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MCPS Board of Education
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Montgomery County Schools
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January 3, 2016

Dear Montgomery County COO Dr. Andrew Zuckerman, Interim Superintendent Larry Bowers,
Board of Education and Office of Technology;

I have been asked to comment on the [MCPS Statement Concerning Deployment of Wireless Computing Technologies](#). I am happy to do so.

The first paragraph in that statement is not relevant to the issue at hand because it is perfectly possible to use wired communication for such education. This document is being produced on a computer on which I only use wired communication, connecting to the internet, connecting to my printer and for other purposes, as well.

The 2nd and 3rd paragraphs of your statement may well be technically correct. However these give us no assurance whatsoever of safety of Wi-Fi fields. The FCC guidelines as are many other such guidelines, are based on the assumption that only heating effects of microwave/lower frequency EMFs can have biological effects. However that assumption has been falsified by thousands of studies published from the 1950s to the present, each showing that non-thermal levels of exposure often produce biological effects. For example, in 1971, the U.S. Office of Naval Medical Research produced a document reporting over 100 different non-thermal effects [1], listing 40 apparent neuropsychiatric changes produced by non-thermal microwave frequency exposures, including 5 central/peripheral nervous system (NS) changes, 9 central NS effects, 4 autonomic system effects, 17 psychological disorders, 4 behavioral changes and 2 misc. effects [1]. It also listed cardiac effects including ECG changes and cardiac necrosis as well as both hypotension and hypertension, and also 8 different endocrine effects.

Changes affecting fertility included tubular degeneration in the testis, decreased spermatogenesis, altered sex ratio, altered menstrual activity, altered fetal development, programmed cell death (what is now known as apoptosis) and decreased lactation. Many other non-thermal changes were also listed for a total of over 100 non-thermal effects. They also provided [1] approximately 2000 citations documenting these various health effects. That was almost 45 years ago and is only the beginning of the evidence for the existence of non-thermal effects. My own recent paper [2] shows that widespread neuropsychiatric effects are caused by non-thermal exposures to many different microwave frequency electromagnetic fields (EMFs).

Tolgskaya and Gordon [3] in 1973 published a long and detailed review of effects of microwave and lower frequency EMFs on experimental animals, mostly rodents. They report that non-thermal exposures impact many tissues, with the nervous system being the most sensitive organ in the body, based on histological studies, followed by the heart and the testis. They also report effects of non-thermal exposures on liver, kidney, endocrine and many other organs. The nervous system effects are very extensive and include changes many changes in cell structure, disfunction of synaptic connections between neurons and programmed cell death and are discussed in Refs. [2,3] and more modern studies reporting extensive effects of such non-thermal EMF exposures on the brain are also cited in [2]. There are also many modern studies showing effects of non-thermal exposures on fertility in animals.

The Raines 1981 National Aeronautics and Space Administration (NASA) report [4] reviewed an extensive literature based on occupational exposures to non-thermal microwave EMFs. Based on multiple studies, Raines [4] reports that 19 neuropsychiatric effects are associated with occupational microwave/ radiofrequency EMFs, as well as cardiac effects, endocrine including neuroendocrine effects and several other effects.

I reviewed many other scientific reviews on this topic, each of which clearly supports the view that there are various non-thermal health impacts of these EMFs [5]. In 2015, 206 international scientists signed [a statement](#) sent to the United Nations Secretary General and to member states, stating that international safety guidelines and standards are inadequate to protect human health [6]. Each of these 206 scientists from 40 countries had scientific publications on biological effects of such EMFs and therefore each is well qualified to judge this. ***It can be seen from this statement to the UN, that there is a strong scientific consensus that current safety guidelines and standards are inadequate because they do not take into consideration all of the non-thermal health effects produced by various EMF exposures.***

That scientific consensus also rejects, therefore, the FCC EMF guidelines, guidelines that cannot be defended despite your own attempt to do so in MCPS Statement Concerning Deployment of Wireless Computing Technologies.

It can be seen from the previous paragraphs, that the following non-thermal effects of EMF exposures are well documented:

- Ø Widespread neuropsychiatric effects
- Ø Several types of endocrine (that is hormonal) effects
- Ø Cardiac effects impacting the electrocardiogram (Note: these are often associated with occurrence of sudden cardiac death)
- Ø Male infertility

However, there are many additional types of biological changes produced by non-thermal EMF exposures (reviewed in 5,7] including:

- Ø Oxidative stress
- Ø Changes in calcium fluxes and calcium signaling
- Ø Several types of DNA damage to the cells of the body, including single strand and double strand DNA breaks and 8-OH-guanine in DNA
- Ø Cancer (which is undoubtedly caused, in part, by such DNA damage)
- Ø Female infertility
- Ø Lowered melatonin; sleep disruption
- Ø Therapeutic effects of EMFs when they are highly controlled and focused on a specific part of the body

It can be seen from the above, that each of the things that we most value as individuals and as a species are being attacked by non-thermal microwave frequency EMFs [5.7]:

§ **Our Health**

§ **Our brain function**

§ **The integrity of our genomes**

§ **Our ability to produce healthy offspring**

I want to emphasize that the specific health effects listed above are **not** the only things that are likely to be impacted by non-thermal EMF exposures, they are however the best documented such effects.

While it has been clear for many years that there are many non-thermal health effects of microwave frequency EMFs, it has not been clear until about 2 ½ years ago, how these effects are produced by such exposures. I stumbled onto the mechanism in 2012 and published on it in mid-2013. This 2013 paper [8] was honored by being placed on the Global Medical Discovery web site as one of the most important medical papers of 2013. At this writing, it has been cited 61 times according to the Google Scholar database, with over 2/3rds of those citations during 2015. So clearly it is having a substantial and rapidly increasing impact on the scientific literature. I have given 26 professional talks, in part or in whole on EMF effects in 10 different countries over the last 2 1/4 years. So it is clear that there has been a tremendous amount of interest in this research.

What the 2013 study showed [8], was that in 24 different studies (and there are now 2 more that can now be added [2]), effects of low-intensity EMFs, both microwave frequency and lower frequency EMFs could be blocked by calcium channel blockers, drugs that block what are called voltage-gated calcium channels (VGCCs). There were a total of 5 different types of calcium

channel blocker drugs used in these studies, with each type acting on a different site on the VGCCs and each thought to be highly specific for blocking VGCCs. What these studies tell us is that these EMFs act to produce non-thermal effects by activating the VGCCs. Where several effects were studied, when one of them was blocked or greatly lowered, each other effect studied was also blocked or greatly lowered. This tells us that the role of VGCC activation is quite wide – many effects go through that mechanism, possibly even all non-thermal effects in mammals. There are a number of other types of evidence confirming this mechanism of action of microwave frequency EMFs [2,]. Each of the 11 health impacts caused by non-thermal EMF exposures can be explained as being produced by indirect effects of VGCC activation [5,7].

It is now apparent [7] that these EMFs act directly on the voltage sensor of the VGCCs, the part of the VGCC protein that detects electrical changes and can open the channel in response to electrical changes. The voltage sensor (and this is shown on pp. 102-104 in [7]) is predicted, because of its structure and its location in the plasma membrane of the cell, to be extraordinarily sensitive to activation by these EMFs, about 7.2 million times more sensitive than are single charged groups elsewhere in the cell. What this means is that arguments that EMFs produced by particular devices are too weak to produce biological effects, are immediately highly suspect because the actual target, the voltage sensor of the VGCCs is extremely sensitive to these EMFs. **Because heating is mostly produced by forces on these singly charged groups elsewhere in the cell, limiting safety guidelines to heating effects means that these guideline allow exposures that are something like 7.2 million times too high.**

Why then does the FCC stick with these totally unscientific safety guidelines? That is the 64 billion dollar question. The FCC has been shown, in a long detailed document published by Harvard University Center for Ethics, to be a “captured agency”, that is captured by the telecommunications industry that the FCC is supposed to be regulating [9; can be obtained full text from web site listed in 9]. So perhaps the failure of the FCC to follow the extensive science in this important area, can be understood. Of course, what that means is that the FCC is completely failing in its role of protecting the public and it is a major blunder, therefore for either you or any other organization to depend on the FCC guideline as a reliable predictor of impacts of EMFs in humans.

So what is known about health impacts of Wi-Fi EMFs?

Table 1. The following Table summarizes various health impacts of Wi-Fi EMF exposures:

Citation(s)	Health Effects
[10,11,12,13,14,15,16]	Sperm/testicular damage, male infertility
[10,15,17,18,19,20]	Oxidative stress
[20]	Calcium overload

[11,12,20]	Apoptosis (programmed cell death)
[17]	Melatonin lowering; sleep disruption
[10,13]	Cellular DNA damage
[21]	MicroRNA expression (brain)
[18]	Disrupts development of teeth
[22]	Cardiac changes, blood pressure disruption; erythrocyte damage; catecholamine elevation
[23,24]	Neuropsych changes including EEG
[25]	Growth stimulation of adipose stem cells (role in obesity?)

Each of the effects reported above in 2 to 7 studies have an extensive literature for their occurring in response to various other microwave frequency EMFs so it should be clear that these observations on Wi-Fi exposures are highly probable to be correct. These include (see Table 1) findings that Wi-Fi exposures produce impacts on the testes leading to lowered male fertility; oxidative stress; intracellular calcium overload; apoptosis (a process that has an important causal role in neurodegenerative diseases); cellular DNA damage; neuropsychiatric changes including EEG changes. Each of these are very serious and oxidative stress has causal roles in many different human diseases; intracellular calcium overload has many different consequences – for example, it has a central role in causing neurodegenerative diseases; cellular DNA damage can cause cancer and produce mutations that impact future generations (if there are any). Other Wi-Fi effects each only documented by a single study are also effects where a variety of other non-thermal microwave EMFs also cause these, as shown by extensive literature on each of them. These include: melatonin lowering and sleep disruption; and the effects reported by Sali et al [22] cardiac changes, blood pressure disruption; erythrocyte damage; catecholamine elevation. So these may well be correct observations as well despite having only a single Wi-Fi specific study for each.

Summary:

1. The EMF safety guidelines supported by the FCC and others assume that only heating effects need be of concern. These assumptions have been known to be false for at least 45 years and there is a scientific consensus on this, that has lead to the petition by 206 highly qualified international scientists to the UN stating that current safety guidelines are inadequate.
2. We now know that low intensity non-thermal exposures work via VGCC activation and that indirect effects of such VGCC activation can produce each of the health effects that have been widely reported to occur in response to such EMF exposures for something like 60 years.

These attack:

a. Our health

- b. Our brain function**
- c. The integrity of our genomes**
- d. Our ability to produce healthy offspring**

3. The voltage sensor of the VGCCs is stunningly sensitive to such low intensity EMFs, about 7.2 million times more sensitive than are singly charge groups elsewhere in our cells. The consequence of this is that safety guidelines allow exposures that are very roughly 7.2 million times too high.

4. The FCC has been shown, in a detailed Harvard University study, to be a Captured Agency, captured by the industry that it is supposed to be regulating. This provides an additional reason to be very highly skeptical about all FCC safety guidelines.

5. 15 studies have each shown health effects of Wi-Fi, most of which have also been shown to occur in response to low intensity exposures to other types of microwave frequency EMFs. These are likely to have massive health effects by producing male infertility (female infertility has not been studied in response to Wi-Fi), oxidative stress (involved in dozens of human diseases), cellular DNA damage (possibly leading to both cancer and mutations in future generations), life threatening cardiac effects, cellular apoptosis and also intracellular calcium overload (with both of these possibly leading to neurodegenerative diseases), various neuropsychiatric changes and many others.

It is my view that it is sheer insanity to fail to see the threat to our and to all human civilization by continuing to ignore the threats from such EMFs, starting with Wi-Fi.

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