigan State University, and practiced medicine as a board certified pediatrician before retiring. Together, they bring a unique combination of public policy, healthcare, and technology experience to the topic of wireless radiation.

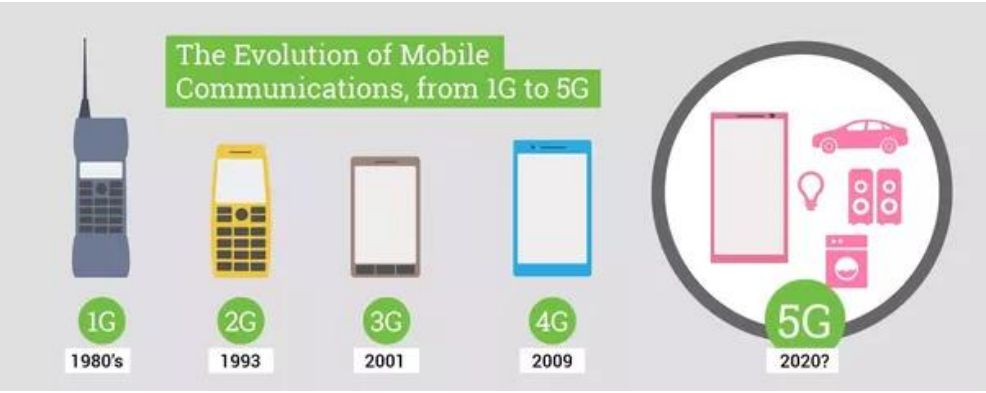
Background

Wireless Radiation Technologies

Wireless transmissions are nothing new. Ever since Marconi made the first radio broadcast in 1894, humans have been harnessing the electromagnetic spectrum in support of communications. Our society now covers the entire spectrum with communication related technology.



What is relatively new is the rapid evolution of wireless personal communication networks. First Generation (1G) personal communication networks started appearing in the 1980's. We are now on the cusp of the deployment of a Fifth Generation (5G) network that promises to provide us with an entirely new level of connectivity with the Internet of Things.



[1]

[1] SOURCE: https://www.quora.com/Where-I-can-start-to-learn-about-2G-3G-4G-and-5G

What is the Internet of Things? In basic terms, it is a network of things where things can be people or electronic devices. This Internet of Things promised connectivity on levels heretofore unrealized.



2

Cellular Networks

Cellular networks feature three basic components – cell tower, cell phone, and hardwired communication backbone. Cell towers have been the face of personal communication networks ever since the 1G network was deployed. Sometimes you can find them on dedicated towers. Sometimes you can find them on water towers. Sometimes you can find them on tall buildings. Sometimes you can't find them at all since we do not have 100% coverage throughout the United States. Since the advent of 3G networks, cell towers not only support phone calls but also data services which enable cell phone users to access the internet. The standards used in support of these communications vary globally and feature GSM, UMTS and LTE bands. These bands feature the broadcast of modulated communication signals anywhere from 460MHz to 6GHz. 2.4GHz is the same frequency for the emissions from a microwave oven. Cell phones in turn communicate with cell towers in the same spectrum. Communications between cells are typically managed by a hardwired communication backbone that connects cell towers.



Smart Meters

Smart meters are the building blocks for the so-called "smart grid" that governs the distribution of electricity to our homes and businesses. Unlike the analog meters of the past, smart meters enable remote monitoring of energy usage within a home and remote shutoff of power to that home. Data

[2] SOURCE: Bignerdranch.com

transmitted to/from smart meters include energy used in a given time interval, time, peak power time, messages, acknowledgements, price signals, and reliability signals. Smart meters broadcast this data for each home via wireless transmissions typically in the 902MHz or 2.4GHz range. This data from smart meters is shared initially within an Advanced Metering Infrastructure (AMI) Communications Network featuring other smart meters in the area. The AMI Communications Network in turn communicates this data with Supervisory Control and Data Acquisition Systems (SCADAS). SCADAS are the brains of the smart grid responsible for regulating the ebb and flow of electricity within a given power substation network. SCADAS in turn are managed by regional control centers which manage the demand for electricity by consumers with the supply of electricity from power generation sources. [3]



Figure 1 Smart Meter

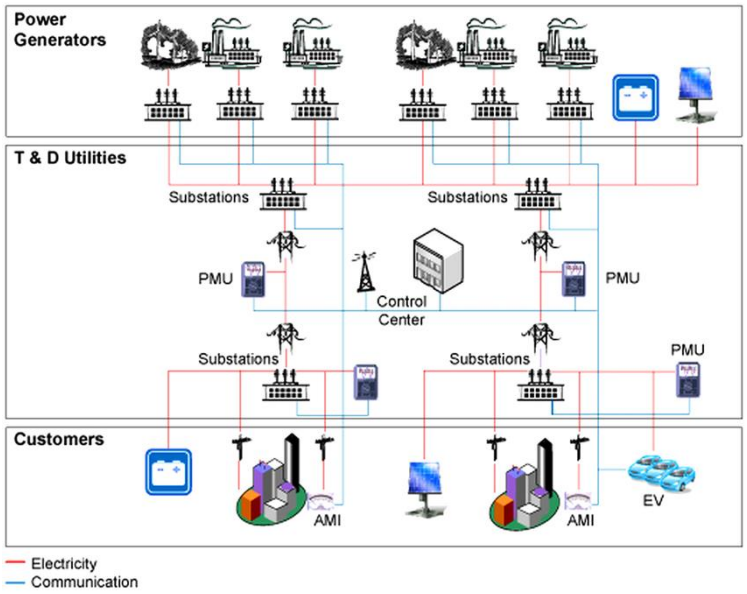


Figure 2 Smart Grid

Wi-Fi

Wi-Fi is a trademarked term for wireless internet access points conforming to IEEE 802.11 protocols. These wireless access points are typically routers which are connected to either hardwired, Ethernet routers or to modems which connect to the internet. Wireless devices such as computers, game consoles, tablets or smart phones use these wireless access points to connect to the internet. Wi-Fi routers typically broadcast continuously in the 2.4GHz or 5.0GHz spectrum.

5G "Small" Cells

5G "Small" Cells represent a specialized cellular network that broadcasts in the 24GHz to 90GHz spectrum. Higher frequency transmissions have difficulty penetrating solid objects such as the walls of buildings. In order to overcome this difficulty, a higher density of cell towers is required to provide reliable network access in a given area. In contrast to current cellular networks requiring one cell tower

[3] SOURCE: https://www.researchgate.net/figure/Power-generation-control-and-measurement-diagram-across-the-distribution-network-and_fig2_289504234

for every 1-3 km in urban environments, some analyses of 5G networks have concluded that as many as one "small" cell transmitter will be required for every 2-10 houses.

Public Policy

In the United States, policies regarding wireless radiation are regulated by the Federal Communications Commission (FCC). The FCC Chair is typically a former executive within the telecommunications industry which is why many view it as "captive agency" meaning that it prioritizes the interests of the telecommunications industry over the best interests of our citizens at large. In this light, it is worth noting that the FCC not the CDC, FDA or EPA is responsible for definition of human exposure standards. Per Section 704 of the Telecom Act of 1996:

- (iv) No State or local government or instrumentality thereof may regulate the placement, construction, and modification of personal wireless service facilities on the basis of the environmental effects of radio frequency emissions to the extent that such facilities comply with the Commission's regulations concerning such emissions
- (b) RADIO FREQUENCY EMISSIONS- Within 180 days after the enactment of this Act, the Commission shall complete action in ET Docket 93-62 to prescribe and make effective rules regarding the environmental effects of radio frequency emissions

It is important to note that the ability of state or local governments to regulate the placement of wireless service infrastructure on the basis of environmental or health effects is explicitly prohibited. Furthermore, it is important to note that the rules regarding environmental effects are defined by the FCC. The subsequent regulations for "environmental effects" are reflected by the human exposure limits specified in Figure 3. The telecommunications industry is effectively indemnified against lawsuits for "environmental effects" (i.e. adverse health impacts) so long as they limit emissions to the levels specified in Figure 3.

The prohibition on regulations surrounding the placement of wireless service infrastructure has not kept local units of government from passing other forms of legislation related to wireless services. A summary of this legislation can be viewed in Table 1.

Table 1 Local Government Actions

Date	Location	Jurisdiction	Description
2015	Berkeley, CA	City	Berkeley is the first city in the nation to require cell phone retailers to provide those who purchase a new phone an informational fact sheet which informs buyers to read the user manual to learn the cell phone's minimum separation distance from the body.
2014	Suffolk County, NY	County	The Suffolk County Legislature passed legislation to require all county buildings to post notices that wireless routers are in use such as, "Notice: Wireless technology in use." The resolution, sponsored by Legis. William Spencer (a physician), warns that every wireless device emits radio frequency radiation or

Date	Location	Jurisdiction	Description
			microwave radiation.
2014	Greenbelt, Maryland	City	The Greenbelt Maryland City Council voted unanimously on November 24, 2014 to alert citizens about the fine print warnings and possible health risks of cell phones and wireless devices, to send the FCC Chairman a letter urging the adoption of "radiation standards that will protect human health and safety." They also voted to oppose cell towers on school grounds.
2012	Jackson Hole, Wyoming	City	Jackson Hole issued a Proclamation of Cell Phone Safety which cites concern over long term health effects as well as the increased risk the radiation poses to children.
2012	Pembroke Pines, Florida	City	Pembroke Pines passed Resolution 3362 expressing the City's "Urgent Concerns" about Wireless Radiation and Health and which encourages citizens to read their manuals and presents information on how to reduce exposure by using a headset or speakerphone. Jimmy Gonzalez, an attorney who had developed brain cancer after heavy cell use, initially petitioned the Commission.
2010	San Francisco, California	City	Cell Phone Radiation (How to Reduce Exposures) Webpage launched. San Francisco developed a poster, factsheet and display stickers.
2010	Burlingame, California	City	Burlingame California City Council voted to include cell phone safety guidelines in their Healthy Living in Burlingame initiative (WHO classification and consumer precautions).
2010	Portland, Maine	City	Mayor Mavodenes, Jr. declared October "Cell Phone Awareness Month".

Table 2 Wireless Radiation Policy Initiatives Outside of the U.S.

Country	Description
Israel	The Israeli Ministry Of Education has issued guidelines limiting Wi-Fi and cell phone use in schools. Preschool through 2nd grade have banned the use of wireless networks. A hard wired direct cable connection is required if the teacher has a computer in the class. Magnetic fields below 4MG are being reduced.
Israel	The Israeli Supreme Court ordered the Israeli government to reply on ceasing Wi-Fi installations.
Israel	In third and fourth grade class internet is restricted to 3 hours per week.
Israel	The Education Ministry has instructed all schools to perform radiation tests.
Israel	The Health Ministry has called for a halt to Wi-Fi installations.
France	National Legislation minimizing Wi-Fi has been passed and the National Agency for Health, Food and Environmental Safety (ANSES) issued a report on the science in 2013.
France	2015 law passed banning Wi-Fi from nursery schools. Wi-Fi must be turned off in elementary schools when not in use. Cell phone advertisements must recommend headsets to reduce exposure to brain.
France	2011 statute requiring merchants to display SAR Radiation levels for different phone

Country	Description
	models. All phones must be sold with a headset. Cell phone ads aimed at children younger than 14 are banned and phones made for children under 6 are banned.
France	2013 ANSES Report recommends hands free phones, SAR labeling, and "limiting the population's exposure to radiofrequencies… especially for children and intensive users, and controlling the overall exposure that results from relay antennas."
France	The French National Library along with other libraries in Paris, and a number of universities have removed all Wi-Fi networks.
France	Herouville-Saint-Clair has removed all Wi-Fi equipment installed in municipal buildings.
Russia	The Russian National Committee on Non-Ionizing Radiation Protection has repeatedly warned about electromagnetic radiation impacts on children and recommended Wi-Fi not be used in schools.
India	2012 The Ministry of Communications and Information Technology issued EMF Guidelines with new Exposure Limits lowered to 1/10 of the ICNIRP level and requiring SAR labeling on phones. Official guidelines for cell phone use include: headsets, speakerphones, limiting cell use, increasing distance from devices, and choosing landlines.
India	2013: Supreme Court of India upheld the High Court of the State of Rajasthan decision to remove all cell towers from the vicinity of schools, hospitals and playgrounds because of radiation "hazardous to life."
India	The Ministry of Communications and Information Technology has an EMF webpage.

Wireless Radiation Exposure Limits

While we are all immersed in constant exposure to radiation throughout the electromagnetic spectrum, wireless communications are distinct in that they feature concentrated emissions of radiation within specific segments of this spectrum. These concentrations are measured as power density levels. An extreme example of a high power emission of wireless radiation would be nuclear detonation. While emissions from wireless devices are not on that order, but prolonged exposure to lower power emissions from wireless devices at much lower power density levels can have similar adverse health impacts. In order to protect citizens from such adverse health impacts in the United States, the FCC has defined the maximum power density levels to which humans should be exposed. These limits[4] were established on the basis of 1970's data and are specified in Figure 3. By comparison, the wireless radiation human exposure limits for other countries are specified in Figure 4.[5] Note that the allowable power density levels in other countries are *significantly* lower than those defined in the United States.

[4] SOURCE: https://transition.fcc.gov/bureaus/oet/info/documents/bulletins/oet65/oet65.pdf
[5] NOTE: The 100 mW/cm2 specified in Figure 3 equals the 1000 μW/cm2 in Figure 4

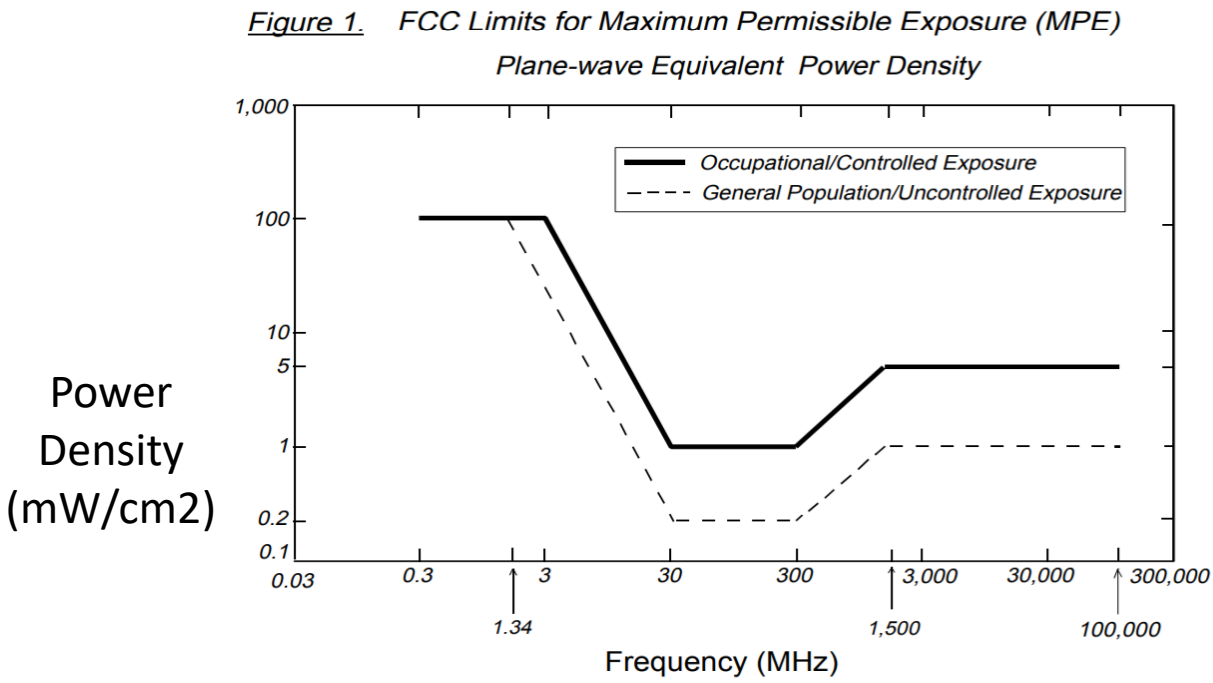


Figure 3 FCC Human Wireless Radiation Exposure Limits

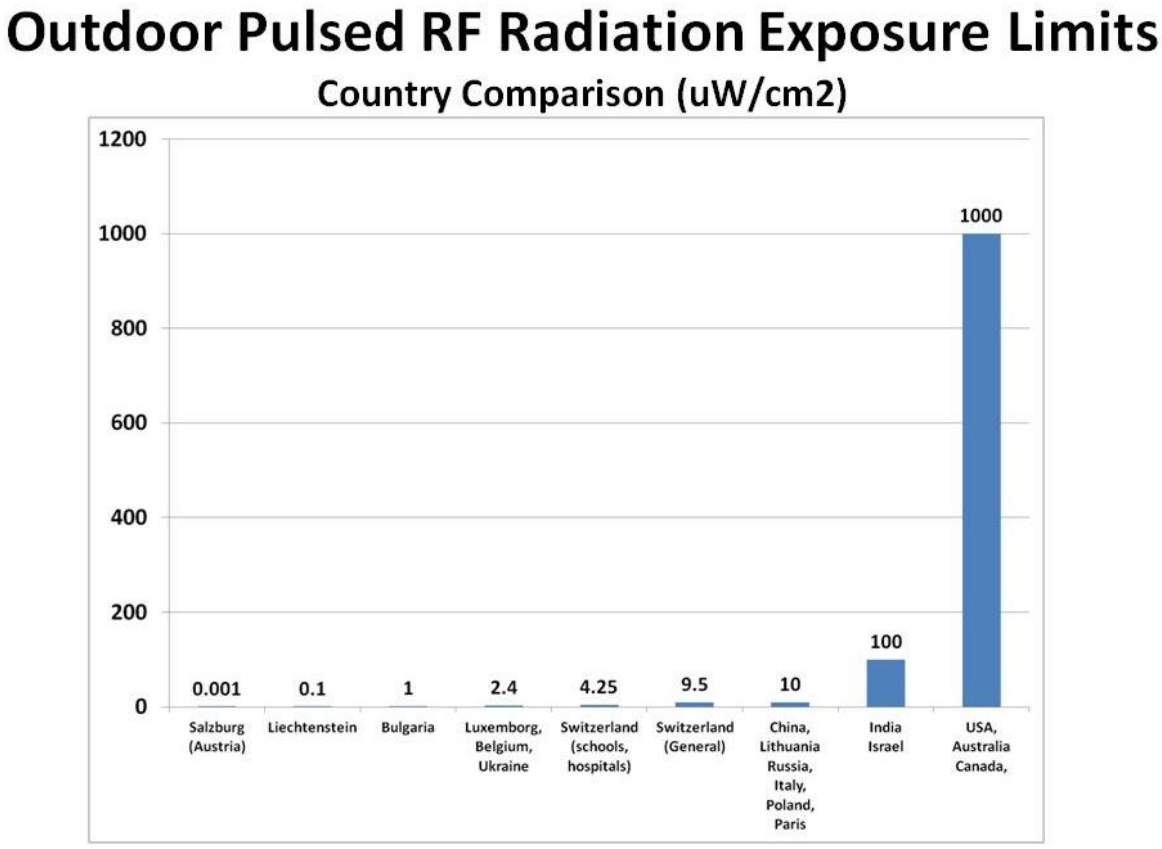


Figure 4 Wireless Radiation Exposure Limits in Other Countries

Wireless Technology Initiatives

Smart Grids

Public utilities are increasingly rolling out smart grids to manage the distribution of resources such as electricity, water and natural gas. Invariably, this results in the installation of smart meters for each utility service at the point of delivery – typically the exterior of a home or office building.

Citizens who would prefer to keep their analog meters rather than have a smart meter installed are typically left with no option to do so. They are given the choice of no utility service or paying a fee to opt-out of a smart meter. Opting out of a smart meter often entails additional service fees despite no service fee credit being provided for those who adopt the smart meters.

5G Rollout

The Federal Telecomm Act of 1996 already prohibits restrictions upon the placement of wireless service equipment by states and local units of government, but many state legislators have been lobbied to pass state statutes that prohibit local units of government from impeding the deploying of wireless service equipment. These prohibitions effectively leave people who are sensitive to wireless transmissions without any community safe havens. Furthermore, autonomous vehicles are increasingly being used as justification for the deployment of 5G networks in a manner that precludes the ability of local jurisdictions to block the placement of 5G transmitters. Autonomous vehicle developers are increasingly dependent upon data from 5G networks to improve safety. The addition of safety concerns to the significant financial investments in autonomous vehicle technology results in significant pressure upon legislators to enact legislation that ensures the unfettered deployment of 5G networks.

Risks

Adverse Health Impacts

Like many other states in the United States, the Michigan Constitution states in Article IV Section 51 that the health of our citizens is to be a primary concern of our government officials. One would think that such a provision would not be necessary, but when policy decisions involve tradeoffs between economic benefit, convenience and health concerns, the wisdom of such a provision becomes much more evident.

As early as the 1970's, studies began emerging that indicated **there are adverse health impacts due to wireless radiation used for communication**. These adverse health impacts include the following:

- Cancer
- Oxidative damage/ROS/DNA damage/DNA repair failure
- Cardiac arrhythmias and other effects on heart muscle as well as blood pressure, vascular effects
- Disrupted calcium metabolism
- ADHD, behavioral disorders and learning difficulties

- Sleep disturbances and memory loss. Changes the blood brain barrier and effects the neuron firing rate and EEG
- Disrupted immune function and change in stress proteins, HSP.
- Reproduction/Fertility effects

These impacts are well-documented in over 3,600 papers. A compendium of these studies can be found at BioInitiative.org.

As the evidence for these health impacts began to emerge, so did the push back from the telecommunications industry in much the same as the tobacco industry pushed back against such evidence. In an attempt to prove conclusively once and for all whether or not wireless radiation is harmful, the FDA sponsored an extremely thorough, $25 million study in 1999. The study was conducted by the National Toxicology Program (NTP). The study results were first reported in 2016.

The study confirmed that wireless radiation indeed causes cancer and DNA damage at non-thermal levels, below the FCC "safety" limits (which deny non-thermal effects). Dr. Ron Melnik, PhD, Senior Toxicologist and Director of Special Programs in the (NIEHS) who led the study until he retired, said: "The NTP tested the hypothesis that cell phone radiation could not cause health effects and that hypothesis has now been disproved. The experiment has been done and, after extensive reviews, the consensus is that there was a carcinogenic effect." In regard to the DNA damage he said that the results of the study: "should put to rest the old argument that RF radiation cannot cause DNA damage". The scientists in the press conference in 2016 said that "the public must be warned".

On March 26, 2018, a peer review panel of 11 experts appointed by the NIEHS to review the cancer findings confirmed that the study shows "**CLEAR EVIDENCE" of cancer**. The study findings are not new and confirm what other animal studies and epidemiological studies have shown.[6]

In spite of these findings, as of September 14, 2018, the official FCC position on adverse health impacts are as follows.

> "Some studies have also examined the possibility of a link between RF exposure and cancer. Results to date have been inconclusive. While some experimental data have suggested a possible link between exposure and tumor formation in animals exposed under certain specific conditions, the results have not been independently replicated. Many other studies have failed to find evidence for a link to cancer or any related condition. The Food and Drug Administration has further information on this topic with respect to RF exposure from mobile phones at the following Web site: FDA Radiation-Emitting Products Page ."[7]

There is a clear disconnect between the FCC policy and scientific findings regarding the adverse health impacts of wireless radiation.

[6] SOURCE: Dafna Tachover, Lawyer and Director of WeAreTheEvidence.org.
[7] https://www.fcc.gov/engineering-technology/electromagnetic-compatibility-division/radio-frequency-safety/faq/rf-safety#Q6

Personal Privacy

The vast amount of data shared on so-called smart grids has led to many concerns regarding who has access to this data and how will it be used. In the Information Age, data is power. It also translates to money. More information translates to more control over the behavior of our citizens either directly by controlling their access to utility services such as electricity, water or natural gas or indirectly via glossy brochures comparing your energy usage to that of your neighbors. The control of behaviors is taken to an entirely new level when this personal information is sold to businesses seeking to influence your purchase decisions. Personal information collection, analysis and dissemination is a multi-billion dollar industry.

The smart grid provides government and businesses with a treasure trove of information about each consumer. Smart appliances and other devices are being designed to communicate with the smart grid. Communications from these devices provide a VERY detailed consumer profile. This consumer profile can tell interested parties what specific devices they own, when they use them, when they are home, when they go to sleep, when they wake and so much more. This information is as good as gold for those seeking to influence the behavior of citizens.

One of the most concerning aspects of this information collection is that it is not only being enabled by government but it is often enforced by government entities charged with the oversight of utility monopolies. Why is this concerning?

The 4th Amendment of the United States Constitution reads as follows:

> "The right of the people to be secure in their persons, houses, papers, and effects, against unreasonable searches and seizures, shall not be violated, and no Warrants shall issue, but upon probable cause, supported by Oath or affirmation, and particularly describing the place to be searched, and the persons or things to be seized."

Data from smart grids has already been used in court cases without warrants. However, the 7th Federal Circuit Court has recently ruled that the 4th Amendment applies to smart meter data. Smart grids fit in very well with George Orwell's dystopian society in his classic 1984.

Service Access Security

As we increase our dependence upon wireless technology, we also increase our susceptibility to the interruption of services dependent upon this technology. It is much more difficult to implement broad-based disruption of hardwired or analog systems than wireless systems.

Smart grids pose a significant risk to what many deem as essential services such as electricity, water, and natural gas.

> *"A so-called 'Smart Grid' that is as vulnerable as what we've got is not smart at all. It's a really really stupid grid."*
>
> - James Woolsey, former CIA Director, 2011

The risks of smart grid technology are clearly identified in 10-K Filings required by the Security and Exchange Commission (SEC]. This filing for one of the two regulated utilities in Michigan (DTE) reads as follows:

> "*Threats of terrorism or cyber-attacks could affect the Registrants' business.* The Registrants may be threatened by problems such as computer viruses or terrorism that may disrupt the Registrants' operations and could harm the Registrants' operating results. The Registrants' industry requires the continued operation of sophisticated information technology systems and network infrastructure.
>
> *Despite implementation of security measures, all of the Registrants' technology systems are vulnerable to disability or failures due to hacking, viruses, acts of war or terrorism, and other causes. If the Registrants' information technology systems were to fail and they were unable to recover in a timely way, the Registrants might be unable to fulfill critical business functions, which could have a material adverse effect on the Registrants' business, operating results, and financial condition*.
>
> In addition, the Registrants' generation plants and electrical distribution facilities and, for DTE Energy, gas pipeline and storage facilities, in particular may be targets of terrorist activities that could disrupt the Registrants' ability to produce or distribute some portion of their products. The Registrants have increased security as a result of past events and may be required by regulators or by the future terrorist threat environment to make investments in security that the Registrants cannot currently predict."

Clearly, the utilities understand their risks related to the interruption of their services. As policy makers, government officials need to go beyond an understanding of the risks to utilities to understand the risk to the security of our citizens. In an age when most citizens shop for their groceries on a daily basis, how would a prolonged disruption in electricity impact their lives? Grocery stores depend upon trucks to get their products to the store. Trucks depend upon fuel. Fuel is pumped from gas stations. Fuel pumps require electricity. Some experts predict civil disorder in as little as 1 or 2 weeks of prolonged electrical outage.

Recommendations

Let us be clear. We are not recommending a ban on wireless transmissions. We are asking for a much more responsible approach to policies regarding wireless transmissions than has been taken to date, however.

The purpose of government is to secure the rights of the governed. In this context, a key question policy makers need to ask is *"Do the perceived benefits for our citizens outweigh the risks?"* If duly elected representatives of the people are unable or unwilling to ask this question and respond accordingly with sound policy decisions that impact all of our citizens, we believe that individual citizens should be empowered to make those decisions for themselves.

Among the policy recommendations that we would like to make based upon the findings in this briefing are the following:

Promote Wired Rural Broadband

Many rural communities are pursuing adoption of 5G networks as a means of accessing high speed internet connections. Rather than deploy 5G "small" cells throughout rural communities, telecommunication companies should be encouraged to provide high speed internet access via wired technologies such as fiber optic cables. These wired systems are more reliable, more secure and provide higher speed access than wireless networks.

Lower Human Wireless Radiation Exposure Thresholds

If the FCC were to lower the Human Exposure Thresholds currently specified in Figure 3, telecommunication companies would be incentivized to consider the adverse health impacts of technology prior to rolling it out to the public. If the FCC is unwilling to do so, responsibility for the definition of human exposure limits should be reassigned to the EPA, CDC, or FDA.

Restore Local Control

Remove prohibits on state and local units of government from regulating the placement of wireless transmitters in their communities. This policy would allow communities to designate themselves as "Wi-Fi" free zones providing safe haven for people suffering from electro-sensitivity.

Promote Removal of Wi-Fi from Schools

Young children including babies in the womb are much more sensitive to adverse health impacts than fully developed adults. In this light, we should follow the lead of countries such as Israel and France by prohibiting Wi-Fi networks in schools and encouraging hardwired internet connections where necessary.

Promote Alternative Autonomous Vehicle Technologies

Encourage automotive manufacturers to pursue autonomous vehicle technology that does not require a 5G network or other technologies that result in broad-based risk of adverse health impacts.

Contact Information

This briefing merely scratches the surface of the data available on this topic. The data which has been provided was done so in an attempt to focus policy considerations upon some of the more salient issues. If you are interested in additional information regarding this policy area, please do not hesitate to contact the authors.

Angie Colbeck, MD
accolbeck@comcast.net

Patrick Colbeck, MI State Senator
pjcolbeck@comcast.net