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## Chapter 1

I have been asked to respond to the unsigned letter from ARPANSA dated December 18, 2018. I am happy to do so. The first document that I am attaching is a document listing 41 statements of high level concern about the inadequacy of the current US and international safety guidelines which are only based on thermal (that is heating) effects. These were all statements written by scientists and/or physicians who are experts on EMF effects. Several of these statements have been signed by a hundred or more (going up to over 3000 or in one case over 23,000 in the most recent of these) scientists, physicians, other professionals and in some cases concerned lay people. It should be clear that independent scientists and physicians know that these safety guidelines, which do not take into account the many thousands of studies on non-thermal EMF effects, have no connection with the genuine scientific literature.

The second document attached is my seven chapter, 90 page document, completed on May 17, 2018. Copies of it are available on at least 8 internet sites. Let's start out by discussing Chapter 1 in that document.

Chapter 1 contains 8 different EMF non-thermal each of which is *very extensively documented* in from 12 to 35 different review articles, each of which provides a substantial body of evidence showing that one of these effects do occur following non-thermal EMF exposures. These effects are as follows:

**Lowered fertility, including tissue remodeling changes in the testis, lowered sperm count and lowered motility and other measures of lowered sperm quality, lowered female fertility including ovarian remodeling, oocyte (follicle) loss, lowered estrogen, progesterone and testosterone levels (that is sex hormone levels), increased spontaneous abortion incidence, lowered libido** (18 reviews).

**Neurological/neuropsychiatric effects including sleep disturbance/insomnia; fatigue/tiredness; headache; depression/depressive symptoms; lack of concentration/attention/cognitive dysfunction; dizziness/vertigo; memory changes; restlessness/tension/anxiety/stress/agitation; irritability** (25 reviews).

**Effects on cellular DNA including single strand and double strand breaks in cellular DNA and on oxidized bases in cellular DNA; also evidence for chromosomal mutations produced by double strand DNA breaks. These produce all of the important type of mutations, as described at the DNA level that have roles in cancer causation and in human whole organism mutation** (21 reviews).

**Apoptosis/cell death (an important process in production of neurodegenerative diseases that is also important in producing infertility responses)** (13 reviews).

**Oxidative stress/free radical damage** (important mechanisms involved in almost all chronic diseases; direct cause of cellular DNA damage) (19 reviews).

**Endocrine, that is hormonal effects; Includes changes in non-steroid and also steroid hormones (12 reviews).**

**Increased intracellular calcium levels, thought to be the cause in all other effects (15 different reviews).**

**Cancer including initiation, promotion and progression, further including tumor progression, tissue invasion and metastasis) (35 reviews).**

We have here, a total of 158 bodies of evidence each showing that non-thermal exposures cause an important health-related effect. These 8 different non-thermal effects are not the only effects being produced. Because many of these reviews provide bodies of evidence on the occurrence of more than one health-related effect, there are fewer than 90 actual review articles listed here. These 158 bodies of evidence individually provide strong evidence against the claims of the unsigned ARPANSA letter and collectively provide massive amounts of evidence that the undocumented ARPANSA claims of no non-thermal effects are completely false. ARPANSA and also other agencies supposed to provide expert information and advice on EMF effects, including ICNIRP, SCENIHR and WHO have systematically avoided citing and discussing these review articles and the 158 bodies of evidence within them, grossly avoiding their professional responsibilities to provide an objective assessment of the relevant scientific literature. This is shown in Chapters 5 and 6 of my 90 page document, as well as in the third attachment to this message, which critiques the 2018 ICNIRP draft.

The ARPANSA Dec. 18, 2018 letter, at the bottom of p. 1, top of p. 2 makes the following statement: ***“The ARPANSA RF Standard is based on scientific research that shows that the levels at which harmful effects occur and it sets limits well below these harmful levels, with various elements of precaution, based on international guidelines. The ARPANSA RF Standard is designed to protect people of all ages and health status against all known adverse effects from exposure to RF EME.”***

ARPANSA provides not one iota of evidence that its exposure standard is based on scientific research or that it protects us from any, let alone all harmful effects nor that it protects people of all ages and health status against all known adverse effects of RF (the word they are using for microwave frequency) exposures. ***What is absolutely clear***, is that what ARPANSA needs to do is to carefully examine each of the thousands of studies which apparently falsify their statement when these studies report various effects that occur at levels well below average exposure levels of the ARPANSA safety guidelines and show that each of those thousands of studies is deeply flawed and therefore fails to falsify the ARPANSA claims. What Karl Popper, one the two most important philosophers of science of the 20<sup>th</sup> century has shown, is that even one well conducted falsifying study is sufficient to throw out a theory and we have here thousands of such apparent well-conducted studies. ARPANSA has failed to start on this extensive task, and similarly no other organization touting any similar claims has done so either. What is shown in Chapter 5 of my 90 page document, is that the SCENIHR 2015 document which is the best candidate for any such examination from an industry perspective, systematically avoids examining such falsifying studies. The SCENIHR 2015 report was also shown to have multiple falsehoods, to have used false logic in examination of the literature and to have other serious flaws such that the SCENIHR 2015 report must be viewed as being deeply flawed.

The ARPANSA statement is clearly falsified by each of the 18 reviews on non-thermal exposures producing reproductive effects, by each of the 25 reviews of non-thermal exposures causing neurological/neuropsychiatric effects, by each of the 21 different reviews of non-thermal exposures causing three different types of DNA effects, by each of the 13 different reviews showing that non-thermal exposures cause increased apoptosis (programmed cell death), by each of the 19 reviews each showing that non-thermal exposures cause oxidative stress/free radical damage, by each of the 12 different reviews showing that non-thermal exposures cause endocrine effects, by each of the 15 different reviews showing that non-thermal exposures cause increased intracellular calcium levels [Ca<sup>2+</sup>]<sub>i</sub> and by each of the 35 reviews each showing that non-thermal exposures cause cancer. We have here, in total 158 bodies of evidence each comprised of many primary literature citations each showing that ARPANSA is wrong with regard to causation of a particular biomedical effect.

ARPANSA can, if it wishes, challenge each of these 158 bodies of evidence each showing that ARPANSA is clearly wrong here. The way to do that, of course, is for ARPANSA to cite each of these reviews in the context of causation of a particular effect, describe clearly and extensively what evidence is provided and then (and only then) present whatever criticisms they may have these reviews in the context of causation of these effects. What ARPANSA has opted to do is to completely ignore each of these bodies of evidence and by ignoring them, ***completely fail in their responsibility to protect the health of Australians.*** ARPANSA has also completely failed to consider the high level concerns with their safety guidelines expressed in the 41 statements written by international scientists and physicians and endorsed by many other scientists, physicians and in some cases, other people (see first attachment). It can be seen from these 41 different statements, that the ARPANSA position is widely rejected by independent scientists from all over the world. Of course, that is not at all surprising given the vast amount of evidence on each of these non-thermal effects.

When ARPANSA states that their Standard is *“designed to protect people of all ages and health status”* they are again stating this without providing one iota of evidence. As discussed in Chapter 4 in my 90 page document, there are four types of findings each of which show that children are more sensitive to EMFs than are adults. Children have much larger surface to volume ratios and much thinner skulls, such that their brains and other tissues are much more exposed to effects of EMFs. Children have much higher densities of stem cells which are particularly sensitive to the EMFs, as has been discussed by Dr. Belyaev and his colleagues. The developing brains are particularly sensitive to the effects of EMFs. This is particularly true of the developing brains during the perinatal period, a finding that may be especially important for apparent EMF causation of both ADHD and autism. The tissues in children have much higher extracellular water content, such that the effects of EMFs are much more penetrating, as discussed by Dr. Devra Davis. Each of these factors cause children to be much more sensitive to EMFs than adults and the younger they are, the more sensitive they are. It can be seen, in general, that ARPANSA makes grandiose claims that are both undocumented and found to be false or, at best highly questionable when one examines the scientific literature.

### **Multiple Fatal Flaws in the ARPANSA Regulatory Scheme**

The ARPANSA regulatory scheme, and the same scheme is used by ICNIRP, SCENIHR, the US FCC and many other regulatory agencies only considered averaged intensities, usually averaged over a 6 minute period or as ICNIRP does, over a 30 minute period, and sets the allowable cut off at levels that produce little or no heating. These only consider thermal

effects and the failure to consider non-thermal effects such as documented in the 158 bodies of evidence discussed above have lead the 41 groups of scientists and physicians to reject these safety guideline over and over again, as shown in the first attachment. The regulatory scheme of ARPANSA and others can be seen to be deeply flawed because of each of six additional distinct, repeatedly documented findings:

1. There were 13 reviews cited in Chapter 1 of my 90 page document, each of which showed that pulsed EMFs are, in most cases, much more biologically active than are non-pulsed (also known as continuous wave) EMFs of the same average intensity. Because average intensities, typically averaged over 30 minute periods, are the basis of the ARPANSA, ICNIRP, SCENIHR and US FCC guidelines this raises a major, even fatal flaw in the structure of those safety guidelines. Average intensities are **not** predictive of biological effects and therefore cannot be used as the basis of any useful regulatory scheme. Pulsation is also of great importance, because all wireless communication devices, communicate at least in part, via pulsation and the smarter they are, the more they pulse. Consequently, the role of pulsation is stunningly important with regard to the EMFs we are most exposed to.
2. There is a large literature on nanosecond pulses producing biological effects. These are pulses between 1 nanosecond and 1 microsecond in length such that when the 30 minute average intensities of these are calculated, ARPANSA, ICNIRP, SCENIR, the US FCC and other regulatory agencies will tell you that they cannot produce effects but they do. If you search under nanosecond pulse in the EMF-Portal database, you will find 206 hits where about 170 of which genuine nanosecond pulse studies that produced non-thermal effects. These do produce effects at levels that fall far short of those needed to produce electroporation, so electroporation is not the primary mechanism here. So here again the ARPANSA etc. safety guidelines are not predictive of biological effects and average intensities tell us nothing about biological effects. It might be reasonable to average intensities over 1 microsecond, but averaging them over 30 minutes, 1.8 billion times longer than one microsecond is contradicted by each of these nanosecond pulse studies that found effects and is not based on any science whatsoever.
3. There is also a large literature on the existence of exposure intensity windows where certain specific ranges of intensity of a particular EMF, produce maximum biological effects and where ranges ***either lower or higher produce much lower effects***. The consequences of these findings is that dose response curves are non-linear and are also non-monotone, that is they do not always increase with increasing exposure nor do they always decrease with decreasing exposure. Therefore, the ARPANSA et al safety guidelines are fatally flawed for still an additional reason. I am listing here a series of studies that have reviewed studies of this type. Some of these are genuine review articles and some are primary literature articles that have reviewed substantial amounts of earlier literature. One of the things that is striking here, is that many of these studies have found exposure windows that occur at levels 3, 4 or 5 or more orders of magnitude below the safety guideline cutoffs. So again, the safety guidelines give us absolutely no assurance of safety.
  - a. Pall, M. L. 2015 Scientific evidence contradicts findings and assumptions of Canadian Safety Panel 6: microwaves act through voltage-gated calcium channel activation to induce biological impacts at non-thermal levels, supporting a paradigm shift for microwave/lower frequency electromagnetic field action. Rev. Environ. Health 3, 99-116. doi: 10.1515/reveh-2015-0001.
  - b. Belyaev, I., 2005. Non-thermal biological effects of microwaves. Microwave Rev. 11, 13-29.

- c. Belyaev, I., 2015. Biophysical mechanisms for nonthermal microwave effects. In: Markov M.S. (Ed), *Electromagnetic Fields in Biology and Medicine*, CRC Press, New York, pp 49-67.
  - d. Adey WR. 1980 Frequency and power windowing in tissue interactions with weak electromagnetic fields. *Proc IEEE* 68, 119-125.
  - e. Blackman CF, Kinney LS, House DE, Joines WT. 1989 Multiple power density windows and their possible origin. *Bioelectromagnetics* 10:115-128.
  - f. Panagopoulos DJ, Margaritis LH. 2009 Biological health effects of mobile telephone radiations. *Int J Med Biol Front* 15:33-76.
  - g. Persson BRR, Eberhardt J, Malmgren L, Persson MB, Brun A, Salford LG. 2005 Effects of microwaves from GSM mobile phones on blood-brain barrier and neurons in rat brain. *PIERS Online* 1:638-641.
  - h. Wei Q, Cao ZJ, Bai XT. 2005 [Effect of 900 MHz electromagnetic fields on the expression of the GABA receptor of cerebral cortex cortical neurons in postnatal rats] *Wei Sheng Yan Jiu* 34: 546-548.
  - i. Markov MS. 2004 Myosin light chain modification depending on magnetic fields II. *Electromagn Biol Med* 23:125-140.
  - j. Thompson CJ, Yang YS, Anderson V, Wood AW. 2000 A cooperative model for Ca<sup>++</sup> efflux windowing from cell membranes exposed to electromagnetic radiation. *Bioelectromagnetics* 21:455-464.
4. Another important factor in determining EMF responses is the type of cell being studied. The relevant studies documenting the importance of cell type are studies where different cell types were studied by the same research group using identical methodologies and where the different cell types repeatedly responded differently to the same EMF exposures. I reviewed several studies where such findings were obtained in my 2013 study where single strand breaks in cellular DNA were being measured (Pall ML 2013 *Electromagnetic fields act via activation of voltage-gated calcium channels to produce beneficial or adverse effects. J Cell Mol Med* 17:958-965. doi: 10.1111/jcmm.12088). I also reviewed several studies of this type when reviewing various genotoxicity studies in my 2015 study (Pall, M. L. 2015 *Scientific evidence contradicts findings and assumptions of Canadian Safety Panel 6: microwaves act through voltage-gated calcium channel activation to induce biological impacts at non-thermal levels, supporting a paradigm shift for microwave/lower frequency electromagnetic field action. Rev. Environ. Health* 3, 99-116. doi: 10.1515/reveh-2015-0001). It has repeatedly been found in such studies that stem cells are unusually sensitive to EMF exposures, producing effects where most other cell types do not. Some of these studies have been reviewed by Dr. Belyaev and his colleagues (Belyaev IY, Markovà E, Hillert L, Malmgren LO, Persson BR. 2009 *Microwaves from UMTS/GSM mobile phones induce long-lasting inhibition of 53BP1/gamma-H2AX DNA repair foci in human lymphocytes. Bioelectromagnetics* 30:129-141. doi: 10.1002/bem.20445; Markovà E, Malmgren LO, Belyaev IY. 2010 *Microwaves from Mobile Phones Inhibit 53BP1 Focus Formation in Human Stem Cells More Strongly Than in Differentiated Cells: Possible Mechanistic Link to Cancer Risk. Environ Health Perspect* 118:394-399. doi: 10.1289/ehp.0900781). These cell-type specific findings clearly show that that effects are produced via cell type specific biological processes and that all claims that are made that one can predict effects just from the physical properties of the EMFs, as ARPANSA, ICNIRP and the US FCC does, are fraudulent.
5. The last of these are findings that there are very specific EMF frequencies which produce vastly larger EMF effects than do other frequencies that differ only slightly. These have been interpreted as being due to resonance interactions, where the specific frequency

produces a resonance response in the target involved and therefore produces vastly larger responses. These findings have been reviewed three times, to my knowledge:

- a. Belyaev, I., 2005. Non-thermal biological effects of microwaves. *Microwave Rev.* 11, 13-29.
  - b. Belyaev, I., 2015. Biophysical mechanisms for nonthermal microwave effects. In: Markov M.S. (Ed), *Electromagnetic Fields in Biology and Medicine*, CRC Press, New York, pp 49-67.
  - c. Adey, WR. 1980 Frequency and power windowing in tissue interactions with weak electromagnetic fields. *Proc IEEE* 68, 119-125.
6. An additional finding will be discussed later in this document, where non-thermal EMF effects are produced by activation of voltage-calcium channels controlled by a voltage sensor that is stunningly sensitive to weak electrical forces produced by the EMFs.

We have, then with the 158 bodies of evidence on 8 non-thermal effects which massively show the failure of the ICNIRP, ARPANSA and other similar safety guidelines. We have, in addition, each of the six other important findings, listed above, each of which again show that the ICNIRP, ARPANSA and other similar guidelines fail to predict safety. What you can also see in the ARPANSA unsigned letter is that every time ARPANSA discusses their “safety guidelines,” ARPANSA provides not one iota of evidence supporting its claims. Let me state that of these seven, the second to the last one, the resonance interactions, is only important at certain very specific frequencies. When it is important, it is *very* important, producing effects of many orders of magnitude. However its relevance is limited. The nanosecond pulses are likely to be widely important because those pulses are similar to the spikes that occur in cell phone radiation, cell phone tower radiation, genuine Wi-Fi radiation and smart meter radiation, such that these spikes may well be responsible for causing much of the effects of these types of radiation. Of the other five, the effects of pulsation, of intensity windows, the influence of cell type have to each be considered to be of nearly universal importance, such that *each individually* show that the safety guidelines are almost universally unable to predict biological effects. The same thing is true of the voltage-gated calcium channel activation mechanism, which is discussed in detail below. It follows from these considerations, that the ICNIRP, ARPANSA and similar “safety guidelines” are fraudulent because they fail to predict biological effects.

Because of this I have three questions for ARPANSA: **Did you know that your letter which is entirely based on your safety guidelines which are totally unscientific? Was that the reason why no one was willing to sign and take responsibility for it and if not why was no one willing to sign and take responsibility for it? Is anyone willing to sign it and take responsibility for it now, and if so who?**

I need to return, at this point to two of the eight extraordinarily well documented effects that were listed above, namely the neurological/neuropsychiatric effects and the reproductive effects. These two effects, were shown in Chapter 3 of my 90 page document, to be among those that are cumulative, becoming more and more severe with time of exposure to a particular type and intensity of exposure and as they become more severe, they become apparently irreversible. By apparently irreversible, what I mean is that when you stop exposure, they do not return to normal or even anything approaching normal. I also mean that conventional medicine does not know how to reverse them. The cumulative and apparently irreversibility of this and several other EMF effects are discussed in Chapter 3 of my 90 page document (second attachment). Both the cumulative nature of these and the apparent irreversibility of neurological/neuropsychiatric effects have been confirmed based on both human and animal studies in that as the effects become more severe, then removing the EMF exposure does not allow the animal to return to normal – there is little improvement. This is true for the neurological/neuropsychiatric effects in humans and for the aberrant brain structure as studied in animals. These can be seen in (Pall ML.

2016 Microwave frequency electromagnetic fields (EMFs) produce widespread neuropsychiatric effects including depression. J Chem Neuroanat 75(Pt B):43-51. doi: 10.1016/j.jchemneu.2015.08.001) and for the animal brain-related effects in (Tolgskaya MS, Gordon ZV. 1973. Pathological Effects of Radio Waves, Translated from Russian by B Haigh. Consultants Bureau, New York/London, 146 pages).

The human effects include sleep disturbance/insomnia; fatigue/tiredness; headache; depression/depressive symptoms; lack of concentration/attention/cognitive dysfunction; dizziness/vertigo; memory changes; restlessness/tension/anxiety/stress/agitation; irritability. These effects are already extremely common in every technologically advanced country on earth, as we all know. So we have reason to think that these effects are already very advanced, such that cumulative effects on our brains may well produce a collapse in our collective brain function. I have estimated that such a collapse may be likely to occur in something like 5 to 7 years, based on the exposures we already have, given how advanced we already are for these effects. That estimate is based on occupational exposure studies that were done in the 1970's and 1980's. That is also based on how rapidly the brain effects occur in rodents, where effects typically develop at about 15 times the rate that they do in humans. That is a very rough estimate and it may well be off by a factor of 2 in either direction. That estimate does not take into account the roles of 5G, further role out of 4G or extensive increases in radar usage, each of which are already planned. I am very concerned, therefore, that we will have a collapse of our collective brain function, completely apart of 5G and because everything is dependent on our collective brain function, that will produce utter chaos. 5G alone might speed things up by a factor of 5 or more. So these effects alone can lead to the rapid demise of every single technologically advanced country on earth. So can the reproductive effects, discussed next.

A second area where there are large numbers of reviews (18) is for drops in human and animal reproduction. EMFs produce a wide variety of changes leading to lowered male fertility (including lowered sperm count, sperm motility and lower sperm quality), lowered female fertility, increased spontaneous abortion, lowered levels of estrogen, progesterone and testosterone, lowered libido . Human sperm count has dropped to below 50% of what used to be considered normal throughout the technologically advanced countries of the world. Reproductive rates have fallen below replacement levels in every technologically advanced country of the world, with a single exception, averaging in those countries approximately 73% of replacement levels in 2016. Magras and Xenos found that mouse reproduction was immediately affected by broadcast radiation at levels well within our safety guidelines, with reproduction crashing essentially to zero within 90 to 150 days exposure, depending on the exposure level. Those crashes were, apparently largely irreversible. Because human exposures are more variable than were the mouse exposures, we would expect human reproductive crashes to take much longer and be less uniform than were the mouse crashes. Nevertheless (and this is not in my 90 page document) we are now seeing evidence of such crashes in three east Asian countries, each starting out with reproduction already below 60% of replacement levels in 2016 and among the lowest in the world. These are Singapore, which had a 31% drop in reproduction between 2016 and 2017; Macao had a 26% drop in reproduction between 2016 and 2017 (Macao is not a separate country, but keeps statistics as if it were). South Korea had an 11% drop in reproduction between 2016 and 2017. The figures for the first 6 months of 2018 are available for South Korea and they dropped another 9%. The South Korean government had been concerned about its low reproductive rate and had changed policies to try to stimulate reproduction, and as you can see, this totally failed. Normally, such rapid drops in reproduction only occur when there is a war, a famine or an economic crash, but none of

these things explain these drops. While we cannot be certain this is caused by EMFs, given that there is very widespread EMF exposures all over these technologically advanced countries and that no other causes are plausible explanations, EMFs are the probable cause. Consequently, the EMF exposures are probably producing another imminent threat to the survival of every technologically advanced country on earth. My best estimate is that we will all suffer from reproductive crashes in something like 5 years and that the countries that currently have among the lowest reproductive rates, including Singapore, Macao and Korea will crash much faster than that.

The threats from the neurological/neuropsychiatric effects and reproductive effects may not be the only imminent existential threat to the survival of every high technology country on earth, but they are the most easily documentable ones. We are threatened by risks of a sort that no rational society on earth can possibly take, raising the question of whether we have any claim to rationality.

## Chapter 2: The primary mode of action of non-thermal EMF exposures is to activate voltage-gated calcium channels

I received his BA degree in Physics at Johns Hopkins University, with honors, Phi Beta Kappa and his PhD degree in Biochemistry and Genetics at Caltech, two of the top institutions in the world. His PhD training focused on how to determine biological mechanisms. The PhD training and the Physics have each been central to my ground breaking recent work on how low intensity electromagnetic fields (EMFs) impact the cells of our bodies and the many health consequences produced by that mechanism. My Hirsch index is currently at 36 and has gone up rapidly since I “retired,” showing high level of recognition for his research generally.

My first paper on EMFs, published in 2013, showed that low intensity EMFs act by activating voltage-gated calcium channels (VGCCs). This was shown by findings that EMF effects can be blocked or greatly lowered by 5 types of calcium channel blockers, drugs specific for blocking the VGCCs. It was also shown by evidence of immediate increases in calcium signaling following EMF exposures and by further findings that the EMFs act by through the voltage sensor that controls VGCC opening (discussed further below). Surprisingly, all of the EMFs ranging from the extremely high millimeter wave EMFs to be used with 5G through microwave frequencies, radiofrequencies, intermediate frequencies, extremely low frequencies including 50 Hz and 60 Hz from our power wiring through static electrical fields and static magnetic fields all act via VGCC activation. This mechanism has been confirmed in a patch-clamp study and in a strictly cell free, cell membrane study.

Much of my subsequent work, in the 7 papers that have followed, has been to greatly expand our understanding of what EMF effects are produced via VGCC activation, how they are produced and why the VGCCs are so stunningly sensitive to activation by these weak EMFs. Before going into all of those important findings, let’s look at how the VGCC breakthrough has been treated by the biomedical research community.

The 2013 paper, the first paper I published on the VGCC mechanism was placed onto the Global Medical Discovery web site as one of the best medical papers of 2013. At this writing, early March, 2019, the paper has been cited 213 times, at this writing according to the Google scholar database. This shows an unusual amount of interest from the scientific community, especially because that was my first paper on EMFs and it involves a new paradigm of EMF action, and such new paradigms usually face much inertia before they are



widely accepted. Still, wide acceptance is not universal acceptance, even among the independent scientists working in this area. I have given 45 invited professional talks on EMFs over the past 6 years, again showing an unusual amount of interest. These include a talk at the French parliament on EHS, a talk at the Swedish parliament and a talk at the US National Institutes of Health. Two talks that are not included in the 45, because they were not invited talks, were given in September 2016 at one of the U.S. Senate Office Buildings and at the U.S. FCC. Essentially everything that is discussed below with regard to EMFs, has been discussed in my invited professional talks.

#### How the Physics Predicts the Very High Level VGCC Sensitivity to Low Intensity EMFs

The VGCC protein molecule contains a four domain structure with each domain carrying an alpha helix containing 5 positive charges. Those four charged alpha helices act together as what is called the voltage sensor, the structure that responds to electrical changes across the plasma membrane to open the channel. It has been shown that not only 4 distinct types of VGCCs, but also a voltage gated sodium channel, potassium channel and chloride channel are all activated by EMFs, suggesting that the EMFs act on the voltage sensor. In plants, EMFs apparently act via activation of some other channels, known as TPC channels, which also contain a similar voltage sensor. The voltage-gated sodium, potassium and chloride channels apparently play only minor roles in producing EMF effects, so that to a first approximation, effects can be explained as being predominantly from VGCC activation.

How then can these very weak EMFs activate the voltage sensor? I have analyzed the known structure and location of the voltage sensor in the plasma membrane and also based on two laws of physics, Coulomb's law and Ohm's law. The forces on the voltage sensor are calculated to be approximately 7.2 million times stronger than the forces on singly electrically charged groups in the aqueous parts of our cells and bodies. This means that the forces of these weak EMFs are stunningly strong and are therefore, more than sufficient to activate the VGCCs. Because heating is the basis of the current safety guidelines and heating is mainly produced by the forces on singly charged groups in the aqueous parts of our cells and bodies, this predicts that the current safety guidelines may allow us to be exposed to EMFs that are approximately 7.2 million times too strong. The biology tells us that the VGCCs are the main targets of the EMFs. The physics tells us that the voltage sensor is the direct target and why it is so sensitive to these very weak EMFs. The industry has been telling us for years that the electrical forces of these weak EMFs are too weak to do anything, and these calculations tell us why the industry has been completely wrong about this.

#### What Are the Biomedical Consequences of EMFs Activating the VGCCs?

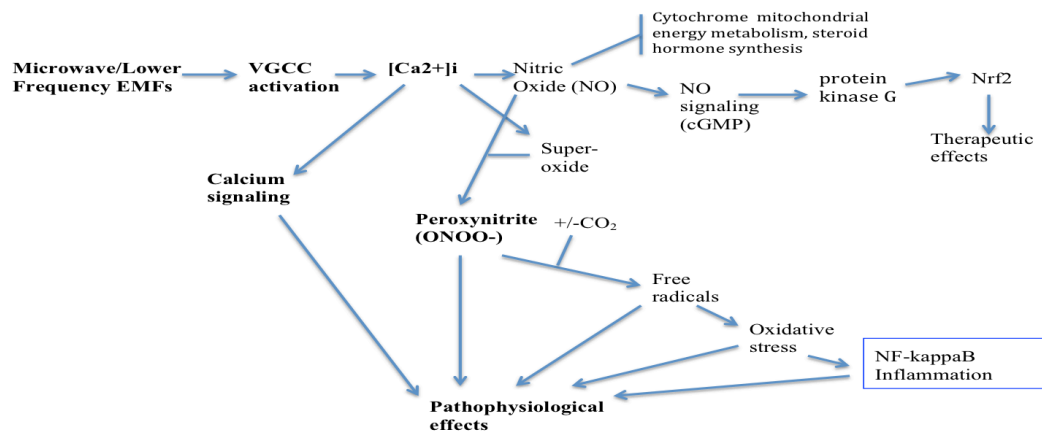


Figure 1. Downstream effects of EMF, acting via VGCC activation.

The immediate consequence of VGCC activation is that one gets a very large influx of calcium ions into the cell through the plasma membrane that surrounds our cells, leading to very large increases in intracellular calcium  $[Ca^{2+}]_i$ .  $[Ca^{2+}]_i$  increases produce in turn, different downstream effects that, individually or collectively produce each of the extremely well documented effects following EMF exposures. The main pathophysiological effects are produced through excessive calcium signaling and also by the peroxynitrite/free radical/oxidative stress/NF-kappaB activation inflammation pathways. There are also therapeutic effects and other damaging effects produced by excessive nitric oxide (see Fig. 1).

**Table 1. How Eight Established Effects of EMFs Can Be Produced by VGCC Activation**

EMF effect	Probable mechanism(s)
Oxidative stress	Produced by elevated levels of peroxynitrite and the free radical breakdown products of peroxynitrite and its CO <sub>2</sub> adduct. Four studies of EMF exposure, cited in Pall (2013) showed that oxidative stress following exposure was associated with major elevation of 3-nitrotyrosine, a marker of peroxynitrite, thus confirming this interpretation. Two other studies each found 3-nitrotyrosine elevation, both following 35 GHz exposures [Sypniewska et al (2010); Kalns et al (2000)].
Lowered male/female fertility, elevated spontaneous abortion, lowered libido	Both the lowered male fertility and lowered female fertility are associated with and presumably caused by the oxidative stress in the male and female reproductive organs. Spontaneous abortion is often caused by chromosomal mutations, so the germ line mutations may have a causal role. Lowered libido may be caused by lowered estrogen, progesterone and

	testosterone levels. It seems likely that these explanations may be greatly oversimplified. One mechanism that may be important in lowered fertility is that VGCC activation and consequent high $[Ca^{2+}]_i$ levels is known to have a key role in avoiding polyspermy. Consequently, if this is triggered before any fertilization of an egg has occurred, it may prevent any sperm from fertilizing and egg.
Neurological/ neuropsychiatric effects	Of all cells in the body, the neurons have the highest densities of VGCCs, due in part to the VGCC role and $[Ca^{2+}]_i$ role in the release of every neurotransmitter in the nervous system. Calcium signaling regulates synaptic structure and function in 5 different ways, each likely to be involved here. Oxidative stress and apoptosis are both thought to have important roles. Lowered sleep and increased fatigue are likely to involve lowered nocturnal melatonin and increased nocturnal norepinephrine.
Apoptosis	Apoptosis can be produced by excessive $Ca^{2+}$ levels in the mitochondria and by double strand breaks in cellular DNA; it seems likely that both are involved following EMF exposure. A third mechanism for triggering apoptosis, endoplasmic reticulum stress (see bottom row in this Table), may also be involved.
Cellular DNA damage	Cellular DNA damage is produced by the free radical breakdown products of peroxynitrite directly attacking the DNA [see Pall (2018) for discussion].
Changes in non-steroid hormone levels	The release of non-steroid hormones is produced by VGCC activation and $[Ca^{2+}]_i$ elevation. The immediate effects of EMF exposures is to increase hormone release and to raise, therefore, hormone levels. However many hormone systems become “exhausted” as a consequence of chronic EMF exposures. The mechanism of exhaustion is still uncertain, but it may involve oxidative stress and inflammation.
Lowered steroid hormone	Steroid hormones are synthesized through the action of cytochrome P450 enzymes; activity of these hormones is inhibited by binding of high levels of nitric oxide (NO) leading to lowered hormone synthesis.
Calcium overload	Produced by excessive activity of the VGCCs; secondary calcium overload is produced by oxidative stress activation of TRPV1, TRPM2 and possibly some other TRP receptors, opening the calcium channel of these receptors.
Heat shock protein induction	There is a large literature showing that excessive $[Ca^{2+}]_i$ induces very large increases in heat shock proteins. This is thought to be produced by complex calcium signaling changes involving the endoplasmic reticulum, mitochondria and the cytosol and also involving excessive $[Ca^{2+}]_i$ producing increasing protein misfolding [Garbuz (2017), Park et al (2014), Krebs et al (2011)]. It should be noted that some calcium is essential for proper protein folding in the endoplasmic reticulum such that only excessive calcium leads to misfolding and consequent endoplasmic reticulum stress.

These explained effects include: 1. Neurological neuropsychiatric effects including insomnia, fatigue, depression, anxiety, loss of concentration, memory dysfunction, headache and other pain, stress, agitation and sensory dysfunction. These are all extremely common in our societies around the world and we know they can be caused by EMF exposures. 2. Reproductive effects including disruption of the structure of the testis and ovaries, lowered sperm count, lowered sperm motility and other measures of lowered sperm quality; lowered female fertility including lowered numbers of oocytes; increase spontaneous abortion; lowered levels of each of the three sex hormones; lowered libido. We have reason to think that these are already far advanced in every single technologically advanced country on earth. 3. DNA effects including single strand and double strand breaks in cellular DNA and oxidized bases in the cellular DNA. These have important roles in producing germ line mutation (producing mutant babies) and in causing cancer. 4. Oxidative stress and free radical damage. These have important roles in causing essentially all common and many not so common chronic diseases. 5. Increased levels of apoptosis (programmed cell death) which has particularly important roles in causing the reproductive effects and also the neurodegenerative diseases including Alzheimer's. 6. Excessive  $[Ca^{2+}]_i$ , which is the cause of everything else. 7. Hormonal (that is endocrine) effects in all or almost all hormone systems. 8. Cancer which is caused by the DNA effects and other effects, leading to increases in not only initiation of cancer, but also increased tumor promotion and progression including tissue invasion and metastasis. 9. Therapeutic effects. 10. Life threatening cardiac effects producing aberrant electrical control of the heart beat. We are having an epidemic of young, apparently healthy athletes dying in the middle of an athletic competition, due to sudden cardiac death. Are these deaths caused by EMF exposures? 11. Breakdown of the blood-brain barrier. 12. Stress responses including heat shock responses (without heating) and AMPK activation. There are other effects, but where the primary role of EMFs in causation can still be questioned. These include: 1. Very early onset Alzheimer's dementia's and other dementias. We are seeing people age 30 coming down with Alzheimer's disease and young people said to be addicted to Wi-Fi internet connections coming down with what are called digital dementias. 2 & 3. Autism and ADHD, where late prenatal and early postnatal exposures seem to be the most important. The excessive  $[Ca^{2+}]_i$  caused by such early exposures, is thought to disrupt the formation of synapses in the developing brain. 4. Electromagnetic hypersensitivity (EHS); while the mechanism of EHS is still somewhat uncertain, it is clear that excessive  $[Ca^{2+}]_i$  produces sensitivity syndromes and that oxidative stress and sensitivity in the brain each have important roles in EHS. Each of these 16 different important EMF effects and apparent effects can be caused by downstream effects of VGCC activation.

#### How the VGCC activation mechanism provides powerful information with regard to microwave frequency EMF causation of Alzheimer's disease

One of the things that is very important about the VGCC activation mechanism, is that it provides very important information about what types of health impacts are likely to be caused by EMF exposures. Specifically, any biological process that involves excessive VGCC activity, excessive  $[Ca^{2+}]_i$  or downstream effects shown in Fig. 1, above, is likely to be caused by EMF exposures. What that means is that we are no longer strictly dependent on evidence from epidemiological studies, experimental studies and anecdotal reports, but we have powerful evidence from both the VGCC activation mechanism and our knowledge of how downstream effects of it cause different diseases. The example I am giving you here is just one example of how this powerful information can support EMF disease causation, in

Alzheimer's disease. A lot of what I am discussing here is also discussed in Chapter 3 in my 90 page document, where citations are provided.

Alzheimer's disease has excessive  $[Ca^{2+}]_i$ , calcium signaling, peroxynitrite and free radical formation and NF-kappa B each having essential causal roles in causing the disease. Because each of these are produced following EMF exposure (see Fig. 1), *it is almost inevitable from these findings alone, that Alzheimer's disease will be caused by EMF exposure.* We also have occupational exposure studies showing that people who are exposed to high levels of extremely low frequency EMFs from our power wiring suffer from increased incidence of Alzheimer's disease. Because the extremely low frequency EMFs act as do microwave frequency EMFs via activation of VGCCs, this strongly suggests that microwave frequency EMFs also cause Alzheimer's disease. It is also the case that young people who are exposed to microwave frequency EMFs from Wi-Fi, tablets or smart phone radiation develop what have been called digital dementias. We are now having in our technologically advanced societies, increased incidence of Alzheimer's disease at younger ages, including people age 30 coming down with Alzheimer's disease – these 30 year old cases are still quite rare, but they were previously unheard of.

Let's consider the role of the amyloid beta protein ( $A\beta$ ) in Alzheimer's causation.  $A\beta$  has been shown to have an essential role in causing Alzheimer's disease, acting through small protein aggregates of the  $A\beta$  protein. Studies have shown that neuronal mammalian cells in culture can produce large amounts of  $A\beta$  following microwave EMF exposures. We also have studies, discussed further below, where animals exposed to such EMFs produce high levels of  $A\beta$  in their brains. How, then might EMFs act to produce high levels of  $A\beta$ ?  $A\beta$  is produced by a protease sometimes called BACE1 which cuts  $A\beta$  from a protein precursor, APP. BACE1 production can be greatly increased by NF-kappa B and can, in this way, be triggered by EMF exposure (see Fig. 1).

The  $A\beta$  protein aggregates are thought to diffuse through the extracellular space in the brain, insert themselves into other brain cells and spread the Alzheimer's disease to many other parts of the brain. It is this massive spread of destruction that is thought to be most characteristic of Alzheimer's disease that makes the disease so massively powerful. How then do these  $A\beta$  protein aggregates act? They are thought to act in five distinct ways to increase  $[Ca^{2+}]_i$ .  $A\beta$  protein aggregates are thought to act via activation of two different calcium ion channels in the plasma membrane, TRPM2 and NMDA receptors and via activation of IP3 receptors and ryanodine receptors to increase  $[Ca^{2+}]_i$  via calcium influx through the plasma membrane (TRPM2 and NMDA receptors) and also release  $Ca^{2+}$  from intracellular pools (IP3 and ryanodine receptors). The  $A\beta$  protein aggregates are also reported to insert themselves into the plasma membrane and act themselves as calcium channels. It follows from each of the 5 mechanisms discussed in this paragraph,  $A\beta$  protein aggregates can increase  $[Ca^{2+}]_i$  in other cells in 5 different ways, spreading the whole gamut of processes characteristic of Alzheimer's disease to other parts of the brain. I think you can see that almost the whole analysis of the probable role of microwave frequency EMFs in Alzheimer's causation, in these four paragraphs, is dependent on our understanding of VGCC activation as the predominant causal mechanism in non-thermal EMF effects. We can take a situation where the evidence is relatively weak and convert it into a situation where a powerful case can be made.

Let's go back to the rat studies that were referred to briefly above. It has been shown that exposing young rats to a series of short microwave frequency pulses and then stopping

those exposures causes those previously exposed rats to develop into the equivalent of middle aged Alzheimer's rats. They have behavioral and memory changes similar to Alzheimer's in humans as well as elevated levels of oxidative stress and A $\beta$  in the rat brains, again similar to Alzheimer's disease in humans.

There is one other thing here that may make the situation vastly worse than this already apparently horrendous situation. Alzheimer's disease is thought to have a long latency period from the time the disease starts to the time where symptoms become apparent, a latency period of something like 25 years. If this latency period is true under conditions of EMF exposure (and I don't know that it is true) it is possible that the cases of people age 30 coming down with Alzheimer's disease were caused by the EMF exposures we had 25 years ago, when our exposures were vastly, vastly lower than they are now. If this true, then ***we will have a huge epidemic of very early onset Alzheimer's dementias coming down the pike even if we stop all exposures tomorrow***, based on the exposures we already have had. I certainly hope this is not true, but what should be absolutely clear, is that we are taking risks of the sort that no rational society can possibly take. It should also be absolutely clear, is that ARPANSA is complicit in foisting those risks on the people of the continent of Australia.

### Chapter 3: Discussion of Further Points Raised in the ARPANSA Letter:

The ARPANSA Dec. 18, 2018 letter, at the bottom of p. 1, top of p. 2 makes the following statement: **"The ARPANSA RF Standard is based on scientific research that shows that the levels at which harmful effects occur and it sets limits well below these harmful levels, with various elements of precaution, based on international guidelines. The ARPANSA RF Standard is designed to protect people of all ages and health status against all known adverse effects from exposure to RF EME."**

ARPANSA provides not one iota of evidence that its exposure standard is based on scientific research or that it protects us from any, let alone all harmful effects nor that it protects people of all ages and health status against all known adverse effects of RF (the word they are using for microwave frequency) exposures. ***What is absolutely clear***, is that the seven repeated findings discussed in Chapter 1 completely falsify this statement: the 158 bodies of evidence on non-thermal effects, the role of pulsation, the VGCC mechanism, the nanosecond pulse studies, the exposure window findings, the roles of different cell types and the role of specific frequency windows. The ARPANSA statement is clearly falsified by each of the 18 reviews on non-thermal exposures producing reproductive effects, by each of the 25 reviews of non-thermal exposures causing neurological/neuropsychiatric effects, by each of the 21 different reviews of non-thermal exposures causing three different types of DNA effects, by each of the 13 different reviews showing that non-thermal exposures cause increased apoptosis (programmed cell death), by each of the 19 reviews each showing that non-thermal exposures cause oxidative stress/free radical damage, by each of the 12 different reviews showing that non-thermal exposures cause endocrine effects, by each of the 16 different reviews showing that non-thermal exposures cause increased intracellular calcium levels [Ca<sup>2+</sup>]<sub>i</sub> and by each of the 35 reviews each showing that non-thermal exposures cause cancer. We have here, in total 158 bodies of evidence each comprised of many primary literature citations each showing that ARPANSA is wrong with regard to causation of a particular biomedical effect.

ARPANSA can, if it wishes, challenge each of these 158 bodies of evidence each showing that ARPANSA is clearly wrong here. The way to do that, of course, is for ARPANSA to cite each

of these reviews in the context of causation of a particular effect, describe clearly and extensively what evidence is provided and then (and only then) present whatever criticisms they may have these reviews in the context of causation of these effects. ARPANSA has also completely failed to consider the high level concerns with their safety guidelines expressed in the 41 statements written by international scientists and physicians and endorsed by many other scientists, physicians and in some cases, other people (see first attachment). It can be seen from these 41 different statements, that the ARPANSA position is widely rejected by independent scientists from all over the world. Of course, that is not at all surprising given the vast amount of evidence on each of these non-thermal effects.

There is an important additional concern about the ARPANSA quote, concerning the safety guidelines that is referred to as “**the ARPANSA RF Standard.**” This safety guideline and similar guidelines advocated by ICNIRP, SCENIHR and the US FCC are all based on the notion that there is an average intensity, above which effects are produced and below which no effects are apparent and below which, it is argued, there are no safety concerns. However these claims are destroyed by each of seven findings each of which have been repeatedly documented: 8 repeatedly documented effects, VGCC activation, role of pulsations, etc. This whole structure is *at best*, a house of cards, ready to blow down in the slightest wind. The completely undocumented claim that one can assure all Australians or all people on earth that this scheme will protect their health is simply a falsehood of Olympic proportions.

P. 3 of the unsigned ARPANSA letter states that “**Where RF EME exposure exceeds protection guidelines, it can heat the human body with a risk of permanent damage (known as thermal effect). It is the assessment of ARPANSA , the WHO and other international health authorities that there are no established health effects from RF EME at levels below current protection guidelines.**” ARPANSA provides not one iota of evidence regarding its “protection guidelines” which have been completely destroyed as discussed in the preceding two paragraphs.

The ARPANSA letter on page 3, has a 5 paragraph section entitled “**evidence on health effects.**” That section has no information whatsoever on evidence of health effects. What it has in it is a claim that biological effects do not necessarily produce health effects. That claim is correct, in principle. However the ARPANSA letter fails to *provide even a single example of a non-thermal biological effect that does not produce negative health impacts.* That claim may, therefore, be completely irrelevant.

Later on in this section, ARPANSA states that “**Even damage, as a biological effect, occurs on a regular basis from different types of radiation from a range of sources. However DNA-repair is also a key characteristic of cell biology, which means that the bioeffect of DNA damage does not translate into a detrimental health effect.**” Now if you go into the PubMed database, and search under mutation\* and ionizing radiation, you will find over 13,000 studies each showing mutations produced by ionizing radiation exposure, despite (or because of) DNA repair mechanisms. The earliest of these go back to 1929. Surely ARPANSA knows about these studies, because they are so central to its main function! Surely ARPANSA knows, in addition, that DNA repair is never 100% efficient and surely ARPANSA knows that there is a very large literature on error-prone DNA repair, where the DNA repair mechanisms themselves have central roles in producing mutations and consequent detrimental health effects. The first studies that were published on non-thermal microwave frequency EMF-caused mutations were published in the 1950s where chromosomal rearrangements, known now to be products of error-prone repair of double

strand breaks in cellular DNA, were found to be produced following low intensity EMF exposures. These are produced in plant cells as well as in animal including human cells. ARPANSA may not be aware of all of those early chromosomal rearrangement findings, but surely ARPANSA should be aware of the many rearrangement studies showing that micronuclei are produced following such low level EMF exposures of mammalian, including human cells. Micronuclei are also a product of error-prone repair of double strand breaks in cellular DNA. I have, therefore, **five questions for ARPANSA. Do you really not know that ionizing radiation produces mutations due to the fact that many of the DNA effects produced fail to be repaired via non-error-prone repair mechanisms? Do you really not know that there are error-prone repair mechanisms that contribute to detrimental health effects through the production of mutations both in somatic cells and in germ line cells? Are you really unaware that there are at least 20,000 studies in the PubMed database that each contradict your claim that the “the bioeffect of DNA damage does not translate into a detrimental health effect”? Why is it that with this huge contradictory literature, you rush to follow industry propaganda claims rather than well-established findings in the scientific literature? When these areas of science are so central to ARPANSA’s professional roles, why should we not conclude that ARPANSA cannot be relied upon to provide expert advice on any area whatsoever?**

The unsigned ARPANSA letter continues as follows: **“Where RF EME exposure exceeds protection guidelines, it can heat the human body with a risk of permanent damage (known as thermal effect). It is the assessment of ARPANSA, the WHO and other international health authorities that there are no established health effects from RF EME at levels below current protection guidelines.”** Now, overarching statements like this one, each require careful, extensive documentation to determine whether there are contradictory findings that falsify this claim. They also require an objective assessment of the available literature. They also require the application of good logic. And they require the application of other principles of science. This statement fails on all four categories, even if you include considerations made previously by ICNIRP, the US FCC, the US FDA, SCENIHR or other organizations.

The next section of the ARPANSA letter is entitled: Health reactions (EHS)

**“ARPANSA recognizes that there are anecdotal reports of potential health effects (or reactions) from exposure to RF EME from various wireless technologies claiming a variety of ill effects that have been generally termed ‘electromagnetic hypersensitivity’ or EHS.”** In the next paragraph they state:

**“ARPANSA or the World Health Organization are not aware of any well-conducted scientific investigations where EHS symptoms were confirmed as a result of RF EME exposure. Several studies have indicated a nocebo effect – that is, an adverse effect due to the belief that something is harmful.”**

Any person, without extensive knowledge of EMF effects, would interpret those two paragraphs as saying that there are only anecdotal reports and that these reports are only on EHS. And let me state that anecdotal reports on EHS, comprising much less than 1% of the total EMF literature, are probably among the weakest studies we have. In these statements, ARPANSA completely ignores the many epidemiological studies, the many experimental studies on humans or on animals or on human or animal cells in culture. ARPANSA also completely ignores all of the vast literature showing that non-thermal EMFs



cause objectively measurable changes, changes not dependent on people's perceptions. We hear nothing from ARPANSA on the reproductive effects, the neurological/ neuropsychiatric effects, the causation of oxidative stress/free radical damage, the causation of increases in cellular DNA damage, nothing on the increases in apoptosis (programmed cell death), nothing on hormonal effects, nothing on VGCC activation and increases in intracellular calcium, nothing on neurodegenerative effects including Alzheimer's disease, nothing on the cardiac effects that act through aberrations of the electrical control of the heart, nothing on perinatal exposures apparently causing ADHD and autism. There are only two explanations that I can see for these two paragraphs on "health reactions." One is that the goal of ARPANSA is to deceive the reader, including possibly the Health Minister. The second that ARPANSA is systematically avoiding looking at each of the thousands of strong studies in EMF effects. Of course, neither of those is acceptable. In this statement, ARPANSA is implying that over 99% of the studies on health effects including all of the strongest studies do not exist.

Whatever the explanation of this, the consequences of these two paragraphs are immense. As was discussed in Chapter 3 of my 90 page document, The best available evidence demonstrates that several of the effects of EMFs are cumulative (that is they get more and more severe with time of exposures over weeks, months or years) and as they become more severe, they become irreversible. That pattern applies to the reproductive effects and the neurological/neuropsychiatric effects. The mutational effects produced by the attacks on cellular DNA are inherently cumulative and irreversible. A similar pattern probably applies to the cardiac effects, the neurodegenerative effects and to ADHD and autism, although the cumulative nature of the effects with regard to autism and ADHD may be limited mainly to perinatal exposures. The consequences of this pattern of development of EMF effects is that, as discussed in Chapter 3 of my 90 page document, any organization that makes it much more difficult to avoid such exposures will inevitably cause millions of people to become severely and irreversibly effected by multiple, serious EMF effects. **I have two questions here for ARPANSA: Was your goal to deceive or did you systematically avoid looking at the strongest studies or do you have some other explanation here? Secondly, is the reason that no one signed your letter because no one was willing to take responsibility for the possible civil and/or criminal liability for the nonsense of so much of the ARPANSA letter?**

Now I haven't dealt with the second paragraph above in the ARPANSA letter quote, except in the context of the first paragraph. We need to consider the second paragraph on its own. Repeating, the second paragraph states **"ARPANSA or the World Health Organization are not aware of any well-conducted scientific investigations where EHS symptoms were confirmed as a result of RF EME exposure. Several studies have indicated a nocebo effect - that is, an adverse effect due to the belief that something is harmful."**

The studies that follow have debunked these claims in that ARPANSA statement. We have four studies which showed that it was possible to identify genuine EHS people who responded to blinded exposures to low intensity EMFs in a highly reproducible fashion but did not respond when there was no exposure. The first three studies also used objectively measurable responses to EMF exposure, such that there could be no question that the responses did occur. The fourth used a somewhat different approach. The four studies collectively clearly show that there are genuine sensitivity responses in at least some previously identified EHS people. It follows that the claim made by ARPANSA that EHS is a nocebo effect is false.

- 1.Rea WR, Pan Y, Yenyves EJ, Sujisawa I, Suyama N, Ross GH. 1991. Electromagnetic field sensitivity. *J Bioelectr* 10:241-256.
- 2.Havas M. 2006 Electromagnetic hypersensitivity: biological effects of dirty electricity with emphasis on diabetes and multiple sclerosis. *Electromagn Biol Med* 2006;25(4):259–68.
- 3.Havas M, et al. 2010 Provocation study using heart rate variability shows microwave radiation from DECT phone affects autonomic nervous system. In: Giuliani L, Soffritti M, editors. “Non- thermal Effects and Mechanisms of Interaction Between Electromagnetic Fields and Living Matter”, *European J Oncology — Library*. National Institute for the Study and Control of Cancer and Environmental Disease Bologna: Mattioli; 2010. pp. 273–300. 2010.
- 4.McCarty DE, et al. 2011 Electromagnetic hypersensitivity: evidence for a novel neurological syndrome. *Int J Neurosci*. [www.ncbi.nlm.nih.gov/pubmed/21793784](http://www.ncbi.nlm.nih.gov/pubmed/21793784). 2011 Sep 5.

There are other studies that show that there are genuine physiological changes occurring in EHS. Two studies have shown that EHS people have high levels of oxidative stress:

- 1.De Luca C, Raskovic D, Pacifico V, Thai JC, Korkina L. 2011 The search for reliable biomarkers of disease in multiple chemical sensitivity and other environmental intolerances. *Int J Environ Res Public Health*. 2011 Jul;8(7):2770-97. doi: 10.3390/ijerph8072770.
- 2.Irigaray P, Caccamo D, Belpomme D. 2018 Oxidative stress in electrohypersensitivity self-reporting patients: Results of a prospective *in vivo* investigation with comprehensive molecular analysis. *Int J Mol Med*. 2018 Oct;42(4):1885-1898. doi: 10.3892/ijmm.2018.3774.

The De Luca et al. citation also showed that genetic polymorphisms in genes encoding enzymes for glutathione utilization produce increased susceptibility to EHS. These findings show that oxidative stress and lowered chemical metabolism have roles in causing EHS such that the ARPANSA claim that it is caused by a nocebo effect is again falsified.

Furthermore, it has been shown using fMRI that there are regions of the brain in EHS people who are especially sensitive to EMF stimulation. This Heuser and Heuser study is a very important one.:

- Heuser G, Heuser SA. 2017 Functional brain MRI in patients complaining of electrohypersensitivity after long term exposure to electromagnetic fields. *Rev Environ Health*. 2017 Sep 26;32(3):291-299. doi: 10.1515/reveh-2017-0014.

Finally, the largest set of epidemiological studies of human occupational EMF exposures were reviewed by Professor Emeritus Karl Hecht in Berlin (Hecht, Karl. 2016 Health Implications of Long-Term Exposures to Electrosmog. Brochure 6 of A Brochure Series of the Competence Initiative for the Protection of Humanity, the Environment and Democracy. [http://kompetenzinitiative.net/KIT/wp-content/uploads/2016/07/KI\\_Brochure-6\\_K\\_Hecht\\_web.pdf](http://kompetenzinitiative.net/KIT/wp-content/uploads/2016/07/KI_Brochure-6_K_Hecht_web.pdf) (accessed Feb. 11, 2018). These studies of over 35,000 individuals showed that exposures of less than 1/1000<sup>th</sup> of those allowed by the ARPANSA safety guidelines produced over periods of from 3 to 10 years, increasingly progressive and more severe cases of EHS, including the neurological/neuropsychiatric effects, cardiac effects and others. The Hecht review shows that EHS can be caused by EMF exposures less than 1/1000<sup>th</sup> of the levels that ARPANSA advocates. In summary, the best available evidence shows that EHS is a genuine hypersensitivity condition with major sensitivity responses in the brain with causation involving both EMF and chemical exposures and also oxidative stress, We can also conclude from these studies that EHS is not a nocebo effect as the

unsigned ARPANSA letter claims, a claim for which ARPANSA provided not one iota of evidence. It is also clear that when ARPANSA claims that they are “not aware of any well conducted studies where EHS symptoms have been confirmed by well-conducted experiments” that does not mean that there are no such studies. There are in fact 5 such studies, the first four citations listed above and the Heuser and Heuser study.

In the above quoted sections from the unsigned ARPANSA letter, the letter provided not one iota of evidence. In the quoted sections below, however, ARPANSA does attempt to provide a small amount of evidence, but leaves out vast amounts of contrary evidence and opinion that contradicts the ARPANSA position.

ARPANSA cancer outline: **“Epidemiological studies on links to cancer: A major ARPANSA-led epidemiological study has recently been published with the British Medical Journal Open, which found no link between the use of mobile phones in Australia and incidence of brain cancers. The study compared the incidences of brain cancer in Australia from 1982 to 2013, to mobile phone use during the same period. The study found that there was no increase in brain tumours that can be attributed to mobile phone use. This study was completed in conjunction with The University of Wollongong, Monash University and the University of Auckland, and is available online at <https://bmjopen.bmj.com/content/8/12/e024489.full>.”**

In the ARPANSA press release following publication of that study, they went even further than this statement in the unsigned ARPANSA letter. They stated that **“If such an association (between cell phone use and cancer) were true, then the brain tumor rates would be higher than those that are observed.”** But that is not true when you look at other studies and the only evidence that the increase seen in the ARPANSA study was not due to cell phone radiation is that a lot of it occurred too early, before cell phones were very commonly in use. That is an argument, but there is a counter argument, which seems not to have occurred to ARPANSA, namely that cordless phones may also cause brain cancer and cordless phones came into common use something like two decades earlier than did cell phones. This is not a new idea. For example, Hardell et al (Int J Oncol. 2013 Dec;43(6):1833-45) reviewed earlier evidence showing that “previous studies have shown a consistent association between long-term use of mobile and cordless phones and glioma and acoustic neuroma” and a pooled analysis of the data on cell phone and cordless phone usage showed the same association (Int J Oncol 2013; 43 (4): 1036-1044). There are two additional flaws in the ARPANSA study. They only used data for tumors occurring in people age 59 and under, eliminating those over 60. The reason that is important is because there was a much larger study in the UK published by Philips et al, about 7 months earlier, which found that there were very large increases in glioblastomas (GBMs), the most aggressive and rapidly fatal of all of the gliomas, over the period from 1995 to 2015 and that by far the largest increases occurred in people over age 60. Philips et al *found that the levels of GBMs increased circa 3 to 8 fold in people of different ages within the 70-89 age range. They also found that most of the tumor increases occurred for tumors in the frontal and parietal lobes of the brain, the two regions of the brain shown previously to be most impacted by cell phone radiation* because of their proximity to where cell phones are held during phone usage. Volkow et al (2011) showed that these two regions of the brain showed the largest increases in brain glucose metabolism immediately following cell phone usage. It follows from this the increase seen in the ARPANSA study would probably have been vastly larger if they had been included the over 60 people who suffer from over half of the glioblastoma cases. The ARPANSA study did cite the Philips et al study as follows: **“Philips et al reported that the incidence of glioblastoma more than doubled in England between**

**1995 and 2015; however, the authors did not analyse different periods to investigate the impact of mobile phone use.”** Philips et al did analyze different time periods in Fig.2 in their paper did provide data on the time course of the increase seen between 1995 and 2015 in their Fig.2. Consequently, the statement that ARPANSA makes about them is false.

*Microwave News* ran a news article on the ARPANSA study with the headline: **Aussies Claim no Brain Tumor Link: Skepticism Abounds. Why were older people excluded? No One Wants to Talk About It. January 2, 2019.** In that article, the *Microwave News* writer asked questions of both Dr. Karapidis, the senior author of the study and also of Dr. Croft, the principal investigator of the 2.6 million Australian dollar government grant that was used to fund the study. Probably the most important question is what happens to the results if the data for those over 60 is included in that study. *Microwave News* was unable to get answers to any of their questions from either of those two authors about the study. One scientist commenting on the ARPANSA study said that it “was a biased study.” Dr. Bruce Armstrong, Professor Emeritus at the University of Sydney School of Medicine was also critical of the dropping of the data for those over 60. Dr. Philips stated that “By stopping at age 59, they are missing the group with the largest increase in GBM, and those with the most exposure to mobile phone radiation. This is impossible to justify. Frankly, I find their limited analysis shocking and I don’t understand how it cleared peer review. You can see that, for GBM, ignoring those over 59, eliminates 63% of all the cases in England,” Philips said. “Essentially the entire increase in GBM over the last 20 years is among the older group of people — the difference between the red and blue dotted lines (in a graph Philips provided for the article). If we had eliminated that group, we would have reached a similar conclusion as Karipidis. But doing that would be nonsensical. The Australian paper is nothing more than misleading pseudoscience and should be withdrawn.” I have two questions for ARPANSA: **How do the numbers change if you include the data on people over 60?** Second question: **What happens to the increase in the frontal and parietal regions of the brain, as opposed to other regions if you include people over 60?**

### The Issue of Scientific Fraud

Before leaving this issue of the ARPANSA study and cancer epidemiology as represented in the ARPANSA unsigned letter, we need to consider another issue – that of scientific fraud. Encyclopedia.com defines SCIENTIFIC FRAUD as follows. “The term ‘scientific fraud’ is used to describe intentional misrepresentation of the methods, procedures, or results of scientific research. Behavior characterized as scientific fraud includes fabrication, falsification, or plagiarism in proposing, performing, or reviewing scientific research, or in reporting research results. Scientific fraud is unethical and often illegal. When discovered and proven, fraud can end the scientific careers of researchers who engage in it. Nonetheless, the substantial financial and reputational rewards that can accrue to scientists who produce novel and important research or who obtain certain desired results have induced some scientists to engage in scientific fraud.” What I’m going to do here, is to focus mainly on the issue of intentional misrepresentation. The statement they made on the ARPANSA epidemiological study, copying it again was: **“Epidemiological studies on links to cancer: A major ARPANSA-led epidemiological study has recently been published with the British Medical Journal Open, which found no link between the use of mobile phones in Australia and incidence of brain cancers. The study compared the incidences of brain cancer in Australia from 1982 to 2013, to mobile phone use during the same period. The study found that there was no increase in brain tumours that can be attributed to mobile phone use. This study was completed in conjunction with The**

**University of Wollongong, Monash University and the University of Auckland, and is available online at <https://bmjopen.bmj.com/content/8/12/e024489.full>.”**

First of all, the ARPANSA letter statement, copied above is about “epidemiological studies” (plural) but the letter chooses to only discuss a single such study, their own. ARPANSA knew that many other studies existed many of which came to diametrically opposite conclusions from their own – they had to know that in order to write their paper, and yet they chose to ignore all of those studies and just present their own study. That is intentional misrepresentation and is, therefore, scientific fraud. They presented their own ARPANSA study as if no criticisms of it had been raised when they knew that very serious criticisms had been raised. They knew that because both Dr. Karapidis and Croft had been questioned about these issues and they knew neither of them had been able or willing to answer those questions. The Microwave News article actually came out after the ARPANSA letter was written so we cannot blame the ARPANSA letter for misrepresenting those other facts. But you can see that this sort of misrepresentation leads to the tragic pillorying of Australian science as shown in the headline of the *Microwave News* article. That is tragic for the many scientists producing excellent scientific work on the continent of Australia.

There are three other areas in the ARPANSA letter that cross the line into “intentional misrepresentation.” **“ARPANSA recognizes that there are anecdotal reports of potential health effects (or reactions) from exposure to RF EME from various wireless technologies claiming a variety of ill effects that have been generally termed ‘electromagnetic hypersensitivity’ or EHS.”** In this statement ARPANSA intentionally misrepresents the literature on health effects of EMFs by suggesting they are all anecdotal and that they are all on EHS. ARPANSA knows that both of those are incorrect in the area of cancer and the area of cellular DNA effects where they know that there are both experimental and epidemiological studies on both cancer and DNA effects. The ARPANSA statement suggests that the over 99% of the studies on EMF effects do not exist and that none of the strongest studies on EMF effects, experimental studies and large well-designed epidemiological studies do not exist.

An additional area of concern is: **“Even damage, as a biological effect, occurs on a regular basis from different types of radiation from a range of sources. However DNA-repair is also a key characteristic of cell biology, which means that the bioeffect of DNA damage does not translate into a detrimental health effect.”** This has already been discussed. ARPANSA with its long history of dealing with ionizing radiation, clearly knows about the literature of DNA breaks and its failure to be repaired with 100% efficiency via an error-free process. That is, of course why we get chromosomal rearrangements rather than just repair back to the original chromosome structure. And those are very important mutations in carcinogenesis as well as in human genetics, so ARPANSA knows of the health impacts. When you get double strand DNA breaks from microwave and other frequency non-ionizing radiation, it is completely disingenuous for ARPANSA to suggest that this will “not translate into a detrimental effect.” There are similar problems with single strand breaks and with oxidized bases being produced by non-ionizing radiation exposures, in that these are often either repaired by an error prone process, microhomology recombination of single strand breaks or error prone repair of bases leading to both transition or transversion mutations. Maybe ARPANSA is so incompetent that they don’t know about those latter two types of error prone repair but they do know about the double strand break error-prone repair leading chromosomal rearrangement. This is, therefore still another example of intentional misrepresentation

and therefore, scientific fraud. In my judgment, it is a particularly deceitful one, given ARPANSA's professional expertise.

A fourth area of concern, discussed below, is the complete lack of any consideration in the ARPANSA letter of the important studies showing that cancer and several other effects occur predominantly on the ipsilateral side of the head, where people use their cell phones and cordless phones, as opposed to the contralateral side of the head, the side opposite that used for phone calls. The only plausible explanation for these findings is that cell phone and possibly also cordless phone radiation cause these effects. ARPANSA's Dr. Croft knows about this area, having published in this area and consequently, this serious omission is clearly intentional misrepresentation.

My questions for the Health Minister: **Are you going to ignore these four clear examples of scientific fraud on the part of ARPANSA? Are you going to ignore these clear failures on the part of ARPANSA to protect the health and safety of the people of Australia? If the answer is no to either of these questions, what are you going to do about either or both of them?**

It is, of course, nonsensical to fail to discuss each of the 35 reviews, each arguing that EMF exposures do cause cancer. It is also nonsensical to fail to discuss each of the 21 different reviews each showing that non-thermal EMF exposures do cause cellular DNA damage, including double strand DNA breaks, single strand DNA strand breaks and oxidized bases in the cellular DNA. Those types of DNA damage act, in turn, to produce the following types of mutations: chromosomal rearrangements, gene amplification, copy number mutations and point mutations. Each of those types of mutations have roles in cancer causation based on very extensive studies in the carcinogenesis literature.

There are two other areas which clearly need to be discussed with regard to EMF cancer causation that have also been avoided not only in the ARPANSA unsigned letter but also by other agencies that claim to be giving objective information on this topic but clearly are not – notably ICNIRP, SCENIHR and the US FCC and US FDA.

The first of these are the two reviews that have provided strong evidence that the Bradford Hill criteria are supported with regard to cancer causation by non-thermal microwave frequency EMF exposures (Hardell L, Carlberg M. 2013 Using the Hill viewpoints from 1965 for evaluating strengths of evidence of the risk for brain tumors associated with use of mobile and cordless phones. *Rev Environ Health* 28:97-106. doi: 10.1515/reveh-2013-0006 ; Carlberg M, Hardell L. 2017 Evaluation of Mobile Phone and Cordless Phone Use and Glioma Risk Using the Bradford Hill Viewpoints from 1965 on Association or Causation. *BioMed Res Int* 2017, Article ID 9218486, <https://doi.org/10.1155/2017/9218486>). The Bradford Hill criteria are *the widely accepted criteria for distinguishing causation from chance association in epidemiological studies*. They are widely recognized both in the scientific context and in the legal context. Consequently it is unacceptable to discuss epidemiological studies of EMFs and cancer causation without discussing the findings in each of these two reviews. But that is what the ARPANSA letter has done. And the ARPANSA letter failures in discussing cancer epidemiology goes far beyond this. The ARPANSA letter fails to discuss any other epidemiological studies except their own and their own study, as you have seen, has been deemed to be seriously flawed by independent scientists. ARPANSA has, therefore produced a stunningly biased treatment of a very important area of science.

A second such very important area are the studies finding that cancer incidence on the ipsilateral side of the head in cell phone users (the side of the head in which they use their cell phones) have been found to be substantially higher than on the contralateral side of the head (the other side of the head, away from the cell phone use side). Given that other types of exposures are expected to be uniform on both sides of the head, these findings argue strongly that cell phones and possibly also cordless phone do cause cancer. These findings have been widely reviewed in the independent scientific reviews on apparent EMF cancer causation but not by ARPANSA or other supposed regulatory “authorities.” Each of the following groups independent scientists has reviewed these findings in the following six reviews (Khurana VG, Teo C, Kundi M, Hardell L, Carlberg M. 2009 Cell phones and brain tumors: a review including the long-term epidemiologic data. *Surg Neurol* 72:205-214; Yakymenko I, Sidorik E. 2010 Risks of carcinogenesis from electromagnetic radiation and mobile telephony devices. *Exp Oncol* 32:729-736.; Carpenter DO. 2010 Electromagnetic fields and cancer: the cost of doing nothing. *Rev Environ Health* 25:75-80; Hardell L, Carlberg M, Hansson Mild K. 2013 Use of mobile phones and cordless phones is associated with increased risk for glioma and acoustic neuroma. *Pathophysiology* 2013;20(2):85-110; Davis DL, Kesari S, Soskolne CL, Miller AB, Stein Y. 2013 Swedish review strengthens grounds for concluding that radiation from cellular and cordless phones is a probable human carcinogen. *Pathophysiology* 20:123-129; Hardell L, Carlberg M, Söderqvist F, Mild KH. 2013 Case-control study of the association between malignant brain tumours diagnosed between 2007 and 2009 and mobile and cordless phone use. *Int J Oncol* 43:1833-1845). Each of the studies that have produced such clearly important findings have been reviewed, except for the one study that post-dates these reviews (Moon IS, Kim BG, Kim J, Lee JD, Lee WS. 2014 Association between vestibular schwannomas and mobile phone use. *Tumour Biol.* 35:581-587). There is also a literature showing that other impacts of cell phone radiation are higher on the ipsilateral side of the head as opposed to the contralateral side of the head including increased inflammation as measured by cytokine levels (Siqueira et al, 2016); brain modulation producing excitation of focal epilepsy (Tombini et al, 2013), tinnitus (Hutter et al, 2010) and EEG alpha wave impact (Croft et al, 2008 The effect of mobile phone electromagnetic fields on alpha rhythm of human electroencephalogram. *Bioelectromagnetics* 2008 Jan 29(1):1-10). Given Dr. Croft’s role in ARPANSA, surely ARPANSA knows about this area of science such that its failure to discuss it despite its obvious relevance is deeply troubling.

The unsigned ARPANSA letter adds “**With regard to the recent study by the US National Toxicology Program (NTP), this study investigated RF EME at high levels (mostly above current standards) that are not relevant to mobile phone base stations which emit RF EME at a fraction of the ARPANSA RF standard.**”

This is a bizarre statement in that it discusses mobile phone base station radiation as opposed to mobile/cell phone radiation which the NTP study was designed to study. It also falsely assumes as do many other ARPANSA, that effects are proportional to intensity, which we know to be false and assumes that average intensity can be used to assess biological effects, which we also know to be false.

I am going to assume that ARPANSA meant to discuss cell phone radiation and was trying to make the claim that the intensity study, in some parts of the study was just above the safety guideline levels, a point that has been made by others. This does not mean, however, that the intensity was above the levels that cell phone users are exposed to. Cell phone users are supposed to keep their cell phones 2 to 2 ½ cm away from their ear to keep exposures below allowable levels, something cell phone users almost always fail to do.

The NTP study should be compared with the Ramazzini rodent study which was done at intensities about 1/1000<sup>th</sup> of the intensity studied in the NTP study and also with the human epidemiological studies.<sup>1</sup> Each of these found increased cancer levels of both gliomas and schwannomas/neuromas. The schwannomas and neuromas are essentially identical cancers, with the main difference being that the neuromas found in human epidemiological studies occur in the ear whereas the schwannomas in the rodent studies occurred around the heart. The difference in location are exactly what one would expect, given that the human exposures involve cell phone radiation of the ear whereas the rodent studies were whole body radiation. Consequently, the findings in each of these three types of studies confirms the findings of the others, strongly arguing, therefore, that microwave frequency radiation causes both of these types of tumors both in humans and in rodents.

The NTP studies also found effects on the cellular DNA, effects of the type that cause mutations that cause cancer. Such DNA effects have also been found in many human and animal cell studies, as shown by the 21 different reviews on this topic. We have therefore excellent confirmation across multiple types of studies. Because as has been mentioned earlier, these DNA effects are of the types that produce cell level mutations that can cause cancer, these DNA findings also confirm the cancer studies.

#### Other EMF Effects and What About 5G?

There is a section in the middle of p. 2 of the unsigned ARPANSA letter entitled: **“Exposure to electromagnetic energy (EME), including millimeter waves (5G)”**. In the Table at the bottom of p. 2, ARPANSA claims that Wi-Fi exposure levels were 100,000,000 times lower than the ARPANSA safety limits and that mobile phone base station (also known as cell phone tower) radiation intensities were 500,000 times lower than the ARPANSA safety limits. Clearly ARPANSA is using these figures to argue that there are no effects of either Wi-Fi or cell phone tower radiation. There are several problems here: We have no idea if these were measured or predicted average intensities and, in either case, what conditions were used or assumed for these. ARPANSA provides no citation or other information that might allow the reader to determine what these numbers mean, if anything. And of course, we know that average intensities and the ARPANSA safety limits have no or almost no predictive value with regard to whether biological effects occur or not. What is most disturbing here is that we have substantial empirical evidence that both Wi-Fi and cell phone tower radiation have very substantial health-related effects in humans and that none of the studies showing this are cited by ARPANSA. There are 17 primary literature citations reporting that people living near cell phone towers suffer from 7 of the 8 most extensive documented EMF effects, discussed early in this document and that they typically suffer from these when they live within 300 meters of a cell phone tower. These findings have been reviewed in four publications (Kundi M, Hutter H-P. 2009 Mobile phone base stations—Effects on wellbeing and health. *Pathophysiology* 16:123-135. Khurana VG, Hardell L, Everaert J, Bortkiewicz A, Carlberg M, Ahonen M. 2010 Epidemiological evidence for a health risk from mobile phone base stations. *Int J Occup Environ Health* 16:263-267. Levitt, B. B., Lai, H. 2010. Biological effects from exposure to electromagnetic radiation emitted by cell tower base stations and other antenna arrays. *Environ. Rev.* 18, 369-395. doi.org/10.1139/A10-018; Subhan F, Khan A, Ahmed S, Malik MN, Bakshah ST, Tahir S. 2018 Mobile antennas and their impact on human health. *J Med Imag Health*

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<sup>1</sup> My discussion here, comes from a presentation by Professor Emeritus Anthony Miller, University of Toronto, that was made at a recent international meeting.



Inform 8: 1266-1273). The effects that have been found include neurological/neuropsychiatric effects, cancer, cell DNA effects, hormonal effects, reproductive effects, increased apoptosis (programmed cell death), oxidative stress/free radical damage and cardiac effects. The only one of the 8 extremely well documented effects that has not been reported to occur in people living near cell phone towers is increased intracellular calcium  $[Ca^{2+}]_i$ , which has never been measured in such studies. Given the extraordinarily extensive literature on these effects occurring following other EMF exposures, there should be no doubt these are genuine effects of cell phone tower radiation. The most recent review (Subhan et al, 2018) states that “These studies concluded that incidence of cancer cases was remarkably higher among people residing within 400 meters from mobile antennas, in comparison to those living further away.” These are major public health concerns given that typically over a third of people live within 300 meters of a cell phone tower and that over half of the people typically live within 400 meters of a cell phone tower. So here again, we have a substantial important literature that is being completely ignored by ARPANSA in violation of its duty to protect public health in Australia.

There is a similar pattern of evidence with regard to Wi-Fi radiation. There are 23 studies of genuine Wi-Fi radiation each of which were found to produce effects. These include seven of the eight effects previously extensively documented here as being caused by other microwave frequency EMF exposures as reviewed in Wilke I. 2018 Biological and pathological effects of 2.45 GHz on cells, fertility, brain and behavior. Umwelt Medizin Gesselshaft 2018 Feb 31 (1) and in Pall ML. 2018 Wi-Fi is an important threat to human health. Environ Res 164:404-416. According to both of these reviews, Wi-Fi exposures produce lowered reproductive activity, increased cellular DNA effects, increased oxidative stress/free radical damage, increased  $[Ca^{2+}]_i$ , increased apoptosis, changes in endocrine (hormone) function and changes in neurological activity. There may also be cardiac effects produced.

Two documents focused on Wi-Fi effects of the 41 in the first attachment expressing high level concern regarding the inadequacy of the safety guidelines that only take into consideration thermal effects, such as the ARPANSA safety guidelines. They each expressed specific concerns about Wi-Fi in schools. These were the American Academy of Environmental Medicine open letter (#16 on the list of 41) and the Reykjavik Appeal on wireless technology in schools (#5 on the list of 41). The positions of these should not be surprising, given the activity of Wi-Fi and the increased susceptibility of children to EMF exposures. Again we have a pattern of evidence which is completely ignored by ARPANSA such that ARPANSA fails in its duty to protect the health of the people of Australia.

ARPANSA states (p. 4, just below centre) “It is not expected that the ‘informed consent’ principle, an international convention for medical experiments established in the Nuremberg Code (1947), would apply to non-experimental activities such as the deployment of technology infrastructure within appropriate regulatory requirements.” What ARPANSA is arguing is that the people of Australia and other countries should be denied the protections of the Nuremberg Code simply because the plan is to put out 5G without actually collecting the data. And the plan is to put out 5G without doing one single biological safety test of genuine 5G with all of the pulsations and intensity variation that it will entail with all of the wireless communication exposures that communication with the “internet of things” of 5G will inevitably entail. We are doing this, therefore, in complete and total ignorance of what will occur as a consequences of 5G will be to humans and to entire ecosystems. Let’s look at the strictures of the Nuremberg Code:

## THE NUREMBERG CODE

1. The voluntary consent of the human subject is absolutely essential.

This means that the person involved should have legal capacity to give consent; should be so situated as to be able to exercise free power of choice, without the intervention of any element of force, fraud, deceit, duress, over-reaching, or other ulterior form of constraint or coercion; and should have sufficient knowledge and comprehension of the elements of the subject matter involved, as to enable him to make an understanding and enlightened decision. This latter element requires that, before the acceptance of an affirmative decision by the experimental subject, there should be made known to him the nature, duration, and purpose of the experiment; the method and means by which it is to be conducted; all inconveniences and hazards reasonably to be expected; and the effects upon his health or person, which may possibly come from his participation in the experiment. The duty and responsibility for ascertaining the quality of the consent rests upon each individual who initiates, directs or engages in the experiment. It is a personal duty and responsibility which may not be delegated to another with impunity.

2. The experiment should be such as to yield fruitful results for the good of society, unprocurable by other methods or means of study, and not random and unnecessary in nature.

3. The experiment should be so designed and based on the results of animal experimentation and a knowledge of the natural history of the disease or other problem under study, that the anticipated results will justify the performance of the experiment.

4. The experiment should be so conducted as to avoid all unnecessary physical and mental suffering and injury.

5. No experiment should be conducted, where there is an a priori reason to believe that death or disabling injury will occur; except, perhaps, in those experiments where the experimental physicians also serve as subjects.

6. The degree of risk to be taken should never exceed that determined by the humanitarian importance of the problem to be solved by the experiment.

7. Proper preparations should be made and adequate facilities provided to protect the experimental subject against even remote possibilities of injury, disability, or death.

8. The experiment should be conducted only by scientifically qualified persons. The highest degree of skill and care should be required through all stages of the experiment of those who conduct or engage in the experiment.

9. During the course of the experiment, the human subject should be at liberty to bring the experiment to an end, if he has reached the physical or mental state, where continuation of the experiment seemed to him to be impossible.

10. During the course of the experiment, the scientist in charge must be prepared to terminate the experiment at any stage, if he has probable cause to believe, in the exercise of the good faith, superior skill and careful judgement required of him, that a continuation of the experiment is likely to result in injury, disability, or death to the experimental subject.

["Trials of War Criminals before the Nuremberg Military Tribunals under Control Council Law No. 10", Vol. 2, pp. 181-182. Washington, D.C.: U.S. Government Printing Office, 1949.]

What ARPANSA seems to be saying is that because no one will be collecting the data in this huge 5G experiment, that for some reason the people of Australia or elsewhere in the world should be denied the protections Nuremberg Code. But of course, by failing to collect the data, there is zero argument in favor of going ahead with the gigantic experiment of the 5G rollout and there are, rather only the many arguments against doing so, including the deceit, complete failure of informed consent, complete failure to perform animal or other safety studies of genuine 5G radiation, the failure to allow people to drop out of the study, the failure to provide any way of helping the people of Australia to deal with health effects, etc, etc.

My understanding is that ARPANSA has legal obligation to protect the health and safety of the people of Australia. My question of ARPANSA here: **Why are you raising a questionable legalistic argument here rather than protecting that health and safety?**

I have raised a number of questions for ARPANSA. I would ask ARPANSA to answer those questions within three weeks of receiving this message and to transmit those answers to me and to the Australians and others who raised their concerns in the first place. Failing that, please transmit whatever answers you may have within three weeks, while simultaneously providing a time frame for answering the other questions.

I have one additional question for the Health Minister. My greatest fear is that our collective brain function has already deteriorated, due to the impacts of EMFs on our brains, to the point that we may already be completely unable to respond effectively to the megacrisis created by the telecommunications industry and organizations like ARPANSA. My greatest fear is that the political system already has a level of brain dysfunction such that it is completely unable to respond effectively to this megacrisis. My greatest fear is that given the cumulative impacts of EMFs leading to severe, irreversible effects in neurological/neuropsychiatric effects, reproductive effects and several others important effects, failure to respond effectively to this megacrisis means that we are doomed. My question to the Health Minister is the following: **In the Australian context, do you see any evidence that this greatest fear is not already true?**

5G?

The sum total of what ARPANSA has to say about 5G is the following:

**“EME from 5G technology will penetrate the skin less than EME from current technology.”** And **“wave technology is common place in the Australian community. Examples include speed radar guns, radar communication systems, security screening, remote environmental sensing and as human medicine for the treatment of diseases.”** ARPANSA says nothing about the studies on actual millimeter waves, studies that are easily accessible simply by searching in the EMF Portal database under millimeter wave. The findings are *not* encouraging. ARPANSA says nothing about the extraordinary pulsation levels and extraordinary power that will be necessary, along with the extraordinary numbers of antennae that will be necessary in order to penetrate sufficiently into our buildings such that 5G signals will be easily accessible. Each of these produce extraordinarily high levels of concern especially because 5G rollouts have already been approved in multiple countries without doing even a single biological safety test of genuine

5G with all of the power and pulsation that it will entail. In Chapter 7 of my 90page document, I make the argument that the millimeter wave frequencies that 5G will entail extraordinary risks when the risks we are already taking are producing multiple imminent existential threats to our survival. I predicted that the millimeter wave frequencies will produce effects much more deeply in the body than the industry claims is possible. I am attaching two CIA translated documents which clearly show that millimeter wave frequencies do produce effects at least 20 times deeper than the industry claims is possible, both in animals and in humans.

Summary:

With 100% consistency, ARPANSA avoids all of the strongest available science in this area. With 100% consistency, ARPANSA has produced a stunningly biased document, whose positions are

repeatedly and consistently contradicted by the strongest science and by large numbers of independent scientists.

With 100% consistency, ARPANSA has failed to protect the health and safety of the people of Australia.

With 100% consistency, ARPANSA has protected the economic interests of the telecommunications industry.

Note: I am also attaching a copy of the ARPANSA letter and also of a pdf file of this document (6<sup>th</sup> and 7<sup>th</sup> attachments).