

**NH COMMISSION TO STUDY THE ENVIRONMENTAL AND HEALTH EFFECTS  
OF EVOLVING 5G TECHNOLOGY**

Meeting held:

10/10/19

8:30-10:30am

LOB 202

Meeting called to order by Rep Abrami at 8:30am.

In attendance: (13) (Each member discussed their backgrounds)

Rep. Patrick Abrami-speaker of the house appointee

Senator Tom Sherman-president of the senate appointee

Rep. Ken Wells- speaker of the house appointee

Kent Chamberlin-UNH-appointed by the chancellor

Carol Miller-NH Business & Economic Affairs Dept.

Denise Ricciardi-public-appointed by the governor

David Juvet-Business and Industry Association

Brandon Garod-AG designee, Asst. AG Consumer Protection

Bethann Cooley-CTIA , trade association for wireless industry and manufacturers

Michelle Roberge-DHHS- Commissioner of DHHS appointee

Dr. Paul Heroux- Professor of Toxicology, McGill University- speaker of the house appointee

Rep. Gary Woods-speaker of the house appointee

Senator Jim Gray-president of the senate appointee

Not present: (1)

Frank MacMillan ,Jr. MD-NH Medical Society Environmental Medicine

Agenda: (attached)

I. Approval of minutes from 9-16-19:

-minutes were approved with changes to be made for Rep. Wells name to be corrected and to correct quote attributed to Kent Chamberlin in error.

II. Commission in agreement to broaden out to RF effects beyond just 5G.

III. Dr. Kent Chamberlin Presentation: Electromagnetic Spectrum Physics: (see attached 6 pages)

- All information/data is transmitted merely as 1s and 0s.
- Everything is electrical in the data transmission system.
- Data rate= how fast you can send information= bandwidth, etc.
- The higher the data rate, the higher the frequency.

- Frequency is inverse relationship to wavelength. Increase frequency, the shorter the wavelength.
- The data rate can be no faster than half the speed of the oscillator for acoustic transmission. Therefore, data cannot be sent very quickly at low frequencies.
- Two fields are generated: Electric and Magnetic fields in electromagnetic transmission.
- Antenna converts voltage to E/M waves or the reverse.
- Wavelength is distance from peak to peak of the wave. The lower the frequency, the greater the wave length, the larger the antenna needed. Need high frequency, shorten wavelength to have smaller antenna.
- We need high frequency for high data rate for small antenna for mobile devices.
- 2.45 Ghz Industrial scientific Medical band.
- 800 Mhz-2.7 Ghz currently for cell phones same as microwave oven frequency.
- 5G is proposed to be 86 Ghz, significantly higher, close to the invisible spectrum.
- Photon Energy = frequency x Planck's constant= to find energy in photons of the frequency.
- Wave particle duality which is part of quantum physics is important to look at for health effects.

Sherman: why doesn't my cell phone fry my hand like a microwave oven if I put my hand in it?

Chamberlin: 1.5 Kw for a microwave is more watts of power than your cell phone. Power drives the heating. Increased power increases photons but energy remains constant. We need to look at Quantum Physics and photons.

Rep Abrami: non ionizing vs ionizing?

Chamberlin: We need to look at photons for that. EMR can be represented as discrete packets of energy called photons. If photon energy is great enough to detach electrons from molecules, you have ionizing radiation or heating, if power is great enough. It is a fuzzy line between ionizing vs non ionizing radiation. You will have heating if thermal radiation from microwaves is strong enough.

Sherman: if visible light is that far along the spectrum, why isn't it damaging?

Chamberlin: We know that it is. You are also exposed to UV rays in light like sun or tanning beds.

Woods: Can it be damaging but non-ionizing?

Wells: yes...an example of an egg frying.

Woods: Proton tunneling- protons go from one side to other of DNA which creates a misread or error. Non-ionizing is in that category because hydrogen bonding can be flipped during proton tunneling. Quantum physics. There is a probability it can go through the energy barrier. Be aware, because there are other mechanisms by which energy levels can be damaging but non-ionizing.

Chamberlin: EMF simulation- if we increased the wavelength and it strikes something like wet wood, some of the energy reflects back like radar. Some of it gets transferred into the wood or object. The wave is getting smaller as it enters because it gives up heat and warms the wood. You get heating from within and you do get heating from the outside.

Sherman: Does impact of reflected wave change the amplitude of the incoming wave?

Chamberlin: Yes. It causes a partial standing wave.

- High frequency supports higher data rates and allows for designs of convenient sized devices.

- Relatively (600 mw to 3 watts) low power of cell devices, supposedly won't cause heating.

- Signal loss increases with increasing frequencies which is why they need to be so close to towers.

- Cell phones adjust power output as needed. Cell works harder if signal is weak or antenna is covered. It will pump more EM energy into the user. (22-45 miles) typical cell power distance ranges.

The closer your cell phone is to your body, the power is significantly greater. What goes through someone's head while talking on cell phone? It uses your head as a ground plane before radiating outside, standing waves and resonances within cavities like sinuses. This isn't good. We need to ask. If it's harmful, what can we do about that?

Sherman: Are you saying that human tissue becomes part of antenna or diffuses power into tissue?

Chamberlin: Yes. Your head acts as antenna or ground plane. It excites current inside your skull and causes heating. Is it significant heating? I don't know.

Abrami: original studies in 1990s studied thermal effects. Studies say potential biological effects. As a Commission, we will be about science, not speculation.

Wells: Besides ionizing or non-ionizing radiation, other photo chemical reactions are at play. For example, vitamin D or Plastic beach balls out in the sun. The red ones fade from photo chemical reactions. It is consequential.

Sherman: Seacoast terrible cell service. Does that mean cellphones work at higher level then Manchester? If that's the case, are we getting more of one kind of EMR from cell tower? Or cell phone?

Chamberlin: If cell tower is far away, will not get constant radiation. However, your cell phone will give off higher radiation because it works harder to find the signal. But, we can choose to have a cell phone off or not radiation constantly.

Cooley: with small cells, your phone battery is not working as hard to find signal and works at lower power.

Sherman: what are you getting in exposure from that closer infrastructure?

Chamberlin: which is worse? Short high bursts? Or constant low level doses?

Roberge: On your slide, the higher the red in the brain, the higher the intensity?

Chamberlin: yes.

Denise: Does that explain the rise in brain cancer?

Chamberlin: It's a correlation but is that causation? I don't know that answer. We need to look at epidemiology.

Wells: Brain Cancer and reproductive organs don't require big voltage to affect.

Woods: much of our tissue is ionized and that is a natural state. Your bones don't grow or heal unless you have an ionized state. Biological tissue can operate in an ionized state.

Abrami: Some say it's safe because it's non-ionizing. But is that a true statement? That's why I bring that up.

IV. Dr. Paul Heroux Presentation: Biological Effects of RF Radiation: *(see attached 6 pages)*

- Occasionally, we make mistakes in public health with uncertainty. Because we did not recognize accurately the danger, In 2007, we changed chromium 6 from 100 to 5 which is a factor of 20 that we misjudged safety. Workers under the old limits have 35% chance of cancer from exposure. The new limits reduced to 4.5%.

-Risk is a part of life. We cannot have zero risk. Important to realize that legal exposure limits are what is known at the time, for the exposed population, and if there are the alternatives should be part of risk assessment for an agent.

-EMR standard came about after second WW. U.S. was the only country to produce a standard because they were the only ones who had that capability. The military was the source of deciding that heat would be the criteria.

- Navy, Air Force, Army: EMR enormous importance in time of war... would need radar to survive. Applications involving military were given high priority at that time. Colonel George Knauf of USAF and Dr. Herman Schwann, bio-physicist, were those making decisions. At that time, it was perceived as non- patriotic to suggest any ban of use of Emfs because of Cold War with what was considered a nefarious power. People gave green light to military which was understandable at that time.

-Debating the danger of microwave: 1960-1990. There was a rift in science at that time.

-Biophysicist, Dr. Herman Schwann, using physics thermal guidelines for heating experiments with short 30 minute exposures. His understanding was limited at that time.  
-Biologist Allan Frey used biology based guidelines, microwave heating, blood-brain barrier leakage and chronic 24x7 exposure. Some research was fabricated to discredit his work.

Military point of view: yes there is doubt to risk but people in service get hurt all the time. So we err on side of keeping armed forces with best technology available. Lots of things are acceptable in times of war.

USAF standard from 1960 survived more or less in this form as standard today in the US. Interestingly, USAF was 10mW/cm<sup>2</sup>; General Electric was 1mW/cm<sup>2</sup>; Bell labs was .1mW/cm<sup>2</sup> and the Soviets .01mW/cm<sup>2</sup>.

Soviets based their standard on nervous system disturbances, not heating. They provided two standards; a higher standard for their military and much lower standard for domestic applications.

The US did not accept this difference. USAF, ANSI, IEEE, FCC...standards still based on heating... as being the only dangerous agent. It's not easy to measure real exposure in high frequency. This limited capabilities for biologists to be part of this process.

1966 Health Standards were ultimately developed by 15 people: 10 from military, 1 oil, 1 space, 1 General Dynamic, 1 US Treasury and only 1 from Public Health.

Very heavily biased to applications vs biological affects... are exposures for fighter pilot in F16 appropriate for children in classrooms today?

In commerce and engineering, people are highly motivated to promote product. If someone says, maybe there is a subtle affect related to your product that you have not investigated, most companies will not have the desire nor resources to do so. This is not a recent story. Adam Smith...warned if merchants have their way, they will act in such a way to promote their product... beware. This has lead in the past to public health issues:

-Air pollution is one of these. Air pollution is visible. However, no one realized it until 1952 when 12,000 people died in four days...and that was what finally motivated people because it was obvious.

-Lead: 1930s. They knew at the time it was toxic and GM could have decided to use ethanol in fuel but they knew it could not be patented and you could not make more money. The company decided to use lead instead. You may not die immediately, but your civilization will be inferior as a result... 15 million US children lost 10 IQ points as a result of that decision.

-We should use alternatives, if they exist for public health.

-Today an average of three hours a day are spent on mobile phones, texting and internet access. The cell phone has been an incredible success. Schwann or the Colonel did not anticipate the situation we are in right now. This explosion in constant exposure should have changed the risk assessment today.

-We are being exposed to chronic man made waves in a very short span of time. The reason we adapted to the radiation of light is we have had millions of years to adapt. What is less certain is if we are resistant to other forms of radiation like man made technological radiation.

-RF exposure and Low Frequency exposure: all signals that carry data, function in bursts. Many biological effects we detect, refer to modulation at LOW FREQUENCY (non thermal and non ionizing). This is important.

What evidence do we have that this radiation is biologically active?

\*Altered enzyme activity, biochemical changes, Oxidative Stress (ROS), pathological cell changes, neuro-behavioral effects, DNA damage, Altered Gene Expression, Brain wave changes. (hundreds of research papers)

- Currently, 44% of the world is living under much lower standards vs. US and much of the western world which have the highest standards allowed.

-How did IEEE react to these facts?

Engineers had the notion that public health people are trying to get grants based on the success on the telecom industry. There was a great deal of suspicion as they used research unfamiliar to them. Public health people, doctors and biologists realized they could not bridge the gap between engineering and health.

Dr. Carpenter designed the Bioinitiative Report to establish a better standard. But this group is lightweight compared to interests of industry. Academics are a loose group with very limited means and the results had very little influence. The situation is starting to change in Europe in particular in allowing the exposure to humans.

What is 5g? What does it mean?

-Slice spectrum into tiny bands changing 12.5 times per second your cell phone can change frequency.

- Time domain multiple access in bursts.

-Space segmentation...instead of broadcasting in every direction use narrow beams, 3-10 degrees in width. Tom Wheeler of FCC said it's a wonderful new idea ...but Russians had in 1981 most sophisticated radar... already in military long time ago but what is new is beam steering and beam focusing. This results in a lot more radiation and information being broadcast for the Internet of Things. ( IOT)

- Noise is important. IOT seems like a great idea but it will be a self-fulfilling prophecy. It will be difficult to extract information from all the noise from all the waves constantly radiating.

-Some people think less penetration in the body will result from 5G...but UV causes skin cancer at penetration of .1mm which is less penetration than 5g.

Abrami: pulsing?

-Amplitude modulation... allowed us to send voice over large areas... modulated with voice of person. When FM came along, this allowed us large amount of stations but you had to allow more power. Then, we changed from analog to digital or data as it can be compressed. Now, it is sent as pulses. Are pulses more negative affect than waves? All indications are that they are more biologically active. The irregularity of the pulse creates a challenge to the organism. The organism is hit vs being pushed. Irregularity of the challenge to organism is important.

-3G/4G cell phones... we had a lot of exposure to these pulses. These bursts are so useful that this was not taken into account. You do not want your phone to use high frequency all the time so you can save power.

Sherman: The difference between 10Ghz and 50Ghz is less penetration but is there increase in intensity of penetration?

Heroux: Yes.You will have more concentration of energy.

-Caution: Phone industry wants to get rid of SAR because they won't be able to sell them because that concentration will raise the SAR above the limits. They will be illegal. They will say power density should be the new standard. All that will do is change the location of the cancer in the body as it will be more concentrated. Regulators are coming from the industry to set standards for their products.

- RF in cars is a public health threat. They will become radiation intensive. Companies are more concerned about "features" in car vs the biological effects.

-IOT is dream of engineers to put RF in anything that you can get information from. But they are also taking information from people without authorization.

-We want the capacity but should a company be able to put that in a product without my authorization or knowledge? It has to be controlled.

Abrami: Can you touch on autonomous vehicles? Colleges have grant money to look at it.

- It is NOT TRUE you need 5g for autonomous vehicles.

-Vision and laser scanning are being done at MIT. You need very rapid scanning but it is being developed.

-Engineers are smart. If we tell them to do it safely, they will.

-You don't need 5g for remote medicine although they will say you do because of low latency.

-In terms of humans, low latency does not mean much. It means a lot in a process in a plant or with robots, but not humans.

-Is it possible to non thermally affect cancer cells? Yes. Dr. Heroux's research.

- ALL cancer cells react to artificial EMFs.

-Low level radiation, similar to cell phone at low frequency have same or higher power of oxygen that can affect the body. O2 is fuel for body that generates ROS but we need O2. However, fields that produce larger effects like cell phones, we can CHOOSE not to have.

-Organs that need the most oxygen are most affected. Cells die more by necrosis than apoptosis.

- In 1900s rates of disease and chronic disease very different than what we have now.

Abrami: has your research been replicated? Yes... there are hundreds of research papers to support this.

Cell necrosis vs fibrosis:

Sherman: necrosis (cell death) to fibrosis (scarring)

Tissues most at risk...are brain, pancreas which has high levels of ROS already, diabetes.

-Non thermal effects... RF changes behavior of cells..... which is why we talk about children and digital RF exposure in their lifetime. There are places now eliminating wifi from schools.

-Pregnant women, infants, children: cells replicate quickly, developing tissues are vulnerable, microwaves penetrate young brains more deeply.

- Reproduction and sperm counts are very serious subject but I do not have time to cover all effects.

-You don't need energy to affect biology, they are already ionized.



- According to Prof Martin Blank: DNA becomes unstable from EMR.

Our bodies are electrical machines...the movement of protons tunneling and effect on ATP synthase, which is one of the most sensitive places in the body result from EMR.

-Importance of cell phones are so great people are not willing to act on risk. We need to find a way to maintain function and minimize the risk.

-If you expose brain to EMR: penetration of albumin in brain= egg white which carries toxins so now you have toxins carried into the brain. Alan Frey detected permeation of blood brain barrier. The lesions were occurring have pattern have no connection to simulation by a physicist. It means there is penetration of albumin into the brain. 50% of protein in blood is albumin. It is used to capture toxicants of all sorts so your body is not affected too rapidly. It captures it and releases slowly so you aren't shocked. When albumin goes into brain, it carries all toxins that you carry in body into your brain. It is not a good thing and happens in a very short time.

Ramazzini & NTP studies.... Yes... DNA damage & cancer particularly, in nervous system.

Wells: EMR studies with plants? Yes...There is a lot of literature even with visible light. The visible light is not a grave problem because we have evolved over millions of years... tissues can adapt over time...rapid changes we cannot adapt to.

Abrami: We ran out of time. Dr. Heroux, you may finish your presentation at our next meeting.

Next meeting will be Thursday, Oct 31<sup>st</sup> at 9 am.

Nov 1<sup>st</sup>, first draft report due

V. Meeting Adjourned at 10:30 am.