

Smart Meter™ Opt-Out Proceedings Phase 2
Consolidated

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DIRECT TESTIMONY OF JEROMY JOHNSON

SMART METER™ OPT-OUT PROGRAM PHASE 2

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JEROMY JOHNSON

CHAPTER 1

**TESTIMONY: COST AND COST ALLOCATION OF SMARTMETER™ OPT-OUT
PROGRAM**

Chapter 1

Cost and Cost Allocation of SmartMeter™ Opt-Out Program

Introduction

The purpose of my testimony is to show that all of the expenditures of the wireless mesh SmartMeter™ network should not be borne by ratepayers or those who utilize the SmartMeter™ Opt-Out Program. This is because in the past two years there have been a tremendous number of red flags with respect to the safety of this program from utility customers, communities and the general public, and the utilities have been imprudent in that they have continued to implement the SmartMeter™ Program. Additionally, as the Maine Supreme Judicial Court has recently ruled, the burden of proof is on Central Maine Power to prove to the Maine PUC that this technology is safe. Thus, there is legal precedent to question the safety of this technology. Therefore, from a cost standpoint, it is unreasonable to ask utility customers to pay an opt-out fee for a technology in which the safety has not been determined.

Furthermore, a person who is made sick by the installation of SmartMeters™ should not be forced to pay a fee to a utility company in order to avoid pain and disability. To have to pay a penalty fee in order to be safe in one's own home is a violation of human rights. Also, CPUC code section 453(b) does not allow for discriminatory fees based upon a medical condition. The safety of this technology has not been determined and health professionals and scientists throughout the world are showing evidence of harm from non-thermal effects of pulsed microwave radiation, which SmartMeter™ technology utilizes. Here is a sample of the hard science:

"Evidence is accumulating on the results of exposure to RF at non-thermal levels including increased permeability of the blood-brain barrier..., harmful effects on sperm, double strand breaks in DNA which could lead to cancer genesis, stress gene activation indicating an exposure to a toxin and alterations in brain glucose metabolism"
(Namkung, Appendix D-4)

1 *"More than a thousand studies done on low intensity, high frequency, non-*
2 *ionizing radiation, going back at least fifty years, show that some biological*
3 *mechanisms of effect do not involve heat. This radiation sends signals to living tissue*
4 *that stimulate biochemical changes, which can generate various symptoms and may*
5 *lead to diseases such as cancer."* (Carpenter et al, Appendix B-2)

6
7 *"Cordless phones, which transmit a similar pulsed signal as Wi-Fi networks at*
8 *2.4 Gigahertz, have been shown to impact heart rate"* (European Journal of Oncology,
9 Appendix C-2)

10
11 *"High frequency EMFs such as the microwaves used in cell phones, smart*
12 *meters, Wi-Fi and cordless "DECT" phones, appear to be the most damaging when*
13 *used commonly. Most of their biological effects, including symptoms of electro-*
14 *hypersensitivity, can be seen in the damage done to cellular membranes by the loss of*
15 *structurally-important calcium ions. Prolonged exposure to these high frequencies may*
16 *eventually lead to cellular malfunction and death."* (Carpenter et al, Appendix B-3)

17
18 *"EMF hypersensitivity can occur as a bona fide environmentally inducible*
19 *neurological syndrome."* (McCarty et al, LSU Department of Neurology, Appendix C-1)

20
21 *"There is no scientific data to determine if there is a safe RF exposure level*
22 *regarding non-thermal effects"* (Namkung, Appendix D-5)

23
24 Persons who are electro-hypersensitive should not be forced to pay fees for themselves
25 or their neighbors to opt-out. This is discrimination against persons with a medical condition
26 and should not be allowed to stand in the State of California or anywhere in the United States.

27
28 In authorizing and designing the wireless SmartMeter™ Program, the CPUC and
29 investor-owned utilities made a critical omission. They did not take into account the non-
30 thermal biological impacts of pulsed microwave radiation (See Appendices B through G) on the

1 at least 3% of residents in California who are electro-hypersensitive (EHS) (Appendix D-4). They
2 did not realize that these citizens would no longer be able to safely live in their homes,
3 buildings or neighborhoods once they were filled with pulsed microwave radiation from the
4 wireless mesh network.

5
6 Although scientific research has shown that non-thermal effects and EHS are real, this is
7 not the only reason to question the safety of the wireless mesh SmartMeter™ network. Even if
8 we leave the scientific debate behind, there is a repeated correlation between SmartMeter™
9 installation and A.) the development of EHS and B.) new symptoms of pain and disability for
10 those who are already EHS. This cause and effect between SmartMeters™ and disability are
11 supported by the personal testimonials of a large number of people who initially knew nothing
12 about SmartMeters™ and whose painful symptoms appeared at the time of or soon after
13 SmartMeter™ installation, even though they did not realize until later that a SmartMeter™ had
14 been installed. This is further supported by the testimony of myself and my wife in Chapter 2
15 and letters from my physician in Appendix A.

16

17 **Cost and Cost Allocation of SmartMeter™ Opt-Out Program**

18

19 Utility companies and their investors have erred. They chose a wireless technology
20 without testing the human biological impact and safety. There were and are other alternatives.
21 Other countries (Italy for example) have implemented SmartGrid™ programs without wireless
22 SmartMeters™. As this debacle has been brought on by the investor-owned utilities (See
23 Appendix E), any costs to fix this mistake should be borne by the companies and investors that
24 also make the profits when things go right. This is only fair and reasonable and is how our
25 system of capitalism is supposed to work. To put the costs of the SmartMeter™ Opt-Out
26 Program on the individuals and families whose lives have been disrupted by this technology
27 should never have been considered in the first place. There should be no fee at all for
28 individuals/families to opt-out of the SmartMeter™ Program, especially when so many
29 questions exist regarding the safety of the SmartMeter™ Program.

30

1 **Single-Family Homes in Residential Neighborhoods**

2
3 The idea of an “individual” opt-out is an illusion because entire neighborhoods are now
4 filled with pulsed microwave radiation. For an electro-hypersensitive person or any individual
5 who chooses to opt-out, the benefits of removing only one of the SmartMeters™ will be
6 insufficient or minimal and currently their only recourse is to move and seek refuge in a
7 community without SmartMeters™ (few such places remain in California). This is an
8 involuntary, mandated, 24/7 exposure to pulsed microwave radiation. The only way to unravel
9 this is to take the wireless SmartMeters™ out of entire neighborhoods. As the safety of this
10 program is in serious question and for at least the past two years there have been calls from
11 across the state to stop implementation of the SmartMeter™ Program, the cost of this
12 unraveling should be paid for by the utility and its investors.

13
14 **Multi-Unit Dwellings**

15
16 A large number of citizens in this state live in multi-unit dwellings. Under the currently
17 proposed SmartMeter™ Opt-Out Program, a tenant who is electro-hypersensitive or a tenant
18 that has a family member who is susceptible to illness from microwave radiation (small
19 children, pregnant women and people with compromised immune systems (Appendix G-4)) has
20 two choices: 1.) Convince all neighbors to opt-out and pay the fees (or have the affected
21 person(s) pay all the fees for dozens or even hundreds of meters) or 2.) Move to a different
22 location. Both of these options are very difficult or impossible logistically if one does not have
23 resources (many people in multi-unit dwellings are low to middle income). In effect, the
24 currently proposed SmartMeter™ Opt-Out program is forcing electro-hypersensitive people
25 without resources to stay in their homes and suffer or seek refuge elsewhere. This should not
26 be the case. A no-cost opt-out for multi-unit dwellings and automatic opt-out for entire
27 buildings with an electro-hypersensitive person would solve this problem and should be part of
28 any SmartMeter™ Opt-Out Program. This costs should be borne by the utilities.

1 "What if another tenant wants a SmartMeter™?" First, the health and safety of a
2 person with EHS is paramount above the desire of a nearby resident to have a SmartMeter™
3 which will cause harm to the person with EHS. Second, if someone in a multi-unit building
4 wants real-time data on their energy use, there are devices that can be bought on Amazon or at
5 Lowes for under \$100 that allow a person to monitor and track their energy usage from their
6 home. Finally, time-of-use electrical energy meters that do not utilize SmartMeter™ technology
7 are also available and have been employed by the utilities for some time.

8 9 **Other SmartMeter™ Opt-Out Locations/Costs**

10
11 As the number of electro-hypersensitive people in our state continues to grow, there is
12 a need for places that these people must go in order to seek treatment and heal. These places
13 are often Low-EMF areas such as resorts and retreat centers in nature. They could also be
14 medical offices and food stores/restaurants. Such organizations must have the right and the
15 ability to opt-out of the SmartMeter™ Program. The cost structure for these opt-outs should be
16 the same as for individuals and families – absolutely free – as no organization should have to
17 pay a fee in order to keep their employees and guests safe, especially when the safety of this
18 program is in question. It is critical that the State of California have places, indeed entire
19 communities, for this growing population of electro-hypersensitive individuals to live, work,
20 shop and heal. Thus, an organization that wants to opt-out of the SmartMeter™ Program must
21 be able to do so without an opt-out fee.

22 23 **Additional Cost Factors of the SmartMeter™ Program**

24
25 For individuals who are electro-hypersensitive, avoidance of EMF exposure is their only
26 recourse. This incurs tremendous costs, which includes: 1.) relocation 2.) loss of employment
27 and/or income 3.) medical treatment and 4.) potential long-term disability. There are also
28 mental/emotional/societal costs associated with this condition. It affects the person, his/her
29 family, their relationships and the entire community. Persons that are EHS have a difficult time
30 working or finding work that does not involve exposure to EMF. They also have a very difficult

1 time finding safe housing, especially with the implementation of the SmartMeter™ Program,
2 and many resort to sleeping in the woods, off-the-grid or in their car in a safe location. There is
3 also considerable isolation and ostracism that comes with this condition (most people do not
4 yet understand EHS because it has not affected them personally). Is it fair to ask these affected
5 individuals and their families to bear all the burdens and costs of this condition? Instead of
6 asking these individuals to pay opt-out fees, we should be asking the investor-owned utility
7 companies and their investors to first admit, and then correct their mistake and compensate
8 these persons for the health damages and prevent damage to even more people.

9 10 Conclusion

11
12 People that are electro-hypersensitive should not be forced from their homes, their
13 multi-unit buildings or their communities. Too many have already been forced to move and
14 have had their lives turned upside down. These individuals have a right to exist in this society
15 and the SmartMeter™ Program is making this much more difficult for them. Technical
16 alternatives exist to reverse the mistakes inherent in the wireless SmartMeter™/SmartGrid™
17 Program. However, the first and immediate step will be for the CPUC to make the
18 SmartMeter™ Opt-Out Program free for people who are being harmed by this technology. This
19 is the only reasonable course of action considering that the safety of the wireless SmartMeter™
20 program has not been determined and so many safety questions exist. The CPUC should also
21 make it easy for entire neighborhoods and multi-unit buildings to opt-out together. If even one
22 person in a multi-unit building or neighborhood is affected, then it should automatically trigger
23 a complete and free opt-out for the area. Finally, the CPUC should ensure that there are places
24 in this state that are free of SmartMeters™ where individuals who are electro-hypersensitive
25 can live, work and heal.

JEROMY JOHNSON

CHAPTER 2

**TESTIMONY: TIMELINE OF PERSONAL IMPACTS SINCE IMPLEMENTATION OF
SMARTMETER™ PROGRAM**

Chapter 2

Timeline of personal impacts since implementation of SmartMeter™ Program

The following timeline is pertinent to the cost and cost allocation of the SmartMeter™ Opt-Out Program considering that the safety of this technology is in question. A primary reason that citizens opt-out is because of EHS symptoms. At least 3% of California residents are EHS (see Appendices B, C and D-4). It is unreasonable to force a technology upon this population and then charge them a penalty fee in order to return to or keep a safe technology.

Summary of Timeline

- Prior to August 2011, perfect health with no knowledge of SmartMeters™.
- August 2011: Began to experience headaches, insomnia and other EHS symptoms.
- September 1, 2011: Realized SmartMeters™ were present in our building (they were installed in the June or July, while we were out of the country).
- September 2011: EHS symptoms worsened and first realized thousands of other people in California were experiencing the same disabling effects – all since SmartMeters™ were installed. We asked PG&E numerous times to remove the SmartMeters™.
- October 15, 2011: Forced to leave our home as our health continued to deteriorate and PG&E would not remove the bank of four SmartMeters™ that were directly below our bedroom. Once away from SmartMeter™ technology, our symptoms lessened.
- October 2011 through mid-January 2012: Lived in several different locations, which was very disruptive to our lives. We were SmartMeter™ refugees. Realized that severe headaches were initiated by wireless technology sources.
- January 13, 2012: PG&E removed the bank of SmartMeters™ from our San Francisco building. The effects were noticeable right away – we could again live in our home.
- February 2012 – Present: My EHS symptoms persist. When around wireless technology or dirty electricity, I have headaches and heart palpitations. My only recourse is avoidance. When in nature, my EHS symptoms completely disappear within 1-2 days. When I return to populated areas, they reappear within minutes.

1 **Comprehensive Timeline**

2
3 **Prior to August 15, 2011:** Perfect health with no awareness or knowledge of electro-
4 hypersensitivity (EHS) and/or radio-frequency sickness. My wife and I had no idea that electro-
5 magnetic radiation (EMR) was so harmful to health or that many other countries have much
6 stricter regulations for microwave radiation (Appendix D-5). We lived a normal life with use of
7 technology that is befitting of two accomplished professionals at 35 years of age, which
8 included multiple computers, cell phones and Wi-Fi without any problems (I have a master's
9 degree in Civil & Environmental Engineering and work as a manager at a large Bay Area firm.
10 My wife, Katharina, is a medical doctor). After receiving a mailing from PG&E earlier in the year,
11 we had put our San Francisco apartment on the SmartMeter™ delay list because we had heard
12 negative reports (billing errors/privacy issues) from relatives, media and other California
13 citizens with regard to this program.

14
15 **August 15, 2011:** Returned home to San Francisco after 2 months of work and travel in
16 Austria/Europe, where my wife is from. The SmartMeters™ were supposedly installed in our 4-
17 unit Victorian building in July while we were traveling. We were not aware of this.

18
19 **August 15 – 31, 2011:** Started to experience headaches, disturbed sleep, fatigue and tinnitus –
20 symptoms which I had never experienced before in my life. Had a difficult time concentrating at
21 work due to headaches and lack of sleep.

22
23 **September 1, 2011:** Realized that smart meters were installed in our building – a co-located
24 bank of 4 smart meters were installed 10 feet directly below our bedroom. This was the only
25 change to our living environment and our home that we had lived in for five years.

26
27 **September 10, 2011:** Spent 1-2 hours painting around the downstairs area in close proximity to
28 where the smart meters were located. We did not realize that the pulsed microwave radiation
29 emissions from the SmartMeters™ were so high (as we later learned from having them
30 measured and filmed by an EMF professional). There were no warning signs on any of the

1 wireless SmartMeters™. PG&E had stated publicly that the meters communicate wirelessly for
2 only 45 seconds each day. They did not say it was through high-intensity millisecond pulses that
3 the SmartMeter™ bank produced every 2 - 8 seconds (essentially pulsing continuously). PG&E
4 later admitted that their wireless SmartMeters™ transmit between 10,000 and 190,000 times
5 per day (Appendix B-4).

6
7 **September 10 – 30, 2011:** Symptoms worsened for both of us. Headaches, heart
8 palpitations/arrhythmia, insomnia, fatigue and tinnitus increased in intensity. Work became
9 difficult. Sleep was reduced from my normal eight hours to three intermittent hours per night.
10 Our marriage became strained because of the tension we were feeling in our own home. We
11 started to feel depressed – after having an incredibly positive and creative time in Austria and
12 normally being very positive and productive people. We even put aside two businesses that we
13 had started over the summer because of our health condition. It was as though a switch had
14 been flipped (A recent study explains the mechanism for this - see Appendix G).

15
16 During this month we began to research SmartMeters™ and realized that thousands of people
17 across California were having the exact same symptoms. I also checked with our neighbors and
18 some of them were having similar symptoms. We had nearly one dozen friends in the San
19 Francisco Bay Area who were experiencing the exact same health impacts – all since
20 SmartMeters™ were installed at their homes (as predicted in Appendix E).

21
22 Once we realized how dangerous these devices were, we immediately and repeatedly
23 contacted PG&E to have them removed. They would not listen to us or our neighbors and
24 building owner. PG&E treated us very poorly. They even sent out people to test carbon-
25 monoxide levels because they thought that was the problem (it was not) and a PG&E
26 representative told one of our neighbors that pulsed microwave radiation is actually good for
27 her brain (she slept 5 feet from the bank of SmartMeters™, was pregnant at the time and
28 quickly moved back to Sydney, Australia). After over one dozen calls from us, our neighbors and
29 our landlord, PG&E essentially told us to go away and stopped returning our calls.

30

1 **October 1 – 15, 2011:** Symptoms got worse. We gave notice on our apartment where we had
2 lived for 5 years and had rent control (a substantial benefit in a booming San Francisco rental
3 market where a comparable flat had almost doubled in price). We simply could not live in our
4 home without experiencing debilitating health effects. Our safety was at stake both in our
5 home and while driving – Katharina noted that her memory and concentration while driving
6 was not nearly what it had been two months prior and had deteriorated to the point where she
7 did not feel safe. The effects of the SmartMeters™ were getting worse, so we started to look
8 for a place outside of San Francisco. We looked in Mill Valley, CA and found a home near
9 downtown. However, they had a SmartMeter™ and I realized for the first time that I got
10 headaches when near a cell phone tower (there is one in downtown Mill Valley – just one block
11 from the home). I had now become electro-hypersensitive and could not be near wireless
12 communication equipment (cell towers, smart phones, Wi-Fi and wireless SmartMeters™)
13 without experiencing headaches. We realized that we had to move to Fairfax, CA because it was
14 one of the only communities without SmartMeters™ in our area. This was a burden, however,
15 because it was almost 2 hours by car from my place of employment. We had no choice as we
16 had to give our health a chance to recover. Again, we were completely healthy just two months
17 prior and the only thing in our lives that had changed was the co-located bank of four smart
18 meters 10 feet from our bedroom (there are some situations where there are dozens or even
19 hundreds of SmartMeters™ next to apartments in multi-unit dwellings).

20
21 **October 15 – November 22, 2011:** We began to sublet a home in Fairfax. We had to keep our
22 San Francisco apartment because we realized that finding a new rental in this market would
23 take a long time (typically 3-4 months). We paid for two places. While living in Fairfax our
24 symptoms eased. We could sleep again. The heart palpitations decreased and the
25 tension/anxiety/fatigue went away. However, the headaches continued. Any time I went
26 downtown to Fairfax, the local cell tower and Wi-Fi exacerbated the headaches. Every time I
27 went into San Francisco or drove near a cell phone tower, the headaches would worsen. Using
28 a cell phone became nearly impossible. I could only text, and sparingly at that. I would later
29 meet other people experiencing the exact same phenomenon.

30

1 We experienced considerable stress while in Fairfax as well. We had essentially been uprooted
2 by PG&E's SmartMeter™ Program and were forced to seek refuge in a town that was not our
3 home. In addition it was very hard to find housing. Because of the housing/financial crisis, there
4 are many more renters than there are places available. We did not know where we would live
5 next. We were smart meter refugees. We met others who were also moving to Fairfax because
6 they too were having health effects that they had attributed to SmartMeter™ installations.

7
8 During this time we also began to seek considerable health treatments. Katharina is already a
9 medical doctor. However, we needed the help of others and sought various therapies to help
10 reduce our electro-hypersensitivity. We spent thousands of dollars during this month on
11 alternative therapies because allopathic medicine does not know how to treat this condition,
12 other than medicating the symptoms away, which actually makes things worse over time. These
13 therapies provided some relief, but it was never long-lasting. We did feel like we were getting
14 stronger while living in Fairfax. It seems the only known way to reduce electro-hypersensitivity
15 once it occurs is avoidance of all wireless technology and high electrical fields. This is
16 increasingly difficult in our world – especially now that utility companies want to put
17 SmartMeters™ in every community in the state.

18
19 We contacted our Kaiser Permanente physician about our condition. He had heard from other
20 Kaiser doctors that other patients were experiencing the same thing since SmartMeters™ were
21 installed. He provided a letter for each of us to give to PG&E and the CPUC to have the smart
22 meter bank removed from our building (Appendix A).

23
24 During this time we spoke publicly at CPUC meetings, explained our symptoms and the damage
25 SmartMeters™ had caused and were continuing to cause to our lives and the lives of others. No
26 one on the Commission or any PG&E representative contacted us after we spoke to offer
27 assistance. They continued to ignore us.

28
29 **November 23 – December 31, 2011:** Without a new place to live in Fairfax and our sublet
30 ending, we were again under considerable stress. We tried to go back to our San Francisco

1 home, but after only 15 minutes there our symptoms would reoccur. Katharina would sit in the
2 kitchen and watch her pulse go from 60 to 120 beats per minute spontaneously, which is a
3 common symptom of electro-hypersensitivity (European Journal of Oncology, Appendix C-2).
4 We could not even consider spending one night in our home. We had no idea where we would
5 go next. Luckily, the day we had to leave Fairfax, a friend from San Francisco offered to sublet
6 his home for a month while he traveled. He had a SmartMeter™, but it was on the other side of
7 the home. We could sleep at this home, but being back in San Francisco was not easy. Our
8 electro-hypersensitivity (EHS) symptoms were worse in San Francisco. We learned that we had
9 to unplug all Wi-Fi and cordless phones and we had to keep any cell phones around us on
10 “airplane” mode or off. We felt like refugees and did not know where we would live next. We
11 really felt hopeless as PG&E was not admitting that there was a problem. We also realized
12 through research that thousands (possibly tens of thousands) of people throughout California
13 were experiencing the exact same thing. Some were living in their cars in nature to seek relief.
14 Many had abandoned their homes and careers and now live off-the-grid in places like Big Sur or
15 other states. Others had left the country. Lives were being destroyed and no help was on the
16 way.

17
18 **January 1 – 15, 2012:** We sent a package to the top executives at PG&E and to each of the
19 CPUC Commissioners demanding that they take the bank of SmartMeters™ out of our building
20 in San Francisco within five days or we would hire a certified electrician to do this for us. Within
21 48 hours of the executives receiving this package, the SmartMeters™ were out of our building
22 and safe analog meters were installed. The PG&E customer relations manager that called, Mark
23 Torez, was very cordial and helpful. He called six or seven times within 24 hours of our initial
24 conversation. I wondered why someone had not contacted us months prior when we contacted
25 PG&E so many times about our issues with the SmartMeters™. Mark and his superiors
26 authorized the installation of the safe analog meters at our building, but would not admit that
27 people were getting sick because of the SmartMeters™ (for obvious liability reasons). He stated
28 that people go through phases in life and that apparently my wife and I were going through our
29 “electro-sensitivity phase”. The next day the SmartMeters™ came out. For the first time in 3
30 months, we were able to live and sleep in our own home.

1
2 **January 15 – May 31, 2012:** The effect of having the smart meters taken out was very
3 noticeable. The home felt completely different. We could sleep again in our home. With the
4 bank of four SmartMeters™ directly below our bedroom, this was not possible. Our tinnitus
5 decreased somewhat and the heart palpitations/arrhythmia were not as frequent. The nervous
6 system overload that we had been experiencing slowly started to diminish.

7
8 The damage had been done however. I am now electro-hypersensitive; a condition that I did
9 not even know existed a few months prior (See Appendices C and D-4). Being around wireless
10 communications technology brings about headaches, fatigue and a lack of concentration and
11 memory. I experience a tremendous pressure in my head that is very painful. It takes hours,
12 sometimes days, for this head tension to decrease after I am exposed to wireless
13 communication technology, strong electro-magnetic fields or a home or neighborhood with
14 dirty electricity. Being sensitive to dirty electricity is a huge problem, as experts have shown it
15 has increased on the power grid and on the wiring of homes with the deployment of
16 SmartMeter™/SmartGrid™ technology. We now use electricity sparingly in our apartment
17 because it causes headaches. We only run our refrigerator when we are not at home and have
18 to turn off the circuit breakers to our home at night.

19
20 Many physicians, scientists and biologists are increasingly stating that SmartMeters™, the
21 SmartGrid™ and wireless communications technology are a serious health concern (See
22 Appendix B & D). Not only is a growing portion of the population experiencing acute electro-
23 hypersensitivity symptoms, there are hundreds of peer-reviewed studies showing significant
24 long-term effects including cell damage, DNA chain breaks, immune and neurological system
25 impairment, infertility and damage to the blood brain barrier (See Appendices B, D, F & G).

26
27 **June 1, 2012 - Present:** The electro-hypersensitivity issues persist. My wife has moved back to
28 Europe for now as she just did not feel well here. Her symptoms have reduced since leaving
29 California, but moving has forced her to give up her practice in the Bay Area. My own condition
30 has worsened. It is difficult for me to be in urban environments, in a normal office environment

1 or even on certain computers because of the electro-hypersensitivity (wireless devices and
2 computers are now very difficult to be around, which was not the case just one year ago). I
3 have persistent headaches that only diminish when I am away from wireless technology and
4 other electro-magnetic fields. This will likely affect my ability to earn income, the places that I
5 can live and may completely change my life, as it has for many other affected people. I question
6 whether these costs are factored into the SmartMeter™ Opt-Out Program? **The interesting**
7 **thing is that when I spend time in nature, away from all wireless communications equipment**
8 **and electro-magnetic fields, my EHS symptoms, including headaches, completely disappear**
9 **within 24-48 hours. However, they reappear almost immediately once I return to a populated**
10 **area.** I have also inadvertently done dozens of experiments of my own where I would feel a
11 microwave radiation source before seeing it. My personal experience, along with similar
12 testimonials of many other affected people and a growing body of scientific evidence of
13 biological harm from non-thermal microwave radiation is how I know that we are harming
14 people with SmartMeter™/ SmartGrid™ technology. The past 12 months have been extremely
15 difficult for my wife and I. We have spent periods of time at approximately 15 different
16 locations the past year, mostly searching for safe places to live. This has been very disruptive to
17 our lives. We are currently living on separate continents, but are searching for a safe place to be
18 together where we can both live and work.

19
20 Finally, the opt-out process, as currently proposed, is unworkable for tenants of multi-unit
21 buildings or people that need a medically prescribed SmartMeter™-free zone in their
22 neighborhood. I have been in contact with my neighbors and the owner of our building. None
23 of the residents are able or willing to pay the opt-out fees (\$75 plus \$10/month), even though
24 they are all supportive of not having SmartMeters™ in our community. We often find this same
25 situation elsewhere – people want to opt-out, but cannot afford to do so or they live in a
26 building where doing so would be very expensive and very difficult logistically (with dozens or
27 even hundreds of SmartMeters™ installed). The situation in my building puts me in a position
28 where I would have to pay for the entire building and the neighboring buildings – because of a
29 medical condition that was caused by SmartMeter™ technology. As stated above, this is
30 discriminatory under CPUC Code Section 453(b). The United States Access Board also

1 recognizes that electro-hypersensitivity may be considered under the Americans with
2 Disabilities Act (www.access-board.gov/recreation/final.pdf). Furthermore, the fees for just our
3 building add up to nearly \$1,000 the first year, while our *yearly* PG&E bill is now typically under
4 \$500. As currently proposed, it appears an electro-hypersensitive person would also have to
5 pay \$75 each time a new resident moves into a building, along with the \$10 monthly fees. This
6 is unfair and unreasonable, especially when the safety of this program is in question. I am
7 presently faced with the logistical issues of paying for all of our neighbors and having to explain
8 my medical condition to any new residents who move into the building or having to explain
9 everything to the owner/neighbors of the next place I live (I will only be able to live in places
10 with owners and residents who are sympathetic to and willing to rent to EHS individuals). This is
11 yet another hardship that PG&E and the CPUC have created in our lives through the currently
12 proposed SmartMeterTM Opt-Out Program. Similar situations exist for tens of thousands of
13 other electro-hypersensitive citizens that live in multi-unit buildings and single-family homes
14 throughout California. These citizens should not be subjected to the pulsed microwave
15 radiation from the wireless mesh grid that SmartMetersTM have created. Electro-hypersensitive
16 individuals should not be discriminated against and should instead be protected by the very
17 government body whose duty it is to provide safety – the California Public Utilities Commission.

JEROMY JOHNSON

APPENDIX A

LETTERS FROM KAISER PERMANENTE PHYSICIAN

The Permanente Medical Group, Inc.

DEPARTMENT OF MEDICINE 4NE

2238 Geary Blvd

San Francisco CA 94115-3416

Dept: 415-833-2200

Main: 415-833-2000

November 27, 2011

Jeromy C Johnson

San Francisco CA

Dear Pacific Gas & Electric Company and California Public Utilities Commission:

My patient, Jeromy Johnson, began suffering symptoms shortly after the installation of the wireless transmitting smart meters at his San Francisco residence.

The symptoms include headaches, insomnia, heart palpitations, tinnitus and an inability to concentrate fully. Prior to the installation of the wireless smart meters, Jeromy was a perfectly healthy 35-year-old individual. Over the past several months, his quality of life has deteriorated significantly and he reports that the only way to reduce his symptoms is to seek temporary residence in communities that have not implemented the smart meter technology. This has put considerable stress on Jeromy and his wife as they may be forced from their home, community and places of employment.

As the symptoms occurred soon after Jeromy was exposed to two banks of smart meters (approximately 10 devices) that are within 15 feet of his bedroom and the fact that many other California citizens are reporting similar conditions after the installation of their smart meters, I am of the opinion that smart meter technology cannot be ruled out as a potential cause for Jeromy's health.

Because of this, if possible, I do not think it is unreasonable to honor this patient's request to remove the above mentioned smart meters and replace them with the non-transmitting analog meters to see if the patient symptomatically feels better.

Sincerely,



MARK JUNG CHEN MD

The Permanente Medical Group, Inc.

DEPARTMENT OF MEDICINE 4NE

2238 Geary Blvd

San Francisco CA 94115-3416

Dept: 415-833-2200

Main: 415-833-2000

April 24, 2012

Jeromy C Johnson

San Francisco CA

Dear Pacific Gas & Electric Company,

My patient, Jeromy Johnson, has been complaining of electro-hypersensitivity symptoms since last September. The symptoms include headaches, trouble sleeping, heart palpitations, tinnitus and an inability to focus. He reports that the symptoms occurred shortly after the bank of smart meters were installed 10 feet from his bedroom in his San Francisco apartment building.

It is my understanding the smart meters were taken out of the building in January. Shortly after the meters were taken out, Jeromy and his wife were able to move back into their home and his symptoms began to subside. There was a noticeable reduction in headaches and he was again able to sleep adequately.

During the past three months Jeromy has had to spend time in different South Bay homes for work reasons. Each of these homes had smart meters and in all of the cases where the meter was located in the vicinity of his sleeping room, the headaches, tinnitus and sleep disturbances reoccurred. Jeromy reports that he has now become sensitive to wireless communication technology and can no longer use a cell phone, be near cell towers or use computer equipment that operate using wi-fi without getting a headache. Prior to September, 2011 he was able to use all of these technologies with no symptoms.

As my patient appears to be part of the 3-5% of Californians who have become sensitive to wireless technologies and the dirty electricity they create, I recommend that no smart meters be installed at his home. The analog meters are the safest technology for my patient.

Sincerely,



MARK JUNG CHEN MD

JEROMY JOHNSON

APPENDIX B

**STATEMENT FROM 52 PHYSICIANS AND SCIENTISTS CORRECTING
MISINFORMATION RELATED TO SMARTMETER™ PROGRAM**

Smart Meters: Correcting the Gross Misinformation

| 11 juin 2012 |

<http://maisonsaine.ca/smart-meters-correcting-the-gross-misinformation/>

Quebec-based magazine *La Maison du 21e siecle* asked physician David O. Carpenter, former founding dean of the University at Albany (NY)'s School of Public Health, to comment an open letter published in the Montreal daily *Le Devoir* last May 24. This letter claimed wireless smart meters pose no risk to public health. More than fifty international experts contributed to the following rebuttal.

We, the undersigned are a group of scientists and health professionals who together have coauthored hundreds of peer-reviewed studies on the health effects of electromagnetic fields (EMFs). We wish to correct some of the gross misinformation found in the letter regarding wireless "smart" meters that was published in the Montreal daily *Le Devoir* on May 24. Submitted by a group Quebec engineers, physicists and chemists, the letter in question reflects an obvious lack of understanding of the science behind the health impacts of the radiofrequency (RF)/microwave EMFs emitted by these meters.

The statement that « Thousands of studies, both epidemiological and experimental in humans, show no increase in cancer cases as a result of exposure to radio waves of low intensity... » is false (1). In fact, only a few such studies — two dozen case-control studies of mobile phone use, certainly not thousands, have reported no elevations of cancer, and most were funded by the wireless industry. In addition, these reassuring studies contained significant experimental design flaws, mainly the fact that the populations followed were too small and were followed for a too short period of time.

Non industry-funded studies have clearly demonstrated a significant increase in cancer cases among individuals who have suffered from prolonged exposure to low-level microwaves, transmitted notably by radio antennas. The effects were best documented in meta-analyses that have been published and that include grouped results from several different studies: these analyses consistently showed an increased risk of brain cancer among regular users of a cell phone who have been exposed to microwaves for at least ten years.

Brain Cancer Rates

Furthermore, the argument that brain cancer rates do not indicate an overall increase in incidence is not evidence that cell phones are safe: the latency for brain cancer in adults after environmental exposure can be long, up to 20-30 years. Most North Americans haven't used cell phones extensively for that long. The evidence of the link between long-term cell phone use and brain cancer comes primarily from Northern Europe, where cell phones have been commonly used since the 1990s. Nevertheless, the most recent collection of primary brain tumors mined from pathology units in Australia showed brain cancer incidence rose by about 35% between 2000 and 2008 in the Australian Capital Territory and New South Wales (total population : more than 7 million).

Children are especially at risk. In May 2012, the U.K.'s Office of National Statistics reported a 50 percent increase in incidence of frontal and temporal lobe tumors in children between 1999 and 2009. This statistic is especially disturbing since in May 2011, after reviewing the published scientific literature regarding cancers affecting cell phone users, the International Agency for

Research on Cancer (IARC) classified radiofrequency radiation as a 2B, possible human carcinogen. Despite the absence of scientific consensus, the evidence is sufficiently compelling for any cautious parent to want to reduce their loved one's exposure to RF/microwave emissions as much as possible, as recommended by various countries such as Austria, Belgium, Germany, Russia and the United Kingdom.

Electrosensitivity

Public fears about wireless smart meters are well-founded. They are backed by various medical authorities such as those of the Santa Cruz County (California) Public Health Department. These authorities are worried about the growing number of citizens who say they have developed electrohypersensitivity (EHS), especially since for many of them, the symptoms developed after the installation of such meters (it takes some time for most people to link the two events).

Since the turn of the millennium, people are increasingly affected by ambient microwaves due to the growing popularity of wireless devices such as cell phones and Wi-Fi Internet. Therefore, the mass deployment of smart grids could expose large chunks of the general population to alarming risk scenarios without their consent. According to seven surveys done in six European countries between 2002 and 2004, about 10% of Europeans have become electrosensitive. The most famous person to publicly reveal her electrosensitivity is Gro Harlem Brundtland, formerly Prime Minister of Norway and retired Director of the World Health Organization (WHO).

While there is no consensus on the origins and mechanisms of EHS, many physicians and other specialists around the world have become aware that EHS symptoms (neurological dermatological, acoustical, etc.) seem to be triggered by exposure to EMF levels well below current international exposure limits, which are established solely on short-term thermal effects (2). Organizations such as the Austrian Medical Association and the American Academy of Environmental Medicine have recognized that the ideal way to treat of EHS is to reduce EMF exposure.

Therefore, caution is warranted because the growing variety of RF/microwave emissions produced by many wireless devices such as smart meters have never been tested for their potential biological effects.

Well-known bioeffects

While the specific pathways to cancer are not fully understood, it is scientifically unacceptable to deny the weight of the evidence regarding the increase in cancer cases in humans that are exposed to high levels of RF/microwave radiation.

The statement that « there is no established mechanism by which a radio wave could induce an adverse effect on human tissue other than by heating » is incorrect, and reflects a lack of awareness and understanding of the scientific literature on the subject. In fact, more than a thousand studies done on low intensity, high frequency, non-ionizing radiation, going back at least fifty years, show that some biological mechanisms of effect do not involve heat. This radiation sends signals to living tissue that stimulate biochemical changes, which can generate various symptoms and may lead to diseases such as cancer.

Even though RF/microwaves don't have the energy to directly break chemical bonds, unlike ionizing radiation such as X-rays, there is scientific evidence that this energy can cause DNA damage indirectly leading to cancer by a combination of biological effects. Recent publications have documented the generation of free radicals, increased permeability of the blood brain barrier allowing potentially toxic chemicals to enter the brain, induction of genes, as well as altered electrical and metabolic activity in human brains upon application of cell phone RF/microwaves similar to those produced by smart meters.

These effects are cumulative and depend on many factors including RF/microwave levels, frequency, waveform, exposure time, biovariability between individuals and combination with other toxic agents. Clear evidence that these microwaves are indeed bioactive has been shown by the fact that low-intensity EMFs have proven clinically useful in some circumstances. Pulsed EMFs have long been used to successfully treat bone fractures that are resistant to other forms of therapy. More recently, frequency-specific, amplitude-modulated EMFs have been found useful to treat advanced carcinoma and chronic pain.

High frequency EMFs such as the microwaves used in cell phones, smart meters, Wi-Fi and cordless "DECT" phones, appear to be the most damaging when used commonly. Most of their biological effects, including symptoms of electrohypersensitivity, can be seen in the damage done to cellular membranes by the loss of structurally-important calcium ions. Prolonged exposure to these high frequencies may eventually lead to cellular malfunction and death.

Furthermore, malfunction of the parathyroid gland, located in the neck just inches from where one holds a cell phone, may actually cause electrohypersensitivity in some people by reducing the background level of calcium ions in the blood. RF/microwave radiation is also known to decrease the production of melatonin, which protects against cancer, and to promote the growth of existing cancer cells.

Early warning scientists attacked

In recommending that the Precautionary Principle be applied in EMF matters, the European Environment Agency's Director Jacqueline McGlade wrote in 2009: "We have noted from previous health hazard histories such as that of lead in petrol, and methyl mercury, that 'early warning' scientists frequently suffer from discrimination, from loss of research funds, and from unduly personal attacks on their scientific integrity. It would be surprising if this is not already a feature of the present EMF controversy... » Such unfortunate consequences have indeed occurred.

The statement in the *Le Devoir* letter that « if we consider that a debate should take place, it should focus exclusively on the effects of cell phones on health » is basically an acknowledgement that there is at least some reason to be concerned about cell phones. However, while the immediate exposure from a cell phone is of much greater intensity than the exposure from smart meters, cell phone use is temporary.

Smart meters

As Australian Associate Professor of neurosurgery Vini G. Khurana reports, adverse neurological effects have been reported in people who sustain close proximity to wireless meters, especially under 10 feet (3 metres).

A wireless smart meter produces radiofrequency microwave radiation with two antennas in approximately the same frequency range (900 MHz to 2.4 GHz) as a typical cell tower. But, depending on how close it is to occupied space within a home, a smart meter can cause much higher RF exposures than cell towers commonly do. If a smart meter is located on a common wall with a bedroom or kitchen rather than a garage wall, for example, the RF exposure can be the same as being within 200 to 600 feet distance of a cell tower with multiple carriers. With both cell towers and smart meters, the entire body is immersed by microwaves that go out in all directions, which increases the risk of overexposure to many sensitive organs such as the eyes and testicles. With a cell phone, people are exposed to microwaves primarily in the head and neck (unless using speaker mode), and only when they use their device.

Wireless smart meters typically produce atypical, relatively potent and very short pulsed RF/microwaves whose biological effects have never been fully tested. They emit these

millisecond-long RF bursts on average 9,600 times a day with a maximum of 190,000 daily transmissions and a peak level emission two and a half times higher than the stated safety signal, as the California utility Pacific Gas & Electric recognized before that State's Public Utilities Commission. Thus people in proximity to a smart meter are at risk of significantly greater aggregate of RF/microwave exposure than with a cell phone, not to mention the cumulative exposure received by people living near multiple meters mounted together, pole-mounted routers or utility collector meters using a third antenna to relay RF signals from 500 to 5,000 homes.

A technical study performed by Sage Associates in California indicates that RF levels from various scenarios depicting normal smart meter installation and operation may violate even the out-of-date US public safety standards which only consider acute thermal effects. This can happen when a person stands close to the meter to read the power consumption, or touches it, or shades the meter face with a hand to better read it. Emissions are also increased by reflective materials, such as stainless steel, other metals and mirrors, which can re-radiate stronger than the otherwise unaltered background. Microwaves are absorbed and dissipated by partially conductive materials, such as cement and special RF shielding paints and fabrics.

In addition to the erratic bursts of modulated microwaves emitted by wireless smart meters transferring usage data to electric, gas and water utilities, wireless as well as wired smart (powerline communication) meters are also a major source of "dirty electricity" (electrical interference of high frequency voltage transients typically of kilohertz frequencies). Some scientists, such as American epidemiologist Sam Milham, believe that many of the health complaints about smart meters may also be caused by dirty electricity generated by the « switching » power supply activating all smart meters. Since the installation of filters to reduce dirty electricity circulating on house wiring has been found to relieve symptoms of EHS in some people, this method should be considered among the priorities aimed at reducing potential adverse impacts. Indeed, the Salzburg State (Austria) Public Health Department confirms its concern about the potential public health risk when in coming years almost every electric wire and device will emit such transient electric fields in the kilohertz-range due to wired smart meters.

Rather be safe than sorry

The apparent adverse health effects noted with smart meter exposure are likely to be further exacerbated if smart appliances that use wireless communications become the norm and further increase unwarranted exposure.

To date, there have been few independent studies of the health effects of such sources of more continuous but lower intensity microwaves. However, we know after decades of studies of hazardous chemical substances, that chronic exposure to low concentrations of microwaves can cause equal or even greater harm than an acute exposure to high concentrations of the same microwaves.

This is why so many scientists and medical experts urgently recommend that measures following the Precautionary Principle be applied immediately — such as using wired meters — to reduce biologically inappropriate microwave exposure. We are not advocating the abolishment of RF technologies, only the use of common sense and the development and implementation of best practices in using these technologies in order to reduce exposure and risk of health hazards.

- David O. Carpenter, MD, Director, Institute for Health & the Environment, University at Albany, USA
- Franz Adlkofer, M.D., Chairman of the Pandora Foundation, Coordinator of the European Reflex Report on DNA-damage by cellphone radiation, Neuendorf, Germany
- M. S. H. Al Salameh, PhD, Professor of Electrical Engineering, University of Science & Technology, Irbid, Jordan
- Jennifer Armstrong, MD, Past President, American Society for Environmental Medicine, Founder, Ottawa Environmental Health Clinic, Ontario, Canada
- Pierre L. Auger, MD, Occupational medicine, Multiclinique des accidentés 1464, Montreal, Quebec, Canada
- Igor Beliaev, PhD, Head research scientist, Cancer Research Institute, Slovak Academy of Sciences, Bratislava, Slovak republic
- Fiorella Belpoggi, PhD, Director Cesare Maltoni Cancer Research Center, Ramazzini Institute, Bologna, Italy
- Dominique Belpomme, MD, Director of the European Cancer and Environment Research Institute, Brussels, Belgium
- Martin Blank, PhD, former President, Bioelectromagnetics Society, Special Lecturer, Department of Physiology and Cellular Biophysics, Columbia University Medical Center, New York, USA
- Barry Breger, MD, Centre d'intégration somatosopique (orthomolecular medicine), Montreal, Quebec
- Simona Carrubba, PhD, Prof. Biophysics, Daemen College, Amherst, NY, Associate Researcher, Neurology, Buffalo General Hospital, Buffalo, NY
- John Cline, MD, Professor, Institute for Functional Medicine, Federal Way, WA, USA, Medical Director, Cline Medical Centre, Nanaimo, BC, Canada
- Alvaro Augusto de Salles, PhD, Professor of Electrical Engineering, Federal University of Rio Grande do Sul, Porto Alegre, Brazil
- Christos Georgiou, Prof. Biochemistry, Biology Department, University of Patras, Greece
- Andrew Goldsworthy, PhD, Honorary lecturer in Biology, Imperial College, London, UK
- Claudio Gómez-Perretta, MD, Director, Centro de Investigación, Hospital Universitario LA Fe, Valencia, Spain
- Livio Giuliani, PhD, Senior Researcher, National Insurance Institute (INAIL), Chief of Radiation and Ultrasounds Research Unit, Rome, Italy
- Yury Grigoriev, PhD, Chair Russian National Committee on Non-Ionizing Radiation Protection, Moscow, Russia
- Settimio Grimaldi, PhD, Director, Institute of Translational Pharmacology (Neurobiology and molecular medicine), National Research Council, Rome, Italy
- Magda Havas, PhD, Centre for Health Studies, Trent University, Canada
- Lennart Hardell, MD, Professor of Oncology, University Hospital, Örebro, Sweden
- Denis L. Henshaw, PhD, Professor of Physics, Head of The Human Radiation Effects Group, University of Bristol, UK
- Ronald B. Herberman, MD, Chairman of Board, Environmental Health Trust, and Founding Director emeritus, University of Pittsburgh Cancer Institute, USA
- Donald Hillman, PhD, Dairy Science, Professor Emeritus, Department of Animal Science, Michigan State University, USA
- Isaac Jamieson, PhD, Environmental Science (electromagnetic phenomena in the built environment), independent architect, scientist and environmental consultant, Hertfordshire, UK
- Olle Johansson, PhD, Professor of Neuroscience (Experimental Dermatology Unit), Karolinska Institute, Stockholm, Sweden
- Yury Kronn, PhD, Soviet authority on physics of nonlinear vibrations and high frequency electromagnetic vibrations, founder of Energy Tools International, Oregon, USA

- Vini G. Khurana, MBBS, Associate of Professor of Neurosurgery, Australian National University, Australia
- Henry Lai, PhD, Professor of Bioengineering, University of Washington School of Medicine, Seattle, WA, USA
- Abraham R. Liboff, PhD, Professor Emeritus, Department of Physics, Oakland University, Rochester, Michigan, USA
- Don Maisch, PhD, Researcher on radiation exposure standards for telecommunications frequency, EMFacts Consultancy, Tasmania, Australia
- Erica Mallery-Blythe, MD, Emergency Medicine Physician, England
- Andrew A. Marino, MD, Professor of Neurology, LSU Health Sciences Center, Shreveport, LA, USA
- Karl Maret, MD, President, Dove Health Alliance, Aptos, CA, USA
- Fiorenzo Marinelli, PhD, Researcher on biological effects of EMFs, Institute of Molecular Genetics, National Research Council, Bologna, Italy
- Andrew Michrowski, PhD, Director, Planetary Association for Clean Energy, Ottawa, Canada
- Sam Milham, MD, former chief epidemiologist, Washington State Department of Health, USA
- Joel M. Moskowitz, PhD, Director, Center for Family and Community Health, School of Public Health, University of California, Berkeley
- Gerd Oberfeld, MD, Public Health Department, Salzburg State Government, Austria
- Mike O'Carroll, PhD, Professor Emeritus (Applied Mathematics), University of Sunderland, UK
- Jerry L. Phillips, PhD, Director, Center for Excellence in Science, Department of Chemistry and Biochemistry, University of Colorado, USA
- John Podd, PhD, Professor of Psychology (experimental neuropsychology), Massey University, New-Zeland
- William J. Rea, MD, thoracic and cardiovascular surgeon, founder of the Environmental Health Center, Dallas, Tx, USA
- Elihu D. Richter, MD, Professor, Hebrew University-Hadassah School of Public Health and Community Medicine, Jerusalem, Israel
- Leif G. Salford, MD, Senior Professor of Neurosurgery, Lund University, Sweden
- Nesrin Seyhan, MD, Founder and Chair of Biophysics, Medical Faculty of Gazi University, Turkey
- Cyril W. Smith, PhD, lead author of "Electromagnetic Man", retired from Electronic and Electrical Engineering, University of Salford, UK
- Morando Soffritti, MD, Scientific Director of the European Foundation for Oncology and Environmental Sciences "B. Ramazzini" in Bologna, Italy
- Carlos Sosa, MD, surgeon affected by the Microwave syndrome, Medellin, Columbia
- Antoinette "Toni" Stein, PhD, Collaborative on Health and the Environment (CHE-EMF Working Group), Co-Coordinator, Berkeley, CA, USA
- Stanislaw Szmigielski, MD, PhD Professor of Pathophysiology, Consulting Expert, former director of Microwave Safety, Military Institute of Hygiene and Epidemiology, Warsaw, Poland
- Lauraine Vivian, PhD, Senior Lecturer, Primary Health Care Directorate, Faculty of Health Sciences, University of Cape Town, South Africa.
- Bradford S. Weeks, MD, Director, The Weeks Clinic, Clinton, WA, USA
- Stelios A. Zinelis, MD, Vice-President, Hellenic Cancer Society, Cefallonia, Greece

JEROMY JOHNSON

APPENDIX C

EVIDENCE FOR ELECTRO-HYPERSENSITIVITY

Electromagnetic hypersensitivity: evidence for a novel neurological syndrome.

McCarty DE, Carrubba S, Chesson AL, Frilot C, Gonzalez-Toledo E, Marino AA.

Department of Neurology, LSU Health Sciences Center, Shreveport, Louisiana 71130-3932, USA.

Abstract

OBJECTIVE: We sought direct evidence that acute exposure to environmental-strength electromagnetic fields (EMFs) could induce somatic reactions (EMF hypersensitivity).

METHODS: The subject, a female physician self-diagnosed with EMF hypersensitivity, was exposed to an average (over the head) 60-Hz electric field of 300 V/m (comparable with typical environmental-strength EMFs) during controlled provocation and behavioral studies.

RESULTS: In a double-blinded EMF provocation procedure specifically designed to minimize unintentional sensory cues, the subject developed temporal pain, headache, muscle twitching, and skipped heartbeats within 100 s after initiation of EMF exposure ($p < .05$). The symptoms were caused primarily by field transitions (off-on, on-off) rather than the presence of the field, as assessed by comparing the frequency and severity of the effects of pulsed and continuous fields in relation to sham exposure. The subject had no conscious perception of the field as judged by her inability to report its presence more often than in the sham control.

DISCUSSION: The subject demonstrated statistically reliable somatic reactions in response to exposure to subliminal EMFs under conditions that reasonably excluded a causative role for psychological processes.

CONCLUSION: EMF hypersensitivity can occur as a bona fide environmentally inducible neurological syndrome.

Radiation from Cordless Phones Causes Heart Irregularities, According to New Research Published Today in the European Journal of Oncology

October 23, 2010. Boulder, CO. Cordless phones, which transmit a similar pulsed signal as Wi-Fi networks at 2.4 Gigahertz, have been shown to impact heart rate in new research published today in the *European Journal of Oncology*.

READ ABSTRACT

The double-blind, peer reviewed study validates the condition complained of by increasing numbers of people across the globe today called 'electrosensitivity', demonstrating immediate effects on heart rate, almost doubling the heart rate in some cases. The study, "**Provocation Study using Heart Rate Variability Shows Radiation from 2.4 GHz Cordless Phone Affects Autonomic Nervous System**" (Eur. J. Oncol. Library, vol. 5) was led by Prof. Magda Havas, PhD of the Environmental & Resources Studies Department at Trent University, Canada. Co-investigators included Jeffrey Marrongelle, Bernard Pollner, Elizabeth Kelley, Camilla R.G. Rees and Lisa Tully.

Patients today experiencing electrohypersensitivity symptoms are commonly put on drugs for other conditions with similar symptoms, instead of being taught how to create an electromagnetically clean environment to eliminate symptoms.

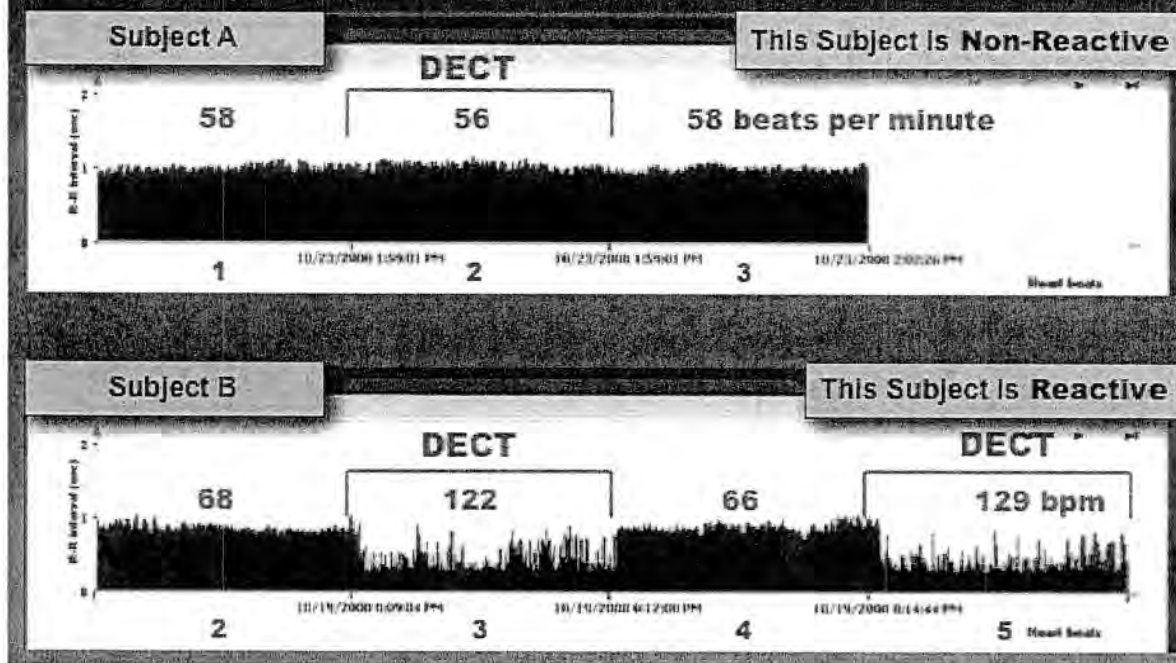
Havas' new study adds to the growing interest in the health effects of cell phones, which also transmit microwave radiation, broadening the focus beyond cell phones' association with brain tumors to their potential effect on other systems, including the heart. It also raises serious concern about risks of exposing schoolchildren to Wi-Fi networks, providing a possible explanation for why some children in schools with Wi-Fi are being diagnosed with, and medicated for, heart irregularities that they believe may linked to Wi-Fi. (See **CBS News Coverage on Dangers of Wi-Fi in School** and **Canadian Global TV Coverage of Dangers of Wi-Fi in School**)

"What we found is what many people have said for a long time about devices that emit microwaves," stated Dr. Havas. "People don't just feel ill, their heart begins to race and this is measurable with medical heart monitoring devices."

AUDIO INTERVIEW WITH DR. HAVAS

In the image below, from the study "*Provocation Study using Heart Rate Variability Shows Radiation from 2.4 GHz Cordless Phone Affects Autonomic Nervous System*" by Havas et al, Subject B experienced an increase in heart rate on exposure to a nearby portable phone. The heart rate immediately returned to the baseline after the cordless phone was unplugged.

Real Time Monitoring of Heart Beat with subjects exposed to a cordless DECT phone



[Download Image Here](#)

Havas' study in the *European Journal of Oncology* on heart rate variability was blinded, which means that the volunteers did not know when the phone was on or off. Forty percent (40%) of subjects had a moderate to severe reaction only when the phone's base station was on, and emitting microwaves. Those who responded experienced arrhythmia (irregular beats of the heart) and/or tachycardia (rapid heart rate). The symptoms were often accompanied by feelings of pain or pressure in the chest and anxiety that would appear and disappear for no apparent reason.

This is the first study documenting immediate and dramatic changes in heart rate associated with microwave radiation exposure at levels of exposure well below (0.5%) federal guidelines in Canada and the United States (1000 microW/cm²). It points to the extraordinary inadequacy of current exposure guidelines to protect the public's health.

Havas states, "While not everyone who is electrically sensitive responds in this manner, those who do will have difficulty being in environments where microwave radiation is present, which is virtually everywhere in our modern, wireless culture." She adds, "Cordless phones and cell phones as well as wireless computers and wi-fi networks generate this form of microwave radiation."

Additional symptoms of EHS include headaches, fatigue, difficulty concentrating, poor short-term memory, difficulty sleeping, skin problems, tinnitus, nausea, and dizziness. Many of these symptoms are subjective and difficult to measure.

Havas' study heralds the ability of health practitioners to determine if cardiac irregularities might be

triggered by electromagnetic radiation, using readily available assessment technology, before resorting to invasive or chemical symptom-suppressing cardiac therapeutics.

READ STUDY PUBLISHED IN THE EUROPEAN JOURNAL OF ONCOLOGY October 23, 2010

Dr. Havas is a world-renowned expert in electromagnetic fields. Her teaching and research is concerned with the biological effects of electromagnetic pollution including radio frequency radiation, electric and magnetic fields, dirty electricity and ground current. She is author of the ***BRAG Antenna Ranking of Schools Report***, which teaches schools how radiation exposure from neighborhood cell phone towers and antennas can be assessed and remediated, ***Zory's Archives***, an ongoing review of thousands of recently released studies on the biological effects of electromagnetic fields, dating back over a half century, drawn from U.S. government and military, and Russian and Eastern European, sources, and co-author of "***Public Health SOS: The Shadow Side of the Wireless Revolution***".

JEROMY JOHNSON

APPENDIX D

**STATEMENT FROM SANTA CRUZ COUNTY PUBLIC HEALTH OFFICIAL CITING RISKS
OF SMARTMETER™ PROGRAM**



County of Santa Cruz

HEALTH SERVICES AGENCY

POST OFFICE BOX 962, 1060 EMELINE AVE., SANTA CRUZ, CA 95061-0962
TELEPHONE: (831) 454-4114 FAX: (831) 454-5049 TDD: (831) 454-4123

Poki Stewart Namkung, M.D., M.P.H.
Health Officer
Public Health Division

Memorandum

Date: January 13, 2012
To: Santa Cruz County Board of Supervisors
From: Poki Stewart Namkung, M.D., M.P.H. *PWN*
Health Officer
Subject: Health Risks Associated With SmartMeters

Overview

On December 13, 2011, Santa Cruz County Board of Supervisors directed the Public Health Officer to return on January 24, 2012, with an analysis of the research on the health effects of SmartMeters.

Background

In order to analyze the potential health risks associated with SmartMeters, the following questions should be asked:

- 1) What is the SmartMeter system and what is the potential radiation exposure from the system?
- 2) What scientific evidence exists about the potential health risks associated with SmartMeters?
- 3) Are there actions that the public might take to mitigate any potential harm from SmartMeters?

SmartMeters are a new type of electrical meter that will measure consumer energy usage and send the information back to the utility by a wireless signal in the form of pulsed frequencies within the 800 MHz to 2400MHz range, contained in the microwave portion of the electromagnetic spectrum. SmartMeters are considered part of 'smart grid' technology that includes: a) a mesh network or series of pole-mounted wireless antennas at the neighborhood level to collect and transmit wireless information from all SmartMeters in that area back to the utility; b) collector meters, which are a special type of SmartMeter that collects the radiofrequency or microwave radiation signals from many surrounding

buildings (500-5000 homes or buildings) and sends the information back to the utility, and c) proposed for the future, a power transmitter to measure the energy use of individual appliances (e.g. washing machines, clothes dryers, dishwasher, etc) and send information via wireless radio frequency signal back to the SmartMeter. The primary rationale for SmartMeters and grid networks is to more accurately monitor and direct energy usage.

The public health issue of concern in regard to SmartMeters is the involuntary exposure of individuals and households to electromagnetic field (EMF) radiation. EMFs are everywhere, coming from both natural and man-made sources. The three broad classes of EMF are:

- extremely low frequency, ELF (from the sun or powerlines)
- radio frequency, RF (from communication devices, wireless devices, and SmartMeters)
- extremely high frequency, known as ionizing radiation (x-rays and gamma rays)

Much of this exposure is beyond our control and is a matter of personal choice; however, public exposure to RF fields is growing exponentially due to the proliferation of cell phones, and wireless fidelity (Wi-Fi) technology. To understand the relationship between EMF from SmartMeters and other sources, it is helpful to view the electromagnetic spectrum:

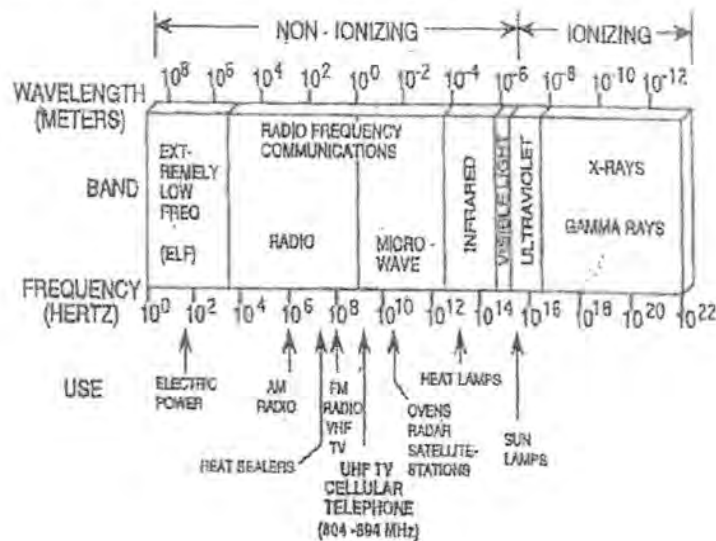


Fig. 1: The electromagnetic spectrum, showing the relations between ELF and RF fields, wavelength and frequency, and the ionizing and non-ionizing portions of the spectrum.

The Federal Communications Commission (FCC) has adopted limits for Maximum Permissible Exposure (MPE) that are based on exposure guidelines published by the National Council on Radiation Protection and Measurements (NCRP). The limits vary with

the frequency of the electromagnetic radiation and are expressed in units of microwatts per centimeter squared. A SmartMeter contains two antennas whose combined time-averaged public safety limit of exposure is $655\mu\text{W}/\text{cm}^2$ (Sage, 2011). According to the California Council on Science and Technology (CCST) Report (2011), within distances of three to ten feet, SmartMeters would not exceed this limit. However, CCST did not account for the frequency of transmissions, reflection factors, banks of SmartMeters firing simultaneously, and distances closer than three feet. There are numerous situations in which the distance between the SmartMeters and humans is less than three feet on an ongoing basis, e.g. a SmartMeter mounted on the external wall to a bedroom with the bed placed adjacent to that mounting next to the internal wall. That distance is estimated to be one foot. The CCST Report also states that SmartMeters will generally transmit data once every four hours, and once the grid is fully functional, may transmit "more frequently." It has been aptly demonstrated by computer modeling and real measurement of existing meters that SmartMeters emit frequencies almost continuously, day and night, seven days a week. Furthermore, it is not possible to program them to not operate at 100% of a duty cycle (continuously) and therefore it should not be possible to state that SmartMeters do not exceed the time-averaged exposure limit. Additionally, exposure is additive and consumers may have already increased their exposures to radiofrequency radiation in the home through the voluntary use of wireless devices such as cell and cordless phones, personal digital assistants (PDAs), routers for internet access, home security systems, wireless baby surveillance (baby monitors) and other emerging devices. It would be impossible to know how close a consumer might be to their limit, making safety a uncertainty with the installation of a mandatory SmartMeter.

This report will focus on the documented health risks of EMF in general, the relevance of that data to SmartMeters exposure, the established guidelines for RF safety to the public at large, and then provide recommendations to ameliorate the risk to the public's health.

Evidence-based Health Risks of EMFs

There is no scientific literature on the health risks of SmartMeters in particular as they are a new technology. However, there is a large body of research on the health risks of EMFs. Much of the data is concentrated on cell phone usage and as SmartMeters occupy the same energy spectrum as cell phones and depending on conditions, can exceed the whole body radiation exposure of cell phones (see Attachment B1, Figure 4). In terms of health risks, the causal factor under study is RF radiation whether it be from cell phones, Wi-Fi routers, cordless phones, or SmartMeters. Therefore all available, peer-reviewed, scientific research data can be extrapolated to apply to SmartMeters, taking into consideration the magnitude and the intensity of the exposure.

Since the mid-1990's the use of cellular and wireless devices has increased exponentially exposing the public to massively increased levels of RF. There is however, debate regarding the health risks posed to the public given these increased levels of radiation. It must be noted that there is little basic science funding for this type of research and it is largely funded by industry. An intriguing divide, noted by Genuis, 2011 is that most

research carried out by independent non-government or non-industry affiliated researchers suggests potentially serious effects from many non-ionizing radiation exposures; most research carried out by independent non-government or non-industry affiliated researchers suggests potentially serious effects from many non-ionizing radiation exposures research funded by industry and some governments seems to cast doubt on the potential for harm. Elements of the controversy stem from inability to replicate findings consistently in laboratory animal studies. However, analysis of many of the conflicting studies is not valid as the methodology used is not comparable. Despite this controversy, evidence is accumulating on the results of exposure to RF at non-thermal levels including increased permeability of the blood-brain barrier in the head (Eberhardt, 2008), harmful effects on sperm, double strand breaks in DNA which could lead to cancer genesis (Phillips, 2011), stress gene activation indicating an exposure to a toxin (Blank, 2011), and alterations in brain glucose metabolism (Volkow, 2011).

In terms of meta-analyzed epidemiological studies, all case-control epidemiological studies covering >10 years of cell phone use have reported an increased risk of brain tumors from the use of mobile phones (Hallberg, 2011). Other studies have pointed to an increasing risk of acoustic neuroma, salivary gland tumors, and eye cancer after several years of cell phone use and the tumors occur predominantly on the same side of the head as the phone is used. The analysis of brain cancer statistics since the mid 20th century in several countries reveals that brain tumor formation has a long latency time, an average of over 30 years to develop from initial damage. (Hallberg, 2011). Therefore using studies such as the Interphone Study which looked at shorter latency periods for the development of specific brain cancers will result in inconclusive data.

Another potential health risk related to EMF exposure, whose legitimacy as a phenomenon remains contentious, is electromagnetic hypersensitivity (EHS). In the 1950's, various centers in Eastern Europe began to describe and treat thousands of workers, generally employed in jobs involving microwave transmission. The afflicted individuals often presented with symptoms such as headaches, weakness, sleep disturbance, emotional instability, dizziness, memory impairment, fatigue, and heart palpitations. Clinical research to verify the physiological nature of this condition did not begin in earnest until the 1990's and found that the EMF involved was usually within the non-ionizing range of the electromagnetic spectrum. In the early 2000's, estimates of the occurrence of EHS began to swell with studies estimating the prevalence of this condition to be about 1.5% of the population of Sweden (Hilleert et al., 2002), 3.2% in California (Levallios et al., 2002), and 8% in Germany (infas Institut für angewandte Sozialwissenschaft GmbH, 2003).

In 2004, WHO declared EHS "a phenomenon where individuals experience adverse health effect while using or being in the vicinity of devices emanating electric, magnetic, or electromagnetic fields (EMFs)...Whatever its cause, EHS is a real and sometimes debilitating problem for the affected persons (Mild et al., 2004)."

Currently, research has demonstrated objective evidence to support the EHS diagnosis, defining pathophysiological mechanisms including immune dysregulation in vitro, with

increased production of selected cytokines and disruption and dysregulation of catecholamine physiology (Genius, 2011).

Until recently, the diagnosis of EHS has not received much support from the medical community due to lack of objective evidence. In an effort to determine the legitimacy of EHS as a neurological disorder, however, a collection of scientists and physicians recently conducted a double-blinded research study that concluded that "EMF hypersensitivity can occur as a bona fide environmentally-inducible neurological syndrome (McCarty et al., 2011).

Safety Guidelines

The guidelines currently used by the FCC were adopted in 1996, are thermally based, and are believed to protect against injury that may be caused by acute exposures that result in tissue heating or electric shock. FCC guidelines have a much lower certainty of safety than standards. Meeting the current FCC guidelines only assures that one should not have heat damage from SmartMeter exposure. It says nothing about safety from the risk of many chronic diseases that the public is most concerned about such as cancer, miscarriage, birth defects, semen quality, autoimmune diseases, etc. Therefore, when it comes to nonthermal effects of RF, FCC guidelines are irrelevant and cannot be used for any claims of SmartMeter safety unless heat damage is involved (Li, 2011).

There are no current, relevant public safety standards for pulsed RF involving chronic exposure of the public, nor of sensitive populations, nor of people with metal and medical implants that can be affected both by localized heating and by electromagnetic interference (EMI) for medical wireless implanted devices. Many other countries (9) have significantly lower RF/MW exposure standards ranging from 0.001 to 50 $\mu\text{W}/\text{cm}^2$ as compared with the US guideline of 200-1000 $\mu\text{W}/\text{cm}^2$. Note that these recommended levels are considerably lower than the approximately 600 $\mu\text{W}/\text{cm}^2$. (time-averaged) allowed for the RFR from SmartMeters operating in the low 900 MHz band mandated by the FCC based on only thermal consideration.

In summary, there is no scientific data to determine if there is a safe RF exposure level regarding its non-thermal effects. The question for governmental agencies is that given the uncertainty of safety, the evidence of existing and potential harm, should we err on the side of safety and take the precautionary avoidance measures? The two unique features of SmartMeter exposure are: 1) universal exposure thus far because of mandatory installation ensuring that virtually every household is exposed; 2) involuntary exposure whether one has a SmartMeter on their home or not due to the already ubiquitous saturation of installation in Santa Cruz County. Governmental agencies for protecting public health and safety should be much more vigilant towards involuntary environmental exposures because governmental agencies are the only defense against such involuntary exposure. Examples of actions that the public might take to limit exposure to electromagnetic radiation can be found in Attachment B2.

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JEREMY JOHNSON

APPENDIX E

**PROFESSIONAL ENGINEER OUTLINES KNOWN FINANCIAL RISKS OF
SMARTMETER™ PROGRAM**

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Two engineers have been diligently working on Smart Meter dirty power and RF issues - the combined team possess two MS degrees from MIT, a California P.E. license (Professional Engineer's License), and a PhD from Stanford in Electrical Engineering, Magna Cum Laude. They have been working on this nearly continuously for the last four months.

The scientific data tells us that 5% of the population will get sick immediately from RF disease, and another 10% will develop the disease over time. This means about 4.5 million people in California are potential victims. Since individuals with no history of RF disease are experiencing symptoms the first day the meter is installed, we can assume the meter's RF emissions are not the only problem. The RF network is activated months after initial meter installation.

Extensive measurements have demonstrated that all of the meters measured so far, including ABB, GE, and Landis Gyr, emit noise on the customer's electric wiring in the form of high frequency voltage spikes, typically with an amplitude of 2 volts, but a frequency any where from 4,000 Hertz, up to 60,000 Hz. The actual frequency of the phenomena is influenced by the devices that are plugged into the customer's power. Some houses are much worse than others, and this observation has been confirmed by PG&E installers that have talked to us.

Since 85% of the population is not significantly affected by this phenomenon, the knowledge about what is causing symptoms in PG&E's customers will be slow to evolve. We expect word of mouth to be the primary information source since the media is so disconnected from this phenomena.

The scientific literature has studied microwave illness since the 1930's when radar operators became ill. Radar equipment emits radiation that is intermittent, and recent scientific papers have increasingly reported that pulsed radiation is significantly worse than continuous radiation. Humans have been exposed to continuous microwave transmissions from radio for decades. Exposure Smart Meters presents to California citizens is new and unlike previous electromagnetic emissions.

PG&E has published none of the functional specifications of the meters now being installed, including their BLOCK DIAGRAMS, SCHEMATICS, or BILL OF MATERIALS. The scientific community has been prevented from identifying any of the design problems prior to their installations.

The decisions by PG&E and the CPUC to conduct NO SAFETY STUDIES has forced them to discover the current problem after the meters have been installed and after

significant capital has been invested in this project. Even a rudimentary safety test with 100 randomly selected people would have probably uncovered this problem long before its appearance in PG&E's customer base.

The fix for preventing dirty power disease in PG&E customers is expensive. Because the dirty power must be stopped in the customer's LOW IMPEDANCE house wiring, all of the filter components must handle high power, and therefore are expensive. Current estimates put the end customer cost at \$500, and that does not include fixing dirty power interactions Smart Meter causes with devices already in the customer's home, such as computers, FAX machines, copiers, plasma TV's, and the like. Merely treating 15% of the California households puts the total liability for aftermarket problems at \$2B, approximately equal to the entire cost of the existing program's roll out.

Though 15% of the population has early and obvious symptoms, a large number of microwave disease related health problems will not surface for some time. As science advances, the links between microwave disease and its sources will only improve, causing ever increasing liability for societal institutions that are responsible for the offending emissions. Though the cell phone industry has purchased immunity from liability through their extensive lobbying efforts, the experience of the tobacco and chemical industries has shown that this immunity can fade as priorities of the general population effects the political process.

Though microwave disease is not directly observed in 85% of the population, the asymptomatic effects (meaning effects that have no apparent symptoms) are well published in the scientific literature, and span a wide variety of lethal and debilitating diseases, including cancers, auto immune diseases, suicide risk, depression, tinnitus (ringing in the ears), and a host of others. Steve Job's pancreas and liver problems are particularly conspicuous when manifested in a lifelong vegetarian who was chronically exposed to pulsed microwave emissions from Wi-Fi, computer power supplies, and the like. Liability for microwave diseases could explode in the future, as data in the cell phone industry already suggests.

Among the population of effected individuals, there are sure to be attorneys who are experienced in class actions suits, and who clearly recognize a \$2B avoidable cost has been imposed on an unwilling public. This type of law suit has been responsible for some of the largest corporate liabilities in our civilization's history, and has already affected PG&E and the CPUC in the past (hexavalent chromium in Hinkley CA).

Once the California real estate community becomes aware that 15% of the general population will no longer be able to live, work, or shop in their properties, the potential liability will be in the trillions of dollars, and will effect a population of wealthy individuals who have significant political influence in Sacramento. These entrepreneurs have been particularly skilled at legally punishing institutions that are responsible for declines in their asset values. In fact, the asset base of the retirement trust of California's state employees is significantly exposed to California's real estate market.

A reasonable person could conclude that the potential liability PG&E currently faces, both immediately and in the evolving future, could be significantly larger than their asset base. Their long term survival as a corporation could be at risk, and a potential outcome could include the wholesale transfer of their asset base into receivership pending settlement of outstanding liabilities. Legal liability could force PG&E to approach the CPUC for a doubling of the existing utility rate. This would be a politically untenable request, and could result in the dissolution of the CPUC's existing regulator authority.

The future for both the CPUC and PG&E is uncertain, and potentially disastrous. A prudent course would be to treat the entire Smart Grid project in California as a major risk, and to aggressively engage in damage control. Since the technology that is actively being dismantled by the CPUC and PG&E has previously demonstrated none of the current risks, an aggressive plan to offer an analog meter opt out is a prudent option. Since so much damage has already been done, there are no guarantees that even this measure will prevail. PG&E's current course of relying on PR spin has little chance of stemming the trends that have already been set in motion.

JEROMY JOHNSON

APPENDIX F

THE BIOLOGICAL EFFECTS OF WEAK ELECTROMAGNETIC FIELDS

The Biological Effects of Weak Electromagnetic Fields

Problems and solutions

Andrew Goldsworthy March 2012

Foreword

Dr Andrew Goldsworthy is a retired lecturer from Imperial College London, which is among the top three UK universities after Oxford and Cambridge and is renowned for its expertise in electrical engineering and health matters. Dr Goldsworthy spent many years studying calcium metabolism in living cells and also how cells, tissues and organisms are affected by electrical and electromagnetic fields. You may find much of what he says both surprising and worrying.

In this article, he explains how weak electromagnetic fields from cell phones, cordless phones and WiFi can have serious effects on our health. These include damage to glands resulting in obesity and related disorders, chronic fatigue, autism, increases in allergies and multiple chemical sensitivities, early dementia, DNA damage, loss of fertility and cancer.

All this happens at levels of radiation that our governments and the cell phone companies tell us are safe because the radiation is too weak to cause significant heating. **This is the only criterion that they use to assess safety.** In fact, the direct electrical effect on our cells, organs and tissues do far more damage to us at energy levels that may be hundreds or thousands of times lower than those that cause significant heating. These are termed non-thermal effects and **our governments are doing nothing to protect us from them.**

Abstract

Many of the reported biological effects of non-ionising electromagnetic fields occur at levels too low to cause significant heating; i.e. they are non thermal. Most of them can be accounted for by electrical effects on living cells and their membranes. The alternating fields generate alternating electric currents that flow through cells and tissues and remove structurally-important calcium ions from cell membranes, which then makes them leak.

Electromagnetically treated water (as generated by electronic water conditioners used to remove lime scale from plumbing) has similar effects, implying that the effects of the fields can also be carried in the bloodstream. Virtually all of the non-thermal effects of electromagnetic radiation can be accounted for by the leakage of cell membranes.

Most of them involve the inward leakage of free calcium ions down an enormous electrochemical gradient to affect calcium-sensitive enzyme systems. This is the normal mechanism by which cells sense mechanical membrane damage. They normally respond by triggering mechanisms that stimulate growth and repair, including the MAP-kinase cascades, which amplify the signal.

If the damage is not too severe or prolonged, we see a stimulation of growth and the effect seems beneficial, but if the exposure is prolonged, these mechanisms are overcome and the result is ultimately harmful. This phenomenon occurs with both ionising and non-ionising radiation and is called radiation hormesis. Gland cells are a good example of this, since

short term exposures stimulate their activity but long term exposures cause visible damage and a loss of function. Damage to the thyroid gland from living within 100 metres of a cell phone base station caused hypothyroidism and may be partially responsible for our current outbreak of obesity and chronic fatigue.

Secondary effects of obesity include diabetes, gangrene, cardiac problems, renal failure and cancer. Cell phone base station radiation also affects the adrenal glands and stimulates the production of adrenalin and cortisol. Excess adrenalin causes headaches, cardiac arrhythmia, high blood pressure, tremors and an inability to sleep, all of which have been reported by people living close to base stations. The production of cortisol weakens the immune system and could make people living near base stations more susceptible to disease and cancer.

Inward calcium leakage in the neurons of the brain stimulates hyperactivity and makes it less able to concentrate on tasks, resulting in attention deficit hyperactivity disorder (ADHD). When this happens in the brains of unborn babies and young children, it reduces their ability to concentrate on learning social skills and can cause autism. Leakage of the cells of the peripheral nervous system in adults makes them send false signals to the brain, which results in the symptoms of electromagnetic intolerance (aka electromagnetic hypersensitivity). Some forms of electromagnetic intolerance may be due to cell phone damage to the parathyroid gland, which controls the calcium level in the blood and makes cell membranes more inclined to leak. Further exposure could then tip them over the edge into full symptoms of electromagnetic intolerance.

Cell phone radiation damages DNA indirectly, either by the leakage of digestive enzymes from lysosomes or the production of reactive oxygen species (ROS) from damaged mitochondrial and plasma membranes. The results are similar to those from exposure to gamma rays from a radioactive isotope.

Effects of DNA damage include an increased risk of cancer and a loss of fertility, both of which have been found in epidemiological studies. The effects of cell phone and WiFi radiation have also been determined experimentally using ejaculated semen. The results showed the production of ROS, and a loss of sperm quality and, in some cases, DNA fragmentation.

The inward leakage of calcium ions from electromagnetic fields also opens the various tight junction barriers in our bodies that normally protect us from allergens and toxins in the environment and prevent toxic materials in the bloodstream from entering sensitive parts of the body such as the brain. The opening of the blood-brain barrier has been shown to cause the death of neurons and can be expected to result in early dementia and Alzheimer's disease. The opening of the barrier in our respiratory epithelia by electromagnetic fields has been shown to increase the risk of asthma in children and the opening of the blood-liver barrier may be partially responsible for the current outbreak of liver disease. The opening of other barriers, such as the gut barrier allows foreign materials from the gut to enter the bloodstream, which may also promote allergies and has been linked autoimmune diseases.

Cell membranes also act as electrical insulators for the natural DC electric currents that they use to transmit power. Mitochondrial membranes use the flow of hydrogen ions to couple the oxidation of food to the production of ATP. The outer cell membrane uses the flow of sodium ions to couple the ATP produced to the uptake of nutrients. If either of these leak, or are permanently damaged, both of these processes will be compromised leading to a loss of available energy, which some people believe to be a contributory factor to chronic fatigue syndrome.

The mechanism underlying electromagnetically-induced membrane leakage is that weak ELF currents flowing through tissues preferentially remove structurally important calcium ions, but they have been shown to do so only within certain amplitude windows, above and below which there is little or no effect. This means that there is no simple dose-response curve, which many people find confusing, but a plausible theoretical model is described. The mechanism also explains why certain frequencies especially 16Hz is particularly effective.

Living cells have evolved defence mechanisms against non-ionising radiation. These include pumping out surplus calcium that has leaked into the cytosol, the closure of gap junctions to isolate the damaged cell, the production of ornithine decarboxylase to stabilize DNA and the production of heat-shock proteins, which act as chaperones to protect important enzymes. However, this is expensive in energy and resources and leads to a loss of cellular efficiency. If the exposure to the radiation is prolonged or frequently repeated, any stimulation of growth caused by the initial ingress of calcium runs out of resources and growth and repair becomes inhibited. If the repairs fail, the cell may die or become permanently damaged.

To some degree, we can make our own electromagnetic environment safer by avoiding ELF electrical and magnetic fields and radio waves that have been pulsed or amplitude modulated at ELF frequencies. The ELF frequencies that give damaging biological effects, as measured by calcium release from brain slices and ornithine decarboxylase production in tissue cultures, lie between 6Hz and 600Hz. It is unfortunate that virtually all digital mobile telecommunications systems use pulses within this range. The Industry clearly did not do its homework before letting these technologies loose on the general public and this omission may already have cost many lives.

Even now, it may be possible reverse their effects by burying the pulses in random magnetic noise, as proposed by Litovitz in the 1990s or by cancelling out the pulses using balanced signal technology but, at present, the Industry does not seem to be interested in either of these.

Until the mobile telecommunications industry makes its products more biologically friendly, we have little alternative but to reduce our personal exposure as far as possible by using cell phones only in emergencies, avoiding DECT cordless phones and substituting WiFi with Ethernet. The only DECT phones that are even remotely acceptable are those that automatically switch off the base station between calls; e.g. the Siemens Gigaset C595 operating in Eco Plus mode. If you are highly electromagnetically intolerant, you may need to screen your home or at the very least your bed from incoming microwave radiation and sleep as far away as possible from known sources of ELF.

INTRODUCTION

There have been many instances of harmful effects of electromagnetic fields from cell phones (aka mobile phones), DECT phones (aka cordless phones), WiFi, power lines and domestic wiring. They include an increased risk of cancer, loss of fertility, effects on the brain and symptoms of electromagnetic intolerance. Many people still believe that, because the energy of the fields is too low to give significant heating, they cannot have any biological effect. However, the evidence that alternating electromagnetic fields *can* have non-thermal biological effects is now overwhelming. See www.bioinitiative.org and www.neilcherry.com. The explanation is that it is not a heating effect, but mainly an electrical effect on the fine structure of the electrically-charged cell membranes upon which all living cells depend.

Alternating electromagnetic fields can induce *alternating currents* to flow through living cells and tissues. These can interfere with the normal *direct currents* and voltages that are essential for the metabolism of all cells. Virtually every living cell is a seething mass of electric currents and electrical and biochemical amplifiers that are essential for their normal

function. Some have tremendous amplifying capacity; e.g. it is claimed that a dark adapted human eye can detect a single photon (the smallest possible unit of light) and the human ear can hear sounds with energies as low as a billionth of a watt. We should therefore not be too surprised to find that our cells can detect and respond to electromagnetic fields that are orders of magnitude below the strength needed to generate significant heat.

My main objective here is to show how most of the adverse health effects of electromagnetic fields can be attributed to a single cause; that being that they remove structurally-important calcium ions (electrically-charged calcium atoms) from cell membranes, which then makes these membranes leak. I will explain the scientific evidence leading to this conclusion and also how we can put matters right, but still keep on using cell phones and other wireless communications. I have included key references that should enable the more inquisitive reader to delve deeper. In many cases, you should be able to find the abstract of the paper in question by copying into Google its entry in the list of references.

Electromagnetic fields affect many but not all people

Many of the experiments on the biological effects of alternating electromagnetic fields appear to give inconsistent results. There are many reasons for this, including differences in the genetic make-up, physiological condition and the history of the test material. In humans, reported effects include an increased risk of cancer, effects on brain function, loss of fertility, metabolic changes, fatigue, disruption of the immune system, and various symptoms of electromagnetic intolerance.

Not everyone is affected in the same way and some may not be affected at all. However, there is increasing evidence that the situation is getting worse. Our electromagnetic exposure is rapidly increasing and previously healthy people are now becoming sensitised to it. In this study, I am concentrating on the cases where there have been definite effects; since this is the most efficient way in which we can find out what is going wrong and what can be done to prevent it.

The frequency of the fields is important

The fields that give the most trouble are in the extremely low frequency range (ELF) and also radio frequencies that are pulsed or amplitude modulated by ELF. (Amplitude modulation is where the strength of a *carrier wave* transmits information by rising and falling in time with a lower frequency that carries the information.).

Why microwaves are particularly damaging

The frequency of the carrier wave is also important. Higher frequencies such as the microwaves used in cell phones, WiFi and DECT phones, are the most damaging. Our present exposure to man-made microwaves is about a million billion billion (one followed by eighteen zeros) times greater than our natural exposure to these frequencies. We did not evolve in this environment and we should not be too surprised to find that at least some people may not be genetically adapted to it. As with most populations faced with an environmental change, those members that are not adapted either become ill, die prematurely or fail to reproduce adequately. Ironically, those who are electromagnetically intolerant may be better equipped to survive since they are driven to do whatever they can to avoid the radiation.

The main reason why microwaves are especially damaging is probably because of the ease with which the currents that they generate penetrate cell membranes. Cell membranes have a very high resistance to direct currents but, because they are so thin

(about 10nm), they behave like capacitors so that alternating currents pass through them easily. Since the effective resistance of a capacitor to alternating current (its *reactance*) is inversely proportional to its frequency, microwave currents pass through the membranes of cells and tissues more easily than radio waves of lower frequencies and can therefore do more damage to the cell contents.

Calcium loss from cell membranes explains most of the adverse health effects

I became interested in this topic when I was working on the biological effects of physically (magnetically) conditioned water, which is widely used to remove lime scale from boilers and plumbing. It is made by allowing tap water to flow rapidly between the poles of a powerful magnet or by exposing it to a weak pulsed electromagnetic field from an electronic water conditioner. Water treated in this way can remove calcium ions (electrically charged calcium atoms) from surfaces, and the effect on the water can last for several days. I was following up some Russian and Israeli work that had shown that magnetically conditioned water could increase the growth of crops, but it turned out to be far more important than that. The underlying principle was also to explain the mechanisms by which weak electromagnetic fields can damage living cells and also what can be done to stop it.

Magnetically conditioned water and electromagnetic fields have similar effects

Probably, our most important discovery was that when tap water was conditioned by weak electromagnetic fields, the treated water gave similar effects in yeast to those from exposing the yeast itself, amongst which was an increased permeability of their cell membranes to poisons (Goldsworthy *et al.* 1999). Since it had been known since the work of Bawin *et al.* (1975) that weak electromagnetic fields could remove calcium ions from the surfaces of brain cells, it seemed likely that both the conditioned water and the electromagnetic fields were working in the same way; i.e. **by removing structurally-important calcium ions from cell membranes, which then made them leak**. We now know that membrane leakage of this kind can explain most of the biological effects of both conditioned water and of direct exposure to electromagnetic fields.

The effects on growth depend on the length of the conditioning treatment

We also showed that the effects of conditioned water on the growth of yeast cultures depended on the length of the conditioning process. Less than 30 seconds of conditioning stimulated growth but more than this inhibited growth. It was as if the conditioning process was steadily generating one or more chemical agents in the water. A low dose from the shorter conditioning period stimulated growth, but longer conditioning periods gave higher doses, which were inhibitory. This toxic effect of heavily conditioned water, where the water is recycled continuously through the conditioner, has now been exploited commercially to poison blanket weed in ornamental ponds (www.lifescience.co.uk/domestic_blanketweed.htm). By the same token, blood continually circulating for prolonged periods under the pulsating fields from a cell phone or similar device could become toxic to the rest of the body. This means that no part of the body, from the brain to the liver and gonads, can be considered to be safe from the toxic effects of pulsed electromagnetic fields.

Radiation hormesis

Many people have shown similar dual effects with direct exposure to both *ionising and non-ionising radiation*. Small doses of otherwise harmful radiation often stimulate growth and appear to be beneficial (a phenomenon known as *radiation hormesis*) but larger doses are harmful. It also explains why small doses of pulsed magnetic fields are effective in

treating some medical conditions such as broken bones (Bassett *et al.* 1974) but prolonged exposure (as we will see later) is harmful.

It also explains some of the apparent inconsistencies found when comparing different experiments and why meta-analysis of the data should be treated with caution. Clear positive and clear negative results (depending on the dose and the condition of the material) when taken together could be mistaken for no effect, but with a high degree of variability.

Cells have tremendous powers to amplify and respond to weak signals

We now know that electromagnetic growth stimulation is almost certainly due to electrochemical amplification followed by the activation of the MAP kinase cascades by free calcium ions leaking into the cytosol (the main part of the cell). The inward leakage of calcium ions is the normal mechanism by which a cell senses that it has been damaged and triggers the necessary repair mechanisms. This involves huge amplification processes so that even minor leakage (e.g. due to membrane perforation or weak electromagnetic fields) can give rapid and often massive responses.

The first stage in the amplification is due to the calcium gradient itself. There is an enormous (over a thousand fold) concentration difference for free calcium between the inside and outside of living cells. In addition, there is a voltage difference of many tens of mV acting in the same direction. This means that even a slight change in the leakiness of the cell membrane can permit a very large inflow of calcium ions. It's like a transistor, where a slight change in the charge in the base can allow a massive current to flow through it under the influence of a high voltage gradient between the emitter and collector.

The next stage in the amplification is due to the extremely low calcium concentration in the cytosol so that even a small ingress of calcium ions makes a big *percentage* difference, to which many enzymes within the cell are sensitive.

Even more amplification comes from the MAP-kinase cascades. These are biochemical amplifiers that enable tiny amounts of growth factors or hormones (perhaps even a single molecule) to give very large effects. They consist of chains of enzymes acting in sequence so that the first enzyme activates many molecules of the second enzyme, which in turn activates still more of the third enzyme etc. The final stage then activates the protein synthesising machinery needed for cell growth and repair.

At least some of these cascades need calcium ions to work (Cho *et al.* 1992) so the inward leakage of calcium through damaged cell membranes will increase the rate of these processes to stimulate growth and repair. However, these repairs can make deep inroads into the cell's energy and resources, and its ability to make good the damage will depend on its physiological and nutritional condition. This means that, if the damage is prolonged or persistent, sooner or later it runs out of resources and gives up, which is when we see the inhibitory phase, perhaps followed by apoptosis (cell death) or the loss of some of the cell's normal functions. We are now seeing this loss of function increasingly after prolonged human exposure to cell phone base station radiation; e.g. the loss of thyroid gland function after six years of exposure (Eskander *et al.* 2012).

Effects on Glands

Gland cells are particularly sensitive to radiation

Gland cells may be particularly sensitive to radiation because their secretions are normally produced in internal membrane systems, which can also be damaged. Their secretions are usually released in vesicles (bubbles of membrane) that fuse with the external

cell membrane and discharge their contents to the outside (exocytosis). The vesicle membrane then becomes part of the external membrane. The resulting excess external membrane is counterbalanced by the reverse process (endocytosis) in which the external membrane buds off vesicles to the inside of the cell, which then fuse with the internal membranes. In this way, an active gland cell may internalise the equivalent of its entire surface membrane about once every half an hour. This means that if the surface membrane is damaged directly by the fields, or by electromagnetically conditioned blood, the damaged membrane rapidly becomes part of the internal membrane system, upon which its normal activity depends. If the damage is too severe, the whole gland may lose its normal function.

Electromagnetic effects on the endocrine system and obesity

Although electromagnetic fields frequently stimulate glandular activity in the short term, long term exposure is often harmful in that the gland ceases to work properly. This is particularly serious for the glands of the endocrine system (those that coordinate our bodily functions) since it can affect many aspects of metabolism and throw the whole body out of kilter. For example it may be responsible, at least in part, for the current outbreak of obesity and the many other illnesses that stem from it.

An good example of this is the thyroid gland, which is in an exposed position in the front of the neck. Rajkovic *et al.* (2003) showed that after three months exposure to power line frequencies, the thyroid glands of rats showed visible signs of deterioration. They also lost their ability to produce the thyroid hormones, which they did not recover even after the fields were switched off. Esmekaya *et al.* (2010) found a similar visible deterioration of the thyroid gland in rats exposed to simulated 2G cell phone radiation for 20 minutes a day for three weeks. Eskander *et al.* (2012) found that people living for six years within 100 metres of a cell phone base station showed a significant reduction in the release into the blood of a number of hormones, including ACTH from the pituitary gland, cortisol from the adrenal glands, and prolactin and testosterone from organs elsewhere. However, the most highly significant loss was in their ability to produce the thyroid hormones. The expected consequence of this is hypothyroidism, the most frequent symptoms of which are **fatigue** and **obesity**. It may not be a coincidence that about a quarter of a million UK citizens are now suffering from what is being diagnosed as chronic fatigue syndrome, and about eight out of ten are either overweight or clinically obese.

The incidence of obesity may be exacerbated by effects on the release of the appetite regulating hormones ghrelin and peptide YY. Ghrelin is synthesised in the stomach wall and makes us feel hungry, whereas peptide YY is made in the intestine wall and makes us feel full. In normal people the level of ghrelin in the blood is high before a meal and goes down afterwards whereas peptide YY goes up, so we go from feeling hungry to feeling full, which stops us overeating.

However, in obese people the level of both hormones stays roughly the same throughout so that they never feel completely full and eat in an unregulated manner (Le Roux *et al.* 2005, Le Roux *et al.* 2006). If prolonged exposure to electromagnetic fields limits the release of these hormones in the same way as they affect the release of ACTH, cortisol, prolactin, testosterone and the thyroid hormones, it may explain why so many people find it difficult to stop eating and end up being clinically obese.

If you are affected in this way, you may be forced to go on a life-long diet, undergo gastric bypass surgery to drastically reduce the size of your stomach or risk the many serious diseases that stem from obesity **AND IT MAY NOT HAVE BEEN YOUR FAULT**. Think twice before you use a cell phone or install a cordless phone or WiFi. The consequences are only now becoming apparent; neither the Government nor the telecommunications industry will tell you what they are, but they are not good.

Obesity can trigger many other illnesses

The consequences of obesity include **diabetes, gangrene, high blood pressure, cardiac problems, renal failure and cancer**. Between them, they cause a great deal of human suffering and cost the nation's economy a great deal of money. The annual cost of obesity and related illnesses to the UK economy has been estimated as being around £6.6 – 7.4 billion (McCormick *et al.* 2007).

The annual cost of chronic fatigue syndrome is about \$20000 per affected person in the USA (Reynolds *et al.* <http://www.resource-allocation.com/content/2/1/4>) and about £14000 in the UK (McCrone *et al.* 2003) so a fair estimate of the total annual cost of chronic fatigue syndrome to the UK economy would be somewhere in the region £3.5 billion. The total annual cost of both conditions together is about £10 billion. If part of this is due to microwave telecommunications, measures need to be taken to minimise their effects, and it would be only fair to ask the Industry to pay for this.

Electromagnetic effects on the adrenal gland

Cortisol: - Augner *et al.* (2010) in a double blind study (where neither the subject nor the person recording the results knows whether the radiation is switched on or off) showed that short-term exposure to the radiation from a 2G (GSM) cell phone base station increased the cortisol level in the saliva of human volunteers. Cortisol is a stress hormone that is normally produced in the cortex of the adrenal glands and is controlled by the calcium level in its cells (Davies *et al.* 1985) so electromagnetically- induced membrane leakage letting more calcium into the cytosol should also have this effect.

Cortisol is part of a mechanism that puts the body into a “fight or flight” mode, in which more sugar is released into the blood, sensitivity to pain is reduced and the immune system is suppressed. In fact, cortisol and its relatives are used medicinally to relieve pain and also to suppress the immune system after transplant surgery. However, when exposure to base station radiation does it, it is not good news since the suppression of the immune system will also increase the risk of infection and of developing tumours from precancerous cells that might otherwise have been destroyed.

Adrenalin: - Buchner and Eger (2011) studied the effect of a newly installed 2G cell phone base station on villagers in Bavaria and found that it caused a long-lived increase in the production of adrenalin. This is an important neurotransmitter which acts on adrenergic receptors to increase the calcium concentration in the cytosol. It is also synthesised in the adrenal medulla in response to signals from the sympathetic nervous system. Adrenalin too puts the body into fight or flight mode by diverting resources from the smooth muscles of the gut to the heart muscle and the skeletal muscles needed for flight or combat. In addition, it stimulates the production of cortisol by the adrenal cortex, and indirectly reduces the activity of the immune system, resistance to disease and increases the risk of getting cancer.

Some people get pleasure from the “adrenalin rush” caused by doing energetic or dangerous things, and this could be a contributory factor to the addictive nature of cell phones. However, on the down side, known effects of excess adrenalin include, headaches, cardiac arrhythmia, high blood pressure, tremors, anxiety and inability to sleep. These results confirm and explain some of the findings of Abdel-Rassoul *et al.* (2007) who found that people living near cell towers (masts) had significantly increases in headaches, memory loss, dizziness, tremors and poor sleep.

Effects on the Brain

Calcium leakage and brain function

Normal brain function depends on the orderly transmission of signals through a mass of about 100 billion *neurons*. Neurons are typically highly branched nerve cells. They usually have one long branch (*the axon*), which carries electrical signals as *action potentials* (nerve impulses) to or from other parts of the body or between relatively distant parts of the brain (a nerve contains many axons bundled together). The shorter branches communicate with other neurons where their ends are adjacent at *synapses*. They transmit information across the synapses using a range of *neurotransmitters*, which are chemicals secreted by one neuron and detected by the other.

Calcium ions play an essential role in brain function because a small amount of calcium must enter the cytosol of the neuron before it can release its neurotransmitters (Alberts *et al.* 2002). Electromagnetically-induced membrane leakage would increase the background level of calcium in the neurons so that they release their neurotransmitters sooner. This improves our reaction time to simple stimuli but it can also trigger the spontaneous release of neurotransmitters to send spurious signals that have no right to be there, which makes the brain hyperactive and less able to concentrate.

Autism

Possibly, the greatest damage to the brain from microwaves is when it is first developing in the foetus and the very young child, where it can lead to autism. Dr Dietrich Klinghardt has shown a relationship between microwaves and autism; a summary of his work can be found at <http://electromagnetichealth.org/media-stories/#Autism> .

What is autism?

Autism is a group of life-long disorders (autistic spectrum disorders or ASD) caused by brain malfunctions and is associated with subtle changes in brain anatomy (see Amaral *et al.* 2008 for a review). The core symptoms are an inability to communicate adequately with others and include abnormal social behaviour, poor verbal and non-verbal communication, unusual and restricted interests, and persistent repetitive behaviour. There are also non-core symptoms, such as an increased risk of epileptic seizures, anxiety and mood disorders. ASD has a strong genetic component, occurs predominantly in males and tends to run in families.

Genetic ASD may be caused by calcium entering neurons

It has been hypothesised that some genetic forms of ASD can be accounted for by known mutations in the genes for ion channels that result in an increased background concentration of calcium in neurons. This would be expected to lead to neuronal hyperactivity and the formation of sometimes unnecessary and inappropriate synapses, which in turn can lead to ASD (Krey and Dolmetsch 2007).

Electromagnetic fields also let calcium into neurons

There has been a 60-fold increase in ASD in recent years, which cannot be accounted for by improvements in diagnostic methods and can only be explained by changes in the environment. This increase corresponds in time to the proliferation of mobile telecommunications, WiFi, and microwave ovens as well as extremely low frequency fields from household wiring and domestic appliances. We can now explain at least some of this in

terms of electromagnetically-induced membrane leakage leading to brain hyperactivity and abnormal brain development.

How membrane leakage affects neurons

Neurons transmit information between one another in as chemical neurotransmitters that pass across the synapses where they make contact. Their release is normally triggered by a brief pulse of calcium entering their cytosols. If the membrane is leaky due to electromagnetic exposure, it will already have a high internal calcium concentration as calcium leaks in from the much higher concentration outside. This puts the cells into hair-trigger mode so that they are more likely to release neurotransmitters and the brain as a whole may become hyperactive (Beason and Semm 2002; Krey and Dolmetsch 2007, Volkow *et al.* 2011). This results in the brain becoming overloaded with sometimes spurious signals leading to a loss of concentration and attention deficit hyperactive disorder (ADHD).

How does this impact on autism?

Before and just after its birth, a child's brain is a blank canvas, and it goes through an intense period of learning to become aware of the significance of its new sensory inputs, e.g. to recognise its mother's face, her expressions and eventually other people and their relationship to him/her (Hawley and Gunner 2000). During this process, the neurons in the brain make countless new connections, the patterns of which store what the child has learnt. However, after a matter of months, connections that are rarely used are pruned automatically (Huttenlocher and Dabholkar 1997) so that those that remain are hard-wired into the child's psyche. The production of too many spurious signals due to electromagnetic exposure during this period will generate frequent random connections, which will also not be pruned, even though they may not make sense. It may be significant that autistic children tend to have slightly larger heads, possibly to accommodate unpruned neurons (Hill and Frith 2003).

Because the pruning process in electromagnetically-exposed children may be more random, it could leave the child with a defective hard-wired mind-set for social interactions, which may then contribute to the various autistic spectrum disorders. These children are not necessarily unintelligent; they may even have more brain cells than the rest of us and some may actually be savants. They may just be held back from having a normal life by a deficiency in the dedicated hard-wired neural networks needed for efficient communication.

Autism costs the UK economy more than the tax income from cell phones

The incidence of autism has occurred in parallel with the increase in electromagnetic pollution over the last thirty years. The chance of having an autistic child may now be as high as one in fifty. Apart from the personal tragedies for the affected children and their families, autism is of enormous economic importance. In the UK alone, the annual cost to the Nation in care and lost production exceeds the annual tax revenue from the entire cell phone industry, which is about 20billion UK pounds.

<http://www2.lse.ac.uk/newsAndMedia/news/archives/2009/05/MartinKnappAutism.aspx> If it were all due to cell phones, the Government could close down the entire industry and actually show a profit! There may be ways in which the modulation of the signal can be changed to avoid this (see later), but in the meantime, we should do whatever we can to minimise our exposure to information-carrying microwaves, including those from cell phones, DECT phones, WiFi and smart meters. Failure to do this could be very costly.

Electromagnetic intolerance (aka electromagnetic hypersensitivity or EHS)

Electromagnetic intolerance is a condition in which some people experience a wide range of unpleasant symptoms when exposed to weak non-ionising radiation. About 3 percent of the population suffers in this way at present, although only a small proportion of these are as yet so badly affected that they can instantly tell whether a radiating device is switched on or off. At the other end of the scale, there are people who are sensitive but do not yet know it because they are chronically exposed to electromagnetic fields and accept their symptoms as being perfectly normal. Electromagnetic intolerance is in fact a continuum with no clear cut-off point. In some cases there may only be relatively mild symptoms on or after using a cell phone but in severe cases it can prevent people living a normal life and force them to live in almost total isolation. There is every reason to believe that prolonged exposure will increase the severity of the symptoms, so if you suffer from any of them you should do whatever possible to minimise further exposure.

Symptoms of electromagnetic intolerance

Symptoms include skin rashes, cardiac arrhythmia, headaches (sometimes severe), pain in muscles and joints, sensations of heat or cold, pins and needles, tinnitus, dizziness and nausea. A more complete list can be found at <http://www.es-uk.info/info/recognising.asp>. Most if not all of these can be explained by the radiation making cells leak.

When skin cells leak, it is perceived by the body as damage to the tissue. This increases the blood supply to the area to repair the damage and causes the rash.

When the cells of the heart muscle leak it weakens the electrical signals that normally control its contraction. The heart then runs out of control to give cardiac arrhythmia. This is potentially life threatening.

When sensory cells leak, they become hyperactive and send false signals to the brain. We have a variety of sensory cells, but they all work in much the same way. Whenever they sense what they are supposed to sense, they deliberately leak by opening ion channels in their membranes. This reduces the natural voltage across these membranes, which makes them send nerve impulses to the brain. Electromagnetically induced cell leakage would have the same effect, but this time it would make them send *false* signals to the brain to give the false sensations of electromagnetic intolerance. This could also be exacerbated by the nerve cells involved being made hyperactive due to calcium ingress.

When leakage occurs in the sensory cells of the skin, it can give sensations such as heat, cold, tingling, pressure etc, depending on which types of cell are most sensitive in the individual concerned.

When leakage occurs in the sensory hair cells of the cochlea of ear it gives tinnitus, which is a false sensation of sound. When it occurs in the vestibular system (the part of the inner ear that deals with balance and motion) it results in dizziness and symptoms of motion sickness, including nausea.

Hypocalcaemia, electromagnetic intolerance and the parathyroid gland

Symptoms of hypocalcaemia are very similar to those of electromagnetic intolerance and include skin disorders, pins and needles, numbness, sensations of burning, fatigue, muscle cramps, cardiac arrhythmia, gastro-intestinal problems and many others. A more comprehensive list can be found at <http://www.endotext.org/parathyroid/parathyroid7/parathyroid7.htm>. It is possible that some

forms of electromagnetic intolerance are due to low levels of calcium in the blood. Electromagnetic exposure would then remove even more calcium from their cell membranes to push them over the edge and give the symptoms of electromagnetic intolerance.

The amount of calcium in the blood is controlled by the parathyroid hormone secreted by the parathyroid gland, which is in the neck, close to where you hold your cell phone. It is adjacent to the thyroid gland and, if it were to be damaged by the radiation in the same way, the production of the parathyroid hormone would go down, the amount of calcium in the blood would be reduced and the person concerned would become electromagnetically intolerant.

Effects on DNA

Cell phone radiation can damage DNA

Lai and Singh (1995) were the first to show this in cultured rat brain cells, but it has since been confirmed by many other workers. A comprehensive study on this was in the Reflex Project, sponsored by the European Commission and replicated in laboratories in several European countries. They found that radiation like that from GSM (2G) cell phone handsets caused both single and double stranded breaks in the DNA of cultured human and animal cells. Not all cell types were equally affected and some, such as lymphocytes, seemed not to be affected at all (Reflex Report 2004).

In susceptible cells, the degree of damage depended on the duration of the exposure. With human fibroblasts, it reached a maximum at around 16 hours (Djem *et al.* 2005). However, it would be unwise to assume that exposures of less than 16 hours are necessarily safe since DNA damage may give genetically aberrant cells long before it becomes obvious under the microscope. It would also be unwise to assume that the damage would be restricted to the immediate vicinity of the handset since, as described earlier; the effects of the radiation can be transmitted in the bloodstream in the form of magnetically conditioned blood; so nowhere is safe, not even the sex organs.

How the DNA is damaged

Because of the very high stability of DNA molecules, they are unlikely to be damaged directly by weak radiation. The most plausible mechanism is that DNase (an enzyme that destroys DNA) and other digestive enzymes leak through the membranes of lysosomes (organelles that digest waste) that have been damaged by the radiation. Other mechanisms involve the leakage of reactive oxygen species (ROS) such as hydrogen peroxide from damaged peroxisomes and superoxide free radicals from damaged mitochondrial membranes and NADH oxidase in the plasma membrane. According to Friedman *et al.* (2007), the first to respond to non-thermal cell phone frequencies is the NADH oxidase in the plasma membrane, which is activated within minutes of exposure.

However, all of these ROS can initiate peroxidation chain reactions in the polyunsaturated phospholipids of cell membranes (the same thing that makes fats go rancid) which disrupts the membranes further and exacerbates the effect. Only one molecule of ROS is needed to initiate a domino-effect chain reaction, in which each damaged lipid molecule generates a free radical that damages the next one. The process normally stops when it reaches an anti-oxidant molecule, which sacrifices itself by combining with the free radical in such a way that it does not generate a new one. Most of our anti-oxidants come from our diet (e.g. vitamin E) but the most important one that we make ourselves is *melatonin*. It's unfortunate that the production of melatonin by the pineal gland is also

disrupted by electromagnetic fields (Henshaw and Reiter, 2005) which makes matters worse.

These ROS are highly reactive and can also damage DNA. In fact, much of the damage done to cells by *ionising radiation* such as *gamma rays* is due to damage to cell membranes and DNA by free radicals from the radiolysis of water. There may therefore be little difference between holding a cell phone to your head and holding a radioactive source of gamma rays. Both can damage cell membranes, cause the fragmentation of DNA and also do considerable collateral damage to other cellular components, which may either kill the cells or make them lose their normal function over time.

Cell phones increase the risk of cancer

If similar DNA fragmentation were to occur in the whole organism, we would expect an increased risk of cancer, since essential genes that control cell division may be either damaged or lost. Recent studies on the incidence of brain cancer are already beginning to show this. Heavy cell phone use roughly doubles the risk of getting brain cancers in adults on the side of the head used for the cell phone. For younger people, the risk increases to five times more (Hardell and Carlberg 2009). Since brain cancers normally take decades to develop, it is too soon to assess the final impact of the radiation, but the World Health Organisation has already classified cell phones as a Group 2B Carcinogen (possibly carcinogenic) similar to benzene and DDT. Other head cancers are also on the increase, including cancers of the parotid salivary gland (next to where you hold your cell phone) and the thyroid gland, which is in the neck.

Cell phones reduce male fertility

We might expect DNA damage in the cells of the germ-line (the line of cells starting in the embryo that eventually gives rise to eggs and sperm) to result in a loss of fertility. A number of epidemiological studies have shown significant reductions in sperm motility, viability and quantity in men using cell phones for more than a few hours a day (Fejes *et al.* 2005; Agarwal *et al.* 2006) and the subject was reviewed by Desai *et al.* (2009). A common finding is that these effects were associated with the production of reactive oxygen species (ROS) which can damage many cellular components, including cell membranes and DNA.

More recently, Agarwal *et al.* (2009) found in controlled experiments that ejaculated sperm from healthy donors showed reduced viability and motility and an increase in ROS after one hour's exposure to a cell phone in talk mode. More recently still, Avandano *et al.* 2012 found that exposing ejaculated semen to a WiFi laptop for four hours gave a decrease in sperm motility and an increase in DNA fragmentation as compared with samples exposed to a similar computer with the WiFi switched off.

A similar relationship between sperm quality and electromagnetic exposure has also been found for low frequency alternating magnetic fields (Li *et al.* 2010). It is therefore advisable for men to avoid strong magnetic fields, restrict their cell phone calls to a minimum and keep them switched off (or in airplane mode if it has this facility). Otherwise, the phones transmit regularly at full power to the base station, even when not in use. If they have to be switched on for any reason, men should at least keep them out of their trouser pockets.

Possible effects on female fertility

We do not yet know the effects of cell phone use on human female fertility, but Panagopoulos *et al.* (2007) showed that exposing adult *Drosophila melanogaster* (an insect

JEROMY JOHNSON

APPENDIX G

**STUDY SHOWING IMPACTS TO MAMALIAN BRAIN RELATED TO LEARNING,
MEMORY AND ALZHEIMER'S IMPACTED BY WHOLE BODY EMF EXPOSURE**

Greek Researchers Show Crucial Regions of the Brain Related to Learning, Memory, Alzheimer's Impacted by Whole Body EMF Exposure in Animals

25.01.2012 by emily Category [Electromagnetic Health Blog](#)

A Greek scientific study led by Adamantia Fragopoulou and Lukas Margaritis has demonstrated important protein changes in the brain of animals following whole body exposure to RF electromagnetic fields, similar to the kind of microwave radiation emitted from cell phones, portable phones, WiFi and wireless computer equipment. The study, “**Brain proteome response following whole body exposure of mice to mobile phone or wireless DECT base radiation**”, was published in *[Electromagnetic Biology and Medicine](#)*. Early Online: 1–25, 2012 (See Abstract, below).

Important regions of the brain necessary for **learning, memory** and **other functions of the mammalian brain** were impacted by the microwave radiation, including the **hippocampus, cerebellum** and **frontal lobe**, at exposures *below* the ICNIRP (*International Commission on Non-Ionizing Radiation Protection*) safety

guidelines. A total of 143 proteins in the brain were impacted by the RF radiation over a period of 8 months, providing new evidence for a potential relationship between everyday cell phone use, wireless transmitters and wireless computer equipment and electrosensitivity symptoms, such as headaches, dizziness and sleep disorders, as well as with tumors, Alzheimer's and even metabolic effects.

The study simulated 3 hours of cell phone exposure over eight months, 8 hours of DECT portable phone exposure over eight months, and included a sham exposure control group. The results showed both down regulation and up regulation of the proteins.

TABLE 1 Number of differentially expressed proteins across three major brain regions, following long-term electromagnetic radiation exposure to conventional mobile phone (M) and DECT wireless base (B).

Proteins	Hippocampus		Frontal lobe		Cerebellum	
	B	M	B	M	B	M
Upregulated	11	37	12	19	8	36
Downregulated	11	33	11	18	10	18
Total number of proteins changed	22	70	23	37	18	54

Several **neural function related proteins** (i.e. Glial Fibrillary Acidic Protein (GFAP), Alpha-synuclein, Glia Maturation Factor beta (GMF), and apolipoprotein E (apoE)), heat shock proteins, and cytoskeletal proteins (i.e. neurofilaments and tropomodulin), were shown to be impacted by the radiation, as well as **proteins of the brain metabolism** (i.e. Aspartate aminotransferase, Glutamate dehydrogenase), in *nearly all of the brain regions studied*.



Figure 2 from the study shows the 143 proteins that have changed (up- or down-regulated) and their functional relationship based on a literature survey.



Adamantia F. Fragopoulou, M.Sc., PhD Candidate, in the Dept of Cell Biology and Biophysics at University of Athens, Greece, lead author of the study, says,

“Our study is important because it shows for the first time protein changes in the mouse brain after EMF exposure and in particular in very crucial regions like **hippocampus, cerebellum and frontal lobe, all involved in learning, memory and other complicated functions of the mammalian brain.** We have demonstrated that **143 proteins** are altered after electromagnetic radiation, including proteins that have been correlated so far with Alzheimer’s, glioblastoma, stress and metabolism. In its perspective, this study is anticipated to throw light in the understanding of such health effects like headaches, dizziness, sleep disorders, memory disorders, brain tumors, all of them related, to the function of the altered brain proteins.

“Until now there is limited evidence relating EMFs with the impact on specific brain proteins. Further analysis of the affected proteins as well as replicating the experiment under similar conditions (data presently under analysis) is expected to offer new insights explaining the overall effects.”



Lukas H. Margaritis, PhD, Professor Emeritus (as of Sept 2010) of Cell Biology and Radiobiology, Dept of Cell Biology and Biophysics, University of Athens, head of the Athens research group, says,

“A **high throughput approach (mass characterization of biomolecules, similar to microarrays that analyze the total genes of an organism)** as that of the **Proteomics*** has never been used so far in **EMF research of BRAIN TISSUES** following whole body exposure of model animals (mice) at **SAR values below ICNIRP’s recommendations.** It is also the first time that wireless DECT phones base radiation is involved in lab animal studies and specifically in such molecular effects. The message taken out of this work is that people should be very cautious when using mobile phones next to their body (especially next to their brain), whereas the wireless DECT should be located as far away as possible from places that people use to spend many hours a day, not to mention children of all ages.”

** Proteomics is the study of the structure and function of proteins. Proteins are the primary components of the physiological metabolic pathways of all cells. They influence the functioning of all bodily systems, such as the immune system, endocrine system, neurological system (including cognitive function),*

respiratory system, etc. Malfunction in protein integrity has been linked to hereditary diseases, nervous system disorders, diabetes, to name just a few cases. Proteins are responsible for energy production and information transfer, in fact modern CELL BIOLOGY considers that there is no single cellular function that is not mediated by proteins.

The study by Fragopoulou et al. suggests immediate follow up on these findings are warranted, as changes in molecular effects in the brain can raise questions about what the effects would be on the brain **after much longer durations** of exposure to RF radiation, as is common today from frequent cell phone use and wireless exposures, as well as the **effect of cumulative exposures** on the brain and mental functioning; immune system defects; fatigue; chronic sleep disorders; and effects on fetuses and sperm quality. The research extends our understanding from the **Volkow et al. study** (*JAMA. 2011;305(8):808-813. doi: 10.1001/jama.2011.186*), which demonstrated impacts of cell phone radiation exposure on brain glucose metabolism, without understanding the mechanisms of action. The Fragopoulou et al. study presents a plausible theory why glucose metabolism in the brain may become altered, possibly through an oxidative stress effect.

Special Concern for Children

Regarding the implications of the Greek findings for the learning capability of children in formative years, the authors say,

“The evidence for dysregulation of proteins in the brain from whole body exposure to RF/MW radiation, such as the radiation emitted by cell phones, portable phones, wireless devices or ambient RF/MW from cell towers, whether proteins are upregulated or downregulated, is of great concern for its impact on children’s capacity to learn.”

When considered together with other studies published by the University of Athens team ([Fragopoulou et al., 2010](#), on **spatial memory disorder**, and [Ntzouni et al., 2011](#) on **recognition memory disorders**), the authors say, “This proteome study implies that mobile phone radiation exposure at a normal intensity (and even below ICNIRP’s guidelines) is capable of detuning **learning/memory functions** and possibly other brain functions important in **person-to-person communication and understanding**. The impacts on society are unpredictable as EMFs are not a drug that is delivered to specific body parts or functions. EMFs can attack through oxidative stress every single cell that receives enough energy at non-thermal levels. The potential consequences for learning, memory and interpersonal relations, at the very least, need society’s immediate attention, given the widespread exposure to microwave radiation across the globe.”

People exposed to microwave radiation from cell phones, wireless networks and citywide Wi-Fi have long complained of cognitive difficulties ranging from attention problems, difficulty focusing, poor memory, visual and hearing disruptions, headaches, dizziness, depression and foggy thinking. The Fragopoulou et al. study deepens scientists’ understanding of the **mechanisms of action** of microwave radiation’s effect on the brain, and on mental functioning, due to changes in proteins and in protein functioning .

Dr. Martin Blank, Associate Professor, Department of Physiology and Cellular Biophysics, Columbia University, and Past President of the Bioelectromagnetics Society, says,

“The paper by Goodman and Henderson (1987) showed that short-term (minutes) exposure to EMF will

stimulate protein synthesis, and Fragopoulou et al. now show that this can lead to important changes in brain composition and function. Such changes may account for symptoms like insomnia, nervousness, fatigue, headaches, etc. that people report after exposure to cell phones and other wireless technologies. The biological verdict became obvious when Goodman and Blank (1994) showed that cells react to EMF as potentially harmful by activating the cellular stress response. There is no question that we should limit our exposure to EMF to help protect our brains and all cells in the body.”

Studies Showing RF Effects Below Safety Guidelines

A growing body of research clearly shows health effects from microwave radiation *at non-thermal levels* of exposure, and effects at exposures far lower than international safety guidelines. One review of the literature, by Carlos Sosa, MD of Columbia, South America, found biological effects from non-thermal levels of EMF exposure at exposure levels well below international safety guidelines in several respects:

	Effects at:	Less Than Guidelines
Psychological changes	.03 W/kg	50x Less
Immune System Effects	.015 W/kg	100x Less
Increase Calcium Efflux	.005 W/kg	300x Less
DNA Damages	.0024W/kg	600x Less
Induces Stress Response	.0110 W/kg	1,600x Less
Affects BBB	.0004 W/kg	4,000x Less
Affects Cardia Ca	.00015 W/kg	10,600x Less
Enhances Cell Proliferation	.00002 W/kg	76,000x Less

Source: Carlos Sosa, MD

The UK charity MobileWise recently published *“Mobile phone health risks: the case for action to protect children”* in November 2011, summarizing and listing more than 200 peer-reviewed studies from a range of international research institutions linking mobile phones at non-thermal exposures to serious biological and health consequences.

A Russian team of researchers also has recently released a study published in **Radiation Biology, Radiation Ecology 2011**. Volume 51, No.5, p 611-623 showing **significant long-term (4 years) cognitive decline in children** (ages 7-12) in users of mobile devices compared to controls, once again demonstrating exposure guidelines are inadequate. Lead author of the study, Professor Yury Grigoriev, Chairman of Russian National Committee on Non-Ionizing Radiation Protection and a member of the WHO’s International Advisory Committee on “EMF and Health”, says,

“Our recent 4-year monitoring of effects from cell phone radiation on children, published in Radiation Biology. Radiation Ecology (Volume 51, No.5, 2011), demonstrates an increase in phonemic perception disorders, abatement of efficiency, reduced indicators for the arbitrary and semantic memory and increased fatigue. Over the four-year monitoring of 196 children ages 7-12 who were users of mobile communication devices, a steady decline in these parameters from high values to bottom standards compared to controls, was observed. **The short-term and long-term potential consequences for society from exposing children to microwave radiation from cellular communication devices must be immediately acknowledged, globally, and**

responsibly addressed.”

A history of exposure standard setting in the telecommunications industry, [The Procrustean Approach](#), by Don Maisch, PhD of EMF Facts in Australia, describes *‘the manipulation of telecommunications standards by political, military, and industrial vested interests at the expense of public health protection.’*

The [Seletun Scientific Statement](#), a statement by international scientists in February 2011 ([watch video](#)), called for reduction EMF exposures globally to reflect the known biological effects at radiation exposures far lower than international guidelines in order to protect the public health and the health of future generations.

The recent Fragopoulou et al. research adds to the body of science demonstrating we are changing and disregulating biological functioning in the brain with the unchecked proliferation of RF electromagnetic fields from telecommunication and utility technologies. These effects are occurring at exposures below safety guidelines and the safety guidelines urgently need to be changed to protect public health.

JEROMY JOHNSON

APPENDIX H

STATEMENT OF QUALIFICATIONS

1 **JEROMY JOHNSON**

2 **STATEMENT OF QUALIFICATIONS**

3 Q 1 Please state your name and address.

4 A 1 My name is Jeromy Johnson and I live in San Francisco, California.

5 Q 2 Briefly describe your work responsibilities.

6 A 2 I work as a tax accountant and have a business, EMF Analysis Associates, which helps
7 people understand and reduce the electromagnetic field pollution in their homes and
8 businesses.

9 Q 3 Please summarize your educational and professional background.

10 A 3 I have bachelors and masters degrees in Civil and Environmental Engineering from the
11 South Dakota School of Mines and Technology. I graduated from the South Dakota
12 School of Mines and Technology in 1999. I have worked in the fields of engineering,
13 financial planning and tax accounting.

14 Q 4 What is the purpose of your testimony?

15 A 4 The purpose of my testimony is to show that it is unreasonable to force citizens to pay a
16 fee in order to opt-out of a technology for which there are questions of safety. In the
17 face of substantial public concern and thousands of people reporting health problems,
18 the utilities have not acted prudently. Thus, any costs associated with the SmartMeter™
19 Opt-Out Program should be borne by the utilities and their investors.

20 Q 5 Does this conclude your statement of qualifications?

21 A 5 Yes, it does.