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I want to thank the Commissioners for opening this docket, to allow the truth to come to light out about the smart meters, along with the strong arm tactics, threats, intimidation and prevarications by NV Energy (NVE) to their customers.

This comment will encompass eight (8) months of on going non-responsiveness from NVE, prevarications, science, federal issues, health, safety, and security. I will start with a chronology of my interactions with NVE with related documentation. Then I will incorporate highly referenced scientific and medical standpoint with both peer reviewed articles, professional medical assessments and other government citations on acceptance, legalities or endorsements of non-acceptance/deployment of smart meters (s'meters), refuting NVE claim that these meters are no more dangerous than a cell phone and proof that the smart grid is incompatible with solar power, which is one of the renewable energy sources NVE is seeking to implement.

I would like to address the 'expected' response from NVE about their financial outlay for these s'meters. They received a 138 million dollar grant for these meters, to help offset the purchase price of these 'necessary' s'meters. Which according to Paul Kaleta, (Kaleta)" *is to be matched by NVE for its advanced delivery service project…"* when he on October 8, 2010 presented "NV Energy Smart Grid: Opportunities and State Regulatory Challenges at the 2010 EEI Fall Legal Conference (Conference). Exhibit 1

Since NVE is manically obsessed over their chronic 'perceived' losses and necessity for rate increases, how is this possible: "..*on Oct. 7, 2011, NVE announced today that it will* ***redeem all of its outstanding 6 3/4% Senior Notes due 2017 (the "6 3/4% Notes"), totaling $191,500,000 in principal amount, on November 7, 2011*** *(the "Redemption Date"). Upon such redemption, there will not be any 6 3/4% Notes outstanding. The 6 3/4% Notes will be redeemed at a redemption price of 102.250% of the principal amount (the "Redemption Price"), plus accrued and unpaid interest up to but not including November 7, 2011.* Exhibit 2

These notes did not require prepayment by six (6) years. This payment should have been used to pay for the s'meters that they purchased in anticipation of public acceptance. The interest is minimal on these notes and the prepayment of

the s'meters, for every current meter, would have allowed less 'losses' than they are feigning, prior to be assured of consumer acceptance.

According to the Terms and Conditions of sale from Sensus, Section 17 " RETURNS. No Equipment may be returned for credit or repair without the prior written authorization of Sensus. Authorized return shipments must be returned in good condition to Sensus' designated receiving point, must be accompanied by a packing slip, including Sensus' Return Authorization Number, and must have transportation charges prepaid. Correspondence concerning all returned Equipment must be addressed to the appropriate Sensus office. Sensus reserves the right to deduct an adequate service charge to cover all inspection, testing and handling from any credit." Exhibit 3

Is NVE going to return the s'meters that their customers are refusing? Or are the customers going to be saddled with their hallucinogenic dream of full deployment?

Customers were never notified of what their 'share' of the cost of the s'meters will be. If we use the figures that we have heard from NVE, the s'meter program will be funded with 138 million grant matched by NVE equal contribution, for 1.45 million s'meters. Thus the cost of the meter will be approximately $190/meter. Initially the customer will be paying $8.00 for the meter. If we 'assume' that at the rate of $5/month it would take approximately 36 months to 'pay off' the purchase price of the s'meter, how much longer for the 'profit', along with installation costs on this 'investment'. Along with 'taxes' for energy efficiency etc. Since these taxes are a defined percentage charged per kilowatts used, no one has the identical power consumption, therefore, some customers will have their 'portion' paid off sooner than others, yet, others will never have paid their 'fair share' of this purchase. Who is going to make up the difference? This is discrimination as those with larger bills are carrying more of the financial burden.

If these s'meters are able to circumvent employees from coming out to turn on/off service, saving NVE money, to be 'passed' on to the consumer, one has to seriously wonder how much this 'automated' service will actually cost. According to their flier dated July 1, 2011 Nevada Power Company d/b/a NV Energy Electric Rate Schedules for Residential Customers, they are charging the customer **Remote meter charge...$ 100.00.** Is this charge for the s'meter or to have 'modifications' done via the s'meter? Since we are 'technically' paying for these, but, do not own them, then NVE is solely responsible for their care and maintenance, why is there a "**Other customer– requested visits...$ 15.00"?** Along with "**Additional meter test charge...$ 10.00".** Currently, NVE owns both the analog and s'meter, if they malfunction, it should be part of their 'service', not an additional charge to the customer. What does their currently monthly service charge actually include? Exhibit 4

You do not need to be a CPA to see this is a highly thought out scheme to present something as a benefit to consumers, when in fact it is lucrative to NVE's financial bottom line.

Since these s'meters have a 'lifespan' of about 20 years, are we going to be bulldozed again, down the road with these replacement costs? Or is NVE going to be solely responsible for these replacement s'meters? We didn't have to pay for the analogs initially, nor when they were replaced, so why are we being forced to pay for something that we will never own?

Why are customers who do not have the s'meters on their homes/businesses paying for these taxes when they have no association with them? This constant penalization of consumers for operating costs of NVE is not our responsibility if we are not benefiting from it or associated with it. NVE's creative accounting needs to be forensically reviewed and corrected.

Every business has expenses and some are losing their business over the economy, why is it that NVE has to operate at a certain 'profit' level, that no other business here in Nevada is afforded this luxury?

NVE investor's return on investment should not be on the backs of the cash strapped citizens of Nevada. Only here in Nevada are NVE stockholders assured of a certain dividend, what about other investors, they are subjected to the fluctuations of a business.

If employees throughout the state are taking pay cuts, then NVE's executives can take a cut, if they are so concerned with their operating costs. Five (5) million dollars annual salary for NVE's President? His only concern is to keep his job, as he can be voted out by the stockholders, so of course, he is concentrating on protecting the stockholder dividends over the customers rising cost of maintaining power to their homes/businesses.

When I first received my 'notification' regarding s'meters, in March, I contacted NVE on March 22, 2011, and demanded they not install the meter. The initial customer service representative (CSR), stated that had I no choice, either I accept the meter or they would not provide service. The meter was federally mandated and everyone in the country had to get one, absolutely no one was exempt from the meters.

After arguing with her for a while, she put me through to Peter Easler (Peter) who initially was very attentive and responsive to emails. Peter stated, that the meters were in fact safe, they would save money on the power bills, and that unless I agreed to the meter, I would be denied service, they were mandated by the federal government.

I made it very clear that I had a medical condition and this meter was in fact problematic and would cause an exacerbation of my disability. Peter assured me that these meters were in fact, safety tested and approved by the FCC for deployment and safety concerns.

Peter did at that time agree to temporarily halt the installation, to my 'building until' December of 2011, then I would have to either accept the meter or receive no electrical service. I insisted that since I walk the property and they would impede my ability to walk my service animal, they could not be installed at all here.

We went back and forth for a while, then he suggested it would be better if we met to discuss my concerns with others at NVE who were knowledgeable about the meters and could answer all my concerns. **Peter tried to reinforce that these s'meters were just as safe as a cell phone regarding any emissions**, that people are already being exposed to electro-magnetic radiation (EMF). He queried me on having a cell phone, baby monitor, microwave, plasma tv. I told him having a microwave does not mean it is being utilized, I do not have a cell phone, nor any of the other things he mentioned.

We agreed to meet on April 27th at 1 p.m., at their satellite office across from their main building. In attendance were to be 2 other 'qualified' employees to address my concerns, Steve Tam (Steve) and Schad Koon (Schad), a Customer Communications Manager.

Prior to the meeting I did a background check on the 'qualified' individuals and was only able to obtain information on Steve. A 'child' basically fresh out of UNLV with a degree in electrical engineering. Upon researching the requirements for this degree, it was extremely apparently, that Steve was completely incompetent to even sit in on the meeting, let alone try to answer the health concerns. His entire background in science was limited to physics with ½ of a year long course in general chemistry, nothing in the biological sciences.

On April 23, 2011**,** Exhibit 5**,** I sent Peter an email asking about the model/brand so I could do research on the meter, to date no one at NVE has provided the model.

On April 27th, Peter, Steve, Schad and my associate Karen Smith were in attendance and conferenced in with Lawrence A. Plumlee, MD, from Maryland.

During the entire meeting Steve regurgitated 'the FCC says it's safe' ad nauseum,. When questioned about his understanding of basic human anatomy/physiology he had no education, Peter had a Business Administration Degree, along with Schad, also, I believe.

Steve decided to 'question the credentials' of Dr. Plumlee. The 2 questions that seemed to solidify Steve was out of his league were; where Dr. Plumlee got his undergraduate degree and medical school education.

Let me digress and show the qualifications of Dr. Plumlee:

Lawrence A. Plumlee, M.D is a graduate of Princeton University and the Johns Hopkins University School of Medicine. After an internship in internal medicine and a postdoctoral fellowship in physiology at Johns Hopkins, he was a research investigator in physiology at the Walter Reed Army Institute of Research (WRAIR) in the Division of Neuropsychiatry, and the Division of Cardiovascular Diseases.

Subsequently, Dr. Plumlee became medical science adviser in the office of research of the U.S. Public Health Service's Consumer Protection and Environmental Health Service, and later at the U.S. Environmental Protection Agency (EPA), where he was responsible for coordinating toxicology. He was a member of the Second National Institute of Environmental Health Sciences (NIEHS) Task Force for Research Planning in Environmental Health Sciences.

Dr. Plumlee's affiliations include:

1979-present: American Academy of Environmental Medicine (AAEM)
1993-present: National Coalition Against the Misuse of Pesticides/Beyond Pesticides
1993-present: Northwest Coalition for Alternatives to Pesticides
1989-present: National Center for Environmental Health Strategies
1977-present: American Chemical Society (ACS), Chemical Health & Safety Division
1973-present: Air Pollution Control Association (Air and Waste Management Association)
1965-present: Johns Hopkins Medical and Surgical Society
1975-present: Society for Occupational and Environmental Health (SOEH)
1965-1985: American Association for the Advancement of Science (AAAS)
1964-1985: Society for Psychophysiological Research
1970-1985: Environmental Mutagen Society
1971-1985: American Public Health Association (APHA)
1973-1985: Society for Environmental Geochemistry and Health
1977-1988: International Academy of Environmental Safety
1976-1979: New York Academy of Sciences

As you can ascertain, Dr. Plum is highly trained and qualified to answer questions regarding health and the environment.

When Dr. Plumlee attempted to educate the NVE representatives on electro-magnetic radiation and human health, Steve attempted to prove he was more knowledgeable and embarrassed all in attendance. Finally, Dr. Plumlee got disgusted by the erroneous verbiage from Steve and terminated the call.

Steve, Schad and Peter admitted to not having any knowledge of human physiology nor cell biology/physiology. Yet, they kept attempting to cite FCC says it's safe. I kept asking how the electro-chemical interactions of the cell would be impacted by these meters and no one was able to elicit a response.

When asked for the actual safety testing of the meters, we were referred to Sensus, the manufacturer. None of them knew the model number, so that we could have them checked out. Which we found to be highly suspect, as these 'qualified' individuals proclaimed they knew everything about the meters.

It was extremely obvious, that Steve had no concept of the diverse lifestyles of NVE customer base. As he claimed that 'no one is home all the time, so they can turn up the thermostat'. He even questioned whether disabled people or seniors were so restricted to their homes on a constant basis. Nor did he understand that some medical conditions are exacerbated with elevated outside temperatures and their ambient inside temperatures were a medical necessity to be lower. They should not be penalized for using more energy for said medical issues.

Ms Smith asked about the effects upon people with medical conditions and implanted medical devices and again "FCC says they are safe". She specifically asked about people with Multiple Sclerosis and they had no response/knowledge, nor testing to prove they would not be problematic to them.

They all stated that the s'meters transmit about 45 seconds in total per day.

I believe the following calculations are fairly accurate, if not, I apologize for the error:

The meters transmit approximately every 4 seconds.
The meters transmit approximately 22,500 times per day.
The meters transmit 24/7 at the rate of approximately 15 times per minute.

The answers are approximate because each meter transmits a different number of times partly related to its position within the mesh network. Different meters receive and transmit different numbers of signals from other meters based on the size of their neighborhood mesh network and on their position within the mesh network.

(1) The number of radiation transmissions per day (24 hour period) is approximately **22,500**.
(2) The Frequency of radiation transmissions is approximately **1 radiation transmission every four seconds** (on average). That is approximately **15 radiation transmissions per minute**.

The information above is consistent with:

NVE's **claim that the meters transmit for a total of 45 seconds per day** (22,500 pulsed radiation transmissions, each 2/1000 of a second long, take 45 seconds total during a 24-hour day to complete)

THE MATH

NVE claims the meters transmit for only 45 seconds per day.
The individual transmissions are approximately 2/1000 in duration (two thousandths of a second long).

1 second / 2/1000 = 500 transmissions per second.

500 transmissions per second X 45 seconds = 22,500 transmissions.

Transmitting 45 seconds per day as NVE claims therefore indicates **22,500 individual transmissions per day**.

22,500 transmissions per day / 1,440 minutes per day = 15.625 transmissions per minute (approximately **15 transmissions per minute**).

22,500 transmissions per day / 86,400 seconds per day = .26 transmissions per second or 1 transmission per 3.84 seconds (approximately **1 transmission per 4 seconds**).

I asked, if you are claiming that they are so safe, I wanted a letter from their legal department, citing that if there were any health issues/exacerbations, NVE would accept full liability. No comment was made.

After Steve left, we asked, since there are fires associated with s'meters is NVE prepared for potential claims, what about personal injury litigation, who is going to pay for these costs, the customer? Both men had no answer and were going to look into it. Middle management with business degrees and they failed to address liability, very suspect.

When asked at what point will they force us to either accept or lose the ability to have power become effective, went unanswered. Along with, how are they going to handle the numerous amount of people who are refusing the deployment? Are they going to deny all of these customers service? Peter responded, we are monitoring what is transpiring in California, we are still working things out and not sure how to proceed.

Schad attempted to try to gain my acceptance of the s'meter, by using my environmental activism as a propaganda ploy. They would cut down on emissions from vehicles on the road, etc. I informed him my activism was more highly concentrated on indoor air environments.

If they did not have contingency plans regarding customers refusing these meters, they should never have been approved. This was not a fully thought out or researched project by NVE. One has to question, what did they submit to the PUC regarding customers refusal to accept these meters. This is nothing short of a baptism by fire on the part of NVE.

After the meeting Peter 'insisted' that we have a follow up meeting within thirty (30) days with more experienced engineers, I requested someone from legal to be present. We all agreed to work on a date for the follow up meeting.

After the meeting, I sent Peter 2 emails, Exhibits 6, 7 with additional technical questions, that to date have not been provided.

In an email dated, April 28th, Exhibit 8 I asked about the purchase details on the meters, as the manufacturers 'Terms and Conditions" of sale, highly restricted their liability to the purchase price, along with additional questions, regarding the meters, that of this date, have not been acknowledged or answered. Citing that the manufacturer had shielded themselves of any liability for product liability: ***"Sensus' aggregate liability in any and all causes of action arising under, out of or in relation to this agreement,*** *its negotiation,* ***performance****, breach or termination (collectively "Causes of Action")* ***shall not exceed the total amount paid to Sensus under this Agreement.*** *This is so whether the* ***Causes of Action are in tort,*** *including, without limitation,* ***negligence*** *or strict liability, in contract, under statute or otherwise."* Exhibit 3

Again, I digress, as the attorneys on this Commission are aware that a tort has various sub-groups. I believe that this entry from Wikipedia is fairly accurate:
""A person who suffers a tortious injury is entitled to receive "damages", usually monetary compensation, from the person or people responsible — or liable — for those injuries. ***Tort law defines what is a legal injury*** *and, therefore, whether a person may be held liable for an injury they have caused.* ***Legal injuries are not limited to physical injuries. They may also include emotional, economic, or reputational injuries as well as violations of privacy, property, or constitutional rights****. Tort cases therefore comprise such varied topics as auto accidents, false imprisonment, defamation,* ***product liability*** ***(for defective consumer products),*** *copyright infringement, and environmental pollution (toxic torts), among many others."*

In much of the common law world, the most prominent tort liability is negligence. ***If the injured party can prove that the person believed to have caused the injury acted negligently – that is, without taking reasonable care to avoid injuring others*** *– tort law will allow compensation. However, tort law also* ***recognizes intentional torts, where a person has intentionally acted in a way that harms another****, and "****strict liability,"*** *which allows* ***recovery under certain circumstances without the need to demonstrate negligence****.*

Negligence is a breach of legal duty to take care resulting in damage to the plaintiff.

Amongst unintentional torts one finds negligence as being the most common source of common law, most Americans are under the impression that most people can sue for any type of negligence, but it is untrue in most US courts (partly because negligence is one of the few torts for which ordinary people can and do obtain liability insurance.) ***It is a form of extracontractual liability that is based upon a failure to comply with the duty of care of a reasonable person, which failure is the actual cause and proximate cause of damages. That is, but for the***

tortfeasor's act or omission, the damages to the plaintiff would not have been incurred, and the damages were a reasonably foreseeable consequence of the tortious conduct."

I believe that NVE can be held 'liable' under numerous aspects of a tort action; physical injury, emotional, violations of privacy/property, constitutional rights and negligence, regarding s'meters. Which, if in fact is true, there would be a 'perception' of endorsement of this and possibly opening the PUC and/or state to be co-Defendants in any possible litigation.

On May 1st, Exhibit 9 I sent Peter an email with a possible date for the follow-up meeting. May 4th, Exhibit 10 a reminder to please respond to the follow-up meeting. Later on May 4th, Exhibit 11 Peter responded *"I appreciate all the correspondence you have provided me over the past several days. At this time, I can assure you that NVE has agreed to postpone your meter exchange until a later date. If the need arises, we will contact you for future meeting arrangements."* I followed up with the 'truth' in California regarding the s'meters and what the utility companies in California were feigning to the California PUC (CPUC).

PG&E 'answers' to the CPUC seem to 'mirror' the 'tendency' to downplay the problems, until more direct questioning: "Exhibit 12 *SACRAMENTO, CA (KGO) -- There is a startling admission from PG&E about the controversial SmartMeters. The utility has insisted its new meters are accurate, but on Monday they admitted to some problems at a state Senate committee hearing.*

PG&E confirmed on Monday that more than 43,000 of its SmartMeters have suffered from various problems. The utility remains insistent however that these problems have had little impact on customers' bills.

The Senate's new Select Committee on the Smart Grid called PG&E's senior vice president of customer relations as its first witness. Helen Burt told the committee only a handful of customers had inaccurate SmartMeters.

"We have found eight meters out of the 5.5 million meters that we installed where there is an issue with the actual meter accuracy," said Burt.

However, under intense questioning from Sen. Dean Florez, D-Kern County, PG&E confirmed there have been other problems. For example, 9,000 of its SmartMeters have not communicated energy usage back to PG&E, more than 11,300 SmartMeters simply failed to work and another 23,000 SmartMeters were installed improperly.

Florez then questioned why PG&E says only eight SmartMeters had accuracy issues.

"This progress report tells me that you have increasing amounts of failure rates in every one of your categories that's going up, whether it's electric meters, whether it's gas meters, you name it," says Florez.

NV Energy Stop Smart Meters was formed.

On May 6th, I spoke with Alicia at the PUC, who referred me to Chris Sewell, as she felt my questions were better off addressed to Chris Sewell, Senior

Compliance Investigator. She sent him an email stating that I would be contacting him regarding my concerns.

On May 8th, Exhibits 13, 14 I sent Chris Sewell an email with related documents regarding NVE. Mr. Sewell on May 12th, Exhibits 15, 16, requested that I call him in response to my email, I notified him I was not feeling well and would get back to him to set up a time. On May 29th, Exhibit 17, I notified him that I would call on June 1st.

On May 31st, Exhibit 18, I notified Peter of the World Health Organization's (WHO) report of cell phones being classified as a 'Class B Carcinogen' like lead and asbestos. Along with citing the Maine precedent regarding opting out of having a smart meter installed. Still no response regarding from Peter regarding all prior questions on s'meters. Exhibit 19

June 1st, Karen Smith and myself spoke with Chris Sewell and Donald Lomoljo of the PUC and had communications regarding docket number for NVE's smart meters and statutes regarding filing a complaint. Mr. Sewell suggested that since some of the issues I raised were not addressed by NVE, the most effective and fastest way for the PUC to address them was via a complaint filed with them.

June 2-3rd, Garrett Weir was cc'ed and he responded to the complaint requirements I was inquiring about. Exhibits 20, 21

June 7th, email to Peter on how NVE will handle fires caused by the s'meters, still no response to any emails since May. Exhibit 22

June 22nd, sent Peter an email asking for answers to my prior emails. Exhibit 23

June 23rd, 6/23/11 2:51, received a phone call from Schad: *"Hi Angel, this is Schad with NV energy. I met with you back at the end of April and Peter Easler sent me an email, and asked that I reach out to you regarding a number of questions you had about our smart meter NV energize program, so if you have an opportunity. Please give me a call back at 402-5757, that's 402-5757 Thanks very much."* I have the actual recording if requested by the Commission.

June 24th NUMEROUS emails to Schad, responding to his phone message, requesting a meeting, additional questions to be answered and communication via email. He refused to answer any questions and referred me to the PUC. Exhibits 24, 25, 26, 27

June 26th, email from Mr. Sewell that the PUC was not formally involved in the matter at this point in time. Exhibit 28

June 30th, I confronted Tony Sanchez (Tony), Sr. VP of Government and Community Strategies, after the PUC meeting. He was completely non-committal, feigned that he had no answers and in front of the 'audience' that had

gathered behind me, agreed to continue the conversation in his office. At this point in time, I had no idea of what position he held or of his background. When confronted about the health and safety testing for the s'meters he evaded the question. No response to the model being purchased or why they switched from Itron to Sensus meters. He said that any damage that 'might' be caused by the meters would be addressed on a case by case basis. He assured me, as he chuckled, that NVE had more than enough insurance to cover any potential claims. **And assured me that there weren't any claims submitted regarding damage from the meters.**

I provided him the emails that Peter never responded to and was 'assured' that he would get me the answers, when he spoke to Peter 'the next day'. We wound up in the elevator together and he asked the other gentleman with him to talk to Schad. I informed them that Schad was on vacation, which they both were surprised I had prior knowledge of. Then Tony told his associate to have Peter get in touch with him. His story vacillated from Peter to Schad back to Peter as to who would be addressing the outstanding queries.

July 1st, sent Tony an email following up on our 'discussion', along with calling his office. His secretary informed me he was out of town for a while for the holiday. All the questions regarding safety etc., posed in the email still have gone unanswered. Exhibit 29

July 18th, Tony responded. Completely using smoke and mirrors, making erroneous and inflated assertions regarding a prior litigation, as a reason to not meet over the issues and refusing to answer the outstanding questions. Referring me to submit my queries to their 'legal department'. His response of *"As you are no doubt aware, the FCC continually monitors the issue of RF exposure and any related health and safety concerns regarding smart meters".* Exhibit 30

That statement was a blatant prevarication, as the FCC does not have the expertise to deal with health relating to their safety standards of RF, as disclosed by the following: "*The FCC does not have the expertise to evaluate whether the standard (RF safety limits) is appropriate." (Julius Knapp, Director of FCC Office of Engineering and Technology in response to Congressman Kucinich's question whether the FCC's RF safety standards are appropriate to protect children and vulnerable adults and others Sept. 25, 2008 Congressional Hearing.)"* Exhibit 31

Tony as a former energy attorney and formerly associated with the PUC should have been aware of this very important and salient fact. NVE citing that the FCC says they are 'safe' is a fallacious statement made to the public and upon information and belief to the PUC in their filing to deploy them.

July 20th, Channel 13 aired a segment on s'meters. In the newscast, Gary Smith, (Gary), (Project Director of Smart Meters) said that there were **about 130 claims of damage from the s'meters. "** *It's the disengagement of power and turning the power back on can cause equipment to have that problem" Smith says."* If that was in fact truthful,

when there are power outages here, there would be numerous claims of equipment damage, which there aren't, upon information and belief. The s'meters are creating the power surges that are damaging the computers, not the disengagement as Gary stated. Possibly could be related to the fact they were never certified by underwriters laboratory?
http://www.ktnv.com/contact13/consumerinformation/125873584.html

How in the span of 18 days did NVE receive 'about 130 claims for damages'?

August 6th, emails to Paul Kaleta, (Paul), (NVE General Counsel), a very direct and to the point questions referenced. Paul did respond with a snail mail response, that currently, I can't locate. But he did 'threaten' that if I kept using my First Amendment rights he would act upon them, citing that my comments were not protected under said Amendment, along with trying to divert the issue at hand to a prior lawsuit, that had nothing to do with NVE and s'meters. Exhibits 32, 33, 34

Oct 8, 2010, Paul , *In approving the project, the Commissionexpressed its general concern with customer acceptance of the project and noted that "it is Companies' that, the Companies responsibility to ensure this [customer acceptance] occurs occurs."* Exhibit 1

It is highly dubious that the PUC when they approved the s'meters, they meant for NVE to lie, harass, threaten the customer to accept these meters. It is impossible to believe that NVE will get the customer to accept these meters based on the facts that NVE are trying to avoid being made public. Acceptance should have been based on complete transparency, not obscuring the facts, threats of denial of service, refusing to answer questions regarding health and safety. Blaming the age of the wiring and code requirements to avoid paying out for claims.

On or about September 14, email to Gary, who appeared on the Heidi Harris Show, with another NVE employee, Mrs. Smith. Gary selectively answered the questions, with a concerted effort to skew the facts in order to sway the listening audience. Again, no response to questions regarding the statements he made on the show, that deviated from what NVE had previously publicized. Exhibits 35, 36

From the Pike Research Cleantech Market Intelligence, 4th Quarter 2011: Utility Cyber Security Seven Key Smart Grid Security Trends to Watch in 2012 and Beyond:
"Utility cyber security is in a state of near chaos. After years of vendors selling point solutions, utilities investing in compliance minimums rather than full security, and attackers having nearly free rein, the attackers clearly have the upper hand. Many attacks simply cannot be defended. *Pike Research has observed a dawning awareness by utilities and vendors during the past 18 months of the importance of securing smart grids with architecturally sound solutions. There is hope.*

However, cyber security solutions remain challenging to implement, especially as attackers gain awareness of the holes between point solutions. Security vendors have finally found time to focus on industrial control system (ICS) security, not only advanced metering infrastructure (AMI) security – although a few security vendors have focused on ICS from the outset. ***The utility cyber security market will be characterized by a frantic race to gain the upper hand against the attackers, while at the same time strong competitors attempt to outdo each other.***

The discovery of Stuxnet during the summer of 2010 demonstrated that control networks are no longer secure simply because they are isolated from enterprise networks. ***Stuxnet also demonstrated that motivated attackers are willing to learn arcane technologies, such as the control sequences for a specific model of centrifuge.***

Stuxnet was a mission and not simply a piece of malicious code. It was not detected until after it had accomplished its purpose and, most likely, evaded detection for more than a year after its release. Few utilities, vendors, or analysts are willing to discuss that even more sophisticated attacks may now be in process, which, so far, have completely evaded detection. However, that must be considered a probability, not merely a possibility.

No enforceable smart grid security standards exist anywhere in the world for power distribution grids. The greatly discussed U.S. NERC CIP standards only apply to generation and transmission, though some of this has leaked into stimulus-funded distribution network projects. Other regulations or legislation may apply to specific situations, such as data privacy laws or payment card industry standards to protect customers' card data used in paying utility bills.

A number of well-written guidelines include the three-volume U.S. NIST Interagency Report (NISTIR) 7628, which covers smart grid cyber security strategy, architecture, high-level requirements, and data privacy. Additionally, NIST Special Publication 800-82 is a thorough examination of ICS cyber security issues. The U.S. and U.K. governments have co-published a document known in the United States as the Control System Security Program (CSSP) Recommended Practice: Improving Industrial Control Systems Cyber Security with Defense-In-Depth Strategies.

None of those guidelines is an enforceable standard and each takes great pain to point out that it is a series of recommendations, but not a baseline for audit or certification. At present, only the NERC CIP reliability standards have the teeth to result in fines for noncompliance.

Even those standards are scoped to consider only critical cyber assets (CCAs). Identification of CCAs is, at best, labyrinthine. This lack of enforceable requirements leads to a scene of mass chaos in utility cyber security. Many utilities – as with large companies in any industry – will only invest in cyber security when financial punishment for not investing is threatened, similar to failing an audit and being fined.

The definition of home energy management (HEM) solutions and the required home area networks (HANs) is in disarray as this paper is written. It is not clear what HAN approaches will prevail – whether customer data will travel via AMI wide area networks (WANs), consumers' Internet service providers (ISPs), or even dedicated HEM networks. ***This lack of standards makes selecting the right security solution for HEM an exercise in risk management and investment protection. It is not clear how to select a HEM security solution with any confidence that it will still be around in 2 years.***

It is possible to have a system in which 100% of the components are secured, but the system as a whole is not secure at all. Cyber security works to protect a whole entity and attackers look for holes. The strongest adversaries are not going to waste time attacking a

component device that is known to be a fortress. One cyber defense expert said, "Do not fear hackers. Fear engineers who hack." Security is only as strong as its weakest link and the best attackers know instinctively to look for that weak link.

Implementation issues exist at the product and system levels. The best encryption algorithm in the world is useless if key distribution is not adequately secured. A sophisticated attacker will not attempt to brute-force attack a strong encryption algorithm, but will try to find the keys as they are being distributed, before the algorithm uses them.

At a system level, adequate security is nearly impossible without a cyber security architecture. *This approach is commonplace in enterprise networks, but, as yet, rarely seen in control networks. To be fair, some control networks have been built – perhaps congealed – over decades, so developing a security architecture could be a substantial backward looking research project.* ***Once again, sophisticated attackers will look for holes in between secure components – things that architecture would address.***

Security event correlation in control networks must support the primary security objectives of those networks: safety, reliability, and integrity. Unlike enterprise networks, these control system objectives cannot be achieved solely at the infrastructure level. Event correlation in control networks also requires a view into the data, rather than just its wrapper. Control system traffic that is perfectly formatted and follows all the rules of the network can still contain malicious set points or other data designed to destabilize a control network.

Securing a SCADA network is a highly contextual activity. ***Simply validating that servers, storage, communications, and endpoints are operating within security policies is not enough.*** *SCADA security must also be aware of the types of actions that are legally occurring within those policies.* ***This requires control system awareness that is built into the security products. Effective SCADA security needs inputs from application sources as well as infrastructure sources. Control system event sources, such as data historians, can provide this enhanced visibility.*** Exhibit 37

What are ALL the security features that NVE has implemented to assure safety, all applications etc?

The smart-meter data that enables this kind of energy management can also provide a detailed profile of the behavior and activities of a particular household, *the report noted. The* ***ability to tie that data to an individual or a household makes the data especially sensitive****, the department said. One of the biggest issues* ***that needs to be resolved is the manner in which third parties should be allowed access to consumer energy usage data****, the department said. While that data can be very sensitive, it can also* ***help companies provide people with innovative new energy management products and services. In some cases, it can be used to deliver highly targeted marketing messages, the report noted.***

However, it should be the consumer who decides whether and for what purposes a third party is allowed to access or receive usage data, the DOE said. Consumers need to have access to their usage data and should be allowed to make informed choices about allowing third-party access to their information. ***Polices need to be in place to ensure that utilities do not share consumer energy usage data with third parties without the consumer's authorization.***

Third-party requests for user authorizations would need to clearly spell out the type of data being sought, the reasons it is being sought and ***whether it will be used for targeted advertising purposes.*** *Third parties that are authorized to access consumer data will need to ensure the privacy, integrity and security of the data and use it only for the purposes for which they were authorized.*

Consumer acceptance of smart grids *"depends upon the development of legal and regulatory regimes that respect consumer privacy, promote consumer access to and choice regarding third-party use of their energy data," the report said.* Exhibit 38

Even the DOE acknowledges 'consumer acceptance of the s'meters. Reaffirming it is a 'voluntary program. I emphatically doubt that the customers are now going to want to be bombarded with ads from NVE. If NVE will be 'marketing' products for companies, will they be compensated for providing said 'referrals' and who will be receiving the compensations from these marketing lists?

One has to speculate that if indeed these s'meters, were in fact, as NVE claimed, federally mandated, the PUC would not have issued the comment regarding 'customer acceptance' of the project. There was never any mention that the NV PUC mandated them, as that could be verified easier than the federal energy bill.

The PUCN makes the utilities liable for risks, accidents and mistakes on the part of the utility companies. Given the subterfuge that NVE has been vocalizing to their customers and possibly the PUC, they need a major microscopic examination of their submissions to the PUCN on s'meters.

It has been confirmed by the DOE, that the utilities were mandated to only "offer" a smart meter "if" the customer wanted one.

Since my first interaction with NVE, Peter, Steve, Schad and others, they reiterated that these meters were federally mandated, that every meter in the United States would be replaced with s'meters, there were absolutely no exemptions, as it was a necessity for the 'smart grid' energy plan. If the s'meters were not installed then there would be no power/electricity delivered.

They would 'grant' a delay until the deployment was almost finished, then those on the delay list would be required to consent or live without electricity/power.

NVE has no authority to consider installations of Smeters as mandatory. Not at the federal, or the state, or the PUC levels. The PUC can only authorize the utilities to install Smeters, but they can't make it mandatory, because that would require legislative authorization concerning the relation between the utility and the people, from which the PUC is barred. The PUC can regulate the utility, but it cannot regulate the relationship between the utility and the people. To pretend to do so is an abuse of power, and overstepping of PUC legitimacy.

The existence of the delay list does imply that the utility thinks it has a mandate to install. But it doesn't. The impunity it has assumed for itself on that basis is illegitimate.

Therefore, if you get on the delay list, it cannot be considered consent, because consent is irrelevant to the idea that installation is mandatory. The utility interprets the fact that it thinks it has a mandate as grounds for impunity.

The salient facts are as follows:

USC Title 15 Commerce and Trade
Not revised, codified and enacted into positive law.
Regardless, Title 15 Commerce and Trade is non-positive Code & Title, ***simply meaning that there is no underlying Constitutional authority for the federal government to enter into these areas and therefore, these "codes" cannot be codified into public law and carry no force of law except as it applies to the District of Columbia, insular possessions and territories. These are the ONLY places the federal government has absolute authority.***

Commerce and trade cannot be codified into public law as there is no underlying Constitutional authority for the federal government to enter into commerce or trade other than as a contracting party or, in the treaty process. *The government* may *enter into trade disputes between the states as an arbitrator when there is a state-to-state dispute although, depending upon the political leanings of SCOTUS at any given time, the twisting and contorting of this provision can change dramatically.*

The federal government has no authority to unlawfully cede to or, empower any federal agency with powers and authority the federal government does not possess and never did.

THERE IS NO FEDERAL SECURITY MANDATE FOR SMART METERS, according to George W. Arnold the national coordinator for smart-grid interoperability at the National Institute of Standards and Technology. This agency of the U.S. Department of Commerce is said not to be involved in regulations but is only tasked with promoting standards among industries. **While both the 2005 and 2007 faux energy bills were codified into public laws, NO part of them creates a federal law pertaining to individual consumers or dictating that the public must be forced to comply with provisions of SMART Grid.**

Contrary to the bleating of manufacturers and utility talking heads, who claim there is no "opt out", the fact is you, the **consumer must be offered the meter, or request a meter and "OPT IN".** No one can be forced to comply with an unrevealed contract between private corporations, and to which you were never a party and had no knowledge of.

An Energy Tax Package was under development in Congress for several years prior to 2008. In September 2008, the package was finally enacted into law via its inclusion in the Emergency Economic Stabilization Act of 2008. This tax package shifted tax liabilities from corporations who were already posting massive record profits, onto the public.

Section 1307 State Consideration of Smart Grid Energy 2007, Page 6 **:** Exhibit 39 This Section amends PURPA to create two additional PURPA Standards. (Note: Two new PURPA Standards are also created in Section

532.)

These standards are in the form of requirements on parties such as utilities to undertake certain actions. **The standards are not directly prescriptive on these parties,** however; it is up to state utility regulatory commissions, or the bodies that govern other types of utilities, to decide that the standards should be actually adopted by utilities subject to their jurisdiction.

The only direct mandate with PURPA standards is for the state or other jurisdictional body **TO CONSIDER** whether the new Standard should be implemented and to demonstrate that it has undertaken such consideration. The first new Standard would require utilities—prior to undertaking investments in non-advanced grid technologies— to demonstrate that they have considered investments in "qualified smart grid systems" based on a list of factors (on page 301) in the section that include total costs, cost-effectiveness, etc.

This Standard would also allow utilities to recover from ratepayers any capital, operating expenditures, or other costs of the smart grid investment, including a reasonable rate-of-return.

Furthermore, this Standard would allow utilities to recover remaining book value of any equipment rendered obsolete by the deployment of such smart grid systems. There is no description or list relative to what "qualified smart grid systems" would be.

So, the consumer is stuck with paying for the remaining life of the analog meter, an undisclosed 'profit', costs of purchasing and hiring an outside contractor to install the s'meters.

A prudent company, would have availed themselves of their currently hired employees whose job 'normally' was to install meters, to do the change out to s'meters. Just how much are these 'independent contractors costing us per meter/hour, etc., for installation?

<u>This is a tax bill.</u> "Ratepayers" are actually taxpayers. This is a new TAX forcing the public to finance SMART METERS/GRID at the rate of 100% of costs plus a profit margin written into it. We are being forced to finance a system sold as energy conservation, efficiency, carbon reduction, and at the same time being subjected to unwarranted surveillance, data mining, and extreme health hazards not to mention the invasion of our homes and businesses. Taxes for this system are applied to your energy bill under several categories and not one part of this bill or the SMART GRID system will reduce consumption or make energy sources more secure or efficient.

The Energy bills of 2005 and 2007 were Energy TAX bills and had nothing to do with conservation, security or efficiency. Reading through the 2005-2007 tax provisions is a laundry list of non-related tax breaks, subsidies, tax credits and other loopholes for gas and oil cartels and other so-called energy producing corporations. All taxes for financing this loss of revenue will be applied to and paid by ….you, the general public.

Public Utility Regulatory Policies Act of 1978 (PURPA) Through PURPA, two standards were established: "The Energy Independence and Security Act of 2007 (EISA 2007) contains two sections (secs. 532 and 1307), that also add additional "States-must-consider" standards to the Public Utility Regulatory Policies Act of 1978 (PURPA)."

The "states must consider" does not mean the states must comply as there is no law to force compliance of the states.

"*DOE itself is NOT involved in the implementation of PURPA–States (or local governing boards) are–and so DOE is not in a position to offer guidance or advice on these new PURPA provisions."*

**This is where the Department of Energy excused itself because it has no lawful authority.

Reading through the Energy Policy Act of 2005 and the subsequent EISA 2007 energy bill, it is **absolutely clear that what did pass pertaining to SMART Metering pertained only to Federal buildings and [federal] housing. This is in adherence to the Constitution which gives the federal government power only over needful buildings, insular possessions and territories. In every other instance the word "voluntary" precedes any item.**

According to the federal government, under Public Utility Regulatory Policies Act, it states '**states must consider',** that is not the same a state must, implement the s'meters.

"List of Covered Electric Utilities" under the Public Utility Regulatory Policies Act of 1978 (PURPA)

The Energy Policy Act of 2005 (EPACT 2005) Subtitle E contains three sections (secs. 1251, 1252, and 1254) that add additional "States-must-consider" standards to the Public Utility Regulatory Policies Act of 1978 (PURPA).
Specifically, EPACT 2005 adds five new Federal standards to PURPA Section 111(d):
(11) NET METERING (see EPACT 2005 Sec. 1251 for details)
(12) FUEL SOURCES (see EPACT 2005 Sec. 1251 for details)
(13) FOSSIL FUEL GENERATION EFFICIENCY (see EPACT 2005 Sec. 1251 for details)
(14) TIME-BASED METERING AND COMMUNICATIONS (see EPACT 2005 Sec. 1252 for details), and
(15) INTERCONNECTION (see EPACT 2005 Sec. 1254 for details).
The Energy Independence and Security Act of 2007 (EISA 2007) contains two sections (secs. 532 and 1307), that also add additional "States-must-consider" standards to the Public Utility Regulatory Policies Act of 1978 (PURPA).
Specifically, EISA 07 adds four new Federal standards to PURPA Section 111(d):

(16) INTEGRATED RESOURCE PLANNING (see EISA 2007 Sec. 532(a) for details)
(17) RATE DESIGN MODIFICATIONS TO PROMOTE ENERGY EFFICIENCY INVESTMENTS (see EISA 2007 Sec. 532(a) for details)
(16) (sic) CONSIDERATION OF SMART GRID INVESTMENTS (see EISA 2007 Sec. 1307(a) for details), and,
(17) (sic) SMART GRID INFORMATION (see EISA 2007 Sec. 1307(a) for details
The impact of these EPACT 05 and EISA 07 changes to the 1978 PURPA law is that State electricity regulators (i.e., State public utility commissions) "must consider," for their regulated electric utilities (usually but not always only investor-owned utilities), whether to adopt verbatim all of these standards as requirements on those electric utilities.

By "must-consider," PURPA as amended says that States must start regulatory proceedings by a specified deadline and then make a yes or no decision by another specified date on whether to actually adopt that standard verbatim as a requirement on its State-jurisdictional utilities.

Note that for non-State jurisdictional utilities, which means publicly- and cooperative-owned electric utilities, PURPA requires the same "must consider" steps on the governing boards (who are either locally elected or appointed) of these utilities. TVA is deemed to be the State regulatory authority for those electric utilities over which it has ratemaking authority.

As Congress has chosen not to itself regulate these retail-level decisions at the Federal level and thus preserve the legal authority of States (or local governing boards) to make these decisions, *how PURPA (as amended) works can be difficult to understand. The reader may thus wish to consult two non-DOE guides that explain and interpret PURPA as modified respectively by EPACT 05 and EISA 07, and/or seek appropriate legal counsel:*
EPACT PURPA Reference & Implementation Procedures Manual
EISA Reference & Implementation Procedures Manual

DOE itself is NOT involved in the implementation of PURPA--States (or local governing boards) are--and so DOE is not in a position to offer guidance or advice on these new PURPA provisions.

Note that PURPA requires that its "states-must-consider" provisions apply only to electric utilities over a certain minimum size threshold. Further, under PURPA Title I, the U.S. Department of Energy (DOE) is required to publish a list identifying each electric utility that Title I applies to, as stated by PURPA itself:

"Title I - RETAIL REGULATORY POLICIES FOR ELECTRIC UTILITIES
Subtitle A—General Provisions
SEC. 102(a)
VOLUME OF TOTAL RETAIL SALES.— This title applies to each utility in any calendar year, and to each proceeding relating to each electric utility in such a year, if the total sales of electric energy by such utility for purposes other than resale exceeded 500 million kilowatt-hours during any calendar year beginning after December 31, 1975, and before the immediately preceding calendar year.
SEC. 102(b)

EXCLUSION OF WHOLESALE SALES.—The requirements of this title do not apply to the operations of an electric utility, or to proceedings respecting such operations, to the extent that such operations or proceedings relate to sales of electric energy for purposes of resale.

SEC. 102(c)
LIST OF COVERED UTILITIES.—Before the beginning of calendar year, the Secretary shall publish a list identifying each electric utility to which this title applies during such calendar year. Promptly after publication of such list each State regulatory authority shall notify the Secretary of

each electric utility on the list for which State regulatory authority has ratemaking authority." (Source: 16 U.S.C. 2612)

Thus, DOE has published this list of PURPA-covered utilities:
2009 List of U.S. Electric Utilities Covered by Title I of PURPA
As required by PURPA, State public utility commissions have the opportunity to point out any inaccuracies on the list, by emailing comments and/or edits to the following e-mail address: PURPAlistupdate@energetics.com, and DOE will periodically update the list as needed based on feedback as it is received from state commissions.
2008 List of U.S. Electric Utilities Covered by Title I of PURPA
2006 List of U. S. Electric Utilities Covered by Title I of PURPA
Thank you,
Larry Mansueti, Director, State & Regional Assistance
Planning, Siting, and Analysis Division
Office of Electricity Delivery and Energy Reliability
U.S. Department of Energy
Washington, D.C. 20585
Phone: 202-586-2588
E-mail: Lawrence.Mansueti@hq.doe.gov"

NVE intentionally neglected to mention that in Green Bank, West Virginia there is what is referred to as a 'quiet zone. A 13,000 square mile rectangular area that is the epicenter of the National Radio Astronomy Observatory established in 1958, to minimize manmade signals that cloud the observations of radio-telescopes at the National Radio Astronomy Observatory. **Exhibits 40, 41**

Estimated population in this area is about 8,700 people, where are they going to have their energy coming from, if this is in fact, mandatory?

In May of 2011, the Law Offices of "*Skelton, Taintor & Abbott secured a landmark decision that will benefit utility customers throughout the country, Alan Stone, chair of the firm's energy law group, successfully convinced the Maine Public Utilities Commission (MPUC) to find that it was an unjust and unreasonable practice for Central Maine Power Company (CMP) to refuse to permit residential and small commercial customers to opt-out of CMP's smart meter program.*

Skelton, Taintor & Abbott represented a group of customers in a complaint against CMP, and convinced the MPUC to order CMP to offer customers the option of opting out of the smart meter program and retaining their existing electromagnetic meters. Stone proved that because of unresolved concerns relating to health, privacy and cyber security resulting from the installation of wireless meters on their homes, customers should have a choice concerning the installation of those meters. CMP argued vigorously that customers should not be allowed to opt out, and the MPUC found that position to be unjust and unreasonable." Exhibit 42

Even NVE General Counsel Paul Kaleta, Exhibit 1**,** acknowledged the following:
"the smaller commercial and residential markets present bigger challenges…PUCN identified eight major issues with regard to ASD:
- Technological Risks: Are the technologies reliable and mature enough to provide the services required?

- Deployment and Customer Acceptance Risks: Are the risks associated with the accelerated deployment of 1.4 million meters over three years acceptable and ***will customers accept*** *these meters as reliable and accurate?*
- Customer Privacy: Have the potential impacts of the proposed technology on customer privacy been identified and are proper controls
in place?
- Cyber Security: Have cyber security issues been in place to ensure that the new system does not result in a degradation of consumer protection?
- Cost and Budget Risks: What are the cost risks associated with this proposal and how will they be distributed?
- Benefit Risks: What are the benefits associated with this proposal and how will these benefits be accounted for?

On NV Energy's Advanced Service Delivery smart-meter system, Thompson's order noted eight areas of concern, including whether the technology is mature and reliable, whether consumers will embrace smart meters and whether NV Energy has crafted effective customer-privacy and cyber-security protections. The order also examined how to ensure smart meters and their related programs, such as optional peak-pricing initiatives, don't erode consumer protections, and it evaluated the initiative's cost and budget risks. Exhibit 43

- ***In approving the project, the Commission expressed its general concern with customer acceptance of the project and noted that, "it is the Companies' responsibility to ensure this [customer acceptance] occurs.*** Exhibit 1

Customer Acceptance: Communications
• Extensive, layered public relations and marketing campaign: mail, media, phone calls, ***government****, media, business leader and* ***customer live events*** *and "expos".*

What 'government' are they going to utilize? There is no federal mandate, the PUC isn't forcing customers to accept them, who is/are the/these intended "government representative/s"?

When Assemblyman Aizley tried to get NVE to hold a meeting/panel discussion with the public about s'meters, NVE refused to participate. We are aware that Peter is 'addressing' small organizations (Southern Nevada Claims Association, Rotary Club of Green Valley, etc.), home owner associations to gain acceptance of the 'smeters. Peter has gone so far as to call up and harass a customer, the very next day, who addressed their neighbors about the true facts surrounding the s'meter.

-Reliability. Commission repeated its concern with technology risks arising from new-ness of the system components but observed that the technology was being used others and warranties by commented on warranties.
– Will there be customer acceptance?
– Beyond acceptance, will it be "transformational" with regard to our relationship with our customers
– Managing costs
– Managing any installation and operational "glitches"
– On-going compliance with federal government requirements" Exhibit 1

Aside from Maine as referenced above, Arizona is currently working on the finalization of their opt out policy. Other states that are arguing against these 'federally mandated' s'meters are:

Illinois Gov. Pat Quinn, citing an excessive financial burden on consumers, "sweetheart deals" and no guarantees of improved service, knocked down legislation that would have paid for the widespread installation of smart meters and other electric grid improvements.

"More than 1.5 million people and businesses have had to deal with power outages and service disruptions this summer," Quinn said in a press release issued by his office. "Now these same utilities are trying to change the rules to guarantee themselves annual rate increases and eliminate accountability. I will not support a bill that contains sweetheart deals for big utilities, which could leave struggling consumers to pick up the tab for costs such as lobbying fees and executive bonuses."

He added that the state could ensure continued innovation and investment in the electric grid and create new jobs "without compromising core safeguards for Illinois consumers." Attorney General Lisa Madigan commented "This bill would have been devastating for consumers." Exhibit 44

"Illinois put the kibosh on an ambitious program in September when Gov. Pat Quinn vetoed legislation authorizing Commonwealth Edison to change its rate structure as part of a deployment of smart grid technology.

***"I want to make it clear to the public that they should not be gouged by something they don't feel is providing better service,"** Quinn said, in vetoing the legislation. Illinois Attorney General Lisa Madigan called the ComEdison plan "legalized pickpocketing."*

ComEd expressed its "disappointment" at the setback and began lobbying efforts to override the governor's veto. But the Illinois example is the latest evidence of a growing consumer backlash in the deployment of smart grid technology.

Illinois officials certainly didn't see any magic in smart meters. Quinn balked at the prospect that a customer paying $82 a month for electricity was going to see $3 added on each month for 10 years, even though ComEd claimed consumers would save at least that much by having more control over their electricity consumption.

Of course it didn't help that John Rowe, chief executive of ComEd parent Exelon, in a March appearance seemed to cast aspersions on smart grid technology on the very day utility president Anne Pramaggiore was telling Springfield lawmakers how beneficial it could be.

"Smart grid we are reluctant to embrace, because it costs too much and we're not sure what good it will do,"** Rowe told an audience at the American Enterprise Institute in Washington, according to press reports at the time. **He went on to say that given a choice between investing in smart grid technology and installing old-fashioned cable, he'd probably "bet on the cable." Exhibit 45

"Members of the Arizona Corporation Commission met at a special meeting earlier this month to talk about the meters after receiving numerous letters about them.

The crux of the letters, some of which are posted on the commission's website, express concerns about health worries over the radio frequencies the meters use to transmit information and

questions about the information that they gather.

Out of that meeting with ***representatives from APS and UniSource Energy Corporation, commissioners ordered staff to craft opt-out proposals, according to Rebecca Wilder, public information officer for the commission****."* Exhibit 46

Connecticut Attorney General comes out rejecting smart meters. Exhibit 47
Connecticut Attorney General Urges Regulators to Reject CL&P's Smart Meter Plan

Connecticut Light & Power Co.'s plan to replace existing electric meters with advanced technology would be expensive and would not save enough electricity for its 1.2 million customers to justify the expense, Attorney General George Jepsen said last week.

Jepsen made the comments in a brief filed Feb. 8 with the state Department of Public Utility Control, which is reviewing ***CL&P's*** ***request to replace all existing meters with advanced meter infrastructure. The company also asked regulators to guarantee that the company will be allowed to recover its full cost of installation before the department actually evaluates what the costs actually were and whether those costs were reasonable.***

"CL&P's proposal would force the company's ratepayers to spend at least $500 million on new meters that are likely to provide few benefits in return," *Jepsen said. He urged the regulators to "****continue to evaluate emerging meter system technologies as well as other conservation programs" and only approve installation of the advanced meters when they are cost-effective.***

To evaluate the technical capabilities and reliability of the advanced metering system, state regulators previously approved a limited study of 10,000 meters. Between June 1 and Aug. 31, 2009, CL&P tested the meters on 1,251 residential and 1,186 small commercial and industrial customers, who volunteered and were paid for their participation in the study. The company reported its results to the DPUC on Feb. 25, 2010.

"The pilot results showed no beneficial impact on total energy usage," Jepsen said. "And, the savings that were seen in the pilot were limited to certain types of customers and would be far outweighed by the cost of installing the new meter systems," *he said.*

Also, the existing meters, installed between 1994 and 2005, have a useful life of 20 years and replacing them early would incur additional costs for customers, Jepsen said.

Assistant Attorneys General Michael C. Wertheimer and John S. Wright are representing Jepsen before the DPUC.

Jepsen's brief, filed February 8, 2011, DOCKET NO. 05-10-03RE04 Exhibit 48

Should the Department choose to proceed in any fashion ***with AMI meters at this time, it should do so in a far more limited fashion than CL&P has proposed. Specifically, the DPUC should approve no more than a "surgical" deployment, which provides AMI meters only to those customers who request them – and are willing to pay for them. In the alternative, the DPUC could allow CL&P to gradually roll-out AMI meters by replacing obsolete AMR meters with AMI technology, perhaps coupled with a user-pays surgical deployment****.*

If the DPUC approves any sort of deployment of AMI meters in this case, however, it must reject CL&P's proposed "presumption" of prudence and guaranteed cost recovery. The

DPUC should treat any deployment of AMI technology as it should most any other utility plant addition. That is, the Department should require CL&P to install the technology at its own expense and then demonstrate during a full rate proceeding, once the technology is installed, the costs are known and measurable and the meters are used and useful, that its expenditure for this purpose was prudently incurred. Only then should the DPUC consider whether, and to what extent, those costs should be included in rates.

This staggering cost produced savings of just $11 for residential customers over a twenty-year period, tr. *1965; 2060-2061, and the total energy usage in the pilot did not change for residential or C&I customers. Pilot Report, 4.*

According to the Company, ***residential customers would save just $11 over a twenty-year period with the new AMI meters****, while C&I customers would save $96.35. EL-64; Deployment CBA 10. For* ***residential customers, those savings come to roughly 55 cents per year.***

Certain types of customers, due to no fault of their own, simply cannot shift their electricity usage to off peak times. These customers include many elderly, those with sick or young children at home, as well as those customers who work second or third shifts. *OCC PFT, 17-18. Also, many businesses simply cannot change the times that they use electricity. Forcing these customers to purchase AMI meters is punitive. First, theses customers cannot take advantage of the time-based rates that the AMI meters are intended to facilitate. Second, these customers will not only be forced to pay for their own meters, but they will also be required to subsidize any savings achieved by those customers that can benefit from time-of-use rates. Third, even if they could shift the times of their electric usage, many of these customers cannot afford the associated controlling technologies that are required to make the AMI meters truly effective.* ***While time-based rates should remain an option for electric customers, they should not be forced on customers to their economic detriment****.*

If the Department determines that it should approve the deployment of AMI meters in this case, it should authorize only a surgical deployment. That is, ***it should allow any CL&P customer that wants an AMI meter to receive one upon request, so long as the costs of those meters are assigned only to the customers who ask for them. Such a deployment strategy has been used in New York and protects customers who do not want or cannot afford to use AMI meters from subsidizing meters and rates that benefit other customers.***

In the event that the DPUC approves any sort of deployment of AMI meters in this case, it must reject the Company's proposal of assured cost recovery up-front. Instead, the Department should only approve cost recovery for the new meters in a full rate case proceeding after the meters are installed and considered "used and useful." *In such a rate proceeding, the DPUC could properly review the prudence of the costs associated with this program, rather than writing the Company a blank check, paid for by customers, up front as CL&P has proposed. See OCC PFT, 30.* ***As noted by the OCC in its testimony, there is a reason that the Company wants to be assured of full cost recovery in advance and place all of the risk of this investment on its customers -- because the Company is not willing to assume this risk itself. OCC PFT, 38-39. If the Company is unwilling to assume this risk, the DPUC should not place it on CL&P's customers, especially when the total projected residential savings associated with the project is just $11 for residential customers over twenty years****.*

Remarks of Stefanie A. Brand Director of the N.J. Division of Rate Counsel Stefanie made it clear that in her view, advanced metering infrastructure ("AMI") also commonly referred to as "smart meters," are not so smart and in New Jersey have not been shown to be cost-effective. As a result, New Jersey is not deploying smart meters at this time. To garner her support, AMI programs should be voluntary and ideally provide consumers rate reductions that are greater than the cost of the meter. "Outage protection and remote shut-off is not enough," explained Brand.
Exhibit 49

In New Jersey, don't expect to get a smart meter of your own any time soon. Despite their initial enthusiasm, the state's major utility companies have dropped plans to install the devices on a widespread basis, citing cost concerns and resistance from regulators. Exhibit 50

The reversal has been rapid. Just two years ago, then Governor Jon Corzine asked utilities to install smart meters to help residents better manage their energy use and cut their bills, and possibly forestall the need to build more power plants.

Dayton Power and Lighting and Westerville, Ohio: *DP&L's caution is not unfounded given the ongoing drama facing PG&E and its smart meter program, which is still reeling from a revolt by a segment of the* ***public wary over possible privacy intrusions and misplaced fears of physical harm****. ..****And in Westerville, Ohio, the city cancelled its smart meter plan last year amid fears by skeptics that smart meters will erode privacy****. However, the city council this week approved the installation of smart meters for businesses and some schools.* Exhibit 51

Counties: Humbolt, Lake, Marin, Mendocino, City and County of San Francisco, San Luis Obispo, Santa Barbara, Santa Cruz, Sonoma, Tehama

Cities and Towns: Arcata, Belvedere, Berkley, Blue Lake, Bolinas, Buelton, Camp Meeker, Capitola, Clearlake, Cotati, Fairfax, Fort Bragg, Grover Beach, Lakeport, Marina, Mill Valley, Monterey, Monte Sereno, Morro Bay, Novato, Pacific Grove, Piedmont, Richmond, Rio Dell, Ross, San Anselmo, San Rafael, San Luis Obispo, Santa Cruz, Sausalito, Scotts Valley, Seaside, Sebastopol, Solvang, Watsonville, Willits

I think the aforementioned states, counties and cities refusal to implement s'meters confirms our assertions these are not federally mandated and proves conclusively that NVE is lying to everyone that they are.

SmartEnergy International 2011 in San Francisco this week I had the opportunity to speak with Brian Shine and Steven Snyder about their company's timely and useful service. Utility Services of the Americas' innovative process yields a zero-landfill method to discard old meters. Regardless of your location, they will arrange for the packaging, transport and recycling of your electric, gas, water and parking meters, adding to the environmental benefits of the smart grid.

Speaking of benefits, meter recycling can also help utilities with their smart meter business cases. Brian tells me their clients receive money back based on the total poundage of the recycled meters. So in addition to cutting the landfills some slack, meter recycling can assist with driving down the costs of smart meter projects*.* Exhibit 52

IS NVE going to recycle the analogs that they are replacing? If so, is the consumer going to receive the credit for the financial compensation NVE is given for recycling these s'meters? If not, how will they be disposed, as NVE is claiming that these s'meters are good for the environment? Was this 'profit/income' submitted when they requested approval the deployment of the s'meters'?

Smart grid data access could give rise to ID theft
Kevin Pomfret, executive director of the US Centre for Spatial Law and Policy, who recently spoke at the US-based Autovation event regarding ***privacy issues, said that ID theft concerns are on the rise for consumers as they do not wish to give access to their energy habits and usage.***

The accessibility of information within companies can provide employees and hackers information that they might be used to conduct identification theft or other scams, he said. According to a Vector1Media blog report, the rights of law enforcement to have access to this information is also in limbo as hackers and ID thieves are becoming much more aware about the power of spatial analysis. Exhibit 53

I am not sure of the date when I called Sensus and requested information on the model of the s'meter that NVE purchased. I also requested that I be provided with the human and animal safety tests they did on the s'meters. I was told that any information was to be requested from our utility company, they were not providing anything to any customer. Their customer relations department was restricted to assist with the buyer not the utility customer.

As NVE is associated with the US Department of Energy (DOE), it would follow suit that they are also required by law to follow the same rules and regulations of the DOE. Especially since they are receiving federal funding via the DOE.

Since these s'meters have not been fully tested and the FCC has acknowledged they can't address health issues, this deployment is nothing short of a human subject experimentation. NVE customers never consented to become 'lab rats' whose ultimate findings will result in unknown and probable long term adverse health implications.

"The ***FCC does not have the expertise to evaluate whether the standard (RF safety limits) is appropriate."*** *(Julius Knapp, Director of FCC Office of Engineering and Technology in response to Congressman Kucinich's question whether* ***the FCC's RF safety standards are appropriate to protect children and vulnerable adults and others*** *Sept. 25, 2008 Congressional Hearing.)* Exhibit 31

If we proceed with that as a viable assessment, then the following are effective and NVE is in direct violation of them.

As there has been absolutely no hardcore status on the long term safety of these meters by any federal agency or international agency, the CFR's, Code of Federal Regulations has strict policies and guidelines on human subject experimentation.

10 CFR Part § 745.111 Criteria for IRB approval of research. Relative to the Dept of Energy
(4) ***Informed consent will be sought from each prospective subject or the subject's legally authorized representative, in accordance with, and to the extent required by*** *§ 745.116.*

*(5)**Informed consent will be appropriately documented**, in accordance with, and to the extent required by § 745.117.*

§ 745.116 General requirements for informed consent.

***Except as provided elsewhere in this policy, no investigator may involve a human being as a subject in research covered by this policy unless the investigator has obtained the legally effective informed consent of the subject or the subject's legally authorized representative**.*

***An investigator shall seek such consent only under circumstances that provide the prospective subject or the representative sufficient opportunity to consider whether or not to participate and that minimize the possibility of coercion or undue influence.** The information that is given to the subject or the representative shall be in language understandable to the subject or the representative. **No informed consent, whether oral or written, may include any exculpatory language through which the subject or the representative is made to waive or appear to waive any of the subject's legal rights, or releases or appears to release the investigator, the sponsor, the institution or its agents from liability for negligence**.*

(a) Basic elements of informed consent.

Except as provided in paragraph (c) or (d) of this section, in seeking informed consent the following information shall be provided to each subject:

*(1) A **statement that the study involves research, an explanation of the purposes of the research and the expected duration of the subject's participation, a description of the procedures to be followed, and identification of any procedures which are experimental;***

*(2) **A description of any reasonably foreseeable risks or discomforts** to the subject;*

*(3) A **description of any benefits to the subject or to others which may reasonably be expected from the research**;*

Where in the NV Revised Statutes is there a blanket, non-consent requirement to allow this inhumane experiment to proceed?

Two out of 2 meters were found to be problematic on the same house, insurance company turned the claim over to Sensus for handling. Seems that the installer never notified the City that there might be a problem with the home being up to code. The odds of two meters, burning, upon the same structure causing the same problem is astronomical. Most likely this 'burning' issue would have been discovered if in fact Sensus sought out underwriters laboratory certification. One has to question, is/was Sensus concerned that they would not pass certification and opted to forgo the certification? **photo of insurance claim**

11/05/2010

Mr. Frank C. Del Piano, AMI Project Manager
SENSUS
8601 Six Forks Road Suite 300
Raleigh, NC 27615

Re: VMLIP Member: Danville, City of
Claimant: PYRTLE, KARI 1958 Blair Loop Road, Danville, VA 24541
Date of Injury: 10/31/2010
Claim Number: 02PC-10-00825-01-PG

Dear Mr. Del Piano:

Please recall that we had discussed this matter yesterday.

Bassed on the information provided by the City and the above claimant, I believe that the proximate cause of this loss is a defective meter and/or installation by SENSUS and/or TRUCHECK, your subcontractor. As I understand the matter, the burned meter was the second one installed at this location. I further understand that when either of these 2 were installed, if there were problems with the property, the meter box or the electrical supply, the installation contractor was obligated to notify the City so that they might address the issue. Based on our conversation, that was obviously not done in this location.

Based on the contractual wording SENSUS has with the City of Danville, I am formally tendering the handling of this matter to SENSUS to handle to a conclusion. Please acknowledge receipt of this tender letter.

Sincerely

J. Scott Martin AIC
Senior Claims Specialist
804/237-7360

cc: W. Clarke Whitfield, Jr., City Attorney, City of Danville
Gary J. Via, Purchasing Director, City of Danville
Ms Kari Pyrtle, 1958 Blair Loop Road, Danville, VA 24541

ABSOLUTEY no testing was ever done on the SMART METERS to substantiate the claims by government and manufacturers that the meters are safe. Independent testing however, exposes the danger of these meters to the overall public health. **'Smart' meter radiation is a Class 2B carcinogen** according to the **Exhibit 54 World Health Organization.** And this is just the tip of the SMART METER iceberg. No one knows what the affects of meshed systems will have on communities and neighborhoods as they are bombarded with massive amounts of radio frequency radiation thousands of times a day.

Even the former CIA director James Woolsey, chimed in on the smart grid:
"… Woolsey said, "they're constructing a smart grid that will make it easier for you or me to all our homes on our cell phones and turn down our air conditioner on a hot afternoon. But that may well mean that a hacker in Shanghai can do the same thing with his cell phone, or worse. ***A so-called***

smart grid that's as vulnerable as what we've got is not smart at all. It's a really, really stupid grid."

Woolsey said a key part of the problem is that no one is in charge. "You can search forever through the federal code to find who that person might be," he said. Woolsey suggested that the proper federal official to regulate grid security is the chairman of the Federal Energy Regulatory Commission. He added that it would be a good idea for the Pentagon to work with local utilities on beefing up the security weaknesses of the grid.

"…Consumers Union said it "has also expressed concerns about the smart grid, though our issues stem from the fact that it ***is not clear whether consumers will reap any real savings, or whether utility companies will come out ahead."*** *Consumers Union was one of five consumer groups that last August issued a 28-page report detailing their objections to current trends in smart grid policy and development. Also joining Consumers Union were the National Association of State Utility Consumer Advocates, AARP, National Consumer Law Center, and Public Citizen."* Exhibit 55

If NVE is so concerned that there are no health risks associated with their s'meters, what biological scientists, medical researchers are employed by them to do their due diligence on the health effects, rather than a preponderance of executives with business or electrical engineering degrees, making fallacious statements of safety?

I may not have a degree in engineering/physicas, but, as an allied health degreed customer, we were required to understand the electrical properties of the human body at the cellular level. As the ENTIRE human body is a series of electrical-chemical interactions.

However, the great majority of this research has focused only on thermal effects and cancer. Thermal effects (think of cooking meat in a microwave oven) are the health endpoint addressed by current FCC guidelines for wireless emissions. There has been relatively little research on health concerns such as damage to the immune, neurological, endocrine, cardiovascular, pulmonary, and other physiological or biological systems.

Another key issue is that the vast majority of the research has been conducted either in vitro, on animals, or on healthy humans. There has been almost no research on people with underlying health disorders, even though it's widely accepted that the body's defense systems in such people tend to be impaired. With about half the US population suffering from one or more chronic disorders, that's a large pool of people who could plausibly be more vulnerable to forces such as wireless emissions.

City of Oak, County of Oakland in Michigan, June 20, 2011 adopted this resolution:
"..4. The MPSC is further asked to consider requiring pubic utilities to allow customers with appropriate medical documentation of their individualized risks to opt out of smart meter installation in their homes." *Exhibit 56*

We know that in California some of the same meters that NVE is installing here have been purchased there. Currently, a lawsuit was filed on October 26th, 2011, with the CA PUC, Wilner & Associates, Plaintiffs v. PG&E, Docket: C1110028 : Exhibit 57

The issues brought up in this action are applicable and can be laterally applied to NVE/Sierra Power.

The Smart Meter deployment authorized by the Commission has drawn heavy criticism from PG&E's customers complaining about health and safety concerns as well as a number of other issues. ***Most striking is the fact that when Smart Meters are installed on certain customers' homes, they become ill and, in some instances, it has become necessary for them to seek medical attention. For some customers, the problem is so severe that they have had to move out of their homes. There are also customers that have become disabled to the point that they are unable to work at their regular occupations****.*

PG&E claims that the electric Smart Meters that it has installed meet FCC guidelines concerning maximum permissible exposure ("MPE") to RF radiation by its customers. ***In fact, PG&E contends that such radiation is substantially lower than those requirements. However, the FCC's guidelines concerning MPE do not relate to electric Smart Meters that operate in the license-free portion of the spectrum (902 to 928 MHz). Since there are no applicable MPE guidelines, PG&E has created a false sense of security for its ratepayers and the public at large****.*

As part of the ***Smart Meter deployment, PG&E is offering customers the option of a feature called Home Area Network ("HAN").*** *There is a* ***separate transmitter and receiver in the Smart Meter that operate in the unlicensed portion of the radio spectrum at 2.4 gigahertz to support this capability****. Under this arrangement, if the customer's appliances are equipped with a communications chip, they will be able to communicate with each other and the Smart Meter to schedule usage times to conserve energy. Ultimately, this would be done automatically; that is, certain appliances would run at different times during the day and night to avoid peak demand periods. For example, the customer's air conditioner would be shutoff when an electric dryer is in use or vice-versa.* ***Unfortunately, the duty cycle for the HAN transmitter is estimated to be 100 times greater than the duty cycle of the RF transmitter in the electric Smart Meter operating at 902 to 928 MHz as part of the mesh network. As a result, there will be substantially more RF radiation in customers' homes and the surrounding area****.*

PG&E is ***completely ignoring the rights of customers that suffer from electromagnetic sensitivity. These customers are entitled to an accommodation (relief) under the Americans with Disabilities Act ("ADA").*** *However, PG&E* ***refuses to offer those customers a conventional analog meter or other solutions to solve their medical problems even though they may have a letter from their doctor confirming the condition.*** *Some* ***customers with electromagnetic sensitivity are receiving disability benefits from the Social Security Administration, but the payments they obtain do not restore the quality of life they enjoyed before Smart Meters were installed*** *on their property.*

SOLAR POWER AND SMART GRID

From numerous reports it appears that this smart grid has problems associated with solar power and the efficiency of the grid. Seems that at certain levels there are unanswered questions and remedies not fully thought out regarding this interaction.

How do you maintain and run a reliable transmission and distribution system when you have variable power?" he said.[Steven Chu] The answer, he said, is massive energy storage of the kind that is only contemplated today. Exhibit 58

While some energy storage can be addressed by batteries, ***the large-scale storage Chu contemplates will likely have to come from the oldest technology for doing so*** *– pumped hydro, which means pumping water uphill when electricity is plentiful, then letting it run downhill to spin a turbine when it's most needed (see Grid Energy Storage: Big Market, Tough to Tackle).*

Federally run dams like Grand Coulee Dam in Washington state are looking at new pumped hydro projects, which offer about 80 percent efficiency but could cost billions of dollars, he said. ***And while the United States has tapped much of its potential for pumped hydro, "Canada has a lot of untapped hydro, and that hydro power can be ported into the United States," he said.***

But getting beyond 20 percent intermittent renewables will create an additional problem for power generation, he said. It could require baseline generation sources like coal-fired and nuclear plants to actually turn down the amount of power they're generating when the wind is blowing hard or the sun is shining bright, *he said.*

Because coal and nuclear plants don't run nearly as efficiently when they're not running full-out, that will make their power more expensive at partial loads, *he said.*

"You're actually dipping into more inefficient ways to generate electricity. This is something that the smart grid can only partially take care of," *he said.*

To combat that, "We're beginning to look at using some of the fossil fuel generation as what is called poly-gen," he said. That is, use the power that's being taken off the power grid to do something useful, like make biofuel or other high-value products, *he said.*

Isn't the purpose of the grid to **reduce the effects of coal fired plants upon the environment and become more 'advanced' with innovations?** If they are looking towards coal fired as a back up, why spend all these billions on a grid to only have to depend upon them again? This is a ½ pregnant solution to a problem that is not as problematic as they are leading us to believe.

Symptoms of Radio Wave Sickness(excerpted from *No Place To Hide* April 2001)

Neurological: Headaches, dizziness, nausea, difficulty concentrating, memory loss, irritability, depression, anxiety, insomnia, fatigue, weakness, tremors, muscle spasms, numbness, tingling, altered reflexes, muscle and joint paint, leg and foot pain, flu-like symptoms, fever. More severe reactions can include seizures, paralysis, psychosis and stroke.

Cardiac: Palpitations, arrhythmias, pain or pressure in the chest, low or high blood pressure, slow or fast heart rate, shortness of breath.

Respiratory: Sinusitis, bronchitis, pneumonia, asthma.

Dermatological: Skin rash, itching, burning, facial flushing.

Ophthalmologic: Pain or burning in the eyes, eye pressure, deteriorating vision, floaters, cataracts.

Others: Digestive problems, abdominal pain, enlarged thyroid, testicular/ovarian pain, dryness (lips, tongue, mouth, eyes), great thirst, dehydration, nosebleeds, internal bleeding, altered sugar metabolism, immune abnormalities, redistribution of metals within the body, hair loss, pain in the teeth, deteriorating fillings, impaired sense of smell, ringing in the ears.

MERCURY SWITCHES

We know that mercury is being replaced in a myriad of products. We have been questioning whether the Sensus s'meters have a mercury switch. Since NVE initially installed s'meters by Itron, which some older models have mercury switches in them, and have consistently refused to provide model numbers for either Itron or Sensus m'meters, we are not aware if there are any with mercury in the tamper switches. Did NVE purchase these s'meters at a discounted rate as they were a older model to conserve money? Exhibit 59

HEALTH:

Everyone at NVE from low level employees such as Steve up to Paul had stated that these s'meters are safe and are not associated with any health effects.

I have been complaining that exposures to these constant, low level emissions (according to NVE), are problematic and we are not sure of the long term consequences associated with said exposure.

NVE contention is that we are exposed to EMF/RF everywhere. That is a fallacious statement, as people can decide not have a cell phone, wi fi etc., you can't escape it when it's attached to your residence. You cannot go from the specific to the general, it must be from the general to the specific. Just because some people have xyz, does not logically follow that everyone has xyz. By broad-brushing their 'perception' of what their customers own, then according to NVE, it should be laterally applicable to all. There are too many variables and each customer has to be perceived as a unique entity, that should be approached as such.

Asthma is a chronic lifelong malady that affects millions, from children to adults. There are varying degrees from acute to chronic. Which can result in major restrictions in lifestyles and livelihood. The American Lung Association strives to educate the public on how to prevent pulmonary damage that could result in asthma or how those with asthma can manage it.

A **recent study has come out citing that fetus' exposed to low levels of electro-magnetic radiation increases the chances of developing asthma**.

In an interview, August 1, 2011, with lead author De-Kun Li, MD, PhD, a reproductive and perinatal epidemiologist at the Kaiser Permanente Division of Research in Oakland, Calif,for the Journal of American Medical Association he stated:

*"*In today's *Archives of Pediatrics & Adolescent Medicine*, *researchers present the first study to show an association between* ***maternal exposure to magnetic fields (MF) during pregnancy and an increased risk of asthma in their offspring.*** *The study included 801 pregnant women whose children were followed up for 13 years. To measure their MF exposures, the women wore 24-hour meters.*

The researchers found that for each 1-milligauss (mG) increase in exposure per day, children had a significant 15% increased risk of asthma. *What's more, children born to women with the highest MF exposures during their pregnancy had a 3.5-fold increased risk of asthma compared with children whose mothers had the lowest exposures. (As a point of reference, other studies have linked increased cancer rates with workday exposures above 4 mG.)*

For our population, we're talking about ***low frequencies generated by electricity****, like from power lines, microwave appliances, hair dryers, an electric toaster, or can opener—anything you plug in that has motors—and even fluorescent lights. We didn't pick out each of the sources, but we did ask about their locations in 5 categories: at home in bed, at home but not in bed, at work, during transit, and all others.* ***We found out that they get to the high level of exposure, greater than 2.0 mG, in each of those categories except in transit. For most people the average [daily] exposure is between 0.3 mG and 2.0 mG. You could have a high 50 mG exposure, but those are short brief bursts. Most times, you usually have constant low exposure levels****.*

Sometimes in science you know there might be something going on, but it's hard to prove it. So I was surprised by how strong [the relationship] is. I think the reason why we find a nice dose-response relationship is because MF is really bad, particularly during pregnancy. ***The fetus is so sensitive in fetal development that any environmental adverse effect is going to be amplified.*** *news@JAMA: What implications for asthma prevention do your findings suggest?*

Dr Li: ***Pregnant women really need to avoid MF exposure as much as they can****. For asthma, particularly if your mother had asthma and if this is your firstborn baby, you should pay more attention. Our [data] show that if your mother had a history of asthma, MF exposure is particularly bad for you, and if this is your firstborn, MF exposure is particularly bad for you. There is no downside of avoiding MF.*

This is the ***first study to show that exposure to MF during pregnancy had a detrimental effect on the offspring****. Hopefully, this opens up a* ***new chapter of studying health effects and also hopefully we'll cut through the thickness of dismissive attitudes out there about MF studies. Everybody is exposed, so if MF truly has adverse effects, it's going to impact huge numbers in the population****.* Exhibit 60

Maternal Exposure to Magnetic Fields During Pregnancy in Relation to the Risk of Asthma in Offspring

Objective *To determine whether maternal exposure to high levels of magnetic fields (MFs) during pregnancy is associated with the risk of asthma in offspring.*
Design *A prospective cohort study.*
Setting *Kaiser Permanente Northern California.*

Participants *Pregnant Kaiser Permanente Northern California members in the San Francisco area.*
Main Outcome Measures *Asthma was clinically diagnosed among 626 children who were followed up for as long as 13 years. All participants carried a meter to measure their MF levels during pregnancy.*
Results *After adjustment for potential confounders, a statistically significant linear dose-response relationship was observed between increasing maternal median daily MF exposure level in pregnancy and an increased risk of asthma in offspring: every 1-mG increase of maternal MF level during pregnancy was associated with a 15% increased rate of asthma in offspring (adjusted hazard ratio [aHR], 1.15; 95% confidence interval [CI], 1.04-1.27). Using the categorical MF level, the results showed a similar dose-response relationship: compared with the children whose mothers had a low MF level (median 24-hour MF level, ≤0.3 mG) during pregnancy, children whose mothers had a high MF level (>2.0 mG) had more than a 3.5-fold increased rate of asthma (aHR, 3.52; 95% CI, 1.68-7.35), while children whose mothers had a medium MF level (>0.3-2.0 mG) had a 74% increased rate of asthma (aHR, 1.74; 95% CI, 0.93-3.25). A statistically significant synergistic interaction was observed between the MF effect and a maternal history of asthma and birth order (firstborn).*
Conclusion *Our findings provide new epidemiological evidence that high maternal MF levels in pregnancy may increase the risk of asthma in offspring.* Exhibit 61

Prenatal Exposure to Weak Magnetic Fields Leads to Childhood Asthma

First Prospective EMF Epidemiological Study Ever Done
A mother's exposure to weak power-frequency magnetic fields during pregnancy substantially increases the chances her child will develop asthma, according to a new study by De-Kun Li and coworkers at Kaiser Permanente in Oakland, CA. ***An average magnetic field exposure of just 2 mG (0.2 µT) during pregnancy more than triples the child's risk of getting asthma by the age of 13,*** *they report in a paper released today by the Archives of Pediatrics & Adolescent Medicine, a publication of the American Medical Association (AMA).*

"It's a very provocative finding that needs replication," Jonathan Samet told Microwave News. Samet, an epidemiologist at the University of Southern California (USC) and a member of the National Cancer Advisory Board, served as the ***chair of the IARC panel that in May classified cell phone radiation as a possible human carcinogen.***

"The fetus of a mother with a history of asthma is especially vulnerable to magnetic field exposures," Li told Microwave News. ***And first-born children, who have been shown to have higher risks of developing asthma, were found to be at even greater risk when their mothers were exposed, on average, to more than 2 mG.*** *Exhibit 62*

Normally the lay public doesn't understand science or research terminology so photos can make more of an impact to this demographic.

Two students of the Gymnasium high school in Spaichingen (Germany) have investigated the influence of using a mobile phone on the red blood cells. With a microscope they made 255 pictures of the blood of 51 testees. The students, Maria Ritter and Wasgan Wolski, received a regional award for young researchers, reports the Schwäbische Zeitung of March 7, 2005.

The testees were not allowed to use their mobile phones for 24 hours. Afterwards the researchers took blood from a finger tip and earlobe. Then the testees had to use a phone for 20 seconds. Immediately after that the researchers took blood

again and ten minutes later again. **The result: after using the mobile phone it was clearly visible that the red blood cells lumped together in 'rolls of coins'.**

Also ten minutes afterwards the 'rolls of coins' still were clearly visible. **The lumping raises the risk of thrombosis**. Moreover the cells take up and transport less oxygen, report Ritter and Wolski. The research was directed by their teacher Dr. Markus Ziegler.

Auswirkungen eines Handy-Telefonats

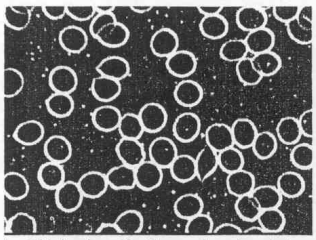
von nur 90 Sekunden Dauer

dargestellt an den Veränderungen des Kapillarblutbildes
im Dunkelfeldmikroskop

Technische Daten der Untersuchung:
Dauer des Telefonats: 1,5 Minuten
Handy Marke Nokia 5110 (D-Netz)
Sendeleistung beim Telefonat: 70 bis 100 µW/cm²
(Gesetzlicher deutscher Grenzwert (D-Netz): 450 µW/cm²)

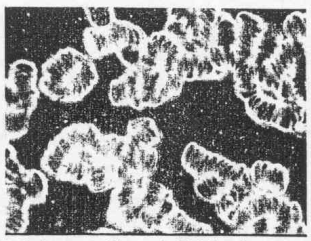
Durchführung der Untersuchung:
Kornelia Tomson, Heilpraktikerin
allgemeine ganzheitliche Naturheilverfahren,
naturheilkundliche Umweltmedizin, Erfahrungsheilkunde
29225 Celle, Tel.: 05141 – 94 12 80

Vor dem Telefonat



Im Bild durch weiße Ringe erkennbar sind die roten Blutkörperchen (Erythrozyten im Kapillarblut aus dem Ohr), die im Blutplasma schwimmen und sich aufgrund ihrer elektrischen Ladung und Polarisierung gegenseitig abstoßen.

Nach dem Telefonat

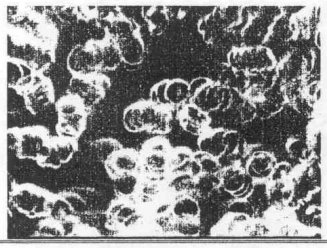


Veränderung im Blut nach 90 Sekunden Mikrowelleneinstrahlung durch das Handy: Die Blutkörperchen sind depolarisiert und haften deshalb aneinander. Folgen: Durchblutungsstörungen und Sauerstoffmangel. Durch die „Geldrollenbildung" kann die Oberfläche der Blutkörperchen nicht genügend Sauerstoff aufnehmen. Da das Gehirn allein 20% des aufgenommenen Sauerstoffs verbraucht, können auch Konzentrationsstörungen und Störungen des Kurzzeitgedächtnisses auftreten.

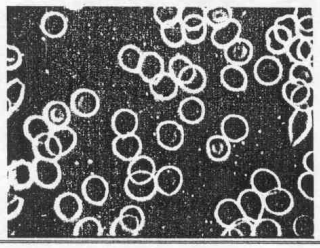
Proband A

telefoniert bei dieser Studie mit einem handelüblichen Handy. Die Strahlungsintensität während des Telefonats beträgt weniger als 25% des gesetzlich zulässigen Grenzwertes. Trotzdem kommt es im Biosystem des Menschen zu beträchtlichen Auswirkungen, wie diese Untersuchung belegt.

20 Minuten nach dem Telefonat



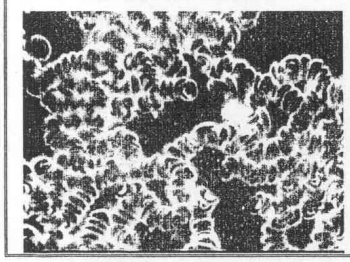
40 Minuten nach dem Telefonat



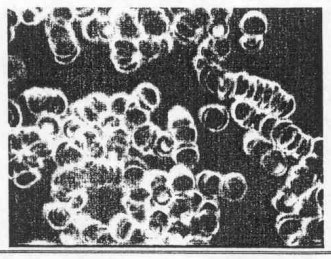
Proband A hält sich nach dem Telefonat in einem gegen Mikrowellen abgeschirmten Raum auf, um äußere Mikrowelleneinflüsse auszuschließen.
Auch 20 Minuten nach dem Telefonat haben sich die Verklumpungen der Erythrozyten noch nicht wieder ganz aufgelöst.
Erst nach 40 Minuten ist eine Normalisierung erkennbar.

Auch Nicht-Handytelefonierer sind betroffen:

Während des Telefonats



20 Minuten nach dem Telefonat



Proband B

Proband B telefoniert nicht selbst mit einem Handy, sondern hält sich während des Telefonats von Proband A in einem Abstand von 1,7 m zu Proband A auf.
Auch bei Proband B kommt es zur Depolarisierung der Blutzellen.
Auch nach 20 Minuten hat sich dieser Zustand noch nicht völlig normalisiert.

Bei einem Handytelefonat treten auch bei in der Nähe befindliche Personen Gesundheitsschäden auf. Besonders betroffen davon sind Kinder, weil deren Nervensystem bis zur Pubertät noch nicht voll ausgebildet ist und die Gefahr der Schädigung des Nervensystems besteht. Die britische Regierung hat deshalb bereits einen entsprechenden Warnhinweis auf dem „Beipackzettel" für Handys gesetzlich verordnet.

Bitte wenden

Herausgegeben von der gemeinnützigen Gesellschaft für Gesundes Leben e.V.
29225 Celle, Ententeich 25, Telefon und Telefax: 05141-330283
Im Internet: www.gesundesleben-ev.de, e-mails an: info@gesundesleben-ev.de

Translation from German: Exhibit 63
The Effect of Cell Phone Radiation on the Red Blood Cell

A Change in the Blood as Seen Under a Dark Field Microscope: The Effects of Mobile Phone Radiation After Just a Ninety-second Cellular-Phone Call

Study Conditions
Length of Phone Call: Ninety seconds
Mobile Phone Make: Nokia 5110 (900 MHz)
Signal Strength: 70-100 uW/cm2 (The maximum limit in Germany for cell phone signal strength is 470 uW/cm2).

Effects seen under a dark-field microscope of blood taken from an ear capillary.

Subject A: Person speaking on mobile phone.
-In spite of the fact that the strength of the call was below the legal limit by 25%, the results of the study show a major effect on the bodily systems.

Photo 1: Before the phone call. The red blood cells due to their electrical charge and polarity are floating in the blood seperated from the other red blood cells.

Photo 2: After the phone call. The cells have lost their polarity and integrity and are clumping together. This results in hypoxia or a lack of oxygen reaching the cells in the body's organs. Due to numerous cells clumping together a cell's surface area is diminished and this results in the inability of the red blood cell to take in sufficient oxygen. Since the brain consumes 20% of the oxygen carried by red blood cells, the possible effects of this are a diminished ability to remember new things.

Photo 3: Twenty minutes after the phone call.

Photo 4: Forty minutes after the phone call.

After the phone call the blood is attempting to regain its original form but even twenty minutes later the cells still haven't returned to their natural state. Finally, forty minutes later we see a return to the orignal form.

The People Around the Mobile Phone User are Also Affected.

Subject B: A person 1.7 meters away from the person using the mobile phone.
-We are seeing a loss of polarity in the blood cell. Even after twenty minutes the blood still hasn't recovered to its normal state.

Photo 5: Blood taken during the mobile phone call from a bystander nearby the mobile phone user.

Photo 6: Blood taken twenty minutes after the phone call.

Mobile phone radiation is shown to affect those people nearby the caller. Children's developing nervous systems - having not reached full maturation - are especially sensitive to the effects of mobile phone microwave radiation. Due to this fact, the British government has made it a legal requirement to include a warning in the instruction packet of mobile telephones.

Statement for the Subcommittee on Labor, Health and Human Services, Education, and Related Agencies
Committee on Appropriations
United States Senate
September 14, 2009
Hearing on The Health Effects of Cell Phone Use

Statement of John R. Bucher, Ph.D.
Associate Director of the National Toxicology Program
National Institute of Environmental Health Sciences
National Institutes of Health
U.S. Department of Health and Human Services

The Food and Drug Administration (FDA) nominated cell phone radiofrequency radiation emissions to the NTP for toxicology and carcinogenicity testing. The FDA nomination was based on the following concerns:

There is widespread human exposure;

Current exposure guidelines are based on protection from acute injury from thermal effects;

Little is known about the potential for health effects of long-term exposure; and

Sufficient data from human studies to definitively answer these questions may not be available for many years.

The NTP is conducting studies in ***three phases: (1) a series of pilot studies to establish field strengths that do not excessively raise body temperature; (2) subchronic toxicology studies where the animals are exposed to various subthermal field strengths for one month; and (3) chronic toxicology and carcinogenicity studies where the animals will be exposed for 24 months. The studies are being carried out with both sexes of rats and mice and with pregnant female rats. Thus, these studies will examine potential health effects resulting from exposures starting in gestation and continuing through old age.***

The projected timeline is that pilot studies should be completed in November 2009. Subchronic toxicology studies then are expected to begin in early 2010, and the chronic toxicology and carcinogenicity studies are expected to start in late 2010, with an anticipated completion in 2012 and subsequent reporting and ***peer review of the data in 2013-2014.***

Collectively, these rodent studies conducted by the NTP will provide critical information regarding the safety of exposure to radiofrequency radiation and strengthen the science base for determining any potential health effects in humans. These data could contribute to information used by the federal government, including FDA, in making decisions with respect to radiofrequency radiation health issues consistent with the protection of public health and safety.

Cellular phone utilization serves as one of the major environmental risk factors being considered in this study*. These grants are expected to conclude in 2010 and 2011, respectively, and findings will be made available shortly thereafter.*

NIEHS is using American Recovery and Reinvestment Act funding to support researchers at the University of California, Los Angeles, who are studying whether exposure to cellular telephones in childhood can have effects on the central nervous system. The cohort for the study consists of over 100,000 Danish children born between 1996 and 2007, with data gathered on cell phone use. The research team plans to study whether cell phone exposure might be related to behavioral and developmental problems, as well as other outcomes such as seizures, migraines, and sleep disturbances. Exhibit 64

TUMORS AND CELL PHONE USE: WHAT THE SCIENCE SAYS HEARING BEFORE THE SUBCOMMITTEE ON DOMESTIC POLICY OF THE COMMITTEE ON OVERSIGHT AND GOVERNMENT REFORM HOUSE OF REPRESENTATIVES- 110th Congress Second Session September 25, 2008 Exhibit 31

IT is 'interesting' that at a hearing to have the opportunity to refute any association that **the CTIA; , the association of the wireless telecommunications** ***industry, declined our invitation to testify. By their refusal, unfortunately, they deny this Congress and the public the benefit of their testimony and the opportunity to pose questions and to hear answers. I hope that the wireless industry will reconsider their decision, should the subcommittee determine it would be beneficial to hold further hearings on this matter.***

This is an important hearing today. It is important for a number of reasons. First of all, I understand it has been ***15 years since the last time a hearing like this was held****. Second, as somebody who spent his career both in the* ***military and then more extensively for 20 years in business, producing radio frequency products, I am acutely aware that in fact there is a link at some point along the spectrum to cancer****.*

My name is David Orlo Carpenter, and I am a public health physician whose major research interest is the study of environmental causes of human disease. I have over 300 publications in peer-reviewed scientific journals. After graduation from Harvard Medical School, I spent 15 years working in federal research laboratories, first at the National Institute of Mental Health and then for the Armed Forces Radiobiology Research Institute, where I first became involved in questions concerning the health effects of electromagnetic fields. I left Bethesda in 1980 to become the Director of the Wadsworth Center for Laboratories and Research of the New York State Department of Health, the third largest public health laboratory in the US. In 1985, I became the founding Dean of the School of Public Health of the University at Albany, created as a partnership between the University and the Department of Health. I held this position until 1998, when I became the Director of the Institute for Health and the Environment and Professor of Environmental Health Sciences at the University at Albany, the positions I hold today. Public health is the profession that attempts to prevent disease in the general population, rather than providing direct medical care to individuals.

The Bioinitiative Report is authored by an international team of scientists, each with specific areas of expertise. The motivation for this report was the consensus among the authors that recent national and international reviews are excessively conservative and that current exposure guidelines do not adequately protect the health of the public. The central conclusions with regard to cell phones and new evidence that has appeared since are as follows:

1. There are literally hundreds of studies that have demonstrated that radiofrequency electromagnetic fields, at intensities that do not cause measureable tissue heating, have harmful effects in animals and isolated human cells (see Carpenter and Sage, 2007). Some of these actions (altered gene induction, production of heat stress proteins, production of reactive oxygen species, altered hormonal levels, altered regulation of cellular calcium and indirect DNA damage) are changes known to be associated with the development of cancer.
2. There have been a number of studies investigating the relation between cell phone use and development of brain cancer. Most of these have not reported an increased risk, but almost

all of the negative studies have been of individuals using a cell phone for a relatively brief period of time. Recent studies, primarily from Scandinavia where cell phones were first manufactured and where there has been longer use as compared to the US, are finding significant increases in risk of brain cancer among individuals who have used a cell phone for ten or more years. In a meta-analysis of ten studies of glioma, Hardell et al. (2008) found a doubling of the risk of developing a brain tumor on the side of the head that the patient held a cell phone, with no elevated risk on the other side of the head. Similar results were found upon analysis of nine studies of acoustic neuroma, a space-occupying tumor of the 8th cranial nerve. They found a 2.4-fold increase in acoustic neuroma but only on the side of the head where the patient utilized the cell phone.

3. Studies from Israel (Sadetzki et al., 2008) have reported about a 50% elevation in the risk of parotid gland cancer among individuals who have used a cell phone for long periods of time, but only on the side of the head on which the patient held his/her cell phone. The parotid gland is one of the salivary glands and is located in the cheek where it is exposed to the radiofrequency emissions from a cell phone.
4. Studies from Korea (Ha et al., 2007) report highly significant increases in rates of leukemia in children living near AM radio transmission towers. Leukemia is the same cancer that is elevated in children as a result of exposure to powerlines. This observation, in light of those cancers found with cell phone usage, suggests that when the full body is exposed to radiofrequency radiation the risk is greatest for leukemia, but that when the exposure is localized, as it is to one side of the head with cell phones, then one sees cancers of the brain, auditory nerve and parotid gland.
5. Very recent studies from Sweden show that young children are at particularly elevated risk from exposure to radiofrequency fields. At a meeting of the Royal Society in London earlier this month, Hardell reported a 40% increase in risk of glioma among individuals of all ages if they had used a cell phone, but a 5.2-fold increase in risk if they were under 20 years of age when they began cell phone usage . This observation is consistent with a large body of scientific studies that demonstrate that children are more vulnerable than adults to carcinogens (Ginsberg, 2003), and poses particular concern because of the widespread use of cell phones by children of all ages today.

The current exposure standards in the US and around the world are based on the assumption that radiofrequency fields are without serious biological effects at intensities that are not adequate to cause tissue heating. The observations listed above demonstrate that this assumption is simply wrong. There are many in the physics and engineering communities that consider it impossible for electromagnetic fields which are not of sufficient energy to directly break chemical bonds to cause harmful effects, and this is the mentality that explains why exposure standards are set as high as they are. This belief ignores the complexities of biology. Setting standards on the basis of this assumption is unjustified, given the evidence in animal and cellular studies and especially in human populations demonstrating a direct relationship between cell phone use and cancer.

Current US standards for uncontrolled public exposure to radiofrequency radiation are about 1,000 times higher than the levels which appear to increase the risk of cancer on prolonged exposure. It is not clear that exposure to radiofrequency electromagnetic fields is safe at any level, but it is very clear that our current standards are incompatible with the evidence of human disease resulting from cell phone exposures. As with other environmental exposures, the scientific evidence indicates that the risk increases with both the intensity and duration of exposure.

On September 4, 2008, the European Parliament passed a resolution stating "the limits on exposure to electromagnetic fields which have been set for the general public are obsolete...and do not address the issue of vulnerable groups, such as pregnant women, newborn babies and children". We call on the US Congress to give similar attention to this issue. There needs to be consideration of biologically-based standards of exposure by the Federal Communications Commission and international agencies. There needs to be health-based warnings, especially designed to protect children, issued by those federal agencies whose responsibility it is to provide such information to the public, including the Centers for Disease Control, the National Institutes of Health and the Environmental Protection Agency. It is essential that the communications industry work to develop technology that will allow the public to enjoy the benefits of the wireless age without associated serious health risks.

Certainly, more research is needed in order to determine the exact magnitude of the risk of cancer from exposure to radiofrequency radiation. The exposure assessment in the studies done to date is poor, often relying on an individual's memory of how frequently they used a cell phone over many years, or whether or not an individual owned a cell phone. The limitations in exposure assessment are likely to lead to an underestimation of the actual risk. The evidence available now poses the frightening strong possibility that we are facing an epidemic of brain cancer and other cancers in the future as a result of the uncontrolled use of cell phones. Of particular concern is the fact that many children spend hours on cell phones, with no warning to them, their parents or physicians indicating that this may be dangerous. While the risks are not solely to children, they are the most vulnerable and should have the possibility of a long life free from brain cancer. Precaution is warranted, even in the absence of absolutely final evidence concerning the magnitude of the risk. We must not repeat the situation we had with the relationship between smoking and lung cancer, where we as a nation waited until every "i" was dotted and "t" was crossed before warnings were issued. We have enough evidence to act now to reduce exposure through education, setting appropriate standards and development of technology that will allow us to safely use cell phones and other wireless devices.

Generally speaking, it is important to stress that children are not just little adults. They often are much more vulnerable to the effects of environmental exposures. *For cell phones, this matters because the* ***skull of children is much less dense than the skull of adults and modeling research has shown that cell phone RF signals are observed much deeper into the brains of children****.*

It is worth noting that in the case of tobacco and lung cancer, debates over whether there was a true increase in lung cancer associated with smoking raged far longer than they should have, fomented by an active disinformation campaign of which this Congress is well aware. The dilemma of public policy when it comes to controlling and identifying the causes of cancer is profound. If we insist we must be certain of human harm and wait for definitive evidence of such damage, we are effectively saying that we can only act to prevent future cancers, once past ones have become evident. Recalling the 70 years that it took to remove lead from paint and gasoline and the 50 years that it took to convincingly establish the link between smoking and lung cancer, I argue that we must learn from our past to do a better job of interpreting evidence of potential risk. In failing to act quickly, we subject ourselves, our children and our grandchildren to the possibility of grave harm and to living with the knowledge that with more rapid action that harm could have been averted.

ANALYSIS OF RECENT STUDIES

Electromagnetic fields generated by cell phones should be considered a potential human health risk. Sufficient time has not elapsed in order for us to have conclusive data on the biological effects of cell phones and other cordless phones—a technology that is now universal.

Studies in humans do not indicate that cell phones are safe, nor do they yet clearly show that they are dangerous. But, growing evidence indicates that we should reduce exposures, while research continues on this important question.

Manufacturers report that cell and wireless phones emit electromagnetic radiation. Electromagnetic fields are likely to penetrate the brain more deeply for children than for adults. Modeling in the diagram below estimates that young children are more susceptible to electromagnetic fields due to smaller sized brains and softer brain tissue.

1) Electromagnetic fields from cell phones are estimated to penetrate the brain especially in children. (Figure 1) [1, 2]

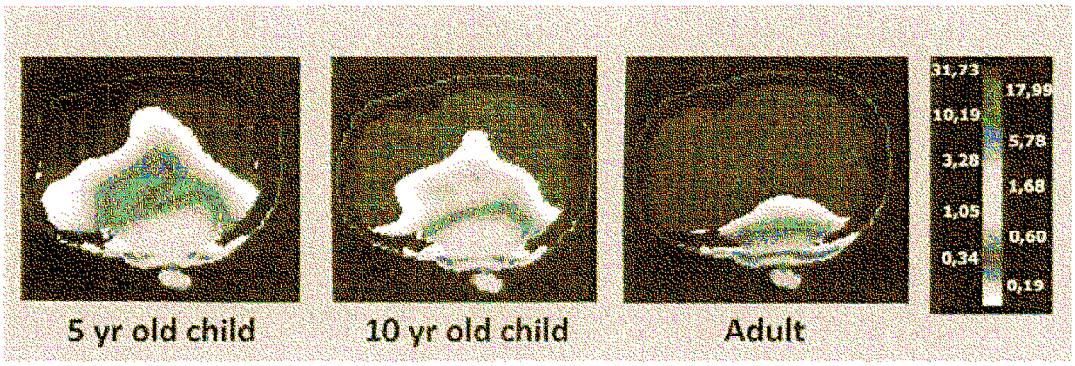


Figure 1 Model estimate of the absorption of electromagnetic radiation from a cell phone based on age (Frequency GSM 900 Mhz) (On the right, color scale showing the *Specific Absorption Rate* in W/kg)[1]

Effect on Genotoxic effect and DNA Damage

RF may be considered genotoxic, cause DNA damage including single and double strand breaks and cross-link, and micronucleus formation. Of 28 total studies on RF exposure and DNA damage, 14 studies reported significa total studies on RF radiation and micronucleation, 16 studies reported effects (55%). Of 21 total studies on chro damage from RF radiation, 13 studies (62%) reported significant effects.

Selected Significant Study Findings	Refe
Exposed mice to 900-MHz RF radiation at a SAR of 0.09 W/kg for 7 days at 12 h per day. A significant damage to both the mitochondrial genome and the nuclear -globin locus was found.	Aitke
Increases in DNA strand breaks and micronucleation in lymphocytes obtained from cell phone users.	Gand
Human fibroblasts and rat granulosa cells were exposed to mobile phone signal (1800 MHz; SAR 1.2 or 2 W/kg; during 4, 16 and 24 h; intermittent 5 min on/10min off or continuous). Effects occurred after 16 h exposure in both cell types. The intermittent exposure showed a stronger effect than continuous exposure.	Diem
Increases in single and double strand DNA breaks in brain cells of rats exposed for 2 hrs to 2450-MHz field at 0.6-1.2 W/kg.	Lai a 2005
An increased in single strand breaks in brain cells of rats after 35 days of exposure to 2.45 and 16.5 GHz fields at 1 and 2.01 W/kg.	Paulr
Exposed male rats to 2.45 GHz RFR fields for 2 hours daily, 7 days a week, at 5-10 mW/cm2 for up to 30 days. Erythrocyte count, haemoglobin and haematocrit were increased in peripheral blood on irradiation days 8 and 15. Anuclear cells and erythropoietic precursor cells were significantly decreased in the bone marrow on day 15, but micronucleated cells were increased.	Buslj
GSM microwaves at 915 MHz did not induce DNA double stranded breaks or changes in chromatin conformation, but affected expression of genes in rat brain cells.	Belya
Human peripheral blood lymphocytes were exposed to continuous 830-MHz EMFs (1.6-8.8 W/kg for 72 hr) showed a SAR dependent chromosome aneuploidy, a major "somatic mutation leading to genomic instability and thereby to cancer. It is suggesting that epigenetic alterations are involved in the SAR dependent genetic toxicity. The effects were non-thermal.	Mash

Effect on Stress Response (Stress Proteins)

The stress response enables cells to survive environmental stressors with the aid of heat shock proteins (HSP). It thermal power (ELF), and non-thermal RF, as well as thermal RF-EMFs. It has been shown that RF stimulates t and cells start to synthesize stress proteins in many different kinds of cells. Safety standards must be developed damage at nonthermal levels, and the standards must be defined in terms of a non-thermal biological dose.

Selected Significant Study Findings	Refe
EMF may affect electron distribution and movement in DNA, and help it to come apart to initiate protein synthesis. Charge transport through DNA depends on the DNA sequence, and there are reasons to believe that EMFs would cause the DNA to come apart at the EMF consensus sequence, nCTCTn.	Shao Blanl
Genotoxic effects were produced in fibroblasts, granulosa cells and HL60 cells by RF field exposure at SARs between 0.3 and 2W/kg. The expression and phosphorylation of the stress protein hsp27 was one of the many proteins affected.	REFI
The stress response threshold can be stimulated in both ELF and RF frequency ranges appears to suggest that the threshold is independent of EMF energy.	Lai a
The separation of thermal and non-thermal mechanisms had been shown, where chromosomal damage observed under RF in lymphocytes was not seen when the cells were exposed to elevated temperatures.	Mash
The molecular damage stimulated by non-thermal ELF fields occurs in the absence of an increase in temperature. ELF energy thresholds are estimated to be about 10^{-12} W/kg, over a billion times lower than the thermal stimuli that cause damage in the RF range.	Blanl
The importance of non-thermal mechanisms was showing that both denaturation and renaturation of β-lactoglobulin are accelerated by microwave EMF. It has also been shown that microwave radiation causes protein aggregation without bulk heating.	Bohr de Pc
Cellular processes are unusually sensitive to non-thermal ELF frequency fields, in the range of 0.5 to 1.0 μT, not very much higher than the environmental backgrounds of ~0.1μT. The low biological thresholds in the non-thermal ELF range undermine claims that an EMF must increase the temperature in order to cause changes in cells or cause DNA damage.	Blanl 1998 Cara 2005
In addition to very low thresholds, exposure durations do not have to be very long to be effective. It has been shown a full response to an occurred with ELF modulated 915MHz sine waves, when cells were exposed for only 10sec.	Litov

Effect on Immune System

Both human and animal studies reported immunological changes with exposure to environmental levels of EMF physiological changes (mast cells increases) that are bedrock indicators of allergic response and inflammatory c EMF exposures. It is possible that chronic provocation by exposure to EMF can lead to immune dysfunction, ch inflammatory responses and ill health if they occur on a continuing basis over time.

Selected Significant Study Findings	Refe
Assessed immunoglobulin concentrations and T-lymphocyte subsets in workers of TV re-transmission and satellite communication centers, increase in IgG and IgA concentrations, increased count of lymphocytes and T8 lymphocytes, decreased count of NK cells and a lower value of T-helper/T-suppressor ratio were found.	Dmo
Mast cells occur in the brain and their presence may under the influence of EMF and/or RF radiation exposure lead to chronic inflammatory response by the mast cell degranulation.	Zhua
For women exposed to EMF induced by radiotelevision broadcasting stations in residential area at least 2 years, a significant reduction of blood NK CD16+-CD56+, cytotoxic CD3(-)- CD8+, B and NK activated CD3(-)-HLA-DR+ and CD3(-)-CD25+ lymphocytes were found.	Bosc
Exposed mononuclear cells isolated from peripheral blood of healthy donors to 1,300 MHz pulse-modulated microwaves at 330 pps with 5 μs pulse width and the value of SAR = 0.18 W/kg. Pulse-modulated microwaves represent the potential of immunotropic influence, stimulating preferentially the immunogenic and proinflammatory activity of monocytes at relatively low levels of exposure.	Dabr
It was estimated that the proportion of individuals in Switzerland with electrical hypersensitivity (EHS) symptoms is about 5%. Based on a study of EHS in the UK, symptoms reported by mobile phone users included headaches (85%), dizziness (27%), fatigue (24%), nausea (15%), itching (15%), redness (9%), burning 61%), and cognitive problems (42%).	Roos Cox,
It was reported that non-thermal microwave exposure from GSM mobile phones at lower levels than the International Commission for Non-Ionizing Radiation Protection (ICNIRP) safety standards affect chromatin conformation and 53BP1/γ-H2AX foci among EHS adults.	Mark
It was reported that EMF from mobile phones affects the synchronization of cerebral rhythms. The finding suggested that prolonged exposure to mobile phone emissions affect cortical activity and the speed of neural synchronization by interhemispherical functional coupling of EEG rhythms.	Vecc

RF and Reactive Oxidative Species (ROS)

Several factors influence the susceptibility to oxidative stress by affecting the antioxidant status or free oxygen r
Radiofrequency fields of cellular phones may affect biological systems by increasing free radicals, which appea
peroxidation, and by changing the antioxidase activities of human blood thus leading to oxidative stress. Acute e
commercially available cellular phones may modulate the oxidative stress of free radicals by enhancing lipid pe
activation of superoxide dismutase (SOD) and total glutathione peroxidase (GSH-Px), which are free radical sca
2001)

RF and gene expression

It was found that some genes were up-regulated during the RF exposure which mainly involved in the following
the basis of reported literatures: cytoskeletal structure, signal transduction pathway, ion channel, complement ac
genes, cell adhesion, etc., whereas oxidation and deoxidization, immediately early genes, transcription factors, p
connexon were down-regulated by clustering analyses. Gene expression of rat neuron could be altered after exp
at a frequency of 1800 MHz modulated by 217 Hz which is commonly used in cell phone. Among 1200 candida
genes and 10 down-regulated genes were identified after 24-h intermittent exposure at an average SAR of 2 W/k

RF and Reproductive System

Animal studies indicate that EMW may have a wide range of damaging effects on the testicular function and ma
1999 and Davoudi et al., 2002). Recently, decreased sperm account has been reported (Agarwal et al.,2008). Me
phones the most had significant poorer sperm quality than those who used them the least. The lowest average sp
men who had the most cell phone use (more than four hours a day).

Overview of Biological Impacts of RF - Epidemiologic Evidence

Study	Population	Period	Study type	No of cases	No of Controls	OR (95% CI)	Cell phone exp
Inskip et al., 2001	USA	1994–1998	Case–control	22	172	1.0 (0.5 – 1.9)[1]	Regular use (a
				5	31	1.9 (0.6 – 5.9)[1]	≥ 5 years of re
				9	51	1.4 (0.6 – 3.5)[1]	> 100 hours of
Muscat et al., 2002	USA	1997–1999	Case–control	11	6	1.7 (0.5 – 5.1)	3–6 years of re cell phone serv
				9	12	0.7 (0.2 – 2.6)	> 60 total hour
Christensen et al., 2004	Denmark	2000–2002	Case–control	45	97	0.9 (0.5 – 1.6)	Regular use (r
				9	25	0.7 (0.3 – 1.9)	> 5 years (> 8
Lönn et al., 2004	Sweden	1999–2002	Case–control	89	356	1.0 (0.6 – 1.5)	Regular use (r
				12	15	3.9 (1.6 – 9.5)	≥ 10 years sinc
Schoemaker et al., 2005	4 Nordic countries, UK	1999–2004	Case–control	360	1934	0.9 (0.7 – 1.1)	Regular use (h months more t
				23	72	1.8 (1.1 – 3.1)	≥ 10 lifetime y
Hardell et al., 2002	Sweden	1997-2000	Case-Control	38	11	3.5 (1.8 – 6.8)	> 1-year latenc
Hardell et al., 2005	Sweden	2000-2003	Case-Control	20	79	2.0 (1.05 – 3.8)	> 1-year latenc
				53	343	4.2 (1.8 – 10)	> 1-year latenc
Hardell et al., 2006	Sweden	1997–2003	Case–control	68	297	2.9 (2.0 – 4.3)	> 1-year latenc
				105	776	1.5 (1.1 – 2.1)	> 1-year latenc
				19	84	3.1 (1.7 – 5.7)	≥ 10-year later
				36	189	2.2 (1.4 – 3.4)	> 1000 hours c
Takebayashi et al., 2006	Japan	2000–2004	Case–control	51	192	0.7 (0.4 – 1.2)	Regular mobil least 6 months
				4	12	0.8 (0.2 – 2.7)	> 8 years cumu
				7	28	0.7 (0.3 – 1.9)	> 900 hours cu
Schüz et al., 2006	Denmark	1982–2002	Cohort	32	43.7	0.7 (0.4 – 1.03)[2]	Regular use (u
				28	42.5	0.7 (0.4 – 0.95)	≥ 10 years use
Klaeboe et al., 2007	Norway	2001-2002	Case–control	22	227	0.5 (0.2 – 1.0)	Regular use (u for at least 6 m
				8	67	0.5 (0.2 – 1.4)	> 6-year latenc
				7	56	0.6 (0.2 – 1.8)	>425 hours cu
Hardell et al., 2008	Sweden		Meta-analysis	824	4261	0.9 (0.7 – 1.1)	Regular cell ph
				83	355	1.3 (0.6 – 2.8)	Using cell pho

1. Relative Risk 2. Standardized incidence ratio (SIR) was calculated based on observed and expected numbers; 3. Based on
4. Based on 4 case-control study (Lönn et al 2004, Christensen et al. 2004, Schoemaker et al. 2004, and Hardell et al., 2006)

Overview of Biological Impacts of RF – Epidemiologic Study (continued)

Study	Country	Period/study	Type of Tumor	No of cases	No of Controls	OR (95% CI)	Cell phone exp
Inskip et al., 2001	USA	1994–1998	Glioma	172	85	0.8 (0.6 – 1.2)[1]	Regular cell ph
		Case–Control		31	11	0.6 (0.3 – 1.4)[1]	≥ 5 years of reg
			Meningioma	172	32	0.8 (0.4 – 1.3)[1]	Regular cell ph
				31	6	0.9 (0.3 – 2.7)[1]	≥ 5 years of reg
			All brain	172	139	0.8 (0.6 – 1.1)[1]	Regular cell ph
			tumors	31	22	0.9 (0.5 – 1.6)[1]	≥ 5 years of reg
Hardell et al., 2002	Sweden	1997-2000	Meningioma	9	2	4.5 (0.9 – 20.8)	> 1-year latency
		Case-Control		11	14	0.8 (0.4 – 1.7)	> 1-year latency
			All benign	49	13	3.8 (2.0 – 6.9)	> 1-year latency
			tumors	35	34	1.0 (0.6 – 1.7)	> 1-year latency
Hardell et al., 2005	Sweden	2000-2003	Meningioma	74	160	1.7 (1.1 – 2.6)	> 1-year latency
		Case-Control		20	39	2.2 (1.1 – 4.3)	> 1-year latency
			All benign	218	343	1.5 (1.1 – 2.1)	> 1-year latency
			tumors	62	79	2.4 (1.5 – 3.9)	> 1-year latency
				200	305	1.5 (1.1 – 2.0)	> 1-year latency
Hardell et al., 2006	Sweden	1997–2003	Meningioma	113	297	1.3 (0.99 – 1.7)	> 1-year latency
		Case–control		295	776	1.1 (0.9 – 1.31)	> 1-year latency
				34	84	1.6 (1.02 – 2.5)	≥ 10-year latenc
				60	102	1.6 (1.1 – 2.2)	> 1000 hours cu
			All benign	199	297	1.6 (1.3 – 2.0)	> 1-year latency
			tumors	437	776	1.2 (0.96 – 1.4)	> 1-year latency
				57	84	1.8 (1.2 – 2.6)	≥ 10-year latenc
				84	102	1.6 (1.2 – 2.2)	> 1000 hours cu
Schüz et al., 2006	Denmark	1982–2002	Glioma	257	253.9	1.0 (0.9 – 1.1)[2]	Regular cell ph
		Cohort	Meningioma	68	79.0	0.7 (0.5 – 1.0)	Regular cell ph
Klaeboe et al., 2007	Norway	2001-2002	Glioma	161	227	0.6 (0.4 – 0.9)	Regular cell ph
		Case–control		55	61	0.7 (0.4 – 1.2)	> 6-year latency
				49	54	0.7 (0.4 – 1.3)	>425 hours cum
			Meningioma	96	227	0.8 (0.5 – 1.1)	Regular cell ph
				28	50	1.2 (0.6 – 2.2)	> 6-year latency
				18	49	0.9 (0.4 – 1.7)	>425 hours cum

1. Relative Risk 2. Standardized incidence ratio (SIR) was calculated based on observed and expected numbers

Overview of Biological Impacts of RF – Epidemiologic Study (continued)

Study	Country	Period/study	Type of Tumor	No of cases	No of Controls	OR (95% CI)	Cell phone expos
Auvinen et al., 2002	Finland	1996 Case–Control	Gliomas	172	921	2.1 (1.3 – 3.4)	Ever use analogu
				188	938	1.0 (0.5 – 2.0)	Ever use digital (
			Meningioma	121	615	1.5 (0.6 – 3.5)	Ever use analogu
				126	623	0.7 (0.2 – 2.6)	Ever use digital (
			All brain	358	90	1.6 (1.1 – 2.3)	Ever use analogu
			tumors	382	96	0.9 (0.5 – 1.5)	Ever use digital (
Johansen et al., 2001	Denmark	1982-1995 Cohort	Glioma	66	70	0.9 (0.7 – 1.2)	Regular cell phor
			Meningioma	16	18.6	0.9 (0.5 – 1.4)	Regular cell phor
			Brain and	84	81	1.0 (0.8 – 1.3)	Analogue cell ph
			nervous	20	15	1.3 (0.8 – 2.1)	Analogue and dig
			tumors	50	56.1	0.9 (0.7 – 1.2)	Digital cell phon
Muscat et al., 2000	USA	1994-1998 Case-Control	Brain Cancer	13	20	0.7 (0.3 – 1.4)	Frequent handhe
				14	19	0.7 (0.3 – 1.4)	> 480 hours cum
Schüz et al., 2006	Germany	2000-2003 Case-Control	Glioma	138	283	0.98 (0.7 – 1.3)	Regular cell phor
				51	91	1.1 (0.8 – 1.7)	≥ 5-year of regul
				34	74	1.0 (0.6 – 1.6)	Lifetime duration
			Meningioma	104	234	0.8 (0.6 – 1.1)	Regular cell phor
				23	50	0.9 (0.5 – 1.5)	≥ 5-year of regul
				24	44	1.0 (0.6 – 1.8)	Lifetime duration
Hepworth et al., 2006	England	2000-2004 Case-Control	Glioma	966	1716	0.9 (0.8 – 1.1)	Regular mobile p
				66	112	0.9 (0.6 – 1.3)	≥ 10-year of regu
				278	486	1.2 (1.0 – 1.5)	Ipsilateral mobile
				199	491	0.8 (0.6 – 0.9)	Contralateral mo
Lahkola et al., 2007	5 North European countries	2000-2004 Case-Control	Glioma	1496	3134	0.8 (0.7 – 0.9)	Regular mobile p
				629	88	0.9 (0.7 – 1.3)	≥ 10-year of regu
			Globlastoma	698	3134	0.8 (0.6 – 0.9)	Regular mobile p
				330	38	0.8 (0.5 – 1.2)	≥ 10-year of regu

1. Standardized incidence ratio (SIR) was calculated based on observed and expected numbers

Summary of weakness and strength of reviewed articles use of cell phone and acoustic r

Study	Strength	Weakness
Inskip et al 2001	Cumulative use was calculated as the product of the duration of regular phone use. The relative risk (RR) were adjusted for several matching variables	Small sample size and inadequat AN. Limited to capture historica heavy exposures. Misclassificati
Muscat et al. 2002	Interviews were performed in person (only one was replied by spouse). The odds ratios were adjusted for several variables including occupational categories.	Definition of regular use can't as phone use, not can response freq term risk measurements.
Christensen et al. 2004[a,b]	The study has power of 75% to detect a doubling risk of AN with a latency 5-year or more. Standardized face-to-face interviews diminished recall bias. Lifetime cumulative use was calculated.	Definition of regular use. High r death. Retrospective case ascerta bias. Lack of information on con
Lönn et al 2004[b]	Control selection was adjusted of their reference dates to ensure that control did not have a longer exposure. Use of analog and digital mobile phones was analyzed separately.	Definition of regular use. Selecti lower response rate among contr control selection.
Schoemaker et al. 2005[b]	Statistical power was high in the larger case-control studies. Lifetime cumulative exposure was calculated. Excluding subjects who reported having radiotherapy.	Definition of regular use. Selecti lower response rate among contr recall bias and changes of cell ph
Hardell et al. 2002, 2005, 2006	Observational bias was reduced by blinding interviewers and data coding. Relatively higher case number and only living cases were included to obtain higher data quality. Long latency of cell phone use was available in the 2006 publication.	Recall bias and misclassification Excluding death cases may unde tumors. Statistical uncertainty du interval.
Takebayashi et al. 2006 [b]	Two indices were considered including cumulative length of use and cumulative call time.	Definition of regular use. Small Participation rate is different am selection bias.
Schüz et al. 2006	The only one cohort study with large population. The mean time since first cell phone subscription was 8-years. Objective measure of exposure and subscription years was derived from the network provider.	Definition of regular use. Exclud who may have higher exposures. calculated. Misclassification of e
Klaeboe et al. 2007[b]	Any substantial change in use that longer than 6 months was reported. Cumulative use was calculated.	Definition of regular use. Small Selection bias due to a 30% non- and controls.

a. First result from the Danish portion of the INTERPHONE project. b. Participants of the INTERPHONE STU

Cancer Epidemiology:

- • Increase the incidence of many types of cancer, including leukaemia, brain tumor, testicular cancer, genitourinary and breast cancer, Robinette et al. (1980), Milham (1985, 1988), Szmigielski (1996), Hocking et al. (1996), Dolk et al. (1997 a, b), Beall et al. (1996), Grayson (1996), Thomas et al. (1987), Lilienfeld et al. (1978), Zaret (1989), Davis and Mostofl (1993), Hayes et al. (1990), Tynes et al. (1996), Cantor et al. (1995), and many others.

These biological and health effects are consistent with the biological understanding that brains, hearts and cells are sensitive to electromagnetic signals because they use electromagnetic signals for their regulation, control and natural processes, including those processes monitored by the EEG and ECG. There is overwhelming evidence that EMR is genotoxic, alters cellular ions, neurotransmitters and neurohormones, and interferes with brain and heart signals, and increases cancer.

Cell Phone Radiation Research:

For years the cell phone companies and government authorities have assured us that cell phone are perfectly safe. For example, they claim that the particular set of radiation parameter associated with cell phones are not the same as any other radio signal and therefore earlier research does not apply. They also mount biased review teams who falsely dismiss any results that indicate adverse biological and health effects and the flawed pre-assumption that the only possible effect is tissue heating. There is a very large body of scientific research that challenges this view. Now we have published research, primarily funded by governments and industry that shows that cell phone radiation causes the following effects:

Neurological Activity:

- • Alters brain activity including EEG, Von Klitzing (1995), Mann and Roschkle (1996), Krause et al. (2000).
- • Disturbs sleep, Mann and Roschkle (1996), Bordely et al. (1999).
- • Alters sleep EEG after awake exposure, Huber et al. (2000).
- • Alters human reaction times, Preece et al. (1999), Induced potentials, Eulitz et al. (1998), slow brain potentials, Freude et al. (1998), Response and speed of switching attention (need for car driving) significantly worse, Hladky et al. (1999). Altered reaction times and working memory function (positive), Koivisto et al. (2000), Krause et al. (2000).
- • Brain cortex interaction as shown by significantly altered human EEG by cellphone radiation, during a 15 minute exposure, Lebedeva et al. (2000).
- • Weakens the blood brain barrier ($p<0.0001$): Persson, B.R.R., Salford, L.G. and Brun, A., 1997.

- • A Fifteen minute exposure, increased auditory brainstem response and hearing deficiency in 2 kHz to 10 kHz range, Kellenyi et al. (1999).

- • While driving, with 50 minutes per month with a cell phone, a highly significant 5.6-fold increase in accident risk, Violanti et al. (1996); a 2-fold increase in fatal accidents with cell phone in car, Violanti et al. (1998); impairs cognitive load and detection thresholds, Lamble et al. (1999). In a large Canadian study Redelmeier and Tibshirani (1997) the risk of collision when using a cellphone was 4 time higher, RR = 4.3, 95%CI 3.0-6.5. Calls close to the time of collision has RR =4.8 for 5 minutes and RR = 5.9, $p<0.001$, for 15 minutes.

- • Significant changes in local temperature, and in physiologic parameters of the CNS and cardiovascular system, Khdnisskii, Moshkarev and Fomenko (1999).

- • Causes memory loss, concentration difficulties, fatigue, and headache, in a dose response manner, (Mild et al. (1998)). Headache, discomfort, nausea, Hocking (1998).

PICTURE MISSING

Figure 7: Prevalence of symptoms for Norwegian mobile phone users, mainly analogue, with various categories of length of calling time per day, Mild et al. (1998).

PICTURE MISSING

Figure 8: Prevalence of symptoms for Swedish mobile phone users, mainly digital, with various categories of length of calling time per day, Mild et al. (1998).

These are the same symptoms that have frequently been reported as "Microwave Sickness Syndrome" or "Radiofrequency Sickness Syndrome", Baranski and Czerski (1976) and Johnson-Liakouris (1998).

Cardiac Activity:

- • Cardiac pacemaker interference: skipped three beats, Barbaro et al. (1996); showed interference, Hofgartner et al. (1996); significant interference, $p<0.05$ Chen et al. (1996); extremely highly significant interference, $p=0.0003$, Naegeli et al. (1996); $p<0.0001$, Altamura et al. (1997); reversible interference, Schlegal et al. (1998); significantly induced electronic noise, Occhetta et al. (1999); various disturbances observed and warnings recommended, Trigano et al. (1999)

- • Significantly increases blood pressure, Braune et al. (1998).

Hormone Activity:

- • Reduces the pituitary production of Thyrotropin (Thyroid Stimulating Hormone, TSH):

PICTURE MISSING

Figure 9: A significant reduction in Thyrotropin (Thyroid Stimulating Hormone) during cell phone use, de Seze et al. (1998).

- • Reduces melatonin significantly, Burch et al. (1997, 1998). A GSM cellphone reduces melatonin, but not significantly in a very small sample (N=18) of subjects, de Seze et al. (1999).

- • A reported but yet to be published Australian Study, EMRAA News, June 2000, used a Clot Retention Test on blood samples to detect hormonal changes. A group of 30 volunteers used a Nokia 6150 cellphone for 10 minutes on each of two consecutive days. The CRT test showed significant changes in the thyroid, pancreas, ovaries, testes and hormonal balance.

Reproductive Activity:

- • Decreases in sperm counts and smaller tube development in rat testes, Dasdag et al. (1999).

- • Increases embryonic mortality of chickens, Youbicier-Simo, Lebecq and Bastide (1998).

Genotoxic Activity:

- • Breaks DNA strands, Verschaeve at al. (1994), Maes et al. (1997), which is still extremely significant $p<0.0001$, at 0.0024W/kg (1.2 $\mu W/cm^2$), Phillips et al. (1998).

- • Produces an up to three-fold increase in chromosome aberrations in a dose response manner from all cell phones tested, Tice, Hook and McRee, reported in Microwave News, March/April 1999. The findings were the same when the experiment was repeated and Dr Tice is quoted as stating: "There's no way you're going to get positive results twice over four different technologies as a chance result."

- • Doubles c-fos gene activity (a proto oncogene) for analogue phones and increases it by 41 % for digital phones, Goswami et al. (1999), altered c-jun gene, Ivaschuk et al. (1997), Increased hsp70 messenger RNA, Fritz et al. (1997).

- • Increases Tumour Necrosis Factor (TNK), Fesenko et al. (1999).

- • Increases ODC activity, Penafiel et al. (1997).

- • DNA synthesis and cell proliferation increased after 4 days of 20 min for 3 times/day exposure. Calcium ions were significantly altered, French, Donnellan and McKenzie (1997). Decreased cell proliferation, Kwee and Raskmark (1997), Velizarov, Raskmark and Kwee (1999)

- • Doubles the cancer in mice, Repacholi et al. (1997).

- • Increases the mortality of mobile phone users compared with portable phone users, RR = 1.38, 95%CI: 1.07-1.79, p=0.013, Rothman et al. (1996).

- • Increases human brain tumor rate by 2.5 times (Hardell et al. (1999)). Associated with an angiosarcoma (case study), Hardell (1999)

- • Hardell et al. (2000), for analogue phones OR = 2.62, 95%CI: 1.02-6.71, with higher tumour rates at points of highest exposure.

- • Significantly increases the incidence of eye cancer (Uveal Melanoma), by between OR = 4.2, 95%CI: 1.2-14.5, and OR = 10.1, 95%CI: 1.1-484.4, Stang et al. (2001).

- • United States, Motorola Study Morgan et al. (2000)

High Exposure	RR = 1.07 (0.32-2.66) n = 3
Moderate Exposure	RR = 1.18 (0.36-2.92) n = 3
High/Mod vs Low	RR = 1.13 (0.49-2.31) n = 6

This project underestimated cancer rates by using a high cancer reference group.

- • Carlo and Schram (2001) report that in the industry funded WTR (Wireless Technology Research) programme Dr Joseph Roti Roti confirmed the Tice, Hook and McRee research showing that cellphone radiation significantly damaged DNA through observed micronuclei formation.

- • Muscat et al. (2000) report elevated brain cancer in cellphone users in the United States, with cerebral tumors occurring more frequently on the side of the head where the mobile phone had been used, (26 vs 15 cases, p=0.06) and for a rare brain cancer, neuroepitheliomatous, OR = 2.1, 95%CI: 0.9-4.7. Mean use of cell phones was 2.5 years for cases and 2.2 years for controls, showing that a small increase in cellphone use (0.3 years) produces a large increase in brain cancer risk.

- • Cell phone users in Denmark Johansen et al. (2001)

Duration of digital subscription		<1 yr	1-2yrs	≥3 yrs
Relative to reference group	SIR	0.7	0.9	1.2
Relative to <1 yr group	RR	1.0	1.29	1.71

Other cancers are set out in "Table 2" below. Over 67 % of phone users had used their phones for 2 years or less. The reference group had a higher than average cancer rate than the age range of cell phone users, underestimating the cancer rates. This is shown by Standard Incidence Ratios (SIR) of some groups being as little as 0.6. For example SIR for users for <1 year is 0.7.

PICTURE MISSING

Table two shows that even with little cellphone use, and even with the use of a high cancer reference group, there are several elevated cancers approaching significance: Testicular cancer SIR = 1.12, 95%CI: 0.97-1.30, Cervical cancer, SIR = 1.34, 95%CI: 0.95-1.85, Female Pharynx cancer, SIR 2.43, 95%CI: 0.65-6.22, Esophagus cancer,

SIR = 1.53, 95%CI: 0.31-4.46 and female breast cancer, SIR = 1.08, 95%CI: 0.91-1.26.

Conclusions:

To date over 50 studies have shown adverse biological or human health effects specifically from cell phone radiation. These research results to date clearly show that cell phones and cell phone radiation are a strong risk factor for all of the adverse health effects identified for EMR because they share the same biological mechanisms. The greatest risk is to cell phone users because of the high exposure to their heads and the great sensitivity of brain tissue and brain processes. DNA damage accelerates cell death in the brain, advancing neurodegenerative diseases and brain cancer. Brain tumour is already an identified risk factor. Cell phones are carried on people's belts and in breast pockets. Hence liver cancer, breast cancer and testicular cancer became probable risk factors.

Altered attention and cognition, as well as the diversion of talking on a phone while driving is a significant risk factor for accidents and fatal accidents.

Some cardiac pacemakers are susceptible to active cell phone signals, recommending keeping cell phones away from hearts and pacemakers.

Because the biological mechanisms are shown and EMR has been observed to significantly increase the following effects, there is extremely strong evidence to conclude that cell phones are a risk factor for breast, liver, testicular and brain cancer. It is also probable that we will observe a very wide range of other effects including cardiac, neurological and reproductive illness and death. Since cell phone radiation cause many cell damages including DNA and chromosome damage, all of these effects will also be caused by cell sites.

Dose-response studies of neurological, cardiac, reproductive and cancer effects in human populations all point to a near zero exposure level of no effect, Cherry (2000). Since cellphone radiation mimics RF/MW radiation effects which mimics ELF biological and health, the adverse effects occur across the spectrum and includes cellphone radiation, with a safe exposure level of zero.

Hence a risk reduction and public health protection based on keeping exposure below a level that doubles the risk, identifies 0.1 $\mu W/cm^2$ as the maximum acceptable exposure. This should allow a mean life-time exposure to be less than 0.01$\mu W/cm^2$ which is necessary to reduce the risk of neurological effects. The lower level is necessary because of the exquisite sensitivity of the brain.

EMR POLICY INSTITUTE (EMRPI) REPLY

May 20, 2011

IN THE COMMISSION'S HISTORY" (FCC Acting Chairman Copps), THIS PROPOSED RULEMAKING DOES NOT COMPLY WITH THE NATIONAL ENVIRONMENTAL POLICY ACT. (NEPA)

2. The FCC is responsible for compliance with NEPA under the regulations issued by the President's Council on Environmental Quality (CEQ) found at 40 CFR 1500. (Emphasis added).

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The primary purpose of an environmental impact statement is to serve as an action-forcing device to insure that the policies and goals defined in the Act are infused into the ongoing programs and actions of the Federal Government. 40 CFR 1502.

Use the NEPA process to identify and assess the reasonable alternatives to proposed actions that will avoid or minimize adverse effects of these actions upon the quality of the human environment. 40 CFR 1500.2 (e)1.

The FCC has not even asked any of the federal health agencies to evaluate the effect on the lives of humans, plants and other animals from this proposal. No government agency studies the biological effects of continuous exposure to RF radiation from wireless devices and antennas. The FCC's new proposal fails to outline how wireless infrastructure will be monitored and regulated. It relies entirely on voluntary compliance from the telecom industry.

ELECTROHYPERSENSITIVE CITIZENS' AMERICANS WITH DISABILITIES ACT (ADA) AND CIVIL RIGHTS VIOLATED

10. This proposed rulemaking violates the rights of citizens with electrohypersensitivity. EHS is defined by the World Health Organization as: "...a phenomenon where individuals experience adverse health effects while in the vicinity of devices emanating electric, magnetic, or electromagnetic fields." There are a significant number of people who are sensitive to electromagnetic fields. *Appendix A at paragraphs 10-15, 21 and Exhibits 3,5-13, 18, 19, 24-26, 29, 31, 33-36, 39-41. Appendix B paragraphs*

*13-**20; Exhibits 58-64.***

11. The U.S. Architectural and Transportation Barriers Compliance Board (Access Board) provides an overview of those sensitive to electromagnetic fields. The Access Board, "recognizes that multiple chemical sensitivities and electromagnetic sensitivities may be considered disabilities under the ADA if they so severely impair the neurological, respiratory or other functions of an individual that it substantially limits one or more of the individual's major life activities." "Another California Department of Health Services survey has found that 3 percent of the people interviewed reported that they are unusually sensitive to electric appliances or power lines." *P. LeVallois, et al., "Prevalence and Risk Factors of Self-Reported Hypersensitivity to Electromagnetic Fields in California," in California's EMF Program, "An Evaluation of the Possible Risks From Electric and Magnetic Fields (EMFs From Power Lines, Internal Wiring, Electrical Occupations and Appliances, Draft 3 for Public Comment, April 2001" http://www.access-board.gov/research/ieq/intro.cfmj Appendix 3.*

*12. **This hypersensitivy to electromagnetic radiation is growing rapidly. Hallberg and Oberfeld1 report a prevalence of electrohypersensitivity (EHS) that has increased from less than 2% prior to 1997 to approximately 10% by 2004 and is expected to affect 50% of the population by 2017.** 1. Hallberg O, Oberfeld G. Letter to the Editor: Will we all become electrosensitive? Electromagn Biol Med 2006; 25: 189-91. **Havas found over 35% of her subjects' heart rates doubled in response to DECT cordless phone base stations being plugged in three feet away.** Provocation Study showing how microwave radiation from DECT phone affects autonomic nervous system. M. Havas, J. Marrongelle, B. Pollner, E. Kelley, C.R.G. Rees, L. Tully; Non-Thermal Effects and Mechanisms of Interaction Between Electromagnetic Fields and Living Matter. Eur. J. Oncol. - Library Vol. 5 p. 273. National Institute for the Study and Control of Cancer and Environmental Diseases "Bernardino Ramazzini" Bologna, Italy 2010. http://electromagnetichealth.org/wp-content/uploads/2010/10/Havas_HRV_Ramazzini1.pdf*

*13**. Just this month, the Council of Europe Committee on Environment, Agriculture, Local and Regional Affairs unanimously recommended reduction in electromagnetic radiation levels across the entire spectrum of frequencies based upon health considerations citing The BioInitiative Report (referenced numerous times in EMRPI Exhibits and ignored by the FCC).** Research performed by Professor Dominique Belpomme, President of the Association for Research and Treatments Against Cancer (ARTAC), on more than 200 people describing themselves as electrosensitive succeeded**, with corroborative results of clinical and biological analyses, in proving that there was such a syndrome of intolerance to electromagnetic fields across the whole spectrum of frequencies. According to these results, not only proximity to the sources of electromagnetic emissions was influential, but also the time of exposure and often concomitant exposure to chemicals or to (heavy) metals present in human tissues. In this context, Sweden has granted sufferers from electromagnetic hypersensitivity the status of persons with reduced capacity so that they receive suitable protection**. Paragraph 60 "The potential dangers of electromagnetic fields and their effect on the environment."*

The proposed actions of this rulemaking will endanger citizens with electronic medical implants that are vulnerable to electromagnetic interference (EMI) from wireless transmissions. A growing number of people rely on various types of medical implants to maintain their health. Eight to ten percent of the population have implants. EMI can prevent the normal theraputic function of these devices, reset or reprogram the device, bring damaging electrical energy into the device or the body of the person with the implant and even cause injury, including death. *Abandonment of landline phones is untenable for Americans with Implanted Medical Devices (IMDs) because of the danger that EMI from cell phones, antennas, and other wireless devices and infrastructure can bring about life- and health-threatening malfunctions of these medically necessary devices.* ***Compliance with NEPA and the ADA requires that the FCC protect Americans who have IMDs from harm to their health and well being from EMI with these medically necessary devices.***

16. EMRPI submits here the Comment filed by Gary Olhoeft PhD, Professor of Geophysics at Colorado School of Mines. in FCC Docket No. ET-10-120 on the www.regulations.gov website at: http://www.regulations.gov/#!documentDetail;D=FDA-2010-N-0291-0029.1 on July 15, 2010 (tracking number 80b1a6f5). Prof. Olhoeft, who is also an electrical engineer, has a Deep Brain Stimulator to treat his Parkinson's Disease and has done extensive research on EMI effects on IMDs.

His comment provides an extensive list of peer-reviewed published scientific papers on this issue. ***He has also researched the number of Americans with IMDs with the National Institutes of Health whose estimate is 8-10% of the population, approximately 20-25 million Americans.*** *See also Prof. Olheoft's 20-minute presentation on YouTube entitled, "Electromagnetic interference with medical implants," presented at The EMR Policy Institute Conf., 8 Nov 2009, Colorado School of Mines, Golden, CO at: http://www.youtube.com/results?search_query=olhoeft&aq=f). Slides 12-18 from Prof. Olhoeft's PowerPoint that references the NIH data are appended to this EMRPI Reply document.* Exhibit 65

Because the FCC has failed to disclose substantial amounts of relevant information necessary for considered debate, because of the constantly evolving discoveries of adverse effects to the health of humans, bees and other organisms from wireless broadband radiation, because of noncompliance with NEPA, ADA and the U.S. Constitution and because the EMRPI has evidence that the FCC reliance on the industry to self report its NEPA compliance is totally misplaced (i.e., the industry exceeds the EMR limits more often than complying with the EMR limits), EMRPI requests a hearing on this FCC proposed rulemaking.

Paper presented at the "Workshop on Possible Biological and Health Effects of RF Electromagnetic Fields", Mobile Phone and Health Symposium, Oct 25-28, 1998, University of Vienna, Vienna, Austria.

NEUROLOGICAL EFFECTS OF RADIOFREQUENCY ELECTROMAGNETIC RADIATION

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INTRODUCTION

Radiofrequency electromagnetic radiation (RFR), a form of energy between 10 KHz-300 GHz in the electromagnetic spectrum, is used in wireless communication and emitted from antennae of mobile telephones (handys) and from cellular masts. RFR can penetrate into organic tissues and be absorbed and converted into heat. *One familiar application of this energy is the microwave ovens used in cooking.*

The close proximity of a mobile telephone antenna to the user's head leads to the deposition of a relatively large amount of radiofrequency energy in the head. *The relatively fixed position of the antenna to the head causes a repeated irradiation of a more or less fixed amount of body tissue. Exposure to RFR from mobile telephones is of a short-term, repeated nature at a relatively high intensity,* ***whereas exposure to RFR emitted from cell masts is of***

long duration but at a very low intensity. The biological and health consequences of these exposure conditions need further understanding*.*

Formal research on the biological effects of RFR began more than 30 years ago*. In my opinion, the research has been of high quality, innovative, and intelligent. All of us who work in this field should be proud of it****. However, knowledge of the possible health effects of RFR is still inadequate and inconclusive. I think the main barrier in understanding the biological effects of RFR is caused by the complex interaction of the different exposure parameters in causing an effect. An independent variable of such complexity is unprecedented in any other field of biological research.***

The intensity (or power intensity) of RFR in the environment is measured in units such as mW/cm2.1 ***However, the intensity provides little information on the biological consequence unless the amount of energy absorbed by the irradiated object is known****. This is generally given as the specific absorption rate (SAR), which is the rate of energy absorbed by a unit mass (e.g., one kg of tissue) of the object, and usually expressed as W/kg.2 We may liken the intensity of RFR to a quantity of aspirin tablets. Let's say, there are 100 mg of aspirin per tablet (i.e., the intensity). This information tells us nothing about the efficacy of the tablets unless the amount taken is also known, e.g., take 2 tablets every 4 hrs (or 200 mg every 4 hrs) (analogous to the SAR). The amount of a drug absorbed into the body is the main determinant of its effect. Thus, in order to understand the effect of RFR, one should also know the SAR.*

*Unfortunately, RFR does not behave as simply as a drug****. The rate of absorption and the distribution of RFR energy in an organism depend on many factors. These include: the dielectric composition (i.e., ability to conduct electricity) of the irradiated tissue, e.g., bones, with a lower water content, absorb less of the energy than muscles; the size of the object relative to the wavelength of the RFR (thus, the frequency); shape, geometry, and orientation of the object; and configuration of the radiation, e.g., how close is the object from the RFR source?*** *These factors make the distribution of energy absorbed in an irradiated organism extremely complex and non-uniform, and also lead to the formation of so called 'hot spots' of concentrated energy in the tissue****. For example, an experiment reported by Chou et al. [1985], measuring local energy absorption rates (SARs) in different areas of the brain in a rat exposed to RFR, has shown that two brain regions less than a millimeter apart can have more than a two-fold difference in SAR. The rat was stationary when it was exposed. The situation is more complicated if an animal is moving in an RF field.*** *Depending on the amount of movement of the animal, the energy absorption pattern in its body could become either more complex and unpredictable or more uniform. In the latter situation, we are all familiar with the case that a microwave oven with a rotating carousel provides more uniform heating of the food than one without. However, the distribution of energy in the head of a user of a mobile telephone is more discrete because of the relatively stationary position of the phone. 'Hot spots' may form in certain areas of the head. As a reference, from theoretical calculations [e.g., Dimbylow 1993; Dimbylow and Mann 1994; Martens et al. 1995], peak (hot spot) SAR in head tissue of a user of mobile telephone can range from 2 to 8 W/kg per watt output of the device. The peak energy output of mobile telephones can range from 0.6-1 watt, although the average output could be much smaller.*

Thus, in summary, the pattern of energy absorption inside an irradiated body is non-uniform, and biological responses are dependent on distribution of energy and the body part that is affected *[Lai et al., 1984a, 1988]. Related to this is that we [Lai et al., 1989b] have found that* ***different areas of the brain of the rat have different sensitivities to RFR. This further indicates that the pattern of energy absorption could be an important determining factor of the nature of the response.***

Two obviously important parameters are the frequency and intensity of RFR. Frequency is analogous to the color of a light bulb, and intensity is its wattage. There is a question of whether ***'the effects of RFR of one frequency is different from those of another frequency.' The***

question of frequency is vital because it dictates whether existing research data on the biological effects of RFR can apply to the case of mobile telephones. Most previous research studied frequencies different from those used in wireless communication. *Frequency is like the color of an object. In this case, one is basically asking the question "Are the effects of red light different from those of green light?" The answer to this is that it depends on the situation. They are different: if one is looking at a traffic light, 'red' means 'stop' and 'green' means 'go'. But, if one is going to send some information by Morse code using a light (on and off, etc.), it will not matter whether one uses a red or green light, as long as the receiver can see and decode it. We don't know which of these two cases applies to the biological effects of RFR.*

It must be pointed out that data showing different frequencies producing different effects, or an effect was observed at one frequency and not at another, are sparse. An example is the study by Sanders et al [1984] who observed that RFR at frequencies of 200 and 591 MHz, but not at 2450 MHz, produced effects on energy metabolism in neural tissue. *There are also several studies that showed different frequencies of RFR produced different effects [D'Andrea et al., 1979, 1980; de Lorge and Ezell, 1980; Thomas et al., 1975]. However, it is not certain whether these differences were actually due to differences in the distribution of energy absorption in the body of the exposed animal at the various frequencies. In addition, some studies showed frequency-window effects, i.e., effect is only observed at a certain range of frequencies and not at higher or lower ranges [Bawin et al., 1975; Blackman et al., 1979, 1980a,b, 1989; Chang et al., 1982; Dutta et al., 1984, 1989, 1992; Lin-Liu and Adey, l982; Oscar and Hawkins, 1977; Sheppard et al., 1979].* ***These results may suggest that the frequency of an RFR can be a factor in determining the biological outcome of exposure.***

*On the other hand, there are more studies showing that different frequencies can produce the same effect. For example****, changes in blood-brain barrier have been reported after exposure to RFRs of 915 MHz [****Salford et al., 1944]; 1200 MHz [Frey et al., 1975], 1300 MHz [Oscar and Hawkin, 1977], 2450 and 2800 MHz [Albert, 1977],* ***and effects on calcium have been reported at 50 MHz [Blackman et al., 1980b], 147 MHz [Bawin et al., 1975; Blackman et al., 1980a; Dutta et al., 1989], 450 MHz [Sheppard et al., 1979], and 915 MHz [Dutta et al., 1984]. If there is any difference in effects among different frequencies, it is a difference in quantity and not quality.***

An important question regarding the biological effects of RFR is whether the effects are cumulative, i.e., after repeated exposure, will the nervous system adapt to the perturbation and, with continued exposure, when will homeostasis break down leading to irreparable damage? The question of whether an effect will cumulate over time with repeated exposure is particularly important in considering the possible health effects of mobile telephone usage, since it involves repeated exposure of short duration over a long period (years) of time. Existing results indicate changes in the response characteristics of the nervous system with repeated exposure, suggesting that the effects are not 'forgotten' after each episode of exposure. *Depending on the responses studied in the experiments, several outcomes have been reported. (1) An effect was observed only after prolonged (or repeated) exposure, but not after one period of exposure [e.g., Baranski, 1972; Baranski and Edelwejn, 1974; Mitchell et al., 1977; Takashima et al., 1979]; (2) an effect disappeared after prolonged exposure suggesting habituation [e.g., Johnson et al., 1983; Lai et al., 1992a]; and (3) different effects were observed after different durations of exposure [e.g., Baranski, 1972; Dumanski and Shandala, 1974; Grin, 1974; Lai et al., 1989a; Servantie et al., 1974; Snyder, 1971]. As described in a later section****, we found that a single episode of RFR exposure increases DNA damage in brain cells of the rat. Definitely, DNA damage in cells is cumulative. Related to this is that various lines of evidence suggest that responses of the central nervous system to RFR could be a stress response [Lai, 1992; Lai et al., 1987a]. Stress effects are well known to cumulate over time and involve first adaptation and then an eventual break down of homeostatic processes when the stress persists.***

Another important conclusion of the research is that modulated or pulsed RFR seems to be more effective in producing an effect. They can also elicit a different effect when compared with continuous-wave radiation of the same frequency *[Arber and Lin, 1985; Baranski, 1972; Frey and Feld, 1975; Frey et al., 1975; Lai et al., 1988; Oscar and Hawkins, 1977; Sanders et al., 1985].* ***This conclusion is important since mobile telephone radiation is modulated at low frequencies. This also raises the question of how much do low frequency electric and magnetic fields contribute to the biological effects of mobile telephone radiation. Biological effects of low frequency (< 100Hz) electric and magnetic fields are quite well established*** *[see papers by Blackman, and Von Klitzing in this symposium].*

Therefore, frequency, intensity, exposure duration, and the number of exposure episodes can affect the response to RFR, and these factors can interact with others and produce different effects. In addition, in order to understand the biological consequence of RFR exposure, one must know whether the effect is cumulative, whether compensatory responses result, and when homeostasis will break down*.*

EFFECTS OF VERY LOW INTENSITY RFR

For those who have questions on the possible health effects of exposure to radiation from cell masts, there are studies that show biological effects at very low intensities. The following are some examples: Kwee and Raskmark [1997] reported changes in cell proliferation (division) at SARs of 0.000021- 0.0021 W/kg; Magnras and Xenos [1997] reported a decrease in reproductive functions in mice exposed to RFR intensities of 160-1053 nW/square cm (the SAR was not calculated); Ray and Behari [1990] reported a decrease in eating and drinking behavior in rats exposed to 0.0317 W/kg; Dutta et al. [1989] reported changes in calcium metabolism in cells exposed to RFR at 0.05-0.005 W/kg; and Phillips et al. [1998] observed DNA damage at 0.024-0.0024 W/kg. Most of the above studies investigated the effect of a single episode of RFR exposure. As regards exposure to cell mast radiation, chronic exposure becomes an important factor. Intensity and exposure duration do interact to produce an effect. We [Lai and Carino, In press] ***found with extremely low frequency magnetic fields that 'lower intensity, longer duration exposure' can produce the same effect as from a 'higher intensity, shorter duration exposure'. A field of a certain intensity, that exerts no effect after 45 min of exposure, can elicit an effect when the exposure is prolonged to 90 min. Thus, as described earlier, the interaction of exposure parameters, the duration of exposure, whether the effect is cumulative, involvement of compensatory responses, and the time of break down of homeostasis after long-term exposure, play important roles in determining the possible health consequence of exposure to radiation emitted from cell masts.***

THERMAL AND NONTHERMAL EFFECTS
When RFR is absorbed, it is converted into heat. ***A readily understandable mechanism of effect of RFR is tissue heating (thermal effect). Biological systems alter their functions as a result of change in temperature. However, there is also a question on whether "nonthermal' effects can occur from RF exposure. There can be two meanings to the term "nonthermal" effect. It could mean that an effect occurs under the condition of no apparent change in temperature in the exposed animal or tissue, suggesting that physiological or exogenous mechanisms maintain the exposed object at a constant temperature. The second meaning is that somehow RFR can cause biological effects without the involvement of heat energy (or temperature independent). This is sometime referred to as 'athermal effect'. For practical reasons, I think it is futile to make these distinctions simply because it is very difficult to rule out thermal effects in biological responses to RFR, because heat energy is inevitably released when RFR is absorbed.***

In some experiments, thermal controls (i.e., samples subjected to direct heating) have been studied. Indeed, there are reports showing that 'heating controls' do not produce the same effect of RFR [D'Inzeo et al., 1988; Johnson and Guy, 1971; Seaman and Wachtel, 1978; Synder, 1971; Wachtel et al., 1975]. These were taken as an indication of non/a-thermal effects. However, as

we discussed earlier, it is difficult to reproduce the same pattern of internal heating of RFR by external heating, as we know that a conventional oven cooks food differently than a microwave oven. And pattern of energy distribution in the body is important in determining the effect of RFR [e.g., Frey et al., 1975; Lai et al., 1984a, 1988]. Thus, 'heating controls do not produce the same effect of RFR' does not really support the existence of nonthermal effects.

On the other hand, even though no apparent change in body temperature during RFR exposure occurs, it cannot really rule out a ' thermal effect'. ***In one of our experiments [Lai et al., 1984a], we have shown that animals exposed to a low SAR of 0.6 W/kg are actively dissipating the energy absorbed. This suggests that the brain system involved in body temperature regulation is activated. The physiology of body temperature regulation is complicated and can involve many organ systems. Thus, changes in thermoregulatory activity can indirectly affect biological responses to RFR.***

Another difficulty in eliminating the contribution of thermal effects is that it can be 'micro-thermal'. ***An example of this is the auditory effect of pulsed RFR. We can hear RFR delivered in pulses. An explanation for this 'hearing' effect is that it is caused by thermoelastic expansion of the head of the 'listener.'*** *In a classic paper by Chou et al. [1982], it was stated that* ***"... one hears sound because a miniscule wave of pressure is set up within the head and is detected at the cochlea when the absorbed microwave pulse is converted to thermal energy." The threshold of hearing was determined to be approximately 10 microjoule/gm per pulse, which causes an increment of temperature in the head of one millionth of a degree centigrade!*** *Lebovitz [1975] gives another example of a* ***'microthermal' effect of RFR on the vestibulocochlear apparatus, an organ in the inner ear responsible for keeping body balance and sensing of movement. He proposed that an uneven distribution of RFR absorption in the head can set up a temperature gradient in the semicircular canals, which in turns affect the function of the vestibular system. The semicircular canals are very minute organs in our body.***

What about in vitro experiments in which isolated organs or cells are exposed to RFR? Generally, these experiments are conducted with the temperature controlled by various regulatory mechanisms. However, it turns out that the energy distribution in culture disks, test tubes, and flasks used these studies are very uneven. Hotspots are formed. There is a question of whether the temperature within the exposed samples can be efficiently controlled.

In any case, my argument is not about whether a non/a-thermal effect can occur. The existence of intensity-windows, reports of modulated fields producing stronger or different effects than continuous-wave fields, and the presence of effects that occur at very low intensity described in the previous section could be indications of non/a-thermal effects. My argument is that it may not be practical to differentiate these effects experimentally due to the difficulty of eliminating thermal effects.

I propose the use of the term 'low-intensity' effects, which is based on the exposure guideline of your community. By multiplying the guideline level with the safety factor used to determine the guideline, one would get a level that supposedly causes an effect(s). ***Any experiment/exposure done below that level would be considered 'low-intensity'. For example, if the safety guideline is an SAR of 0.4 W/kg for whole body exposure, and a safety factor of 10 has been used to determine the guideline, then, the level at which effects should occur would be 4.0 W/kg. Any exposure below 4 W/kg would be considered a 'low-intensity' exposure. Any effect found at 'low-intensities' could conceivably contribute to the setting of future guidelines.***

OUR RESEARCH ON NEUROLOGICAL EFFECTS OF RFR

When the nervous system or the brain is disturbed, e.g., by RFR, morphological, electrophysiological, and chemical changes can occur. A significant change in these functions will inevitably lead to a change in behavior. Indeed, neurological effects of RFR reported in the literature include changes in blood-brain-barrier, morphology, electrophysiology, neurotransmitter functions, cellular metabolism, calcium efflux, responses to drugs that affect the nervous system, and behavior *[for a review of these effects, see Lai, 1994 and Lai et al., 1987a].*

Our research on the effects of RFR exposure on the nervous system covers topics from DNA damage in brain cells to behavior. *My research in this area began in 1980 when I investigated the effects of brief exposure to RFR on the actions of various drugs that act on the nervous system. We found that the actions of several drugs- amphetamine, apomorphine, morphine, barbituates, and ethyl alcohol- were affected in rats after 45 min of exposure to RFR [Lai et al., 1983; 1984 a,b]. One common feature of these responses was that they seemed to be related to the activity of a group of neurotransmitters in the brain known as the endogenous opioids [Lai et al., 1986b]. These are compounds that are generated by the brain and behave like morphine. We proposed that exposure to RFR activates endogenous opioids in the brain of the rat [Lai et al., 1984c]. One interesting finding was that RFR could inhibit morphine withdrawal in rats [1986a, which led me to speculate as to whether low-intensity RFR could be used to treat morphine withdrawal and addiction in humans. When I was in Leningrad, USSR in 1989, a scientist informed me that he had read my paper on 'RFR decreased morphine withdrawal in rats', and he had been using RFR to treat morphine withdrawal in humans.* ***Also, unknown to us at that time was that the 'endogenous opioid hypothesis' could actually explain the increase of alcohol consumption in RFR-exposed rats that we reported in 1984 [****Lai et al., 1984b]. In the summer of 1996, the United States Food and Drug Administration approved the use of the drug naloxone for the treatment of alcoholism. Naloxone is a drug that blocks the action of endogenous opioids. Increase in endogenous opioid activity in the brain can somehow cause alcohol-drinking behavior. In addition, our finding that RFR exposure alters the effect of alcohol on body temperature of the rat [Lai et al., 1984b] was replicated by Hjeresen et al. [1988, 1989] at an SAR half of what we used.*

Interactions between RFR with drugs could have important implications on the health effects of RFR. They suggest that certain individuals in the population could be more susceptible to the effects of RFR. For example, an important discovery in this aspect is that ophthalmic drugs used in the treatment of glaucoma can greatly increase the damaging effects of RFR on the eye *[Kues et al., 1992].*

Subsequently, we carried out a series of experiments to investigate the effect of RFR exposure on neurotransmitters in the brain of the rat. The main neurotransmitter we investigated was acetylcholine, a ubiquitous chemical in the brain involved in numerous physiological and behavioral functions. We found that exposure to RFR for 45 min decreased the activity of acetylcholine in various regions of the brain of the rat, particularly in the frontal cortex and hippocampus. *Further study showed that the response depends on the duration of exposure.* ***Shorter exposure time (20 min) actually increased, rather than decreasing the activity. Different brain areas have different sensitivities to RFR with respect to cholinergic responses*** *[Lai et al., 1987b, 1988b, 1989a,b].* ***In addition, repeated exposure can lead to some rather long lasting changes in the system: the number of acetylcholine receptors increase or decrease after repeated exposure to RFR to 45 min and 20 min sessions, respectively [****Lai et al., 1989a]. Changes in acetycholine receptors are generally considered to be a compensatory response to repeated disturbance of acetylcholine activity in the brain.* ***Such changes alter the response characteristic of the nervous system. Other studies have shown that endogenous opioids are also involved in the effect of RFR on acetylcholine [****Lai et al., 1986b, 1991, 1992b, 1996].*

At the same time, we speculated that biological responses to RFR are actually stress responses, i.e., RFR is a stressor (see Table I in Lai et al., 1987a). A series of experiments was carried out to

compare the effects of RFR on brain acetylcholine with those of two known stressors: loud noise and body restraint [Lai, 1987, 1988; Lai and Carino, 1990a,b, 1992; Lai et al., 1986d, 1989c]. We found that the responses are very similar. Two other bits of information also support the notion that RFR is a stressor. ***We found that RFR activates the stress hormone, corticotropin releasing factor [Lai et al., 1990], and affect benzodiazepine receptors in the brain [Lai et al., 1992a]. Benzodiazepine receptors mediate the action of antianxiety drugs, such as Valium and Librium, and are known to change when an animal is stressed****.*

*Another interesting finding is that some of the effects of RFR are classically conditionable [Lai et al., 1986b,c, 1987c****]. 'Conditioning' processes, which connect behavioral responses with events (stimuli) in the environment, are constantly modifying the behavior of an animal. In a situation known as classical conditioning, a 'neutral' stimulus that does not naturally elicit a certain response is repeatedly being presented in sequence with a stimulus that does elicit that response. After repeated pairing, presentation of the neutral stimulus (now the conditioned stimulus) will elicit the response (now the conditioned response).*** *You may have heard of the story of "Pavlov's dog". A bell was rung when food was presented to a dog. After several pairing of the bell with food, ringing the bell alone could cause the dog to salivate.* ***We found that biological effects of RFR can be classically conditioned to cues in the exposure environment. In earlier experiments, we reported that exposure to RFR attenuated amphetamine-induced hyperthermia*** *[Lai et al., 1983]* ***and decreased cholinergic activity in the frontal cortex and hippocampus*** *[Lai et al., 1987b] in the rat. In the conditioning experiments, rats were exposed to RFR in ten daily sessions (45 min per session****). On day 11, animals were sham-exposed (i.e., subjected to the normal procedures of exposure but the RFR was not turned on) and either amphetamine-induced hyperthermia or cholinergic activity in the frontal cortex and hippocampus was studied immediately after exposure. In this paradigm, the RFR was the unconditioned stimulus and cues in the exposure environment were the neutral stimuli, which after repeated pairing with the unconditioned stimulus became the conditioned stimulus. Thus on the 11th day when the animals were sham-exposed, the conditioned stimulus (cues in the environment) alone would elicit a conditioned response in the animals. In the case of amphetamine-induced hyperthermia [Lai et al., 1986b], we observed a potentiation of the hyperthermia in the rats after the sham exposure. Thus, the conditioned response (potentiation) was opposite to the unconditioned response (attenuation) to RFR.*** *This is known as 'paradoxical conditioning' and is seen in many instances of classical conditioning. We found in the same experiment that, similar to the unconditioned response, the conditioned response could be blocked by the drug naloxone, implying the involvement of endogenous opioids. In the case of RFR-induced changes in cholinergic activity in the brain, we [Lai et al., 1987c] found that conditioned effects also occurred in the brain of the rat. An increase in cholinergic activity in the hippocampus (paradoxical conditioning) and a decrease in the frontal cortex were observed after the session of sham exposure on day 11. In additon, we [Lai et al., 1984c] observed an increase in body temperature (approximately 1.0 oC) in the rat after exposure to RFR, and found that this RFR effect was also classically conditionable and involved endogenous opioids [Lai et al., 1986c].*

Conditioned effects may be related to the compensatory response of an animal to the disturbance of RFR and whether it can habituate to repeated challenge of the radiation. For example, the conditioned effect on cholinergic activity in the hippocampus is opposite to that of its direct response to RFR (paradoxical conditioning), whereas that of the frontal cortex is similar to its direct response. We found that the effect of RFR on hippocampal cholinergic activity habituated after 10 sessions of exposure. On the other hand, the effect of RFR on frontal cortical cholinergic activity did not habituate after repeated exposure [Lai et al., 1987c].

Since acetylcholine in the frontal cortex and hippocampus is involved in learning and memory functions, we carried out experiments to study whether exposure to RFR affects these behavioral functions in the rat. Two types of memory functions: spatial 'working' and 'reference' memories were investigated. Acetylcholine in the brain, especially in the hippocampus, is known to play an important role in these behavioral functions.

In the first experiment, 'working' memory (short-term memory) was studied using the 'radial arm maze'. This test is very easy to understand. Just imagine you are shopping in a grocery store with a list of items to buy in your mind. After picking up the items, at the check out stand, you find that there is one chicken at the top and another one at the bottom of your shopping cart. You had forgotten that you had already picked up a chicken at the beginning of your shopping spree and picked up another one later. This is a failure in short-term memory and is actually very common in daily life and generally not considered as being pathological. A distraction or a lapse in attention can affect short-term memory. This analogy is similar to the task in the radial-arm maze experiment. The maze consists of a circular center hub with arms radiating out like the spokes of a wheel. Rats are allowed to pick up food pellets at the end of each arm of the maze. There are 12 arms in our maze, and each rat in each testing session is allowed to make 12 arm entries. Re-entering an arm is considered to be a memory deficit. The results of our experiment showed that after exposure to RFR, rats made significantly more arm re-entries than unexposed rats [Lai et al., 1994]. This is like finding two chickens, three boxes of table salt, and two bags of potatoes in your shopping cart.

In another experiment, we studied the effect of RFR exposure on 'reference' memory (long-term memory) [Wang and Lai, 2000]. Performance in a water maze was investigated. In this test, a rat is required to locate a submerged platform in a circular water pool. It is released into the pool, and the time taken for it to land on the platform is recorded. Rats were trained in several sessions to learn the location of the platform. ***The learning rate of RFR-exposed rats was slower, but, after several learning trials, they finally caught up with the control (unexposed) rats (found the platform as fast). However, the story did not end here. After the rats had learned to locate the platform, in a last session, the platform was removed and rats were released one at a time into the pool. We observed that unexposed rats, after being released into the pool, would swim around circling the area where the platform was once located, whereas RFR-exposed rats showed more random swimming patterns.*** *To understand this, let us consider another analogy. If I am going to sail from the west coast of the United States to Australia. I can learn to read a map and use instruments to locate my position, in latitude and longitude, etc. However, there is an apparently easier way: just keep sailing southwest. But, imagine, if I sailed and missed Australia. In the first case, if I had sailed using maps and instruments, I would keep on sailing in the area that I thought where Australia would be located hoping that I would see land. On the other hand, if I sailed by the strategy of keeping going southwest, and missed Australia, I would not know what to do. Very soon, I would find myself circumnavigating the globe.3 Thus, it seems that unexposed rats learned to locate the platform using cues in the environment (like using a map from memory), whereas RFR-exposed rats used a different strategy (perhaps, something called 'praxis learning', i.e., learning of a certain sequence of movements in the environment to reach a certain location. It is less flexible and does not involve cholinergic systems in the brain). Thus, RFR exposure can completely alter the behavioral strategy of an animal in finding its way in the environment.*

In summary, RFR apparently can affect memory functions, at least in the rat. The effects are most likely reversible and transient. Does this have any relevance to health? The consequence of a behavioral deficit is situation dependent. ***What is significant is that the effects persist for sometime after RFR exposure.*** *If I am reading a book and receive a call from a mobile phone, it probably will not matter if I cannot remember what I had just read. However, the consequence would be much more serious if I am an airplane technician responsible for putting screws and nuts on airplane parts. A phone call in the middle of my work can make me forget and miss several screws. Another adverse scenario of short-term memory deficit is that a person may overdose himself on medication because he has forgotten that he has already taken the medicine.*

Lastly, I would like to briefly describe the experiments we carried out to investigate the effects of RFR on DNA in brain cells of the rat. We [Lai and Singh 1995, 1996; Lai et al., 1997] reported an ***increase in DNA single and double strand breaks, two forms of DNA damage, in brain cells***

of rats after exposure to RFR. DNA damage in cells could have an important implication on health because they are cumulative. Normally, DNA is capable of repairing itself efficiently. Through a homeostatic mechanism, cells maintain a delicate balance between spontaneous and induced DNA damage. DNA damage accumulates if such a balance is altered. Most cells have considerable ability to repair DNA strand breaks; for example, some cells can repair as many as 200,000 breaks in one hour. However, nerve cells have a low capability for DNA repair and DNA breaks could accumulate. Thus, the effect of RFR on DNA could conceivably be more significant on nerve cells than on other cell types of the body. Cumulative damages in DNA may in turn affect cell functions. DNA damage that accumulates in cells over a period of time may be the cause of slow onset diseases, such as cancer. One of the popular hypotheses for cancer development is that DNA damaging agents induce mutations in DNA, leading to expression of certain genes and suppression of other genes resulting in uncontrolled cell growth. Thus, damage to cellular DNA or lack of its repair could be an initial event in developing a tumor. However, when too much DNA damage is accumulated over time, the cell will die. Cumulative damage in DNA in cells also has been shown during aging. Particularly, cumulative DNA damage in nerve cells of the brain has been associated with neurodegenerative diseases, such as Alzheimer's, Huntington's, and Parkinson's diseases.

Since nerve cells do not divide and are not likely to become cancerous, more likely consequences of DNA damage in nerve cells are changes in functions and cell death, which could either lead to or accelerate the development of neurodegenerative diseases. Double strand breaks, if not properly repaired, are known to lead to cell death. Indeed, we have observed an increase in apoptosis (a form of cell death) in cells exposed to RFR (unpublished results). However, another type of brain cells, the glial cells, can become cancerous, resulting from DNA damage*.*

This type of response, i.e., ***genotoxicity at low and medium cumulative doses and cell death at higher doses, would lead to an inverted-U response function in cancer development and may explain recent reports of increase [Repacholi et al., 1997], decrease [Adey et al., 1996], and no significant effect [Adey et al., 1997] on cancer rate of animals exposed to RFR. Understandably, it is very difficult to define and judge what constitutes low, medium, and high cumulative doses of RFR exposure, since the conditions of exposure are so variable and complex in real life situations.***

Interestingly, RFR-induced increases in single and double strand DNA breaks in rat brain cells can be blocked by treating the rats with melatonin or the spin-trap compound N-t-butyl-?-phenylnitrone [Lai and Singh, 1997]. Since both compounds are potent free radical scavengers, this data suggest that free radicals may play a role in the genetic effect of RFR. If free radicals are involved in the RFR-induced DNA strand breaks in brain cells, results from this study could have an important implication on the health effects of RFR exposure*. Involvement of free radicals in human diseases, such as cancer and atherosclerosis, has been suggested.* ***As a consequence of increases in free radicals, various cellular and physiological processes can be affected including gene expression, release of calcium from intracellular storage sites, cell growth, and apoptosis. Effects of RFR exposure on free radical formation in cells could affect these cellular functions.***

Free radicals also play an important role in aging processes, which have been ascribed to be a consequence of accumulated oxidative damage to body tissues [Forster et al., 1996; Sohal and Weindruch, 1996], and involvement of free radicals in neurodegenerative diseases, such as Alzheimer's, Huntington's, and Parkinson's, has been suggested [Borlongan et al., 1996; Owen et al., 1996]. Furthermore, the effect of free radicals could depend on the nutritional status of an individual, e.g., availability of dietary antioxidants [Aruoma, 1994], consumption of alcohol [Kurose et al., 1996], and amount of food consumption [Wachsman, 1996]. Various life conditions, such as psychological stress [Haque et al., 1994] and strenuous physical exercise [Clarkson, 1995], have been shown to increase oxidative stress and enhance the effect of free radicals in the body.

Thus, one can also speculate that some individuals may be more susceptible to the effects of RFR exposure.

CONCLUDING REMARKS
It is difficult to deny that RFR at low intensity can affect the nervous system. However, available data suggest a complex reaction of the nervous system to RFR. Exposure to RFR does produce various effects on the central nervous system. The response is not likely to be linear with respect to the intensity of the radiation. Other parameters of RFR exposure, such as frequency, duration, waveform, frequency- and amplitude-modulation, etc, are important determinants of biological responses and affect the shape of the dose(intensity)-response relationship curve. In order to understand the possible health effects of exposure to RFR from mobile telephones, one needs first to understand the effects of these different parameters and how they interact with each other. Therefore, caution should be taken in applying the existing research results to evaluate the possible effect of exposure to RFR during mobile telephone use. It is apparent that insufficient research data are available to conclude whether exposure to RFR during the normal use of mobile telephones could lead to any hazardous health effects. Research studying RFR of frequencies and waveforms similar to those emitted from cellular telephones and intermittent exposure schedule resembling the normal pattern of phone use is needed. At this point, little is known about the biological effects of mobile telephone use, but since there are indications that the radiation from these phones can cause biological effects that could be detrimental to health, prudent usage should be taken as a logical guideline. Exhibit 66

A Basic Summary of the Neurological Effects of Radiofrequency Sickness

Utility companies nationwide are moving toward installing transmitting electrical, gas, and water meters at each customer's service. The new digital meters being installed on electrical services are a type of meter being called "smart" meters because they can do time of day metering, keep very close track of energy usage, and potentially perform other functions. In the case of We Energies, and most other utilities, the "smart" meters selected are ***transmitting*** *"smart" meters. The transmitting electrical rate meters We Energies is using transmit in strong bursts every 6 seconds 24 hours per day 7 days a week. The other utility meters also transmit similarly. This is potentially dangerous in the long-term for everyone; however, for people who already have radiofrequency sickness this exposure can cause disability nearly immediately.*

Radiofrequency sickness results from overexposure to radiofrequency radiation. (See Appendix 1 for symptoms.) Radiofrequency sickness is not a disease. It is an environmentally induced functional impairment. Radiofrequency sickness has real and disabling consequences. People with radiofrequency sickness experience illness (or even death) upon exposure to radiofrequency radiation.[1,2,3,4] *The most common sources are electrical pollution – high frequencies that travel on building wiring – and transmitters – all wireless devices.*

Detrimental biological effects, distinct from tissue heating effects, have been extensively documented in studies at a range of different frequencies and at levels below the current United States safety standard.[5]

Our current safety regulations are not designed to protect people from the non-thermal hazards posed by transmitting meters or other devices. *The FCC "safety" guidelines are solely designed to protect a 6 ft 185 lb man from tissue heating during a short (6 minute) exposure. They are not designed to protect even a 6 ft man from biological effects during a continuous exposure.*[6,7] *Exposures from transmitting utility meters and other transmitters are continuous, so these "safety" standards are meaningless. Transmitting devices compliant with current safety standards should not be allowed to portray themselves as "safe". The fact that*

these transmitters are represented as being "safe" because they comply with FCC guidelines is part of the reason that people are being required to have transmitting utility meters. Additional studies are now available. The data warrant complying with the precautionary principle and establishing lower exposure standards for safe levels of exposure for chronic exposures to radio frequency radiation for the population as a whole.[8] Exposure is often involuntary. For instance, exposure to radiofrequency radiation from neighbors often causes sensitive people in town to be chronically ill, unable to recover.

Microwave and radiofrequency radiation are now being associated with attention deficit disorder, autism, sleep disorders, multiple sclerosis, Alzheimer's disease and epilepsy, as well as asthma, diabetes, malignant melanoma, breast cancer, and other illnesses that have become increasingly more common. Please see www.bioinitiative.org to read a 2007 review of the peer-reviewed science on the long-term risks of exposure to transmitted microwave and radio frequency radiation. Studies finding no health effects are predominantly industry funded.[9] A report by Hallberg and Johansson[10] published recently in Pathophysiology asks the provocative question about whether the recent (1997 and later) increase in exposure to microwave frequencies may be responsible for the recent decline in public health in Sweden. The data seem to say that public exposure to microwave frequencies is a likely culprit.*

In addition to transmitting in strong bursts, transmitting "smart" meters can also overexpose the general population to high frequencies by putting high frequencies on home and building wiring, either deliberately through signaling or inadvertantly through poor engineering. High frequency signals on power lines are also biologically active. Milham and Morgan found a dose-response relationship between high frequencies present on building wiring and cancer[11]. Recent analysis of historical epidemiological data indicates a relationship to cancer, diabetes, heart disease, and suicide[12]. Removing high frequencies on building wiring has improved MS symptoms, blood sugar levels, asthma, sleep quality, teacher health, student attentiveness, headaches, ADD, and numerous other health problems[13,14,15]. Technical papers provide a solid electrical and biomolecular basis for these effects. A recent paper by Ozen showed that transients induce much stronger current density levels in the human body than does the powerline 60Hz signal[16]. A technical paper by Vignati and Giuliani discusses the authors' findings that high frequency communication signals on power lines also induce much stronger electrical currents in the human body than a low frequency signal of the same strength[17]. The induced currents disturb normal intercellular communications. This causes harmful short-term and long-term effects. Additional information can be found on www.electricalpollution.com. Information necessary to properly measure the high frequencies causing these health problems can be found on the Technical page. A simple meter is also available that can provide accurate measurements of electrical pollution levels in most situations.

The precautionary principle dictates that only utility meters that do not increase public exposure to microwave and radiowave radiation and "dirty" power should be used while conservative standards to protect the health of the general population during continuous exposure are researched and established. Safe technology is available that can be used to perform the same functions as transmitting "smart" meters. There are non-transmitting meters that can do variable rates and meter both incoming and outgoing power. Meters can easily be engineered that do not put high frequencies on electrical wiring either inadvertantly or deliberately, while still performing all necessary functions. Directly wired connections could be used to shut off key loads. Alternate technologies may cost a bit more up front, but the precautionary principle should apply. In fact, the Health Department in New Mexico agrees. They recently pursuaded a local water utility to use wired connections between monitoring stations, instead of wireless, based on the precautionary principle. If you have questions, you can contact John McPhee, Childhood Injury Prevention Coordinator for the New Mexico Department of Health (505-827-2582).

The only "cure" for radiofrequency sickness is not to be exposed to radiofrequency radiation. People with radiofrequency sickness often become ill almost immediately upon exposure, although the severity of the illness depends on how often the exposure occurs, the frequency and amplitude of the radiation signal and the duration of the exposure. Studies show pulsed microwaves, as utilized by modern communication devices, including transmitting electrical meters, are very potent biologically.[1,2,3,4]

In fact, data presented at the recent conference "Electromagnetic Radiation Impacts on Human Health" sponsored by The EMR Policy Institute showed that radiofrequencies, specifically pulsed modulated microwaves from a DECT cordless telephone base unit can have an instantaneous effect on heart rhythm in susceptible individuals. This technology is the same as that used by cellphones, WiFi internet access, and transmitting utility meters. See: http://www.youtube.com/user/EMRPolicyInstitute presentation of Prof. Magda Havas in three segments.

A number of studies show that electromagnetic radiation, including radiofrequency radiation, alters heart rate variability, blood pressure (including inducing hypertension with microwave exposure – smart meters transmit in the microwave range) and increases risk of arrhythmia related heart disease and heart attack.[4,5]

There is extensive documentation in the literature of alterations of Ca^{2+} homeostasis.[5] *This is likely to be responsible at least in part for the profound effects that radiofrequency radiation has on the heart and neurological function. Ca^{2+} regulates gap junction opening. Gap junctions are key in many intercellular communications.*

Exposure to radiofrequency radiation also interferes with the action of enzymes, signaling pathways, and makes the immune system simultaneously hyperactive and less effective.[5,18] *Immune impairment results in part from the disruptive effect of radiofrequency radiation on calcium ion homeostasis. In addition to radiofrequency radiation-induced immune impairment increasing risk of various types of infection, it is likely to increase the risk of getting cancer from the DNA breakages radiofrequency radiation is well-documented to induce.*[5] *While radiofrequency radiation is non-ionizing, the metabolic changes it can cause result in oxidative damage to DNA and subsequent breakage. Direct interactions between radiofrequency radiation and DNA can have similar results, as well as causing changes in gene transcription, through changes in electron flows induced by the radiation.*[19]

Neurological function can be seriously impaired by radiofrequency radiation. Cholinesterase enzyme activity is impaired by exposure to radiofrequency radiation in a manner similar to impairment caused by organophosphate pesticides often rendering a person with radiofrequency sickness particularly sensitive to small amounts of chemicals.[20] *Radiofrequency radiation can lower the pain threshold, slow reaction times, cause fatigue, muscle weakness, headaches, difficulty concentrating, short-term memory problems and even memory loss.*[1,2,3,4] *These may be caused by disruption of Ca^{2+}, disruption of various enzyme pathways, induction of the stress response and associated effects, increased permiability of the blood-brain barrier, or various other effects of over exposure to radiofrequency radiation.*[4,5,20]

Radiofrequency radiation significantly decreases melatonin levels and decreases the ability of existing melatonin to fight cancer.[5] *Good sleep is essential for good mental and physical health. Good sleep is very difficult, if not impossible to obtain if your melatonin levels are abnormally low. Sleep deprivation along with impaired neurological function and enzyme impaiment are likely to be behind the brain fog and cognitive difficulties those with radiofrequency sickness experience.*

More detailed information can be found in the following references, in The BioInitiative Report at www.bioinitiative.org, and at www.electricalpollution.com.

Appendix 1- Symptoms of Radio Wave Sickness *(excerpted from No Place To Hide April 2001):*

- ***Neurological:*** *headaches, dizziness, nausea, difficulty concentrating, memory loss, irritability, depression, anxiety, insomnia, fatigue, weakness, tremors, muscle spasms, numbness, tingling, altered reflexes, muscle and joint paint, leg/foot pain, "Flu-like" symptoms, fever. More severe reactions can include seizures, paralysis, psychosis and stroke.*
- ***Cardiac:*** *palpitations, arrhythmias, pain or pressure in the chest, low or high blood pressure, slow or fast heart rate, shortness of breath.*
- ***Respiratory:*** *sinusitis, bronchitis, pneumonia, asthma.*
- ***Dermatological:*** *skin rash, itching, burning, facial flushing.*
- ***Ophthalmologic:*** *pain or burning in the eyes, pressure in/behind the eyes, deteriorating vision, floaters, cataracts.*

Others: *digestive problems; abdominal pain; enlarged thyroid, testicular/ovarian pain; dryness of lips, tongue, mouth, eyes; great thirst; dehydration; nosebleeds; internal bleeding; altered sugar metabolism; immune abnormalities; redistribution of metals within the body; hair loss; pain in the teeth; deteriorating fillings; impaired sense of smell; ringing in the ears.*

Military knew of effects of radio frequency upon human health.

A recently declassified U.S. Army scientific study on the bio effects of radiofrequency microwave radiation for the purposes of the development of new weaponry and behavioral control (currently in use by military and police) reveals that microwave radiation exposures have been linked to a large number of biological and health effects.

Many of the effects they note are virtually identical to the unusual clusters of health complaints of people (also related to reactions of their pets) following the installation of smart meters, routinely denied by the state utility regulatory commission (CPUC) and utilities.

These include increased aggression and irritability, inhibition of food and drink intake, increased mobility or conversely, incapacitation via loss of muscle control, muscle weakness, intense muscle spasms, loss of consciousness; cognitive effects such as loss of memory and confusion; microwave hearing (buzzing, ticking, hissing, or knocking sounds that originate within the head or behind it), and even damage to multiple organs or the brain, seizures (convulsions), and death. This study clearly supports that subtle heating of tissue does occur with radiofrequency microwave radiation, associated with these undesirable and potentially very dangerous biological effects.

Importantly, U.S. Army scientists agree with a growing number of independent scientists worldwide, in emphatically stating that 100% of the human population is susceptible to radiofrequency microwave radiation effects, caused by subtle heating, with some sectors of the population more reactive at lower doses, including those with thermoregulatory mechanisms (impacting temperature control, respiration, water loss).

Significantly, likely pertaining to the ringing of ears (tinnitus) that people experience with smart meters, the U.S. Army study says this, with regard to exposure to pulsed microwave radiation: “At this time, virtually all investigators have studied the [microwave hearing, acoustic] phenomenon now accepted as thermoelastic expansion of the brain, the pressure wave of which is received and processed by the cochlear microphonics system, to be the mechanism of acoustic perception of short pulses of rf energy” (p. 8 of 20).

Notably, in one study, this microwave hearing was triggered through exposure to 2450 MHz radiofrequency energy, which is exactly one of the radiofrequencies used by antennas contained within current smart meters. “The sounds are heard as the individual pulses are absorbed. The

effect is immediate, within milliseconds" (p.9 of 20). Army scientists describe a range of sensitivity, with some people unable to hear it, possibly due to cochlear damage.

Alarmingly, the Army study also describes additional aspects of microwave radiation that can control behavior, including a particularly troubling application of this technology: the induction of externally produced messages, simulating voices, into the human brain.

"Application of the microwave hearing technology could facilitate a private message transmission. It may be useful to provide a disruptive condition to a person not aware of the technology. Not only might it be disruptive to the sense of hearing, it could be psychologically devastating if one suddenly heard " voices within one's head."" (p. 10 of 20). Exhibits 67, 68

This report was commissioned by an insurance carrier in Canada to determine their liability if the reports on cell phones are confirmed as carcinogenic.

Cultured human fibroblasts showed the highest level of responsiveness to RF-EME (Fig. 4e, f; Table 2) with an average protein synthesis increase of 128 § 22% (three independent experiments). Thirteen of the fourteen proteins whose rate of de novo synthesis was increased in Jurkat cells were also synthesized at a higher rate in fibroblasts. As well as these, the rates of synthesis of annex in A1 and A5 were found to be significantly increased (Table 2).

Finding suggests that the proteome alterations in responsive cells induced by RF-EME exposure are characteristic for this kind of cell stress.

White blood cells

Primary mononuclear cells isolated from peripheral blood (white blood cells, WBC) responded only marginally to RF-EME (Fig. 4g, h; Table 3). The apparent increase in 35S incorporation was less than 10%, which is within the margin of error of the applied methodology. Inflammatory stimulation of WBCs by treatment with lipopolysaccharide and phytohaemagglutinin increased the level of protein synthesis by these cells (compare Fig. 4g–i), which is consistent with the induction of cell proliferation as previously described in more detail (Traxler et al. 2004). Notably, RFEME further increased the level of 35S incorporation by the stimulated cells (compare Fig. 4i–j) by an average of 43 § 13% (three independent experiments with three different donors). The proteome alterations were, however, less compared to those observed in Jurkat cells and fibroblasts. Only one protein, hsp60, was induced more than two-fold (Table 4).

Discussion

We used a highly sensitive method of measuring protein synthesis rates and protein amounts to investigate the potential effects of low-intensity mobile phone radiation exposure on cells. Our results show that the rate of protein synthesis in proliferating cells is increased by long-term (8 h) RF-EME, while no effect was detectable in quiescent white blood cells treated in the same manner. Although the observed changes reached no statistical significance at short exposure times, we observed some trends consistent with but also extend observations made by Nylund and Leszczynski (2004), who used the same exposure system, but only measured protein amounts (and not de novo synthesis).

Usefully, our results appear to reconcile a number of conflicting previous findings. First, we found both RF-EME responsive and RF-EME-insensitive cells (compare Tables 1, 2 with Table 3). The RF-EME insensitive quiescent WBCs (Table 3) were rendered sensitive to RF-EME by inflammatory activation (Fig. 4). Inflammatory activation of WBC induces T-cell proliferation and consequently an increased rate of protein synthesis (Traxler et al. 2004).

Thus, our data suggest that proliferating cells with high protein synthesis rates are more sensitive to RF-EME than cells with lower protein production. Many studies have been performed with quiescent white blood cells, which were also insensitive under our experimental conditions. During electromagnetic exposure, we applied 5 min of "exposure on" and 10 min of "off" on the same cell types and/or conditions, which revealed DNA breaks (Diem et al. 2005; Franzellitti et al. 2010; Schwarz et al. 2008). Interestingly, we found the same cells reactive (e.g. fibroblasts, Table 2) or nonreactive (e.g. naïve lymphocytes, Table 3), when investigating protein synthesis. This may suggest a common underlying mechanism between DNA breaks and increased protein synthesis in reactive cells.

Most of the proteins found to be induced by RF-EME are chaperones, which are mediators of protein folding. Since the applied electromagnetic Fields were very weak, the direct and active denaturation of existing proteins by RF-EME exposure appears unlikely to underlie the observed increased level of protein synthesis. Resonance phenomena may concentrate radiation exposure-mediated physical energy on hot spots and have already been suggested to cause biological effects (Belyaev 2005). Indeed, exposure to low frequency electromagnetic Welds caused effects, which were reduced by noise signals (Litovitz et al. 1997), providing further support for the concept of resonance as an underlying condition.

Hydrogen bonds are known to resonate with microwaves. Folding of newly synthesized proteins in the endoplasmic reticulum occurs via a process involving the formation of intermediate folded structures (Arai and Kuwajima 2000) mediated by several chaperones (Deuerling and Bukau 2004). This process could potentially respond in a very sensitive fashion to radiation-induced excitation of hydrogen bonds as this could cause a temporary disturbance of spatial orientation. An increased rate of inappropriate folding of newly synthesized proteins would not affect existing proteins and thus render cell function intact for some time (unless key labile proteins are affected).

Furthermore, such a mechanism would not necessarily have a significant impact on total protein amounts. However, later on it would increase the protein synthesis rate in response to an increased rate of turnover of the newly folded proteins. This interpretation plausibly explains the reported increased level of protein synthesis.

Our data describe cell responses to RF-EME exposure specifically observed in actively proliferating cells. When investigating protein synthesis, we found the same cell types nonreactive or reactive, compared to those to reveal DNA breaks (Diem et al. 2005; Schwarz et al. 2008). Active cells continuously repair DNA-damage as it occurs as side product of DNA transcription or respiratory chain products (Alberts et al. 2001; Branden and Tooze 1999). Therefore, a subtle inhibition of any part of the antioxidant protection or the DNA repair system would accumulate damaged DNA. Consequently, interference with protein expression may explain the DNA changes found by others (Belyaev et al. 2005; Diem et al. 2002; Schwarz et al. 2008) as indicator for a risk associated with long-term exposure.

The observed proteome alterations support a novel mechanistic model for the understanding of RF-EME induced bioeffects: this model is based on radiation-induced disturbances of hydrogen bonds, which may be essential during the protein folding process. Our results do not directly indicate a health risk. However, the finding that metabolically active and/or proliferating cells are more responsive to RF-EME implies a higher sensitivity of growing organisms. Exhibit 69

50-Hz Electromagnetic Environment and the Incidence of Childhood Tumors in Stockholm County.

The magnetic fields from overhead power lines and other electromagnetic sources were determined at the birth and diagnosis dwellings of all tumor cases reported in the county of Stockholm during the years 1958-73 for individuals 0-18 years of age. The study was limited to 716 cases having a permanent address in the county both at time of birth and diagnosis. An equivalent number of controls was matched to the cases according to church district of birth, age, and sex. Outside each dwelling, the occurrence of visible electrical constructions (6-200-kV high-voltage wires, substations, transformers, electric railroads, and subways) within 150 m of the dwelling was noted. Also, the 50-Hz magnetic field was measured outside the main entrance of the dwelling. Visible 200-kv wires were noted at 45 of 2,098 dwellings and were found twice as frequently among cases as among controls (P < .05). The magnetic field measured at the dwelling varied between O.OOO4 to 1.9 pT (mean value 0.069 pT). The magnetic field was higher (0.22 pT) at dwellings with visible 200-kV wires than at those without such wires. Magnetic fields of 0.3 pT or more were measured at 48 dwellings, and were found twice as frequently among cases as among controls (P < .05). The difference was most pronounced for dwellings of nervous system tumors and was less for leukemias. Exhibit 70

A New Electromagnetic Exposure Metric: High Frequency Voltage Transients Associated With Increased Cancer Incidence in Teachers in a California School.

In 2003, the teachers at La Quinta, California middle school complained that they had more cancers than would be expected. A consultant for the school district denied that there was a problem. (This study was done) to investigate the cancer incidence in the teachers, and its cause. (The researchers) conducted a retrospective study of cancer incidence in the teachers' cohort in relationship to the school's electrical environment.

A cohort cancer incidence analysis of the teacher population showed a positive trend of increasing cancer risk with increasing cumulative exposure to high frequency voltage transients on the classroom's electrical wiring measured with a Graham/Stetzer (G/S) meter. The attributable risk of cancer associated with this exposure was 64%. A single year of employment at this school increased a teacher's cancer risk by 21%.

Conclusion: The cancer incidence in the teachers at this school is unusually high and is strongly associated with high frequency voltage transients, which may be a universal carcinogen, similar to ionizing radiation.

In the years 1988–2005, 137 teachers were employed at the school. The 18 cancers in the 16 teachers were: 4 malignant melanomas, 2 female breast cancers, 2 cancers of the thyroid, 2 uterine cancers and one each of Burkitt's lymphoma (a type of non-Hodgkins lymphoma), polycythemia vera, multiple myeloma, leiomyosarcoma and cancer of the colon, pancreas, ovary and larynx. Two teachers had two primary cancers each: malignant melanoma and multiple myeloma, and colon and pancreatic cancer. Four teachers had died of cancer through August 2007. There have been no non-cancer deaths to date. Exhibit 71

Age-dependent tissue-specific exposure of cell phone users..

In this study, we compare the absorption in various parts of the cortex for different magnetic resonance imaging-based head phantoms of adults and children exposed to different models of mobile phones. The results show that the locally induced fields in children can be significantly higher (>3 dB) in subregions of the brain (cortex, hippocampus and hypothalamus) and the eye due to the closer proximity of the phone to these tissues. The increase is even larger for bone marrow (>10 dB) as a result of its significantly high conductivity. Tissues such as the pineal gland show no increase since their distances to the phone are not a function of age. This study,

however, confirms previous findings saying that there are no age-dependent changes of the peak spatial SAR when averaged over the entire head. Exhibit 72

Analysis of RF exposure in the head tissues of children and adults.

Limits to protect general public, including children, from overexposure to electromagnetic fields are recommended by international bodies such as the International Commission on Non Ionizing Radiation Protection (ICNIRP 1998) or the International Committee on Electromagnetic Safety (ICES) (IEEE 2005).

Dealing with children exposure, numerical studies (Schoenborn et al 1998, Gandhi et al 1996, Wang and Fujiwara 2003, Hadjem et al 2005, Wiart et al 2005, Beard et al 2006, Kainz et al 2005, De Salles et al 2006, Keshvari et al 2006) have also been conducted to analyze the electromagnetic absorption of RF and SAR in children tissues. Depending on the study, the RF exposure in child models is either higher than in adult models (Gandhi et al 1996, De Salles et al 2006) or similar (Schoenborn et al 1998, Wang and Fujiwara 2003, Hadjem et al 2005, Wiart et al 2005, Beard et al 2006, Kainz et al 2005). Various models have been used; the first models were based on a uniform downsizing of adult heads. However, a child head is not a reduced adult head. For instance the brain of a child grows quickly up to the age of three and reaches adult size between 6 and 14 years of age but at the age of 5 the brain weight is about 90% of the adult brain weight (Huttenlocher 1979).

This analysis confirms that the peripheral brain tissues of children seem to be higher exposed than the peripheral brain tissues of adults. Definitive conclusion must take into account the large variability of the data. Nevertheless such results are not unexpected since the smaller thicknesses of the pinna, skin and skull of children (compared to adult ones) leads to a reduced distance from the handset to the peripheral brain tissues inducing by the way a higher exposure. Exhibit 73

AUVA Report: Nonthermal Effects Confirmed; Exposure Limits Challenged; Precaution Demanded.

All across Europe the debate on exposure limits has flared up; insurance companies do not insure cell phone providers because of the incalculable health risks. The Austrian Social Insurance for Occupational Risks AU-VA (Allgemeine Unfallversicherungsanstalt) commissioned the Vienna Medical University to carry out its own research projects, focusing on effects of cell phone radiation on the brain, immune system, and proteins. The title itself Investigation of Nonthermal Effects of Electromagnetic Radiation in the Cell Phone Frequency Range (ATHEM) indicates that: AUVA runs in direct opposition to the representatives of the "thermal paradigm" radiation protection agencies of the various governments as well as the ICNIRP (International Commission on Non-ionizing Radiation Protection), all of which deny there are effects that are not caused by heating (non-thermal effects). Ultimately, the results of the report confirm long-known health risks associated with cell phone technologies.

The research project ATHEM, therefore, has been aimed at studying the burning issue of interactions between RF/EMF and biology. (p. 7) The significance of the experimental investigations also lies in the fact that the which do not necessarily have disease relevance (e.g. EEG changes), should not even have occurred according to the strictly thermal interaction mechanism that would have been covered by current exposure guidelines." (p. 8)

In plain English: Exposure guidelines, therefore, are generally called into question because they are based on thermal effects only.

Current exposure guidelines do not consider the biological processes which already respond to electromagnetic field levels below the critical heating threshold. As a result, the guidelines do not provide protection.

The AUVA Report is a slap in the face for the German Radiation Protection Commission and the IC-NIRP, which in the interests of industry deny the existence of nonthermal effects and stick to the thermal paradigm [3]. The ATHEM report by the AUVA confirms: Cell phone radiation has adverse impacts on health.

The radiation-induced effects observed, however, were not always dosage-dependent as would be expected from thermal effects. Some cells showed an even stronger response when the 5-minute exposure was followed by a 10-minute break (intermittent exposure). This would also support a nonthermal effect mechanism. The project results, therefore, serve as a further confirmation of the existence of so-called nonthermal effects. Exhibit 74

Largest study finds evidence of association between EMFs and exposed worker suicide

A large and detailed study of the possible link between exposure to low frequency electromagnetic fields (EMFs) and suicide among electric utility workers has uncovered what appears to be a distinct association.

Electricians working for five U.S. power companies faced twice the expected risk of suicide, while linemen faced one-and-a-half times the expected risk, according to the University of North Carolina at Chapel Hill study. Suicides among power plant operators occurred at a rate slightly lower than expected, researchers found.

Younger people appeared to be at greater risk of suicide than older ones, and higher, more recent exposures also seemed to boost the chances that workers might take their own lives.
A report on the study, which began with a group of 138,905 male U.S. electric utility workers, appears today (March 15) in the April issue of Occupational and Environmental Medicine. Authors include doctoral student Edwin van Wijngaarden; Dr. David A. Savitz, professor and chair of epidemiology; Dr. Jianwen Cai, associate professor of biostatistics; and Dr. Dana Loomis, associate professor of epidemiology, all at the UNC-CH School of Public Health. Statistical programmer Dr. Robert C. Kleckner also contributed to the project.

"We believe this work is important because suicide is the eighth leading cause of death in the United States, and many people in this country are exposed to electromagnetic fields," van Wijngaarden said. "While these findings definitely do not prove EMFs cause suicide, they do indicate more research needs to be done on the effects of exposure on depression and suicide."

Why low frequency electromagnetic fields might contribute to suicide among chronically exposed workers is not known, van Wijngaarden said.

"One biologically plausible explanation is that EMFs depress production of melatonin, a hormone that's important for sleep and mood," he said. "Decreases in melatonin can lead to depression, which in turn can lead to suicide."

Rats subjected to electromagnetic fields showed altered production and excretion of the hormone but comparable data on humans is limited and inconclusive, the scientist said. The possibility suggested by the new findings that EMFs could affect young workers more than older ones is entirely new, he added.

The Electric Power Research Institute of Palo Alto, Calif., supported the study. Cooperating electric utility companies were Carolina Power and Light Co., Pacific Gas and Electric, PECO Energy Co., Tennessee Valley Authority and Virginia Electric Power Co. van Wijngaarden and colleagues did the new study because other work in the early 1980s found indications of an association between EMFs and suicide, but later studies could not replicate those findings. Exhibit 75

BC Hydro Smart Meters: Concerns and Requests.

Comments from: Catriona Hamilton Wojtas, British Columbia resident:

Premier McGuinty of Ontario admitted a few months ago that Ontario's program would not be recovering any of the implementation costs from meter usage. There is none. Same story in every jurisdiction. Some states, e.g., Massachusetts and Connecticut, did pilot programs with thousands of homes over many months and discovered there was neither reduction in energy nor in costs, so they scrapped the program.

The provincial government and BC Hydro previously stated that the level of electromagnetic radiation emitted by smart meters falls within Health Canada's Safety Code 6. However, BC Hydro recently removed statements on its website indicating that there are no known health risks related to smart meter radiation. This was in response to the World Health Organizations document on 2b carcinogens of which EMF radiation is one.

Comments from: David O. Carpenter, M.D., Director, Institute for Health and the Environment. University at Albany:

This is a report on the review of the California Council on Science and Technology document, "Health Impacts of Radiofrequency from Smart Meters." I am a public health physician and former Dean of the School of Public Health at the University at Albany. I have been involved in review and analysis of studies on electromagnetic fields, including radiofrequency fields, for many years. I served as the Executive Secretary to the New York State Powerlines Project in the 1980s and have published several reviews on the subject and have edited two books. In addition, I was invited to present to the recent President's Cancer Panel on the subject of powerline and radiofrequency fields and cancer.

This document is not an accurate description of the state of the science on the issue of radiofrequency fields and is full of inaccuracies. My specific concerns are as follows:

1.The benefit of the smart meters is entirely to the utilities and is economic in nature. If they install smart meters, they can fire those individuals who at present are employed to go around reading meters. Thus this is a job-killing proposal, and will increase unemployment in a state that already has too much.

2. When a smart meter is installed, residents have no choice in the matter nor ability to avoid exposure. But every individual has the option to use or not use other personal wireless devices, until more is known about health consequences of chronic RF exposure. There is a major difference between an exposure which an individual chooses to accept and one that is forced on individuals who can do nothing about it.

3. The statement "The potential for behavioral disruption from increased body tissue temperatures is the only biological health impact that has been consistently demonstrated and scientifically proven to result from absorbing RF within the band of the electromagnetic

spectrum that smart meters use" is totally wrong. In the first place, there are many adverse health effects other than "behavioral disruption" demonstrated as a result of tissue heating. The evidence for increased risk of brain tumors, acoustic neuromas and parotid gland tumors in individuals who have used a cell phone for 10 years or more is consistent and the tumors occur only on the side of the head where the phone is used. There is also strong and consistent evidence for increased risk of leukemia in individuals who live near high power AM radio transmission towers, even though this report characterizes such exposures as being "quite low" and show in Figure 7 that they are lower than the RF fields from smart meters.

4. The statement "The scientific consensus is that body temperatures must increase at least 1°C to lead to potential biological impacts from the heat" is totally wrong, and makes it obvious that no persons with medical or biological expertise participated in this report. Every enzyme system in the body is exquisitely sensitive to temperature, and increases activity by even a fraction of a degree increase in temperature. In fact, all RF generates heat, and what is defined as "non-thermal" is only a function of our ability to measure the temperature increase.

5. The statement "While concerns of brain cancer associated with mobile phone usage persist, there is currently no definitive evidence linking cell phone usage with increased incidence of cancer" is incorrect. The evidence is strong and consistent among studies looking at long-term and intensive use of cell phones. The AM radio studies mentioned above are also relevant, particularly because, like smart phones, radio transmission towers give whole body radiation, not just to the head.

6. The statement "There currently is no conclusive scientific evidence pointing to a non-thermal cause-and-effect between human exposure to RF emissions and negative health impacts is inaccurate, and depends totally on what one defines as "conclusive". In biology and medicine, there is nothing that is 100% proven. We rely on statistical significance and weight of evidence when drawing conclusions about health effects. When one uses these definitions, there is conclusive scientific evidence for adverse health effects in humans.

7. The evidence for adverse effects of radiofrequency radiation is currently strong and grows stronger with each new study. Wired meters with shielded cable do not increase exposure. The report clearly indicates that "smart meters could conceivably be adapted to non-wireless transmission of data. However, retrofitting millions of smart meters with hard-wired technology could be difficult and costly." Clearly, the answer to this dilemma is not to install wireless smart meters to begin with.

Thank you for the opportunity to comment on this faulty report and on the general issue of smart meters. Their use is unwise from both a public health point of view, which is where my expertise lies, and also from a purely short- and long-term economic point of view.

Comments from: Magda Havas, B.Sc., Ph.D., Environmental and Resource Studies Program. Trent University.

Dr. Magda Havas is Associate Professor of Environmental and Resource Studies at Trent University (Canada) where she teaches and does research on the biological effects of electromagnetic radiation including radio frequency and microwave radiation, poor power quality, ground current, and low frequency electromagnetic fields. She has served as an expert witness in both Canada and the United States regarding health effects associated with electromagnetic exposure. She is currently science advisor on EMF-related issues to several non-profit organizations in Canada, U.S., U.K., and the Netherlands. Dr. Havas is currently reviewing documents given to her by a retired scientist who worked for the U.S. military and the U.S. government on the biological effects of microwave radiation. These documents include declassified military reports, internal government reports, and translation from the European literature dating back to the 1930s.

Point #1: Whether FCC standards for Smart Meters are sufficiently protective of public health taking into account current exposure levels to radiofrequency and electromagnetic fields.

Dr. Havas's opinion: In my opinion, the FCC standard for Smart Meters is not sufficient to protect public health.

This is based on the following facts:
1)Thermal vs. Non-thermal Debate. The thermal vs. non-thermal debate is largely a red herring that has been perpetuated for decades and has influenced the type of research done in the United States. The FCC standard is based on a thermal effect. It was originally based on the amount of radiation that would heat an adult male in the US military exposed to radar. While the heating effect is not disputed, biological effects, some of which have adverse health consequences, occur well below the thermal guideline (Inglis 1970). As a consequence various countries in the world are opting for a "biologically" based guideline rather than a "thermal" guideline, which takes into account not only adult males in peak physical conditions but children, pregnant women, the elderly, and those who have developed electrohypersensitivity (EHS). I will return to the concept of EHS later.

2)Guidelines in Russia, Switzerland, Poland, and China are well below the FCC standard (i.e. 10 vs. 1000 microW/cm^2 or 1% of FCC guidelines). Some military and government insiders tried to get U.S. guidelines reduced decades ago but were not successful (Pollack and Healer 1967, Dodge 1969). Steneck et al. (1980) provides an excellent account of how the U.S. standards were established for radio frequency radiation.

3)Our exposure to radio frequency radiation (RFR) is increasing exponentially as we design more equipment that relies on higher frequencies in the electromagnetic spectrum. Prior to World War II, this type of radiation was negligible. Today we have radar (military, marine, aviation, and weather), we have cell phone antennas, radio and TV broadcast antennas, and a growing number of WiFi hotspots, citywide WiFi and Wi-Max antennas. Inside buildings we have cordless phones, many of which emit microwave radiation even when they are not being used; wireless alarm systems; wireless baby monitors, wireless computers, iPads, and Smart Phones that can connect to wireless internet or WiFi. More children are playing wireless video games than ever before and radio frequency identification devices (RFID) are placed into merchandise to provide information to the manufacturer about consumer habits. The "smart meter" is just another source of exposure that will be placed on every home and in every apartment. Smart meters are being used to monitor use of electricity, gas and water. As part of this system, appliances are being designed to communicate directly with smart meters, all in a wireless mode, which will ultimately increase levels of radiation in the home.

4) I work with people who have become electrically hypersensitive (EHS) and I have received emails and phone calls from those who have had smart meters placed on their homes. They complain of ill health and many are unable to use the room closest to the smart meter. These individuals have no place to "hide" from the growing levels of electrosmog especially in densely populated urban centers. Sickness contributes to time off work and away from school, growing medical costs and a general poorer quality of life. Children are particularly vulnerable as are pregnant women and those with compromised immune systems. The presence of metal implants in the body (such as metal pins in bones) may concentrate the absorption of radiation at the location of implantation, inducing thermal effects from lower power densities than would ordinarily cause such harm (Massey 1979). Some implants, such as pace makers and deep brain stimulators for Parkinson's disease, may malfunction and this can be fatal. In Switzerland, about 5% of the population has EHS. If the same fraction of the population has EHS in the US, that would come to a staggering 15 million people!

The symptoms following exposure to radio frequency radiation were labeled radiowave sickness and were first reported for those occupationally exposed in the former Soviet Union. These same symptoms are now referred to as electrohypersensitivity (EHS) and are experienced by a growing fraction of the population. They include…

"… headache, eyestrain and tearing, fatigue and weakness, vertigo, sleeplessness at night and drowsiness during the day, moodiness, irritability, hypochondria, paranoia, either nervous tension or mental depression and memory impairment. After longer periods of exposure, additional complaints may include sluggishness, inability to make decisions, loss of hair, pain in muscles and in the heart region, breathlessness, sexual problems and even a decrease in lactation in nursing mothers. Clinically observed effects in persons voicing these complaints include trembling of the eyelids, fingers and tongue, increased perspiration of the extremities, [and] rashes . . ."(Massey, 1979).

1)In addition to sensitive people, Switzerland also identifies Places of Sensitive Use (German acronym is OMEN). These places include: living rooms; classrooms and kindergartens; hospitals and nursing homes; permanent jobs (where people spend more than 2.5 days per week); and playgrounds. For these OMEN sites, the Swiss government recommends that greater precaution be taken for long-term exposure to weak radiation. In these places, radiation from wireless microwave base stations (such as cordless phones or WLAN/WiFi) may exceed radiation from nearby cell phone base stations and hence these devices must generate emissions as low as possible. For more information visit:
http://www.bag.admin.ch/themen/strahlung/00053/index.html?lang=en .
2)Whether additional technology specific standards are needed for Smart Meters and other devices that are commonly found in and around homes, to ensure adequate protection from adverse health effects.

Technology specific standards are definitely needed for Smart meters as well as cordless phones, DECT baby monitors, wireless routers, and all of the other devices that emit radio frequency radiation.

Massey, in a report published by Duke Law Journal in 1979, identifies nine variables that need to be considered when determining the impact of microwave radiation. These are "power density, intensity and relative phase of all field components, specific frequency ranges, waveform characteristics, exposure regimes, specific occupations, level of control over exposed populations, individual differences (age, sex, health, specific predisposing factors) and presence of other environmental stressors." The current FCC guidelines do NOT take these into consideration.

We have evidence that pulsed microwave frequencies, that are generated by WiFi and cordless phones are more harmful than continuous wave and yet this is not considered in the FCC guidelines (Reno 1975).

The key microwave emitting devices in the home/office/school environment are: Cordless phones (some are labeled DECT and others pulsed digital2.4 GHz). These radiate all the time even when no one is using them. They should be replaced by wired phones or cordless phones currently available in Europe, which are "on-demand" phones that radiate only when the handset is not in the cradle of the base station. These phones are so dangerous that I recently submitted a Petition to the Auditor General of Canada to have DECT phones banned (Havas 2008).

The DECT baby monitor also radiates all the time, as does the receiver that is often carried on the Mother's waist. Here we need a voice-activated baby monitor that is used in Europe.

Wireless Internet (WiFi or WLan) is not as common in Europe as they are in North America. There they prefer using wired service in the form of fiber optic and Ethernet connections. Germany hotels ask that you bring an Ethernet cables with you, as they don't provide WiFi. The Swiss government is providing free fiber optics to schools provided they don't install wireless routers.

1)An additional point I would like to make relates to dirty electricity. Wires can act like antennas and the radiation produced by radio frequency generating devices can flow along and reradiate from wires both inside and outside the home. This contributes to dirty electricity and localized radiation exposure. Dirty electricity has been associated with cancers (Milham and Morgan 2008); health and behavior problems in schools (Havas and Olstad 2008); and both diabetes and multiple sclerosis (Havas 2006). From a human health perspective and to protect sensitive electronic equipment it is important to maintain good power quality and to prevent radiation from smart meters.

I have great concern regarding the current levels of microwave radiation in North America. Instead of promoting wireless technology, we should be promoting wired technology and reserving wireless for situations where wired in not possible (while one is travelling for example). Shortly after X-rays were discovered, they were used in shoe stores to determine shoe-size for young children. Fortunately, we recognized that X-rays were harmful and we restricted their use to essential medical diagnoses. We need to recognize that microwaves are also harmful and we cannot use this technology in a frivolous manner. With more frequencies being used, with the levels of radiation increasing, and with so little research on the long-term, low-level effects of this technology we are creating a potential time bomb. If smart meters are placed on every home, they will contribute significantly to our exposure and this is both unwise and unsafe.

Comments from: Olle Johansson, Associate Professor, Department of Neuroscience, Experimental Dermatology Unit, Karolinska Institute.

Wireless communication is now being implemented in our daily life in a very fast way. At the same time, it is becoming more and more obvious that the exposure to electromagnetic fields not only may induce acute thermal effects to living organisms, but also non-thermal effects, the latter often after longer exposures. This has been demonstrated in a very large number of studies and includes cellular DNA-damage, disruptions and alterations of cellular functions like increases in intracellular stimulatory pathways and calcium handling, disruption of tissue structures like the blood-brain barrier, impact on vessel and immune functions, and loss of fertility. Whereas scientists can observe and reproduce these effects in controlled laboratory experiments, epidemiological and ecological data derived from long-term exposures reflect in well-designed case-control studies the link all the way from molecular and cellular effects to the living organism up to the induction and proliferation of diseases observed in humans. ***It*** *should be noted that we are not the only species at jeopardy, practically all animals and plants may be at stake. Although epidemiological and ecological investigations as such never demonstrate causative effects, due to the vast number of confounders, they confirm the relevance of the controlled observations in the laboratories.*

Because the effects are reproducibly observed and links to pathology cannot be excluded, the precautionary principle should be in force in the implementation of this new technology within the society. This will be the only method to support the sustainability of these innovative wireless communication technologies. The February 2, 2000 European Commission Communication on the Precautionary Principle notes: "The precautionary principle applies where scientific evidence is insufficient,

inconclusive or uncertain and preliminary scientific evaluation indicates that there are reasonable grounds for concern that the potentially dangerous effects on the environment, human, animal or plant health may be inconsistent with the high level of protection chosen by the EU". Therefore, policy makers immediately should strictly control exposure by defining biologically-based maximal exposure guidelines also taking into account long-term, non-thermal effects, and including especially vulnerable groups, such as the elderly, the ill, the genetically and/or immunologically challenged, children and fetuses, and persons with the functional impairment electrohypersensitivity.

In November, 2009, a Scientific Panel comprised of international experts on the biological effects of electromagnetic fields met in Seletun, Norway, for three days of intensive discussion on existing scientific evidence and public health implications of the unprecedented global exposures to artificial electromagnetic fields (EMF) from telecommunications and electric power technologies. This meeting was a direct consequence of on-going discussions already from the mid-nineties, when cellular communications infrastructure began to rapidly proliferate, and stretching through, among many, the Benevento (2006), Venice (2008) and London (2009) Resolutions from this decade, and involving important conclusions drawn from the 600-page Bioinitiative Report published August 31, 2007, which was a review of over 2,000 studies showing biological effects from electromagnetic radiation at non-thermal levels of exposure, which partly was published subsequently in the journal Pathophysiology (Volume 16, 2009).

The Seletun Scientific Statement (2011) recommends that lower limits be established for electromagnetic fields and wireless exposures, based on scientific studies reporting health impacts at much lower exposure levels. Many researchers now believe the existing safety limits are inadequate to protect public health because they do not consider prolonged exposure to lower emission levels that are now widespread.

The body of evidence on electromagnetic fields requires a new approach to protection of public health; the growth and development of the fetus, and of children; and argues for strong preventative actions. These conclusions are built upon prior scientific and public health reports documenting the following:

1)Low-intensity (non-thermal) bioeffects and adverse health effects are demonstrated at levels significantly below existing exposure standards.
2)ICNIRP/WHO and IEEE/FCC public safety limits are inadequate and obsolete with respect to prolonged, low-intensity exposures.
3)New, biologically-based public exposure standards are urgently needed to protect public health world-wide.
***4)It** is not in the public interest to wait.*

-EMR exposures should be reduced now rather than waiting for proof of harm before acting. This is in keeping with traditional public health principles, and is justified now given abundant evidence that biological effects and adverse health effects are occurring at exposure levels hundreds to thousands of times below existing public safety standards around the world.
-There is a need for mandatory pre-market assessment.
-The use of telephone lines (land-lines) or fiber optic cables for SmartGrid type energy conservation infrastructure is recommended. Utilities should choose options that do not create new, community-wide exposures from wireless components of SmartGrid-type projects. Future health risks from prolonged or repetitive wireless exposures of SmartGrid- type systems may be avoided by using fiber-optic cable. Energy conservation is endorsed but not at the risk of exposing millions of families in their homes to a new, involuntary source of wireless radiofrequency radiation, the effect of which on their health not yet known.

I encourage governments to adopt a framework of guidelines for public and occupational EMF exposure that reflect the Precautionary Principle. The Precautionary Principle states when there are indications of possible adverse effects, though they remain uncertain, the risks from doing nothing may be far greater than the risks of taking action to control these exposures. The Precautionary Principle shifts the burden of proof from those suspecting a risk to those who discount it--some nations have already done. Precautionary strategies should be based on design and performance standards and may not necessarily define numerical thresholds because such thresholds may erroneously be interpreted as levels below which no adverse effect can occur.

You often hear about "safe levels" of exposure and that there is "no proof of health effects", but my personal response to these seemingly reassuring statements is that it is very important to realize, from a consumer's point of view, that "no accepted proof for health effects" is not the same as "no risk". Too many times, 'experts' have claimed to be experts in fields where actually the only expert comment should have been: "I/we just do not know". Such fields were e.g. the DDT, X-ray, radioactivity, smoking, asbestos, BSE, heavy metal exposure, depleted uranium, etc., etc., etc., where the "no risk"-flag was raised before true knowledge came around. Later on, the same flag had to be quickly lowered, many times after enormous economic costs and suffering of many human beings. Along those lines, it is now (regarding "the protection from exposure to electromagnetic fields" issue) very important to clearly identify the background and employment (especially if they sit, at the same time, on the industry's chairs) of every 'expert' in different scientific committees, and likewise. It is, of course, very important (maybe even more important?) to also let 'whistleblowers' speak at conferences, to support them with equal amounts (or even more?) of economical funding as those scientists and other 'experts' who, already from the very beginning, have declared a certain source or type of irradiation, or a specified product, to be 100% safe.

In the case of "protection from exposure to electromagnetic fields", it is thus of paramount importance to act from a prudence avoidance/precautionary principle point of view. Anything else would be highly hazardous! Total transparency of information is the key sentence here, I believe consumers are very tired of always having the complete truth years after a certain catastrophe already has taken place. For instance, it shall be noted, that today's recommendation values for wireless systems, the SAR-value, are just recommendations, and not safety levels. Since scientists observe biological effects at as low as 20 micro Watts/kg, is it then really safe to irradiate humans with 2 W/kg (i.e., with 100,000 times stronger radiation!), which is the recommendation level for us? And, furthermore, it is very strange to see, over and over again, that highly relevant scientific information is suppressed or even left out in various official documents, as high up as at the governmental level of society. This is not something that the consumers will gain anything good from, and, still, the official declaration or explanation (from experts and politicians) very often is: "If we (=the experts) would let everything out in the open, people would be very scared and they would panic." Personally, I have never seen this happen, but instead I have frequently seen great disappointment from citizens who afterwards have realized they have been fooled by their own experts and their own politicians...

Another misunderstanding is the use of scientific publications (as the tobacco industry did for many years) as 'weights' to balance each other. But you can NEVER balance a report showing a negative health effect with one showing nothing! This is a misunderstanding which, unfortunately, is very often used both by the industrial representatives as well as official authorities. The general audience, naturally, easily is fooled by such an argumentation, but if you are bitten by a deadly poisonous snake, what good does it make for you that there are 100 million harmless snakes around?

In many commentaries, debate articles and public lectures--for the last 20-30 years--I have urged that completely independent research projects must be inaugurated immediately to

ensure our public health. These projects must be entirely independent of all types of commercial interests; public health cannot have a price-tag! It is also of paramount importance that scientists involved in such projects must be free of any carrier considerations and that the funding needed is covered to 100%, not 99% or less. This is the clear responsibility of the democratically elected body of every country.

Many smart meters are close to beds, kitchens, playrooms, and similar locations. These wireless systems are never off, and the exposure is not voluntary. The smart meters are being forced on citizens everywhere. Based on this, the inauguration of smart meters with grudging and involuntary exposure of millions to billions of human beings to pulsed microwave radiation should immediately be prohibited until 'the red flag' can be hauled down once and for all.

Comments from: Cindy Sage, Sage Associates.

The following is a sample of some of the information presented in the Sage letter:

Mandatory Installation. No one can opt-out. Utilities have received authorization in many states to install them.

Community Concerns and Issues. The program is expensive with very little demonstration that consumers will want this service, or choose to participate. They include economic concerns, lack of privacy of personal information, easier disconnection of service, health and safety concerns, reliability, increased vulnerability to hacking, increased risk of planting of malicious software on networks, security risks when away from home (burglaries), fire risks, explosions, interference with critical care equipment (medical), and meter overcharges.

Economics. The economic justification these billion dollar programs is that the costs will be offset by energy savings. 100% compliance or even 50% compliance is unrealistic. What percent compliance is realistic is unknown, but where consumers are educating themselves on the costs and benefits, there is significant resistance. The business case is not proven. Ratepayers will have to pick up the bill for risky billion-dollar investments that benefit the utilities bottom-line, with no assurance that energy savings will be worth the price. The economics do not look reasonable.

Invasion of Personal Privacy. The use of wireless networks to relay energy information leaves open the potential for misuse of personal data, billing and usage information, and other private information. Privacy breaches have already been documented (illegal access of 179,000 accounts at Hydro Toronto, for example). It also may increase burglary risk, since home electrical usage is made electronically visible. When unoccupied, the home uses less electricity. It's like advertising to criminals with wireless detection equipment that you are not home.

Vulnerability to Hacking and Intentional Sabotage. Smart meters are alleged to open up the potential for hacking into personal wireless networks used for banking, bill paying, and private communications.

Concerns over the security of the US electrical grid have received widespread media coverage (Wall Street Journal April27, 2009). Smart meters provide a new vulnerability to intentional sabotage as well as to inadvertent access to private information, since the network is wireless and it adds direct linkage to home computers and personal data.

The wireless network proposed to enable smart grid and smart meter technology is a full-saturation, full-coverage RF blanket of wireless into every home and business that can increase the points of entry for malicious software (malware), to electrical service disruption

or disconnection, and to terrorist attack on the electrical and communications grid throughout the country (Wired.com, March 4, 2010).

CNN launched a "Cyber Shockwave" program two weeks ago that detailed national concerns over the security of the internet and of wireless communications, which makes us vulnerable to loss of the electrical grid, internet and wireless communications across the country (February 20. 2010). Banking, transportation and the electrical grid had the biggest vulnerabilities.

Accuracy in Billing – Meter Overcharges. There are widespread reports of excessive charges, due to malfunctioning smart meters. In Bakersfield, CA, where PG&E started installing the first smart meters, more than 100 people attended a meeting held by State Senator Florez to complain about absurd electric bills. Those with new smart meters had bills 200-400% higher, with no increase in power use as compared to the same months of the previous year. The meters are thought to malfunction because of spurious RF signals (electronic glitches). It is reported that high frequencies can make disc type electric meters spin faster, making it appear that more electricity has been used than actually has. For this reason, electrical bills have also increased near cell antenna towers for the same reason (high radiofrequency environments). A class action lawsuit has already been filed in Bakersfield, CA because of numerous consumer complaints.

Health and Environmental Concerns. Some utilities have provided technical reports on radiofrequency/microwave emissions. They all say the smart meters are "in compliance with FCC public safety limits". However, the RF reports indicate that the smart meter will produce over 300 microwatts/centimeter squared near the meter, and this will produce elevated RF both inside and outside the home. Chronic exposure to radiofrequency and microwave radiation is still considered a potential health risk, and studies continue at NIEHS and at the World Health Agency to determine actual health risks. These smart meter RF/MW levels are far higher than those already reported to cause health risks. Compliance is not safety, since the existing FCC safety limits are under challenge, and have already been called 'insufficient to protect public health' by some federal agencies.

The power transmitters that also have to go inside the home (on each appliance that is reporting to the smart meter) produce high, intermittent RF in short bursts. If the consumer does opt-in to a smart meter program, he/she will have to install multiple power transmitters (one per appliance) inside the home at additional cost for the wireless thermostat, power transmitters and wireless display). These power transmitters are another source of RF, and some calculations show they emit short, but powerful bursts of RF up to several thousand microwatts per centimeter squared. These bursts will occur both day and night, perhaps several times a minute.

To date, none of the technical RF reports we've reviewed is able to predict the cumulative RF from the smart meter plus the power transmitters inside the home, the intervals of RF transmission, and the additional RF transmissions from neighboring homes that can 'piggyback' on your smart meter system. This 'piggybacking' part of the system means that other homes can put additional RF signals through your meter, if they don't have a good signal to the utility's reporting cell antenna network.

Electromagnetic Interference. Wireless medical devices in use within homes may malfunction. Spurious radiofrequency signals are already reported in published studies to interfere with critical care equipment, ventilators, pain pumps, wireless insulin pumps and other medical devices. There does not appear to be any testing results on the effect of smart meters and critical care devices in advance of their deployment, but the issue is real.

There can also be interference with other electronic devices (home office printers, FAX, scanners, computers, television and cable settings, security systems, etc). Appliances and devices that are electrically connected in the home (plugged into home electrical wiring) may experience RF bursts of high enough intensity to cause malfunction and/or damage. These events are reported where smart meters have been installed.

Fires and Explosions. There are reports in Bakersfield and from some Alabama communities that the installation of smart meters caused fires (15 reported in Bakersfield). Exhibit 76

Biological effects from electromagnetic field exposure and public exposure standards.

During recent years there has been increasing public concern on potential health risks from power-frequency fields (extremely low frequency electromagnetic fields; ELF) and from radiofrequency/microwave radiation emissions (RF) from wireless communications. Non-thermal (lowintensity) biological effects have not been considered for regulation of microwave exposure, although numerous scientific reports indicate such effects. The BioInitiative Report is based on an international research and public policy initiative to give an overview of what is known of biological effects that occur at low-intensity electromagnetic fields (EMFs) exposure. Health endpoints reported to be associated with ELF and/or RF include childhood leukaemia, brain tumours, genotoxic effects, neurological effects and neurodegenerative diseases, immune system deregulation, allergic and inflammatory responses, breast cancer, miscarriage and some cardiovascular effects. The BioInitiative Report concluded that a reasonable suspicion of risk exists based on clear evidence of bioeffects at environmentally relevant levels, which, with prolonged exposures may reasonably be presumed to result in health impacts. Regarding ELF a new lower public safety limit for habitable space adjacent to all new or upgraded power lines and for all other new constructions should be applied. A new lower limit should also be used for existing habitable space for children and/or women who are pregnant. A precautionary limit should be adopted for outdoor, cumulative RF exposure and for cumulative indoor RF fields with considerably lower limits than existing guidelines, see the BioInitiative Report. The current guidelines for the US and European microwave exposure from mobile phones, for the brain are 1.6 W/Kg and 2 W/Kg, respectively. Since use of mobile phones is associated with an increased risk for brain tumour after 10 years, a new biologically based guideline is warranted. Other health impacts associated with exposure to electromagnetic fields not summarized here may be found in the BioInitiative Report at www.bioinitiative.org. Exhibit 77

Biological effects from exposure to electromagnetic radiation emitted by cell tower base stations and other antenna arrays.

The siting of cellular phone base stations and other cellular infrastructure such as roof-mounted antenna arrays, especially in residential neighborhoods, is a contentious subject in land-use regulation. Local resistance from nearby residents and landowners is often based on fears of adverse health effects despite reassurances from telecommunications service providers that international exposure standards will be followed. Both anecdotal reports and some epidemiology studies have found headaches, skin rashes, sleep disturbances, depression, decreased libido, increased rates of suicide, concentration problems, dizziness, memory changes, increased risk of cancer, tremors, and other neurophysiological effects in populations near base stations. The objective of this paper is to review the existing studies of people living or working near cellular infrastructure and other pertinent studies that could apply to long-term, low-level radiofrequency radiation (RFR) exposures. While specific epidemiological research in this area is sparse and

contradictory, and such exposures are difficult to quantify given the increasing background levels of RFR from myriad personal consumer products, some research does exist to warrant caution in infrastructure siting. Further epidemiology research that takes total ambient RFR exposures into consideration is warranted. Symptoms reported today may be classic microwave sickness, first described in 1978. Nonionizing electromagnetic fields are among the fastest growing forms of environmental pollution. Some extrapolations can be made from research other than epidemiology regarding biological effects from exposures at levels far below current exposure guidelines.

Additional information from the report:

The intensity of RFR decreases rapidly with the distance from the emitting source; therefore, exposure to RFR from transmission towers is often of low intensity depending on one's proximity. But intensity is not the only factor. Living near a facility will involve long-duration exposures, sometimes for years, at many hours per day. People working at home or the infirm can experience low-level 24 h exposures. Nighttimes alone will create 8 h continuous exposures. The current standards for both ICNIRP, IEEE and the NCRP (adopted by the U.S. FCC) are for whole-body exposures averaged over a short duration (minutes) and are based on results from short-term exposure studies, not for long-term, low-level exposures such as those experienced by people living or working near transmitting facilities. For such populations, these can be involuntary exposures, unlike cell phones where user choice is involved.

Biological effects at low intensities

*Many biological effects have been documented at very low intensities comparable to what the population experiences within 200 to 500 ft (*60–150 m) of a cell tower, including effects that occurred in studies of cell cultures and animals after exposures to low-intensity RFR. Effects reported include: genetic, growth, and reproductive; increases in permeability of the blood–brain barrier; behavioral; molecular, cellular, and metabolic; and increases in cancer risk.*

Some examples are as follows:

_ Dutta et al. (1989) reported an increase in calcium efflux in human neuroblastoma cells after exposure to RFR at 0.005 W/kg. Calcium is an important component in normal cellular functions.

_ Fesenko et al. (1999) reported a change in immunological functions in mice after exposure to RFR at a power density of 0.001 mW/cm2.

_ Magras and Xenos (1997) reported a decrease in reproductive function in mice exposed to RFR at power densities of 0.000168–0.001053 mW/cm2.

_ Forgacs et al. (2006) reported an increase in serum testosterone levels in rats exposed to GSM (global system for mobile communication)-like RFR at SAR of 0.018– 0.025 W/kg.

_ Persson et al. (1997) reported an increase in the permeability of the blood–brain barrier in mice exposed to RFR at 0.0004–0.008 W/kg. The blood–brain barrier is a physiological mechanism that protects the brain from toxic substances, bacteria, and viruses.

_ Phillips et al. (1998) reported DNA damage in cells exposed to RFR at SAR of 0.0024–0.024 W/kg.

_ Kesari and Behari (2009) also reported an increase in DNA strand breaks in brain cells of rats after exposure to RFR at SAR of 0.0008 W/kg.

_ Belyaev et al. (2009) reported changes in DNA repair mechanisms after RFR exposure at a SAR of 0.0037 W/kg. A list of publications reporting biological and (or) health effects of low-intensity RFR exposure is in Table 1.

Out of the 56 papers in the list, 37 provided the SAR of exposure. The average SAR of these studies at which biological effects occurred is 0.022 W/kg — a finding below the current standards.

Long-term exposures and cumulative effects

There is some evidence of cumulative effects. Phillips et al. (1998) reported DNA damage in cells after 24 h exposure to low-intensity RFR. DNA damage can lead to gene mutation that accumulates over time. Magras and Xenos (1997) reported that mice exposed to low-intensity RFR became less reproductive. After five generations of exposure the mice were not able to produce offspring. This shows that the effects of RFR can pass from one generation to another. Persson et al. (1997) reported an increase in permeability of the blood–brain barrier in mice when the energy deposited in the body exceeded 1.5 J/kg (joule per kilogram) — a measurement of the total amount of energy deposited. This suggests that a short-term, high-intensity exposure can produce the same effect as a long-term, low-intensity exposure, and is another indication that RFR effects can accumulate over time.

In addition, there is some indication that test animals become more sensitive to radiation after long-term exposure as seen in two of the critical experiments that contributed to the present SAR standards, called the "behavior–disruption experiments" carried out in the 1980s.

Since most studies with RFR are short-term exposure studies, it is not valid to use their results to set guidelines for long-term exposures, such as in populations living or working near cell phone base stations.

Other discussion points:

People are reporting symptoms near cell towers and in proximity to other RFR-generating sources including consumer products such as wireless computer routers and Wi-Fi systems that appear to be classic "microwave sickness syndrome," also known as "radiofrequency radiation sickness." First identified in the 1950s by Soviet medical researchers, symptoms included headache, fatigue, ocular dysfunction, dizziness, and sleep disorders. In Soviet medicine, clinical manifestations include dermographism, tumors, blood changes, reproductive and cardiovascular abnormalities, depression, irritability, and memory impairment, among others. The Soviet researchers noted that the syndrome is reversible in early stages but is considered lethal over time (Tolgskaya et al. 1973).

It makes little sense to keep denying health symptoms that are being reported in good faith. Though the prevalence of such exposures is relatively new to a widespread population, we, nevertheless, have a 50 year observation period to draw from.

There is early Russian and U.S. documentation of longterm, very low-level exposures causing microwave sickness as contained in The Johns Hopkins Foreign Service Health Status Study done in 1978 (Lilienfield et al. 1978; United States Senate 1979). This study contains both clinical information, and clear exposure parameters. Called the Lilienfield study, it was conducted between 1953 and 1976 to determine what, if any, effects there had been to personnel in the U.S. Embassy in Moscow after it was discovered that the Soviet government had been systematically irradiating the U.S. government compound there.

The symptoms reported were not due to any known tissue heating properties. The power densities were not only very low but the propagation characteristics were remarkably similar to

what we have today with cell phone base stations. Lilienfield recorded exposures for continuous-wave, broadband, modulated RFR in the frequency ranges between 0.6 and 9.5 GHz. The exposures were long-term and low-level at 6 to 8 h per day, 5 days per week, with the average length of exposure time per individual between 2 to 4 years. Modulation information contained phase, amplitude, and pulse variations with modulated signals being transmitted for 48 h or less at a time. Radiofrequency power density was between 2 and 28 mW/cm2 — levels comparable to recent studies cited in this paper.

The symptoms that Lilienfield found included four that fit the Soviet description for dermographism — eczema, psoriasis, allergic, and inflammatory reactions. Also found were neurological problems with diseases of peripheral nerves and ganglia in males; reproductive problems in females during pregnancy, childbearing, and the period immediately after delivery (puerperium); tumor increases (malignant in females, benign in males); hematological alterations; and effects on mood and well-being including irritability, depression, loss of appetite, concentration, and eye problems. This description of symptoms in the early literature is nearly identical to the Santini, Abdel-Rassoul, and Narvarro studies cited earlier, as well as the current (though still anecdotal) reports in communities where broadcast facilities have switched from analog to digital signals at power intensities that are remarkably similar. In addition, the symptoms in the older literature are also quite similar to complaints in people with EHS. Exhibit 78

Cancer morbidity in subjects occupationally exposed to high frequency (radiofrequency and microwave) electromagnetic radiation.

Abstract: Cancer morbidity was registered in the whole population of military career personnel in Poland during a period of 15 years (1971-1985). Subjects exposed occupationally to radiofrequencies (RF) and microwaves (MW) were selected from the population on the basis of their service records and documented exposures at service posts. The population size varied slightly from year to year with a mean count of about 128000 persons each year; each year about 3700 of them (2.98%) were considered as occupationally exposed to RF/MW. All subjects (exposed and non-exposed to RF/MW) were divided into age groups (20-29,30-39,40-49 and 50-59). All newly registered cases of cancer were divided into 12 types based on localisation of the malignancy; for neoplasms of the haemopoietic system and lymphatic organs an additional analysis based on diagnosis was performed. Morbidity rates (per 100000 subjects annually) were calculated for all of the above localisations and types of malignancies both for the whole population and for the age groups. The mean value of 15 annual rates during 1971-1985 represented the respective morbidity rate for the whole period. Morbidity rates in the non-exposed groups of personnel were used as 'expected' (E) rates for the exposed subjects, while the real morbidity rates counted in the RF/MW-exposed personnel served as 'observed' (0) rates. This allowed the calculation of the observed/expected ratio (OER) representing the odds ratio for the exposed groups. The cancer morbidity rate for RF/MW-exposed personnel for all age groups (20-59 years) reached 119.1 per 100000 annually (57.6 in non-exposed) with an OER of 2.07, significant at $P < 0.05$. The difference between observed and expected values results from higher morbidity rates due to neoplasms of the alimentary tract (OER = 3.19-3.241, brain tumours (OER = 1.91) and malignancies of the haemopoietic system and lymphatic organs (OER = 6.31). Among malignancies of the haemopoietic/lymphatic systems, the largest differences in morbidity rates between exposed and non-exposed personnel were found for chronic myelocytic leukaemia (OER = 13.91, acute myeloblastic leukaemia (OER = 8.62) and non-Hodgkin lymphomas (OER = 5.82).

Additional information from the report:

The highest difference in morbidity rate between RF/MW-exposed and non-exposed personnel was found for malignancies of the haemopoietic system and lymphatic organs (Table 2) with the odds ratio exceeding 6 and the incidence of above 40 new cases per 100000 of exposed subjects annually. The most frequent type of this form of malignancy in the RF/MW-exposed group appeared to be non-Hodgkin lymphoma and lymphosarcoma (10.65 new cases annually per 100000> and chronic lymphocytic leukaemia (12.23 cases per 100000 annually), both developing mainly in the 40-49 and 50-59 years age groups. Neoplasms of the haemopoietic system and lymphatic organs are among the malignancies that are to a considerable degree related to multiple environmental and occupational factors, including ionising radiation, organic solvents, some synthetic stains, resins, higher alcohols and numerous other substances [l]. Therefore, many industrial occupations, including e.g. aluminium production, petroleum refining, painting, mining, driving and car servicing, are considered to increase the risk of development of leukaemias and lymphomas. Electric and electronic industry workers have also considerable possibilities for exposure to potential leukaemiogenic factors and substances during their routine or additional duties. This may strongly influence and bias the morbidity rates of haemopoietic and lymphatic malignancies occurring in these populations and their relation to EM fields. Exhibit 79

A Case Study of Mobile Phone Use and Acoustic Neuroma Risk in Japan.

Results of case–control studies of mobile phone use and acoustic neuroma have been inconsistent. We conducted a case–case study of mobile phone use and acoustic neuroma using a self-administered postal questionnaire. A total of 1589 cases identified in 22 hospitals throughout Japan were invited to participate, and 787 cases (51%) actually participated. Associations between laterality of mobile phone use prior to the reference dates (1 and 5 years before diagnosis) and tumor location were analyzed. The overall risk ratio was 1.08 (95% confidence interval (CI), 0.93–1.28) for regular mobile phone use until 1 year before diagnosis and 1.14 (95% CI, 0.96–1.40) for regular mobile phone use until 5 years before diagnosis. A significantly increased risk was identified for mobile phone use for >20 min/day on average, with risk ratios of 2.74 at 1 year before diagnosis, and 3.08 at 5 years before diagnosis. Cases with ipsilateral combination of tumor location and more frequently used ear were found to have tumors with smaller diameters, suggesting an effect of detection bias. Furthermore, analysis of the distribution of left and right tumors suggested an effect of tumor-side-related recall bias for recall of mobile phone use at 5 years before diagnosis. The increased risk identified for mobile phone users with average call duration >20 min/day should be interpreted with caution, taking into account the possibilities of detection and recall biases. However, we could not conclude that the increased risk was entirely explicable by these biases, leaving open the possibility that mobile phone use increased the risk of acoustic neuroma. Exhibit 80

The Challenge of Nonionizing Radiation: A Proposal for Legislation.. Adverse Effects of Electromagnetic Radiation on Man and His Environment

Nonionizing electromagnetic radiation (NEMR) can affect human health adversely in two ways. First, these electromagnetic waves may penetrate the human body and interact with the living system. Second, such radiation causes interference with, and physical degradation of, electronic systems.

Specific documented bioeffects associated with thermal reaction include cataract formation, heat stress, cardiovascular effects, testicular effects, brainwave pattern changes, burns and necrosis of the skin, lesions of the nervous system, subcutaneous burns, hemorrhaging of internal organs and birth defects. These radiation effects are increasingly probable as power densities rise

above the "threshold" for thermal effects. The presence of metal implants in the body (such as metal pins in bones) may concentrate the absorption of radiation at the location of implantation, inducing thermal effects from lower power densities than would ordinarily cause such harm. In addition, research into the bioeffects of lasers and other light-like radiation has documented the fact that cataracts and other serious eye damage, ulceration or burning, and blistering and infection of the skin are associated thermal hazards.

As one researcher and commentator described the situation, "It has been said that present physical laws do not account for any 'nonthermal' effects and unless new laws are discovered, there can be no possible effects of electromagnetic radiation on biologic systems. This statement is slightly contrary to good science." It may be more than "slightly" contrary to good science. Knowledge of mechanisms or physical laws explaining phenomena is obviously very important, particularly for its predictive value. But to say that there are no effects when effects are in fact observed, simply because the effects cannot be explained, is like saying no apples fell until Newton discovered the law of gravity.

In general, however, evidence is increasing that low-level bioeffects do exist. These effects include nervous system and behavioral effects, including a reduction in learning facility; desadaptive effects; damage to the chemical barrier that prevents blood toxins from entering the brain; inhibition of lymphocyyte development (part of the immunological system) and, possibly, genetic defects, birth defects and general effects on growth and aging processes.In addition, Soviet surveys of occupationally exposed persons have identified a chronic exposure syndrome based on subjective evidence- workers' complaints. This syndrome includes headache, eyestrain and tearing, fatigue and weakness, vertigo, sleeplessness at night and drowsiness during the day, moodiness, irritability, hypochondria, paranoia, either nervous tension or mental depression and memory impairment. After longer periods of exposure, additional complaints may include sluggishness, inability to make decisions, loss of hair, pain in muscles and in the heart region, breathlessness, sexual problems and even a decrease in lactation in nursing mothers. Clinically observed effects in persons voicing these complaints include trembling of the eyelids, fingers and tongue, increased perspiration of the extremities, rash, and, at exposures in the 1 to 10 mWIcm2 range, changes in electroencephalogram (EEG) pattems. Exhibit 81

Childhood leukemia and electromagnetic fields: results of a population-based case-control study in Germany.

Abstract: The investigation of an association between increased exposure to residential extremely-low frequency electromagnetic fields (ELF-EMF) and childhood leukemia was part of a population-based case-control study carried out between 1992 and 1995 in the northwestern part of Germany. A total of 129 children with leukemia and 328 controls participated in the EMF-study. Exposure assessment comprised measurements of the magnetic field over 24 hours in the child's bedroom at the residence where the child had been living for the longest period before the date of diagnosis, and spot measurements at all residences where the child had been living for more than one year. The median of the 24h-measurement in the child's bedroom was regarded as the most valid exposure variable. For children exposed to more than 0.2mT, an elevated but not significant odds ratio (OR) was observed (OR = 3.2, 95 percent confidence interval = 0.7-14.9). These figures are based on only four leukemia cases and three controls since only 1.5 percent of the study population was classified as highly exposed. Exploratory analyses revealed ORs that were not statistically significantly increased for other characteristics of the magnetic field at varying cut-points. The results are comparable with those from other studies. Although not statistically significant, they may indicate a positive association between EMF and childhood leukemia. **Exhibit 82**

Childhood leukemia and personal monitoring of residential exposures to electric and magnetic fields in Ontario, Canada.

Objectives: To evaluate the risk of childhood leukemia in relation to residential electric and magnetic field (EMF) exposures.

Methods: A case control study based on 88 cases and 133 controls used different assessment methods to determine EMF exposure in the child's current residence. Cases comprised incident leukemias diagnosed at 0±14 years of age between 1985±1993 from a larger study in southern Ontario; population controls were individually matched to the cases by age and sex. Exposure was measured by a personal monitoring device worn by the child during usual activities at home, by point-in-time measurements in three rooms and according to wire code assigned to the child's residence.

Results: An association between magnetic field exposures as measured with the personal monitor and increased risk of leukemia was observed. The risk was more pronounced for those children diagnosed at less than 6 years of age and those with acute lymphoblastic leukemia. Risk estimates associated with magnetic fields tended to increase after adjusting for power consumption and potential confounders with significant odds ratios (OR) (OR: 4.5, 95% confidence interval (CI): 1.3±15.9) observed for exposures P0:14 microTesla (lT). For the most part point-in-time measurements of magnetic fields were associated with non-significant elevations in risk which were generally compatible with previous research. Residential proximity to power lines having a high current configuration was not associated with increased risk of leukemia. Exposures to electric fields as measured by personal monitoring were associated with a decreased leukemia risk.

Conclusions: The findings relating to magnetic field exposures directly measured by personal monitoring support an association with the risk of childhood leukemia. As exposure assessment is refined, the possible role of magnetic fields in the etiology of childhood leukemia becomes more evident.

Additional information from the report:

In the present study, magnetic fields measured by monitoring the child's exposures during his/her usual activities were associated with an increased risk of developing leukemia. This association persisted after adjustment for potential confounders with some odds ratios increasing in magnitude while retaining statistical significance. The strength of association with magnetic field exposure was more pronounced for children who were less than six years of age at the time of diagnosis than for older children. This might be attributed to differential susceptibility of younger children, but it is also possible that the exposure as measured is a better representation of the exposure received during the relevant etiologic time period. The proportion of time residing in the current residence, relative to the total period of inquiry defined for this study was higher for younger children and unlike earlier studies, which have tended to have lengthy intervals between measurement and diagnosis [8, 14], the average time between measurement and diagnosis was less than three years. The expectation is that these characteristics have made the measurements more relevant to the true etiologic period, particularly for those children diagnosed at a younger age. Estimates of acute lymphoblastic leukemia risk for younger children, the cell type which accounts for proportionately more leukemias in younger than older children, were also significantly elevated. Exhibit 83

Chronic Exposure to ELF Fields May Induce Depression.

Exposure to extremely-low-frequency (ELF) electric or magnetic fields has been postulated as a potentially contributing factor in depression. Epidemiologic studies have yielded positive correlations between magnetic- and/or electric-field strengths in local environments and the incidence of depression-related suicide. Chronic exposure to ELF electric or magnetic fields can disrupt normal circadian rhythms in rat pineal serotonin-N-acetyltransferase activity as well as in serotonin and melatonin concentrations. Such disruptions in the circadian rhythmicity of pineal melatonin secretion have been associated with certain depressive disorders in human beings. In the rat, ELF fields may interfere with tonic aspects of neuronal input to the pineal gland, giving rise to what may be termed "functional pinealectomy." If long-term exposure to ELF fields causes pineal dysfunction in human beings as it does in the rat, such dysfunction may contribute to the onset of depression or may exacerbate existing depressive disorders.

Additional information from this report:

*Pineal function: In its role as a "**neuroendocrine transducer**," the pineal gland has been reported to contribute to the synchronization of endocrine functions with the circadian light/dark cycle by releasing melatonin into the circulation, with higher concentrations occurring during the hours of darkness. The **principal endogenous, circadian, timing signals in mammals are thought to originate in a central "pacemaker" within the suprachiasmatic nuclei. The pineal is a convenient organ in which to study neuroendocrine rhythms because of its pronounced periodicity in both enzyme activity and indoleamine synthesis and release.** Photic stimuli suppress pineal activity [Wurtman et al., 19631; stimulation of the retina during the night can cause a precipitous drop in circulating melatonin levels. Light-induced suppression in melatonin synthesis and release has been demonstrated in several species, including man, nonhuman primates, and several rodent species [Lewy et al., 1980; Klein and Weller, 1972; Perlow et al., 19801. The neuronal pathways mediating this effect are the inferior accessory optic tract, the medial forebrain bundle, the medial terminal nucleus, the preganglionic sympathetic tract, the superior cervical ganglion **(SCG),** and, thence, to the postganglionic fibers that innervate the pineal gland [Moore et al., 19681.*

***ELF-Field Effects in Animals: Several studies have shown that ELF electric and magnetic fields affect the mammalian brain and nervous system. Observed effects include alterations in the EEG patterns of several animals, including rats [Lott and McCain, 1973], guinea pigs [Blanchi et al., 1973], and monkeys [Silney, 1985]. Alterations resulting from electric field exposure also have been reported in the character of synaptic transmission in the superior cervical ganglion (SCG) [Jaffe et al., 1980] and neuromuscular transmission [Jaffe et al., 1981]. Monkeys exposed to a varied schedule of environmental-strength, electric, and magnetic fields for 63 days showed reductions in cerebrospinal fluid concentrations of 5-HIAA and homovanillic acid [Seegal et al., 1985]. Decreased performance in timed-response behavior tasks in electric-field-exposed nonhuman primates has been reported by Gavalas-Medici and Magadaleno** *[1975].* Exhibit 84

Clastogenic Effects in Human Lymphocytes of Power Frequency Electric Fields: In Vivo and In Vitro Studies.

Summary: In vivo and in vitro studies of the clastogenic effects of power frequency electric fields and transient electric currents have been performed. For the in vivo investigation, peripheral lymphocytes from twenty switchyard workers were screened for chromosome anomalies. The rates of chromatid and chromosome breaks were found to be significantly increased compared to the rates in 17 controls. Exposure of human peripheral lymphocytes, in vitro, to a 50-Hz current with 1 mA/cm2 current density did not include any chromosome damage. Exposure to ten 3 us-long spark discharge pluses with a peak field strength in the samples of 3.5 kV/cm, however, resulted in chromosome breaks at a frequency similar to that induced in lymphocytes in vitro by

ionizing radiation at 0.75 Gy. The biological significance of chromosomal damage induced in somatic cells is discussed. Exhibit 85

Cognitive and neurobiological alterations in electromagnetic hypersensitive patients: results of a case-control study.

Background. Hypersensitivity to electromagnetic fields (EMF) is frequently claimed to be linked to a variety of non-specific somatic and neuropsychological complaints. Whereas provocation studies often failed to demonstrate a causal relationship between EMF exposure and symptom formation, recent studies point to a complex interplay of neurophysiological and cognitive alterations contributing to symptom manifestation in electromagnetic hypersensitive patients (EHS). However, these studies have examined only small sample sizes or have focused on selected aspects. Therefore this study examined in the largest sample of EHS EMF-specific cognitive correlates, discrimination ability and neurobiological parameters in order to get further insight into the pathophysiology of electromagnetic hypersensitivity.

Method. In a case-control design 89 EHS and 107 age- and gender-matched controls were included in the study. Health status and EMF-specific cognitions were evaluated using standardized questionnaires. Perception thresholds following single transcranial magnetic stimulation (TMS) pulses to the dorsolateral prefrontal cortex were determined using a standardized blinded measurement protocol. Cortical excitability parameters were measured by TMS.

Results. Discrimination ability was significantly reduced in EHS (only 40% of the EHS but 60% of the controls felt no sensation under sham stimulation during the complete series), whereas the perception thresholds for real magnetic pulses were comparable in both groups (median 21% versus 24% of maximum pulse intensity). Intra-cortical facilitation was decreased in younger and increased in older EHS. In addition, typical EMF-related cognitions (aspects of rumination, symptom intolerance, vulnerability and stabilizing self-esteem) specifically differentiated EHS from their controls.

Conclusions. These results demonstrate significant cognitive and neurobiological alterations pointing to a higher genuine individual vulnerability of electromagnetic hypersensitive patients. Exhibit 86

Combined Risk Estimates for Two German Population-Based Case-Control Studies on Residential Magnetic Fields and Childhood Acute Leukemia.

Overview: From 1992 to 1996, we obtained electromagnetic field measurements in two population-based case-control studies on childhood leukemia in the northwestern part of Germany and in Berlin. Exposure assessment comprised residential 24-hour measurements and short-term measurements. We obtained 24- hour measurements for a total of 176 cases and 414 controls. We compared subjects exposed to median 24-hour measurements of 0.2 ILT or more with those exposed to lower amounts. Multivariate regression analysis revealed an odds ratio of 2.3 (95% confidence interval = 0.8-6.7).

Discussion: We observed stronger associations for younger children as well as for those exposed to stronger magnetic fields during the night. Exhibit 87

Cytogenetic Damage in Human Lymphocytes Following GMSK Phase Modulated Microwave Exposure.

The present study investigated, using in vitro experiments on human lymphocytes, whether exposure to a microwave frequency used for mobile communication, either unmodulated or in presence of phase only modulation, can cause modification of cell proliferation kinetics and/or genotoxic effects, by evaluating the cytokinesis block proliferation index and the micronucleus frequency. In the GSM 1800 mobile communication systems the field is both phase (Gaussian minimum shift keying, GMSK) and amplitude (time domain multiple access, TDMA) modulated. The present study investigated only the effects of phase modulation, and no amplitude modulation was applied. Human peripheral blood cultures were exposed to 1.748 GHz, either continuous wave (CW) or phase only modulated wave (GMSK), for 15 min. The maximum specific absorption rate (_5 W/kg) was higher than that occurring in the head of mobile phone users; however, no changes were found in cell proliferation kinetics after exposure to either CW or GMSK fields. As far as genotoxicity is concerned, the micronucleus frequency result was not affected by CW exposure; however, a statistically significant micronucleus effect was found following exposure to phase modulated field. These results would suggest a genotoxic power of the phase modulation per se.

Dirty Electricity and Electrical Hypersensitivity: Five Case Studies.

Deteriorating power quality is becoming increasingly common in developed countries. Poor power quality, also known as dirty electricity, refers primarily to a combination of harmonics and transients generated primarily by electronic devices and by non-linear loads. We have assumed, until recently, that this form of energy is not biologically active. However, when Graham/Stetzer™ filters were installed in homes and schools, symptoms associated with electrical hypersensitivity (such as chronic fatigue, depression, headaches, body aches and pains, ringing in the ears, dizziness, impaired sleep, memory loss, and confusion) were reduced. Five case studies are presented that include one healthy individual; one person with electrical hypersensitivity; another with diabetes; and a person with multiple sclerosis. Results for 18 teachers and their classes at a school in Toronto are also presented. These individuals experienced major to moderate improvements in their health and wellbeing after Graham/Stetzer filters improved power quality in their home or work environment. The results suggest that poor power quality may be contributing to electrical hypersensitivity and that as much as 50% of the population may be hypersensitive; children may be more sensitive than adults and dirty electricity in schools may be interfering with education and possibly contributing to disruptive behavior associated with attention deficit disorder (ADD); dirty electricity may elevate plasma glucose levels among diabetics, and exacerbate symptoms for those with multiple sclerosis and tinnitus. Graham/Stetzer filters and meters enable individuals to monitor and improve power quality in buildings and they provide scientists with a tool for studying the effects of dirty electricity. For the first time we can progress from simply documenting electrical hypersensitivity to alleviating some of the symptoms. These results are dramatic and warrant further investigation. If they are representative of what is happening worldwide, then dirty electricity is adversely affecting the lives of millions of people.

Additional information from this paper:

This paper included a discussion of 5 case studies. One of the health effects of dirty electricity was tinnitus. They included the following statistics regarding tinnitus:

An estimated 1 out of every 5 people experiences some degree of tinnitus. Of the more than 50 million Americans who experience tinnitus, 12 million seek medical attention, and two million are so seriously debilitated that they cannot function on a "normal," day-to-day basis. There is no known cure for tinnitus and treatments range from biofeedback, to drugs, to cochlear implants.

Another case study involved a woman with multiple sclerosis (MS). After they placed 13 Graham/Stetzer (G/S) filters in her home to help block out the effects of dirty electricity, her symptoms were significantly diminished.

Within 24 hours her sense of balance improved and she was able to walk a short distance carrying objects in both hands without assistance (no cane or wallwalking—where they have to use walls or furniture to maintain balance). Within 1 week joint stiffness, joint pain, and muscle weakness decreased significantly and she had less difficulty walking (Figure 5). Within 2 weeks she was able to walk without ankle support and was able to bend forward without losing her balance. She had less muscle weakness and was not as dizzy (Figure 5). Swelling in her hands and feet decreased and her extremities were not as cold (similar to Case #1). The quality of her sleep improved and her level of fatigue decreased.

Symptoms of multiple sclerosis vary between individuals depending on what part of the brain/nervous system is affected. Symptoms include cognitive dysfunction (including problems with memory, attention, and problem-solving); dizziness and vertigo; difficulty walking and/or balance or coordination problems; bladder and bowel dysfunction; depression; fatigue; numbness in extremities; pain; vision problems; hearing loss; speech and swallowing disorders.

The next case involved a woman with diabetes. After placing G/S filters in her home, her blood glucose levels were back in the normal range and she was able to take a reduced amount of insulin. When she went out to public places such as malls (with high levels of dirty electricity), her blood glucose levels were again significantly elevated.

In addition to Case #4, we have worked with individuals who have both type 1 and type 2 diabetes and those who are pre-diabetic and have found that blood sugar levels can change rapidly (within a matter of 20 minutes or so for some individuals) as they move from an environment that is electrically dirty to one that is electrically clean (and back again). The percentage of the diabetic population that responds to dirty electricity and to RFR needs to be determined.

Diabetes is on the increase. According to the World Health Organization (2004) in 1985 there were 30 million diabetics worldwide; by 1995 the number increased to 135 million and by 2000 to 177 million. The WHO estimates that by 2025 there will be 300 million diabetics globally. Four million deaths each year (9% of the global total) are attributed to diabetes.

Based on our studies we would like to suggest that, in addition to Type 1 and Type 2 diabetes, there is a Type 3 diabetes that may be attributed to poor power quality. This form of pollution may be contributing to the rapid growth of this disease and affecting the large number of people who are classified as "pre-diabetic" according to the American Diabetes Association and who have difficulty controlling their blood sugar with medication (brittle diabetics).

In the Conclusion section: The results from the cases studies are so dramatic that they warrant further investigation. They suggest that: (1) poor power quality may be contributing to electrical hypersensitivity; (2) a much larger population than originally assumed may be electrically hypersensitive (50% vs. 2%); (3) children may be more sensitive than adults; (4) dirty electricity in schools may be interfering with education and (5) possibly contributing to disruptive behavior associated with attention deficit disorder (ADD); (6) dirty electricity may elevate plasma glucose levels among some diabetics and it may exacerbate the symptoms for the those suffering from (8) tinnitus and (9) multiple sclerosis. If these results are representative of what is happening in countries worldwide, then dirty electricity is adversely affecting the lives of millions of people.
Exhibit 89

Disturbance of the immune system by electromagnetic fields—A potentially underlying cause for cellular damage and tissue repair reduction which could lead to disease and impairment.

A number of papers dealing with the effects of modern, man-made electromagnetic fields (EMFs) on the immune system are summarized in the present review. EMFs disturb immune function through stimulation of various allergic and inflammatory responses, as well as effects on tissue repair processes. Such disturbances increase the risks for various diseases, including cancer. These and the EMF effects on other biological processes (e.g. DNA damage, neurological effects, etc.) are now widely reported to occur at exposure levels significantly below most current national and international safety limits. Obviously, biologically based exposure standards are needed to prevent disruption of normal body processes and potential adverse health effects of chronic exposure. Based on this review, as well as the reviews in the recent Bioinitiative Report [http://www.bioinitiative.org/] [C.F. Blackman, M. Blank, M. Kundi, C. Sage, D.O. Carpenter, Z. Davanipour, D. Gee, L. Hardell, O. Johansson, H. Lai, K.H. Mild, A. Sage, E.L. Sobel, Z. Xu, G. Chen, The Bioinitiative Report—A Rationale for a Biologically-based Public Exposure Standard for Electromagnetic Fields (ELF and RF), 2007)], it must be concluded that the existing public safety limits are inadequate to protect public health, and that new public safety limits, as well as limits on further deployment of untested technologies, are warranted.

Additional information from this report:

Around the world, for a number of years, there has been an active debate involving the general public, scientists, journalists, politicians, and people from the electric power and telecom companies, all trying to answer the basic question: Is biology compatible with the ever-increasing levels of electromagnetic fields (EMFs)? Or, to put it in more layman's terms: Can we, as human beings, survive all the radiation? Are we built for a 24-h, whole-body irradiation life? Are we immune to these signals, or are we actually playing with our planet's future, putting life at stake? The answers appear to be: No, we are not designed for such EMF exposure loads. We are not immune. We are gambling with our future.

Very often the biggest threat from EMF exposure is said to be cancer. However, this is not the most horrifying scenario. Just imagine if some basic and general molecular and/or cellular mechanism were altered. For instance, imagine if one morning the nitrogen-binding bacteria in the soil or the honey bees in the air had been destroyed beyond repair. Or, as this paper will indicate, imagine if our immune system, trying to cope with the ever-increasing electromagnetic signals, finally could not do so any longer!

Is the immune system designed to deal with "allergens" never present before, but now being invented, manufactured and used? Is it likely that our immune system, by some enormously intelligent 'glitch' in the evolutionary process has that capacity? Is that even remotely likely? Of course, not.

The recommended safe exposure levels have not taken this into account, since the existing standards are only based on the immediate heating of cells and tissues [most often evaluated in fluid-filled plastic dolls!]. They certainly do not take into consideration long-term effects or non-thermal effects that occur before heating can be detected. Furthermore, the recommendations do not take into account all available scientific reports. ***The recommended exposure levels are not in any sense safe levels and are entirely inadequate.***

Conclusions:

-Both human and animal studies report large immunological changes upon exposure to environmental levels of modern, human-made EMFs. Some of these exposure levels are

equivalent to those of wireless technologies in daily life, and often at low or very low (i.e., non-thermal) levels.

-Measurable physiological changes (mast cells increases, for example) that are bedrock indicators of allergic response and inflammatory conditions are stimulated by EMF exposures.
-Chronic exposure to such factors that increase allergic and inflammatory responses on a continuing basis may be harmful to health. The data presented here, as well as the very rapid international increase in incidence of allergies, asthma and other oversensitivities, together form a clear warning signal.

-It is, thus, possible that chronic provocation by exposure to EMF can lead to immune dysfunction, chronic allergic responses, inflammatory responses and ill health if they occur on a continuing basis over time. This is an area that should be investigated immediately.
-Specific findings from studies on exposures to various types of modern equipment and/or EMFs report overreaction of the immune system; morphological alterations of immune cells; profound increases in mast cells in the upper skin layers, increased degranulation of mast cells and larger size of mast cells in electrohypersensitive individuals; presence of biological markers for inflammation which are sensitive to EMF exposure at non-thermal levels; changes in lymphocyte viability; decreased count of NK cells; decreased count of T-lymphocytes; negative effects on pregnancy (uteroplacental circulatory disturbances and placental dysfunction); suppressed or impaired immune function; and inflammatory responses that can ultimately result in cellular, tissue and organ damage.

-The functional impairment electrohypersensitivity is reported by individuals in the United States, Sweden, Switzerland, Germany, Belgium, Italy, The Netherlands, Norway, Denmark and many other countries of the world. Estimates range from 3% to perhaps 10% of populations, and appear to be a growing condition of ill-health leading to lost work and productivity.
-The WHO and IEEE literature surveys do not include all of the relevant papers cited here, leading to the conclusion that evidence has been ignored in the current WHO ELF Health Criteria Monograph; and the proposed new IEEE C95.1 RF public exposure limits.

-The current international public safety limits for EMFs do not appear to be sufficiently protective of public health at all, based on the studies of immune function. New, biologically based public standards are warranted that take into account low-intensity effects on immune function and health that are reported in the scientific literature. Also the accessibility needs of persons with the functional impairment electrohypersensitivity must be fully addressed and resolved as dictated by the UN22 "Standard rules on the equalization of opportunities for people with disabilities" (about the UN22 Standard Rules, see website: http://www.un.org; since 2007 they have been upgraded into the UN "Convention on Human Rights for Persons with Functional Impairments"). Exhibit 90

Electromagnetic fields and male breast cancer.

In conclusion, the present knowledge from experimental and epidemiological research gives some support to the hypothesis that increased use of electrical power may increase breast cancer risk. The reported excess risk of male breast cancer may be a chance finding that must be expected when many studies are undertaken and many types of cancer are examined, although the US study [2] gives rather firm support to the hypothesis. The public health implications of the discussed excess risks are very small, but the findings call for further research. If the increased risk of female breast cancer is due to some aspects of electric power use, it could have a large impact due to the prevalence of the exposure and the magnitude of the disease. To further test the hypothesis, large prospective studies on female breast cancer, collecting relevant exposure data from

work site, home and leisure time environment should be initiated. The various exposure patterns of EM fields as well as the role of shift work and LAN should be further evaluated in future epidemiological studies. Additional experimental studies are also required to understand the mechanisms by which melatonin can inhibit oncogenic processes.

If the melatonin theory turns out to be consistent, exposure affecting the pineal function may have an impact on the risk of hormone sensitive cancers such as breast cancer, prostate cancer and skin melanoma. Exhibit 91

Effect of Sinusoidally Varying Magnetic Fields on Cell Proliferation and Adenosine Deaminase Specific Activity.

The effect of sinusoidally varying magnetic fields (SVMF) on chick embryo fibroblasts (CEF) was examined by two independent methods: 1) measurement of cell proliferation at 0.06–0.7 mT (100, 60 and 50 Hz) using a colorimetric assay (MTT); 2) monitoring of specific activity of adenosine deaminase (ADA) at 0.3 and 0.7 mT, 60 Hz. Both increased cell proliferation and reduced ADA specific activity are associated with cell transformation. The MTT test showed an increase in cell proliferation of up to 64% after a 24 h exposure to SVMF at 100 Hz, 0.7 mT. Cell proliferation at constant frequency (100 Hz) depended on SVMF intensity. Cell proliferation at constant intensity (0.7 mT) increased with increasing field frequency. At 0.7 mT, 60 Hz cell proliferation increased by 31%, 28%, and 26% when measured by hemocytometry, 3H-thymidine incorporation, and the MTT assay, respectively. ADA specific activity in CEF decreased by circa 48% on exposure to SVMF at 60 Hz, 0.3 mT for 24 h; only a statistically insignificant trend was seen at 0.7 mT, 60 Hz. Our findings showed that CEF cell proliferation and ADA specific activity were modified by SVMF. Both methods, independently, qualitatively detect a magnetic field effect. Exhibit 92

Effects of ELF (1-120 Hz) and Modulated (50 Hz) RF Fields on the Efflux of Calcium Ions From Brain Tissue In Vitro.

We have previously shown that 16-H~.sinusoidal electromagnetic fields can cause enhanced efflux of calcium ions from chick brain tissue, in vitro, in two intensity regions centered on 6 and 40 V,~,/m. Alternatively, I-Hz and 30-Hz fields at 40 V,.,/m did not cause enhanced efflux. We now demonstrate that although there is no enhanced efflux associated with a 42-Hz field at 30, 40, 50, or 60 Vp-,/m, a 45-Hz field causes enhanced efflux in an intensity range around 40 V,-,,/m that is essentially identical to the response observed for 16-Hz fields. Fields at 50 Hz induce enhanced efflux in a narrower intensity region between 45 and 50 Vp.,/m, while radiofrequency carrier waves, amplitude modulated at 50 Hz, also display enhanced efflux over a narrow power density range. Electromagnetic fields at 60 Hz cause enhanced efflux only at 35 and 40 V,,/m, intensities slightly lower than those that are effective at 50 Hz. Finally, exposures over a series of frequencies at 42.5 V,,/m reveal two frequency regions that elicit enhanced efflux-one centered on 15 Hz, the other extending from 45 to 105 Hz. Exhibit 93

Electrohypersensitivity: State-of-the-Art of a Functional Impairment Electromagnetic

Recently, a new category of persons, claiming to suffer from exposure to electromagnetic fields, has been described in the literature. In Sweden, electrohypersensitivity (EHS) is an officially fully recognized functional impairment (i.e., it is not regarded as a disease). Survey studies show that somewhere between 230,000–290,000 Swedish men and women report a variety of symptoms

when being in contact with electromagnetic field (EMF) sources. The aim of our studies has been to investigate possible alterations, in the cellular and neuronal systems of these persons' skin. As controls, age- and sex-matched persons, without any subjective or clinical symptoms or dermatological history, served. Immunohistochemistry using antisera to the previously characterized marker substances of interest has been utilized. In summary, it is evident from our preliminary data that various alterations are present in the electrohypersensitive persons' skin. In view of recent epidemiological studies, pointing to a correlation between long-term exposure from power-frequent magnetic fields or microwaves and cancer, our data ought to be taken seriously and further analyzed.

Additional information from the report:

An ever increasing number of studies has clearly shown various biological effects at the cellular level of electromagnetic fields, including power-frequent and radiofrequent ones as well as microwaves. Such electromagnetic fields are present in your everyday life, at the workplace, in your home, and at places of leisure.

Exposure to electromagnetic fields has been linked to different cancer forms, e.g., leukemia, brain tumours, neurological diseases, such as Alzheimer's disease, asthma, and allergy, and to the phenomenon of electrohypersensitivity/screen dermatitis. There is an increasing number of reports about cutaneous problems as well as symptoms from internal organs, such as the heart, in people exposed to video display terminals. These people suffer from subjective and objective skin and mucosa-related symptoms, such as itch, heat sensation, pain, erythema, papules, and pustules (cf. above). In severe cases, people cannot, for instance, use video display terminals or artificial light at all, or be close to mobile telephones. Mast cells, when activated, release a spectrum of mediators, among them histamine, which is involved in a variety of biological effects with clinical relevance, e.g., allergic hypersensitivity, itch, edema, local erythema, and many types of dermatoses. From the results of recent studies, it is clear that electromagnetic fields affect the mast cell, and also the dendritic cell, population, and may degranulate these cells. The release of inflammatory substances, such as histamine, from mast cells in the skin results in a local erythema, edema, and sensation of itch and pain, and the release of somatostatin from the dendritic cells may give rise to subjective sensations of ongoing inflammation and sensitivity to ordinary light. These are, as mentioned, the common symptoms reported from persons suffering from electrohypersensitivity/screen dermatitis. Mast cells are also present in the heart tissue and their localization is of particular relevance to their function. Data from studies made on interactions of electromagnetic fields with the cardiac function have demonstrated that highly interesting changes are present in the heart after exposure to electromagnetic fields. Some electrically sensitive people have symptoms similar to heart attacks after exposure to electromagnetic fields.

In Sweden, electrohypersensitivity (EHS) is an officially fully recognized functional impairment (i.e., it is not regarded as a disease). Survey studies show that somewhere between 230,000–290,000 Swedish men and women report a variety of symptoms when being in contact with electromagnetic field (EMF) sources.

Swedish municipalities, of course, have to follow the UN 22 Standard Rules on the equalization of opportunities for people with disabilities ("Standardregler för att tillförsäkra människor med funktionsnedsättning delaktighet och jämlikhet"; about the UN 22 Standard Rules, see website: http://www.un.org/esa/socdev/enable/dissre00.htm). All people with disabilities shall, thus, be given the assistance and service they have the right to according to the Swedish Act concerning Support and Service for Persons with Certain Functional Impairments (LSS-lagen) and the Swedish Social Services Act (Socialtjänstlagen). People with disabilities, thus, have many different rights and can get different kinds of support. The purpose of those rights and the support is to give every person the chance to live like everyone else. Everyone who lives in the Swedish municipalities should be able to lead a normal life and the municipalities must have correct

knowledge and be able to reach the people who need support and service. People with disabilities shall be able to get extra support so that they can live, work, study, or do things they enjoy in their free time. The municipalities are responsible for making sure that everyone gets enough support. Everyone shall show respect and remember that such men and women may need different kinds of support.

In Sweden, impairments are viewed from the point of the environment. No human being is in itself impaired, there are instead shortcomings in the environment that cause the impairment (as the lack of ramps for the person in a wheelchair or rooms electrosanitized for the person with electrohypersensitivity). This environment-related impairment view, furthermore, means that even though one does not have a scientifically based complete explanation for the impairment electrohypersensitivity, and in contrast to disagreements in the scientific society, the person with electrohypersensitivity shall always be met in a respectful way and with all necessary support with the goal to eliminate the impairment. This implies that the person with electro-hypersensitivity shall have the opportunity to live and work in an electrosanitized environment.

In addition, it must also be mentioned that quite recently, by the end of 2004, The Irish Doctors' Environmental Association (IDEA) has announced that "they have identified a sub-group of the population who are particularly sensitive to exposure to different types of electromagnetic radiation. The safe levels currently advised for exposure to this non-ionising radiation are based solely on its thermal effects. However, it is clear that this radiation also has non-thermal effects, which need to be taken into consideration when setting these safe levels. The electrosensitivity experienced by some people results in a variety of distressing symptoms which must also be taken into account when setting safe levels for exposure to non-ionising radiation and when planning the siting of masts and transmitters" (IDEA, 2004).

Furthermore, the IDEA also points out the following:

1.An increasing number of people in Ireland are complaining of symptoms which, while they may vary in nature, intensity, and duration, can be demonstrated to be clearly related to exposure to electro-magnetic radiation (EMR).

2.International studies on animals over the last 30 years have shown the potentially harmful effects of exposure to electro-magnetic radiation. In observational studies, animals have shown consistent distress when exposed to EMR. Experiments on tissue cultures and rats have shown an increase in malignancies when exposed to mobile telephone radiation.

3.Studies on mobile telephone users have shown significant levels of discomfort in certain individuals following extensive use or even, in some cases, following regular short-term use.

4.The current safe levels for exposure to microwave radiation were determined based solely on the thermal effects of this radiation. There is now a large body of evidence that clearly shows that this is not appropriate, as many of the effects of this type of radiation are not related to these thermal effects (IDEA, 2004).

It may also be noted that a unique conference recently was held in Stockholm in May, 2006. The theme for the conference was "The right for persons with the impairment electrohypersensitivity to live in a fully accessible society". The conference was organized by the Stockholm City municipality and the Stockholm County Council and dealt with the most recent measures to make Stockholm fully accessible for persons with the impairment electrohypersensitivity. Among such measures are to offer home equipment adjustments and ban mobile phones from certain underground cars as well as certain public bus seats, and through electrosanitized hospital wards. The conference was documented on film. Exhibit 94

Relationship of Electric Power Quality to Milk Production of Dairy Herds. 2003 ASAE Annual International Meeting.

Public Utility Commissions (PUC) in several states adopted 0.5 volt or 1.0 milliampere as the actionable limit for utilities to respond to complaints of uncontrolled voltage. Dairy farmer complaints that animal behavior and milk production were affected by electrical shocks below adopted standards were investigated on 12 farms in Wisconsin, Michigan, and Minnesota. Milk production per cow was determined from daily tank-weight pickup and number of cows milked.

Number of transient events, transients, voltage (peak-to-peak), waveform phase angle degree, sags, and sag-Vrms were measured from event recorders plugged into milk house wall outlets. Data from 1705 cows and 939 data points were analyzed by multiherd least-squares multiple regression and SAS-ANOVA statistical programs. In five herds for 517 days, milk/cow/day decreased -0.0281 kg/transient event as transient events increased from 0 to 122/day (P<0.02). Negative effects on milk/cow/day from event recorder measurements were significant for eight independent electrical variables. Step-potential voltage and frequency of earth currents were measured by oscilloscope from metal plates grouted into the floor of milking stalls. Milk decreased as number of 3rd, 5th, 7th, 21st, 28th, and 42nd harmonics and the sum of triplen harmonics (3rd, 9th, 15th, 21st, 27th, 33rd, and 39th) increased/day (P<0.003). Event recorder transient events were positively correlated with oscilloscope average Vp event readings, with number of measures over 90 Hz, and number of 4th, 7th, 10th, and 42nd harmonics per day.

Steps/min counted from videotapes of a dancing cow with no contact to metal in the barnyard were correlated with non-sinusoidal 8.1 to 14.6 mVp impulses recorded by oscilloscope for 5 min from EKG patches on legs. PUC standards and use of 500-Ohm resistors in test circuits underestimate effects of non-sinusoidal, higher frequency voltage/current common on rural power lines.

Additional information from the report:

A review by California Health Services Department prepared for the PUC, reveals human health risks from electric and magnetic fields from power lines in the home or workplace [29]. Chen et al. [9] reported that ELF (extremely low frequency) inhibition of differentiation of Friend erythroleukemia cells was dose dependent on electromagnetic exposure; and because ELF inhibits the same enzyme in-vitro as phorbal esters, phenobarbitol, and dioxin, it falls in the same class of carcinogens that proliferate but do not cause cancer. Human colon cancer cells increased six-fold during exposure to electromagnetic fields in-vitro [31]. Electrical exposure disturbed melatonin secretion patterns in blood by the pineal gland [5], increased brain cancer and leukemia among electrical workers [23, 37], increased leukemia in children [23], and decreased T lymphocytes in power plant workers [28]. A higher rate of suicide among utility electricians and linemen than utility workers not employed in those jobs, suggesting increased risk of mental depression and disturbed sleep patterns upon chronic exposure to low frequency electromagnetic fields [39], further suggests electric field or electromagnetic field involvement with central nervous system functions [3]. Exhibit 95

Electromagnetic fields stress living cells.

Electromagnetic fields (EMF), in both ELF (extremely low frequency) and radio frequency (RF) ranges, activate the cellular stress response, a protective mechanism that induces the expression of stress response genes, e.g., HSP70, and increased levels of stress proteins, e.g., hsp70. The 20 different stress protein families are evolutionarily conserved and act as 'chaperones' in the cell when they 'help' repair and refold damaged proteins and transport them across cell membranes.

Induction of the stress response involves activation of DNA, and despite the large difference in energy between ELF and RF, the same cellular pathways respond in both frequency ranges. Specific DNA sequences on the promoter of the HSP70 stress gene are responsive to EMF, and studies with model biochemical systems suggest that EMF could interact directly with electrons in DNA. While low energy EMF interacts with DNA to induce the stress response, increasing EMF energy in the RF range can lead to breaks in DNA strands. It is clear that in order to protect living cells, EMF safety limits must be changed from the current thermal standard, based on energy, to one based on biological responses that occur long before the threshold for thermal changes.
Exhibit 96

Electromagnetic Hypersensitivity: Biological Effects of Dirty Electricity with Emphasis on Diabetes and Multiple Sclerosis.

Dirty electricity is a ubiquitous pollutant. It flows along wires and radiates from them and involves both extremely low frequency electromagnetic fields and radio frequency radiation. Until recently, dirty electricity has been largely ignored by the scientific community. Recent inventions of metering and filter equipment provide scientists with the tools to measure and reduce dirty electricity on electrical wires. Several case studies and anecdotal reports are presented. Graham/Stetzer (GS) filters have been installed in schools with sick building syndrome and both staff and students reported improved health and more energy. The number of students needing inhalers for asthma was reduced in one school and student behavior associated with ADD/ADHD improved in another school. Blood sugar levels for some diabetics respond to the amount of dirty electricity in their environment. Type 1 diabetics require less insulin and Type 2 diabetics have lower blood sugar levels in an electromagnetically clean environment. Individuals diagnosed with multiple sclerosis have better balance and fewer tremors. Those requiring a cane walked unassisted within a few days to weeks after GS filters were installed in their home. Several disorders, including asthma, ADD/ADHD, diabetes, multiple sclerosis, chronic fatigue, fibromyalgia, are increasing at an alarming rate, as is electromagnetic pollution in the form of dirty electricity, ground current, and radio frequency radiation from wireless devices. The connection between electromagnetic pollution and these disorders needs to be investigated and the percentage of people sensitive to this form of energy needs to be determined.

Conclusions:

These case studies and anecdotal reports suggest that dirty electricity is biologically active. Once dirty electricity is reduced, people's health improves. For some it is reflected in more normal blood sugar levels, for others symptoms of MS are reduced, and for still others tinnitus disappears and behavior resembling ADD/ADHD improves. Since dirty electricity is becoming ubiquitous large fractions of the population are being exposed to this pollutant and some are being adversely affected.

Diabetes, multiple sclerosis, ADD/ADHD, asthma chronic fatigue, and fibromyalgia are all increasing in the population and the reasons for this increase are poorly understood. Dirty electricity may be one of the contributors to these illnesses.

According to Philips and Philips (2006) 3% of the population has electromagnetic hypersensitivity (EHS) and 35% have symptoms of EHS. If these percentages apply to diabetics then as many as 5–60 million diabetics worldwide may be responding to the poor power quality in their environment (Wild et al., 2004). Evidence from laboratory studies documents that insulin release and insulin-binding capacity to receptors cells is reduced by electromagnetic fields (Li et al., 2005; Sakurai et al., 2004). It is further known that stress increases blood sugar levels in diabetics and that exposure to electromagnetic energy induces stress proteins at various frequencies (Blank and Goodman, 2004; Hinkle and Wolf, 1950).

Dirty electricity can now be monitored with meters and reduced with filters, providing scientists with the tools needed for research. What is presented here is a handful of studies, many preliminary, with dramatic results. Exhibit 97

Empirical Test of an Ion Parametric Resonance Model for Magnetic Field Interactions With PC-12 Cells.

A companion paper describes a predictive ion parametric resonance (IPR) model of magnetic field interactions with biological systems based on a selective relation between the ratio of the flux density of the static magnetic field to the AC magnetic field and the charge-to-mass ratio of ions of biological relevance. Previous studies demonstrated that nerve growth factor (NGF)-stimulated neurite outgrowth (NO) in PC-12 cells can be inhibited by exposure to magnetic fields as a function of either magnetic field flux density or AC magnetic field frequency. The present work examines whether the PC-12 cell response to magnetic fields is consistent with the quasiperiodic, resonance-based predictions of the IPR model. We tested changes in each of the experimentally controllable variables [flux densities of the parallel components of the AC magnetic field (BJ and the static magnetic field (Bd,) and the frequency of the AC magnetic field] over a range of exposure conditions sufficient to determine whether the IPR model is applicable. A multiplecoil exposure system independently controlled each of these critical quantities. The perpendicular static magnetic field was controlled to less than 2 mG for all tests. The first set of tests examined the NO response in cells exposed to 45 Hz BaC from 77 to 468 mG(rms) at a Bdc of 366 mG. Next, we examined an off-resonance condition using 20 mG Bdc with a 45 Hz AC field across a range of BaC between 7.9 and 21 mG(rms). Finally, we changed the AC frequency to 25 Hz, with a corresponding change in Bdc to 203 mG (to tune for the same set of ions as in the first test) and a BaCr ange from 78 to 181 mG(rms). In all cases the observed responses were consistent with predictions of the IPR model. These experimental results are the first to support in detail the validity of the fundamental relationships embodied in the IPR model. Exhibit 98

Endocrinological Effects of Strong 60-Hz Electric Fields on Rats.

Adult male rats were exposed or sham-exposed to 6@Hz electric fields without spark discharges, ozone, or significant levels of other secondary variables. No effects were observed on body weights or plasma hormone levels after 30 days of exposure at an effective field strength of 68 kVim. After 120 days of exposure (effective field strength = 64 kV/m), effects were inconsistent, with significant reductions in body weight and plasma levels of follicle-stimulating hormone and corticosterone occurring in one replicate experiment but not in the other. Plasma testosterone levels were significantly reduced after 120 days of exposure in one experiment, with a similar but not statistically significant reduction in a replicate experiment. Weanling rats, exposed or sham-exposed in electric fields with an effective field strength of 80 kV/m from 20 to 56 days of age, exhibited identical or closely similar growth trends in body and organ weights. Hormone levels in exposed and sham-exposed groups were also similar. However, there was an apparent phase shift between the two groups in the cyclic variations of concentrations of hormones at different stages of development, particularly with respect to follicle-stimulating hormone and corticosterone. We concluded that 60-Hz electric fields may bring about subtle changes in the endocrine system of rats, and that these changes may be related to alterations in episodic rhythms. Exhibit 99

Environmental Magnetic Fields Inhibit the Antiproliferative Action of Tamoxifen and Melatonin in a Human Breast Cancer Cell Line.

We have previously reported that environmental-level magnetic fields (1.2 mT [12 milligauss], 60 Hz) block the growth inhibition of the hormone melatonin (1009 M) on MCF-7 human breast cancer cells in vitro. We now report that the same 1.2 mT, 60 Hz magnetic fields significantly block the growth inhibitory action of pharmacological levels of tamoxifen (1007 M). In biophysical studies we have taken advantage of Faraday's Law of Current Induction and tested whether the 1.2 mT magnetic field or the associated induced electric field is responsible for this field effect on melatonin and tamoxifen. We observe that the magnetic field component is associated with the field blocking effect on melatonin and tamoxifen function. To our knowledge the tamoxifen studies represent the first experimental evidence for an environmental-level magnetic field modification of drug interaction with human breast cancer cells. Together, these findings provide support to the theory that environmental level magnetic fields can act to modify the action of a drug or hormone on regulation of cell proliferation. Melatonin and tamoxifen may act through different biological pathways to down-regulate cell growth, and further studies are required to identify a specific biological site of interaction for the 1.2 mT magnetic field. Exhibit 100

Epidemiological Evidence for a Health Risk from Mobile Phone Base Stations.

Human populations are increasingly exposed to microwave/radiofrequency (RF) emissions from wireless communication technology, including mobile phones and their base stations. By searching PubMed, we identified a total of 10 epidemiological studies that assessed for putative health effects of mobile phone base stations. Seven of these studies explored the association between base station proximity and neurobehavioral effects and three investigated cancer. We found that eight of the 10 studies reported increased prevalence of adverse neurobehavioral symptoms or cancer in populations living at distances < 500 meters from base stations. None of the studies reported exposure above accepted international guidelines, suggesting that current guidelines may be inadequate in protecting the health of human populations. We believe that comprehensive epidemiological studies of long-term mobile phone base station exposure are urgently required to more definitively understand its health impact. Exhibit 101

Evidence for an Effect of ELF Electromagnetic Fields on Human Pineal Gland Function.

A study was carried out to determine possible effects of 60-Hz electromagnetic-field exposure on pineal gland function in humans. Overnight excretion of urinary 6-hydroxymelatonin sulfate (6-OHMS), a stable urinary metabolite of the pineal hormone melatonin, was used to assess pineal gland function in 42 volunteers who used standard (conventional) or modified continuous polymer wire (CPW) electric blankets for approximately 8 weeks. Volunteers using conventional electric blankets showed no variations in 6-OHMS excretion as either a group or individuals during the study period. Serving as their own controls, 7 of 28 volunteers using the CPW blankets showed statistically significant changes in their mean nighttime 6-OHMS excretion. The CPW blankets switched on and off approximately twice as often when in service and produced magnetic fields that were 50% stronger than those from the conventional electric blankets. On the basis of these findings, we hypothesize that periodic exposure to pulsed DC or extremely low frequency electric or magnetic fields of sufficient intensity and duration can affect pineal gland function in certain individuals. Exhibit 102

Exposure to Extremely Low Frequency Magnetic Fields Induces Fos-Related Antigen-Immunoreactivity Via Activation of Dopaminergic D1 Receptor.

We previously demonstrated that repeated exposure to extremely low frequency magnetic fields (ELF-MF) increases locomotor activity via stimulation of dopaminergic D1 receptor (J. Pharmacol. Sci., 2007;105:367-371). Since it has been demonstrated that activator protein-1 (AP-1) transcription factors, especially 35-kDa fos-related antigen (FRA), play a key role in the neuronal and behavioral adaptation in response to various stimuli, we examined whether repeated ELF-MF exposure induces FRA-immunoreactivity (FRA-IR) in the striatum and nucleus accumbens (striatal complex) of the mice. Repeated exposure to ELF-MF (0.3 or 2.4 mT, 1 h/day, for consecutive fourteen days) significantly induced hyperlocomotor activity and FRA-IR in the striatal complex in a field intensity-dependent manner. ELF-MF-induced FRA-IR lasted for at least 1 year, while locomotor activity returned near control level 3 months after the final exposure to ELF-MF. Pretreatment with SCH23390, a dopaminergic D1 receptor antagonist, but not with sulpiride, a dopaminergic D2 receptor antagonist, significantly attenuated hyperlocomotor activity and FRA-IR induced by ELF-MF. Our results suggest that repeated exposure to ELF-MF leads to prolonged locomotor stimulation and long-term expression of FRA in the striatal complex of the mice via stimulation of dopaminergic D1 receptor

Exposure to Magnetic Fields Among Electrical Workers in Relation to Leukemia Risk in Los Angeles County.

Abstract: To address the hypotheses that electrical workers are exposed to higher magnetic fields and are at higher risk of leukemia than nonelectrical workers, we performed a registry-based case-control study among men aged 20-64 years with known occupation who were diagnosed with cancer in Los Angeles County between 1972 and 1990. Controls were men with cancers other than those of the central nervous system or leukemia. Magnetic field measurements on workers in each electrical occupation and in a random sample of occupations presumed to be nonelectrical were used to estimate magnetic field exposures for each occupation. Among men in electrical occupations, 121 leukemias were diagnosed. With the exception of electrical engineers, magnetic field exposures were higher among workers in electrical occupations than in nonelectrical occupations. A weakly positive trend in leukemia risk across average occupational magnetic field exposure was observed (odds ratio [OR] per 10 milligauss increase in average magnetic field = I .2, 95% confidence interval [CI] 1 .O-1 .S). A slightly stronger association was observed for chronic myloid leukemia, although only 28 cases occurred among electrical workers (OR 10 milligauss increase = I .6, 9% CI = 1.2-2.0). The results were not materially altered by adjustment for exposure to several agents known or suspected to cause leukemia. Although not conclusive, these results are consistent with findings from studies based on job title alone that electrical workers may be at slightly increased risk of leukemia. Exhibit 104

Federal Communications Commission. 1996. Guidelines for Evaluating the Environmental Effects of Radiofrequency Radiation. FCC 96-326:1-107.

1.By this action, we are amending our rules to adopt new guidelines and methods for evaluating the environmental effects of radiofrequency (RF) radiation from FCC-regulated transmitters. We are adopting Maximum Permissible Exposure (MPE) limits for electric and magnetic field strength and power density for transmitters operating at frequencies from 300 kHz to 100 GHz.1 We are also adopting limits for localized ("partial body") absorption that will apply to certain portable

transmitting devices.2 We believe that the guidelines we are adopting will protect the public and workers from exposure to potentially harmful RF fields.

2.In reaching our decision on the adoption of new RF exposure guidelines we have carefully considered the large number of comments submitted in this proceeding, and particularly those submitted by the U.S. Environmental Protection Agency (EPA), the Food and Drug Administration (FDA) and other federal health and safety agencies. The new guidelines we are adopting are based substantially on the recommendations of those agencies, and we believe that these guidelines represent a consensus view of the federal agencies responsible for matters relating to the public safety and health.

3.The MPE limits adopted herein are based on exposure criteria quantified in terms of specific absorption rate (SAR), a measure of the rate of RF energy absorption. The basis for these limits, as well as the basis for the 1982 ANSI limits that the Commission previously specified in our rules, is an SAR limit of 4 watts per kilogram. The new MPE limits are derived by incorporating safety factors that lead, in some cases, to limits that are more conservative than the limits specified by ANSI in 1982. The more conservative limits do not arise from a fundamental change in the RF safety criteria for SAR, but from a precautionary desire for more rigor in the derivation of factors which allow limits for MPE to be derived from SAR limits.

4.This action satisfies the requirements of the Telecommunications Act of 1996 for a timely resolution of this proceeding.4 We note that research and analysis relating to RF safety and health is ongoing, and we expect changes in recommended exposure limits will occur in the future as knowledge increases in this field. In that regard, we intend to continue our cooperative work with industry and with the various agencies and organizations with responsibilities in this area in order to ensure that our guidelines continue to be appropriate and scientifically valid.
Exhibit 105

Harper DO. July 2011. Letter to California Public Utility Board.

Excerpts from the letter:

As a health care provider, boarded in Family Medicine with a special interest in environmental medicine, I have become increasingly alarmed over the numbers of patients coming to me with Idiopathic Environmental Intolerance (Electromagnetic field attributed symptoms), or IEI-EMF symptoms. I am treating one to three new cases a week since SDG&E began to install the Smart Meters.

The symptoms most often reported to health care providers and noted on health care questionnaires by such organizations as the CDC and World Health Organization include the following: fatigue, concentration difficulties, sleep disturbances, weariness, crankiness, obliviousness, headache, "gone" feeling, vertigo, increased heart rate, depressed mood, pressure in head, exhaustion, mood changes, pain in extremities, increased sensitivity to noise, equilibrium disturbances, increased sweating, twitching of the eyelids, impaired vision, conditions of fear, anxiety, itching, feeling of warmth inside head, faintness, increased sensitivity to medications and chemicals, nausea, loss of appetite, skin irritations, vomiting ... (appearing in decreasing order of frequency of reporting).

Authors Cindy Sage and David Carpenter began their report of the harmful effects of our wireless technology with this paragraph—

"Exposure to electromagnetic fields (EMF) has been linked to a variety of adverse health outcomes that may have significant public health consequences. The most serious health

endpoints that have been reported to be associated with extremely low frequency (ELF) and/ or RF include childhood and adult leukemia, childhood and adult brain tumors, and increased risk of the neurodegenerative diseases, Alzheimer's and amyotrophic lateral sclerosis (ALS). In addition, there are reports of increased risk of breast cancer in both men and women, genotoxic effects (DNA damage and micronucleation), pathological leakage of the blood-brain barrier, altered immune function including increased allergic and inflammatory responses, miscarriage and some cardiovascular effects. Insomnia (sleep disruption) is reported in studies of people living in very low-intensity RF environments with WI-FI and cell tower-level exposures. Short-term effects on cognition, memory and learning, behavior, reaction time, attention and concentration, and altered brainwave activity (altered EEG) are also reported in the scientific literature. Biophysical mechanisms that may account for such effects can be found in various articles and reviews."

The physiologically induced pathology mentioned by Sage and Carpenter are only a few of the affects that have been reported in the scientific literature. The Bio Initiative Report has a nearly complete listing of the conditions as of 2007, but many more have been confirmed since then.

Dr. Havas made one of the most easily understood presentations on the potential hazards of the harmful radio frequencies. In her report to the San Francisco City Council in May of 2007, she points out many pertinent points that the California Public Utilities should take into consideration and stop the unsupervised installation of "Smart Meters" on the homes and apartments of California citizens:

"The Federal Communications Commission (FCC) Guideline is similar to the international guideline ICNIRP guideline and is based on short-term thermal effects. This guideline is based on the assumption that if microwave energy does not heat tissue it is not harmful. This assumption is incorrect. Adverse biological effects have been documented at levels below federal guidelines and there are no federal guidelines for non-thermal effects, nor are there guidelines for long-term exposure. The technological developments and uses of wireless devices are running well ahead of the policy decisions necessary to ensure their safety."

SDG&E will tell you the meters only beam a short, intense burst for milliseconds every 30 to 60 minutes to the mother board, but this is inaccurate and deceiving since the meter talks to the "smart" energy efficient appliances in the home every seven seconds to regulate the amount of energy consumption. They will also tell you that there will be no increase in the electrical costs, but this is incorrect since the meter reads the time of use constantly and puts any use from 10 a.m. to 6 p.m. at the highest usage rate, often doubling or tripling the monthly bill as you have seen in the complaints to the State PUC. The energy is not constant, like a cordless phone or wi-fi baby monitor, but pulsed in bursts, which has been shown since the 1970's to be much more dangerous to human health than a continuous flow of energy.

I have recently learned of a study by Dr. Deitrich Klinghardt in 2007 in Seattle, where he took ten of his autistic patients and ten healthy children and asked permission to measure the non-ionizing radiation in the bedrooms where the mothers slept during their pregnancies. The results showed that mothers of the autistic children slept in bedrooms with 150 times the perverse energy fields than mothers of neurologically intact children. He strongly believes that the wi-fi energy of Smart Meters and other equipment generating such radiation interrupts the neurological development of the fetus in the womb and is one of the strongest factors in the significant rise of autism in developing nations.

With the proclamations of the countries Germany and Spain strongly urging pregnant women and children to not use cell phones and wireless devices due to their concern over the mounting scientific evidence of the neurological damage done to the brains of children, why do we put more electro-smog into the airways of our citizens with an autism rate of 1 in 89 in the USA last year? San Diego is now the second worst city in the US for electrosmog, only behind Washington DC, and we are adding more with the Smart Meters--water, electric, and gas--three meters to each

home or apartment unit, and each unit receiving the perverse energy from the mother board and hundreds of units in their neighborhood, all beaming unwanted and unhealthy radiation into their private dwelling.

With the scientific studies showing the increase in obesity and diabetes with exposure to ELF EMFs (extra low frequency-such as radio wi-fi waves), why do we want to contribute to the epidemic that is now at 40% of the population having a grossly elevated BMI (body mass index). Newer studies have found diabetes type 3 (gestational diabetes) on the rise with the pregnant women exposed to ELF radiation. Another study shows that ostcopcnia can be attributed to this radiation, also. I have medical articles on Alzheimers, multiple sclerosis, arthritis, obesity, diabetes, and other chronic diseases that are caused or aggravated by the oxidative damage of the radio waves that these "Smart Meters" induce in the cell wall membranes of human tissues.

I am therefore asking that the State of California issue a cease and desist order on the installation of the Smart Meters at this time until the safety can be determined by something other than the "heat" produced by the radiofrequencies. Exhibit 106

Request that first generation DECT Phones be Banned in Canada.

Background

DECT is an acronym for (Digitally Enhanced Cordless Technology, previously known as Digital European Cordless Telephony). It is a technology that originated in Germany and has spread to other countries, including Canada.

DECT phones operate at 2.4 and 5.8 GHz and provide a digital signal that is both powerful and clear. DECT phones can be used up to 300 meters from their base station (cradle that holds the phone). Several manufacturers including Panasonic, GE, Motorola, AT&T, and V-Tech use this technology.

Unlike other types of cordless phones, DECT cordless phones continuously emit microwave radiation at full power as long as the base station is plugged into an electrical outlet. These phones emit radiation 24/7 whether they are being used or sitting idle in their cradle. This exposes people to unnecessary microwave radiation and has been raised as a potential health concern by scientists and doctors in Germany and Austria.

Excerpts from the report:

What Figure 2 shows is that at a distance just beyond 3 meters from my DECT phone base unit (according to studies of RF radiation) EEG brain waves are altered. At 2.8 meters motor function, memory and attention of children are affected. At 1.7 meters sleep is disturbed. How many people have DECT phones near their bed? At 30 cm memory is impaired and at closer distances the immune system is affected, REM sleep is reduced, insulin levels drop, and there are pathological changes in the blood brain barrier. Studies also show that there is 100% increase in adult leukemia between 45 and 130 cm from the phone and a similar increase in childhood leukemia between 35 and 260 cm.

Symptoms of 356 people under long time home exposure to high frequency pulsed electromagnetic fields associated with DECT phones and/or mobile phone base stations were evaluated (Appendix A). At levels well below those in Figure 1, the following symptoms increased with increasing power density: sleep disturbance, fatigue, depression, headaches, restlessness, dazed state, irritability, difficulty concentrating, forgetfulness, learning difficulties, difficulty finding words, frequent infections, Frequent infections, sinusitis, lymph node swellings, joint and limb

pains, nerve and soft tissue pains, numbness or tingling, allergies, tinnitus, hearing loss, sudden hearing loss, giddiness, impaired balance, visual disturbances, eye inflammation, dry eyes, tachycardia, episodic hypertension, collapse, hormonal disturbances, thyroid disease, night sweats, frequent urge to urinate, weight increase, nausea, loss of appetite, nose bleeds, skin complaints, tumours, and diabetes. Many of these are the symptoms now associated with electrohypersensitivity (EHS). Exhibit 107

Passenger Exposure to Magnetic Fields on Gotrains and on Buses, Streetcars, and Subways Run by The Toronto Transit Commission, Toronto, Canada. Biological Effects of EMFs, 3rd International Workshop, Kos, Greece,

Magnetic flux density was measured in the passenger compartment of buses, streetcars, subways and GO-trains that move millions of commuters daily in the Greater Toronto Area. The highest magnetic fields were found in subways (mean 30 mG, range 3 to 100 mG), followed by streetcars (mean 30 mG, range 2 to 100 mG), buses (mean 11 mG, range 1 to 50 mG) and the GO-train (mean 2 mG, range 1.2 to 2.8 mG). The magnetic field increased with acceleration and deceleration and varied with seat location and this was most obvious in subways and streetcars. All seats on subways, 98% of seats in streetcars, 85% in buses, and 38% on the GO train exceeded 2 mG, the magnetic field associated with childhood leukemia. The magnetic fields in the Toronto public transit system are higher than in most residential and occupational settings and are cause for concern considering that several studies have reported increased incidence of breast cancer, brain tumors, and leukemia among transit employees. Commuters with electrical sensitivity may have difficulty using some forms of public transit and as many as 2% of the 1.4 million daily revenue passengers in the Greater Toronto Area may be electrically sensitive. If the magnetic fields obtained in this study are representative of the transit system, then steps need to be taken to reduce magnetic field exposure of both commuters and transit employees. Exhibit 108

Analysis of Health and Environmental Effects of Proposed San Francisco Earthlink Wi-Fi Network. Report to the Board of Supervisors, City and County of San Francisco,

The following pages present guidelines for radio frequency radiation in various countries; scientific studies that document the adverse effects of living near cell phone antennas (it is the closest we have to Wi-Fi antennas) for both humans and animals; and laboratory studies that demonstrate the harmful effects of radio frequency radiation. The levels showing adverse biological/health effects are compared to FCC guidelines and to calculations of likely exposure in San Francisco attributed to the Earthlink Wi-Fi Network as discussed in "Earthlink-Proposed San Francisco-Wide Wi-Fi Network: Observations and Calculations for Relation to Exposure Limits" prepared by Mitch Maifeld of Zenzic Research.

The Federal Communications Commission (FCC) (22) Guideline is similar to the international guideline ICNIRP guideline (15) and is based on short-term thermal effects. This guideline is based on the assumption that if microwave3 energy does not heat tissue it is not harmful. This assumption is incorrect. Adverse biological effects have been documented at levels below federal guidelines and there are no federal guidelines for non-thermal effects, nor are there guidelines for long-term exposure. The technological developments and uses of wireless devices are running well ahead of the policy decisions necessary to ensure their safety.

According to Norbert Hankin, Chief EMF Scientist, U.S. Environmental Protection Agency:

"The U.S. Federal Communications Commission, (FCC's) exposure guidelines are considered protective of effects arising from a thermal mechanism but not from all possible mechanisms. Therefore, the generalisation by many that the guidelines protect human beings from harm by any or all mechanisms is not justified."

A number of adverse health effects have been documented at levels below the FCC guidelines, which include altered white blood cells in school children; childhood leukemia; impaired motor function, reaction time, and memory; headaches, dizziness, fatigue, weakness, and insomnia.

Germany: The aim of this study was to examine whether people living close to cellular transmitter antennas were exposed to a greater risk of becoming ill with malignant tumors. The researchers found that the proportion of newly developing cancer cases was significantly higher among those patients who had lived within 400 meters (m)4 from the cellular transmitter site during the past 10 years, compared to those patients living further away. They also found that the patients fell ill on average 8 years earlier. After five years' operation of the transmitting installation, the relative risk of getting cancer had increased by 3-fold for the residents of the area near the installation, compared to the inhabitants of Naila outside the area.

Spain: In this study the people who lived closest to the cellular antennas had the highest incidences of the following disorders: fatigue, sleep disturbances, headaches, feeling of discomfort, difficulty concentrating, depression, memory loss, visual disruptions, irritability, hearing disruptions, skin problems, cardiovascular disorders, and dizziness

Electrohypersensitivity (EHS) is now recognized by the World Health Organization (WHO) and is defined as:

". . . a phenomenon where individuals experience adverse health effects 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 a debilitating problem for the affected persons, while the level of EMF in their neighborhood is no greater than is encountered in normal living environments. Their exposures are generally several orders of magnitude under the limits in internationally accepted standards. " (23)

EHS is classified as a disability in Sweden and health care facilities with low exposure to electromagnetic fields and radio frequency radiation are available for sensitive individuals. Approximately 2% of the population has severe symptoms of EHS (see Appendix 1 for their stories). These people are unable to live in our modern society with its electrical and electronic appliances and with the increasing exposure to radio frequency radiation. Another 35% of the population has moderate symptoms represented by an impaired immune system and by chronic illness.

Physicians (7, 13, 16) and scientists (2, 3, 26) have issued statements that biological effects from low-intensity RF radiation are scientifically established and are asking governing bodies in Europe and North America to re-examine our use of wireless technology and reduce existing radio frequency guidelines.

More than 3000 physicians have signed the Freiburger Appeal (7). These doctors have observed among their patients an increased incidence of disorders including headaches, chronic exhaustion, agitation, sleeplessness, tinnitus, susceptibility to infection, nervous and connective tissue pains that they associate with increased exposure to high frequency microwave radiation from mobile phone base stations and mobile phones (both cell phones and cordless phones).

Below are direct quotes from this document:

Our therapeutic efforts to restore health are becoming increasingly less effective: the unimpeded and continuous penetration of radiation into living and working areas, particularly bedrooms, an essential place for relaxation, regeneration and healing, causes uninterrupted stress and prevents the patient's thorough recovery.

In the face of this disquieting development, we feel obliged to inform the public of our observations . . .

What we experience in the daily reality of our medical practice is anything but hypothetical!

We see the rising number of chronically sick patients also as the result of an irresponsible "safety limits policy", which fails to take the protection of the public from the short- and long-term effects of mobile telephone radiation as its criterium for action. Instead, it submits to the dictates of a technology already long recognized as dangerous. For us, this is the beginning of a very serious development through which the health of many people is being threatened.

We will no longer be made to wait upon further unreal research results - which in our experience are often influenced by the communications industry, while evidential studies go on being ignored. We find it to be of urgent necessity that we act now!

Above all, we are, as doctors, the advocates for our patients. In the interest of all those concerned, whose basic right to life and freedom from bodily harm is currently being put at stake, we appeal to those in the spheres of politics and public health.

Summary:

Laboratory studies of radio frequency radiation as well as epidemiological studies of people who live near cell phone antennas and/or use wireless technology indicate adverse biological effects. These effects include increase in cancers, DNA breaks, impaired reproduction, increased permeability of the blood-brain barrier, altered calcium flux, changes in enzyme activity, neurological disorders, altered brainwave activity, insomnia, decreased memory, inattention, slower reaction time, tinnitus, dizziness, skin disorders, headaches, chronic pain, chronic fatigue, respiratory problems and arrhythmia. A growing population is becoming sensitive to electromagnetic energy and some of these people are affected by radio frequency radiation and are unable to live near antennas. Animals that live near cell phone and broadcast antennas are also affected by RF radiation, which manifests itself in reproductive impairment and behavioral abnormalities.

The cancers and symptoms of EHS occur at levels well below the FCC guidelines for radio frequency radiation. These guidelines are based on short-term (30-minute) thermal effects and are inadequate to protect the population from long-term, non-thermal exposure. The FCC guidelines conform to ICNIRP guidelines (15) but are much higher (i.e. less protective) than guidelines in other countries.

Metal objects such as wiring in the home, fences, poles, roofs, filing cabinets can redirect RFR and create hot spots or interfere with reception. This applies to metal implants and metal objects on or near the body (zippers, glasses, jewelry, etc.). For this reason calculations of exposure may not be as reliable as actually measurements. Appeals and resolutions from physicians and scientist request governments to provide the strictest guidelines for RF exposure and address the growing number of people developing a sensitivity to this form of energy.

In the conclusion: Science does not have all the answers and the understanding of mechanism is incomplete. However, according to the Precautionary Principle “threats of serious or irreversible damage” is all that is needed to act.

Health Concerns Associated with Energy Efficient Lighting and their Electromagnetic Emissions. Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR), pp 1-11.

According to the Swedish Association for the ElectroSensitive (www.feb.se) approximately 3% of the population have severe symptoms of electrohypersensitivity. These symptoms include sleep disorders, chronic fatigue, chronic pain, cognitive dysfunction, dizziness, skin disorders, among others (see Table 1). The Swedish government recognizes EHS as a functional impairment rather than a disease (6).

Table 1. Symptoms of Electrohypersensitivity or Radio Wave Sickness (7).

***Neurological:** headaches, dizziness, nausea, difficulty concentrating, memory loss, irritability, depression, anxiety, insomnia, fatigue, weakness, tremors, muscle spasms, numbness, tingling, altered reflexes, muscle and joint paint, leg/foot pain, flu-like symptoms, fever. More severe reactions can include seizures, paralysis, psychosis and stroke.*

***Cardiac:** palpitations, arrhythmias, pain or pressure in the chest, low or high blood pressure, slow or fast heart rate, shortness of breath*

***Respiratory:** sinusitis, bronchitis, pneumonia, and asthma*

***Dermatological:** skin rash, itching, burning, and facial flushing*

***Ophthalmologic:** pain or burning in the eyes, pressure in/behind the eyes, deteriorating vision, floaters, and cataracts*

***Others:** digestive problems; abdominal pain; enlarged thyroid, testicular/ovarian pain; dryness of lips, tongue, mouth, eyes; great thirst; dehydration; nosebleeds; internal bleeding; altered sugar metabolism; immune abnormalities; redistribution of metals within the body; hair loss; pain in the teeth; deteriorating fillings; impaired sense of smell; ringing in the ears.*

Appeals:

Medical doctors and scientists around the world are asking governments to establish stricter guidelines for electromagnetic exposure. These guidelines are for both extremely low frequency (ELF) electromagnetic fields and for radio frequency radiation (RFR) (8). We also need stricter guidelines for Intermediate Frequencies. These appeals include:

***2002: Freiburger Appeal**: German Physicians request tougher guidelines for radio frequency exposure, endorsed by 6,500 practitioners.*

***2004: World Health Organization**, EHS Workshop, Czech Republic, Oct 2004.*

***2005: Irish Doctors' Environmental Association** (IDEA): EHS increasing.*

***2005: Helsinki Appeal**: Finland, call for new safety standards, reject ICNIRP, apply Precautionary Principle to EMFs.*

***2006: Benevento Resolution**: International Commission for Electromagnetic Safety (ICEMS), Italy, Precautionary Approach.*

***2007: Bioinitiatives Report**: reviewed 2000 studies, calling for biologically based exposure guidelines. www.bioinitiative.org*

While 3% of the population may be severely affected by EHS, another 35% of the population in developed countries has many of the symptoms of EHS (5). With continued exposure this number is likely to increase.

If we extend these percentages to the population of Europe (728 million as of 2005), then approximately 21.8 million people in the EU are severely affect by EHS and another 254 million have moderate symptoms of EHS. Even if these values are in error by more than 50% we have a serious emerging and newly identified health risk that requires immediate attention. Exhibit 109

Incidence of Selected Cancers in Swedish Railway Workers 1961-79.

Among all Swedish men, 20 to 64 years of age and employed in 1960, railway workers were selected and compared with the population at large, concerning the incidence of leukemia, lymphoma, tumors of the brain, breast, and the pituitary gland. The study was a re-analysis of the 1961-79 incidence data previously showing no increase in risk for leukemia and brain tumors for railway workers. In the present study, follow-up was divided into two 10-year periods, and elevated relative risks (RR) were found for the first decade. For the first decade, engine drivers and conductors combined had an RR of chronic lymphocytic leukemia, acute myeloid leukemia, and lymphoma of 1.9 (95 percent confidence interval [CI] = 0.9-4.0), 1.4 (CI = 0.4-4.3), and 1.0 (CI = 0.5-1.9), respectively. For all brain tumors, the RR was 1.2 (CI = 0.8-1.9), with a higher risk estimate for those below age 30 (RR = 12.2, CI = 2.8-52.5).Three cases of breast cancer and nine cases of tumors of the pituitary gland occurred among engine drivers and conductors, corresponding to RRs of (CI = 1.6-11.8) and 3.2 (CI = 1.6-6.2), respectively. Work on trains entails extremely high exposure to low frequency magnetic fields (EMF). The results give some support to the hypothesis of an association between EMF and certain types of cancers. The outcome for the pituitary gland, being a focal point of hormonal regulation, suggests a hormonal link. Exhibit 110

Leukaemia and residence near electricity transmission equipment: a case - control study.

Summary: A population-based case-control study of leukaemia and residential proximity to electricity supply equipment has been carried out in south-east England. A total of 771 leukaemias was studied, matched for age, sex, year of diagnosis and district of residence to 1,432 controls registered with a solid tumour excluding lymphoma; 231 general population controls aged 18 and over from one part of the study area were also used. The potential for residential exposure to power frequency magnetic fields from power-lines and transformer substations was assessed indirectly from the distance, type and loading of the equipment near each subject's residence. Only 0.6% of subjects lived within 100 m of an overhead power-line, and the risk of leukaemia relative to cancer controls for residence within 100 m was 1.45 (95% confidence interval (CI) 0.54-3.88); within 50 m the relative risk was 2.0 but with a wider confidence interval (95% CI 0.4-9.0). Over 40% of subjects lived within 100 m of a substation, for which the relative risk of leukaemia was 0.99. Residence within 25 m carried a risk of 1.3 (95% CI 0.8-2.0). Weighted exposure indices incorporating measures of the current load carried by the substations did not materially alter these risks estimates. For persons aged less than 18 the relative risk of leukaemia from residence within 50 m of a substation was higher than in adults (RR = 1.5, 95% CI 0.7-3.4). Exhibit 111

Low-frequency electromagnetic radiation enhances the induction of rat mammary tumors by nitrosomethyl urea.

Low-frequency electromagnetic fields enhance the induction of mammary gland tumors in rats using nitrosomethyl urea. The incidence of tumors depended on the duration of exposure to static (dc) and oariable (ac) magnetic fields. Variable magnetic fields induced mammary gland cancer much more frequently than static ones. Apart from increasing the incidence of mammary gland tumors, household low-frequency electromagnetic fields reduced the mean latent period of tumor development and led to predominance of malignant tumors in the exposed animals as compared to controls. Mammary gland tumors developed rarely under the effect of static or variable magnetic fields per se, without preliminary administration of a carcinogen. Household lowfrequency electromagnetic fields may potentially present an oncogenic hazard for animals and humans. Exhibit 112

Maret K. 2011. Commentary on the California Council on Science and Technology Report "Health Impacts of Radio Frequency from Smart Meters"

This is a commentary on the California Council on Science and Technology (CCST) report, "Health Impacts of Radio Frequency from Smart Meters" published January 2011. I submit that the CCST report, written in response to health concerns expressed by Assembly Members of the California Legislature, contains inaccuracies and minimizes the biological effects and health impacts of non-thermal radiofrequency radiation, such as those produced by wireless technologies including Smart Meters.

For the record, my qualifications to make this commentary are that I hold a Bachelor of Science in Electrical Engineering, a Master of Engineering degree in Biomedical Engineering, and a Medical Doctor degree and have additionally completed a four year postdoctoral fellowship in physiology. I have been interested in the health effects of electromagnetic fields (EMFs) for many years and given lectures about the potential health impacts of non-ionizing radiations, both in Europe and the United States. I am president of a non-profit foundation interested in energy medicine, a sub-specialty within the field of Complementary and Alternative Medicine (CAM) as defined by the National Center for Complementary and Alternative Medicine (NCCAM), a center within the U.S. National Institutes of Health (NIH).

My specific concerns with the report are as follows:

1. The minimization of the problem of non-thermal microwave radiation;
2. The minimization of the need for lower exposure standards;
3. The increase in radiation levels at potential local hotspots through reflection;
4. The lack of information about the impact of pulsed radiation from Smart Meters;
5. The lack of information on the health impacts of night-time radiation from Smart Meters;
6. The lack of modeling or actual measurements of the contribution from Smart Meters to the existing background microwave radiation;
7. The lack of health and environmental consideration by the CPUC when the Advanced Metering Infrastructure (AMI) was approved.

Until these issues are more fully addressed it is recommended that the current Smart Meter deployment using radiofrequency radiation (RFR) be halted pending a more unbiased reassessment of the potential health issues associated with these meters, including a reassessment of the Advanced Metering Infrastructure (AMI) program approved by the California Public Utilities Commission (CPUC) without any environmental impact assessment. Further, that the California public be offered the option to opt out of this program, which at present is mandatory for every dwelling.

1.Minimization of Non-thermal Microwave Radiation from Smart Meters

On page 4 of the CCST report it states that "To date, scientific studies have not identified or confirmed negative health effects from potential non-thermal impacts of RF emissions such as those produced by existing household electronic devices or smart meters." This finding minimizes the extensive body of scientific research on the biological effects of non-thermal electromagnetic fields. The biological effects of low-level, non-thermal electromagnetic fields have been researched for over 30 years. The respected 2007 Handbook of Biological Effects of Electromagnetic Fields edited by Barnes and Greenebaum (1) states on page 377:

"*The biophysical lore prevailing until the late 1980s and lingering to this day is that, unless the amplitude and frequencies of an applied electric field were sufficient to trigger an excitable membrane (e.g. heart pacemaker), produce tissue heating or move an ion along a field gradient, there could be no effect. …. However, this position had to be changed as the evidence for weak (non-thermal) EMF bioeffects became overwhelming."*

Prof. Arthur Pilla, PhD
Professor of Biomedical Engineering, Columbia University

The CCST report further states that, "Without a clearer understanding of the biological mechanisms involved, identifying additional standards or evaluating the relative costs and benefits of those standards cannot be determined at this time." I strongly disagree with this conclusion as there is now a large body of scientific literature describing several key mechanisms for the action of weak electromagnetic fields. These include, among others:

- removal of calcium ions bound to cellular membranes, leading to their weakened structure and changed cellular functioning
- change of calcium ion leading to changes in metabolic processes in cells,
- the leakage of calcium ions into neurons generating spurious action potentials,
- fragmentation of DNA in cells seen through the Comet assay
- changes in the blood-brain barrier in animals after microwave exposure
- defined cellular stress response, including the production of heat shock proteins (HSP), that are triggered electromagnetically at non-thermal levels that require much less energy than when triggered by heat (so-called thermal considerations)
- activation of specific genes by exposure to non-thermal electromagnetic fields leading to gene transcription to form RNA, the first stage in the synthesis of proteins

All these biological effects are well substantiated in the scientific literature and occurred at much lower exposure levels than current FCC standards, but are minimized by the CCST report. It takes many years for definitive health effects to be substantiated beyond all shadow of doubt. Yet the evidence is accumulating that health effects will become more widespread, given sufficient time, from the scientifically researched biological responses to RFR. Until the authors of the CCST report can clearly substantiate their conclusions that the California population will not be adversely affected by the Smart Meter program, a precautionary approach should have been recommended.

On page 14 of the CCST report, the statement "There is currently no definitive evidence linking cell phone usage with increased incidence of cancer" is another misleading statement that tends to minimize the cancer risk from cell phones. If the authors of the CCST report had looked at other papers from the scientific literature (not mentioned in pages 38-44 of the CCST report), they might come to different conclusions.

There is mounting evidence of various types of tumors being caused from cell phone usage including parotid gland tumor (Czerninski, 2011), meningioma (Hardell et al., 2006), acoustic neuroma (Sato et al. 2011), brain tumors (Hardell & Carlberg, 2009) and testicular tumors (Hardell et al., 2007), to name only some. Considering the increasing number of scientific papers

describing various types of tumors associated with non-thermal radiation from cell phones that are appearing in the medical literature, it is not helpful that non-thermal radiations from Smart Meters, which might potentially add to our long-term susceptibility to serious diseases, be minimized as was done in the report.

1.The minimization of the need for lower exposure standards

The report states on page 8 that "…given the existing uncertainty about non-thermal effects, there is no generally accepted, definitive, evidence-based indication that additional standards are needed." This statement is misleading since an international collaboration of researchers in this field have called for a reexamination of the current ANSI standard based on the increasing evidence of the adverse effects of low-level electromagnetic fields (Hardell and Sage, 2008) Various research groups have consistently warned that the existing guidelines may be inadequate (Hyland, 2000; Levitt & Lai 2010; Bioinitiative Report, 2007).

Even the International Commission on Non-Ionizing Radiation Protection (ICNIRP) stated in1998 that "interpretation of several observed biological effects of electromagnetic fields is further complicated by the apparent existence of "windows" of response in both the power density and frequency domains. There are no accepted models that adequately explain these phenomena, which challenge the traditional concept of a monotonic relationship between the field intensity and the severity of the resulting biological effects." (ICNIRP, 1998). In other words, there are windows of sensitive biological response in which potential health effects can occur at much lower exposure levels than currently mandated by the FCC standards.

Already in 1999, the federal government's Radiofrequency Interagency Work Group (RFIAWG) had "identified certain issues that we believe need to be addressed to provide a strong and credible rationale to support RF exposure guidelines." Dr. Gregory Lotz from the Department of Health and Human Services, National Institute for Occupational Safety and Health addressed these specific issues in a letter dated June 17, 1999 to Mr. Richard Tell, then Chair of the IEE SCC28 (SC4) Risk Assessment Work Group. Ironically, it was this same Richard Tell Associates of Las Vegas, NV who wrote the report for PG&E describing the apparent safe exposure limits of the Smart Meter program that was also referenced in the CCST report (Tell, 2005; Tell, 2008).

The Tell Associates report simplified the apparent safety of the Smart Meter radiation by: 1. Only considering a single isolated Smart Meter radiator in free space; 2. Time averaging the pulse RF radiation so that it appeared as a low level of 8.8 uW/cm2; 3. Not considering other RF microwave emitters in the home environment; and 4. Considering only ground wave reflections of the microwave emissions and no other reflective surfaces (see below). The report also does not address the concerns of the federal RF Interagency Work Group including among other concerns: 1.The biological basis for local SAR limit; 2. the selection of an adverse effect level; 3. the nature of acute versus chronic exposure; 4. the intensity or pulsed or frequency modulated RF exposure; and 5. the issue of time averaging. These are critical issues which makes the issue of proper exposure guidelines a central issue in this matter. It further casts great doubt on the conclusions of the CCST report that downplays the need for new, lower exposure standards.

Epidemiologic evidence is a major contributor to the understanding of the potential effects of EMF on health. The International Agency for Research on Cancer (IARC) classified EMF as a "possible human carcinogen", or a Group 2B carcinogen; (IARC, 2002) this classification was mostly based on consistent epidemiological evidence. Although the body of evidence is always considered as a whole, based on the weight of evidence approach and incorporating different lines of scientific enquiry, epidemiologic evidence, as most relevant, is given the greatest weight.

1.The increase in radiation levels at potential local hotspots through reflection

Although it is true that the Smart Meters comply with current U.S. Federal Communications Commission (FCC) guidelines because they operate below the existing power density thresholds, power density is not the only factor determining biological effects from radiofrequency radiation. The power density level safety standards are solely based on thermal considerations, yet it is the non-thermal radiation levels that are the key to potential health impacts. The non-thermal effects occur at lower levels from various emitting radiators now in common use including cell phones, cordless phones, Wi-Fi, Wi-Max, to name only some. Smart Meters add to this cumulative ubiquitous low-level background microwave environment.

RFR can increase to higher levels than anticipated due to surface and ground reflections from the various radiators. (Hondou, 2002; Hondou et al, 2006; Vermeeren et al, 2010), even at some distance from the sources. These scientific studies suggest that reflectivity from other metallic surfaces and reflective materials could increase the power density of the RF fields significantly, leading to the development of hot spots in our homes. Richard Tell Associates report commissioned by PG&E in 2005, and updated in 2008, contained calculations of the intensity of RF fields produced by the Smart Meters that included only ground reflections estimated to increase the field strength by 1.6 times (equivalent to a 2.56-fold increase in the power density).

In light of recent scientific findings and actual computer modeling studies, the Tell estimate of ground reflectivity may be significantly too low and does not address the development of possible hotspots in the home. If microwave hotspots occurred near sleeping quarters or near a baby's crib, their health impact could be highly significant. Sage Associates report, which made some estimates of Smart Meter impacts through computer modeling, even suggests that under certain assumptions the emissions from Smart Meters and their local reflections might even exceed FCC standards (Sage, 2011).

The CCST report never even acknowledged the need for computer modeling to ascertain the potential risk of higher microwave radiation levels in our homes as a result of Smart Meter installation, alone or in interaction with other microwave emitters. We believe that such modeling is vital if the public is to know the potential for the development of hot spots in sensitive living areas. The Richard Tell Associates study carried out for PG&E did not consider other microwave sources in the environment stating, ***"The study does not take into account the potential for RF fields that may be produced by other devices or systems that are not part of the Smart Meter program upgrade. Such devices or systems include cellular telephones, cellular telephone base stations, broadcast radio and TV stations, microwave ovens used in the home or any other source of RF energy."***

1.The lack of information about the impact of pulsed radiation from Smart Meters

The is considerable difference between the biological impact of pulsed microwaves, as produced by Smart Meters, compared to continuous waves, such as those produced by microwave ovens. No distinction is made in the safety criteria between continuous and pulsed waves because of the narrow-minded focus on thermal damage alone. Many scientific studies have pointed out that radiofrequency radiation with different modulations and pulse characteristics produce different biological effects even though they may produce the same pattern of different specific absorption rate distribution and tissue heating (Levitt & Lai, 2010).

The CCST report is misleading because it compares the Smart Meter emissions to those of microwave ovens. Microwave ovens produce much higher power output but are not modulated or pulsed in any way. It is imperative to understand that it is the modulation or pulsation pattern that leads to biological effects at non-thermal power levels.

1.The lack of information on the health impacts of night-time radiation from Smart Meters

Another problem that was not addressed in the CCST report is potential health effect of microwave radiation exposure during our sleep which may adversely affect our biological and circadian rhythms (daily physiological regulatory cycles). Smart Meters will pulse intermittently day and night and may have an adverse effect on sleep cycles. We do not use our cellphones during sleep, yet Smart Meters will continue to emit pulsed RFR all night long.

Exposure to microwave /radiofrequency fields affect the neuroendocrine system causing neuroendocrine chemical modulations and behavioral reactions. Already in 1970s it was known that resonant absorption within the cranium may result in the focusing of energy and the production of electromagnetic "hot spots" in the brain (Johnson & Guy, 1972). Microwaves may disturb the critical hormonal regulatory areas including the hypothalamic-pituitary axis through "low intensity" exposure. The body may elicit "different responses relative to the timing of the exposure with respect to circadian rhythm" (Michaelson,1982). At night, while sleeping, the body is principally in a repair mode and the exposure to microwave radiation from Smart Meters may potentially be more damaging than exposure during the day. It is vital that long-term exposure studies during the night be carried out to determine if Smart Meter pulsed microwave radiation could have an adverse biological effect on our population.

6. The lack of modeling or actual measurements of the contribution from Smart Meters to the existing background microwave radiation

The CCST report is misleading on page 20 where it says that he exposure levels to people living in metropolitan areas is quite low, around 0.005 uW/cm2. They base their assertions on an outdated report from July 1986 made by the U.S. Environmental Protection Agency entitled The Radiofrequency Radiation Environment: Environmental Exposure Levels and RF Radiation Emitting Sources, EPA 520/1-85-014. This data is totally outdated since it reflects the situation before the modern cellular telephone networks were put in place.

Conclusions

The time needed for a new technology to be developed and rolled out is much shorter than the time needed for research to investigate the possible health effects on the general population. The current Advanced Metering Infrastructure using microwaves in the 900 MHz frequency spectrum approved by the CPUC is going to adversely impact the physiology and ultimately the health of many Californians over the next twenty years, the anticipated life time of the Smart Meters now being deployed. This program is being implemented without widespread public knowledge or approval and without the specific informed consent in writing from every household.

The dissemination of this Smart Meter technology could have been accomplished without using radiofrequency radiation by using much safer power line, fiber optic or telephone communications technology.

This program represents an epidemiological experiment involving our unsuspecting population whose outcome will only be fully known after many years exposure. Exhibit 113

More Evidence of EMF Genotoxicity. A Report on Non-Ionizing Radiation.

Two presentations on the first morning of the BEMS meeting reached very similar conclusions: Low-frequency magnetic fields can lead to chromosomal abnormalities among occupationally exposed workers.

Researchers led by Dr. Ingrid Nordenson of Sweden's University of Umeå have been working on the genotoxicity of EMFs for more than 15 years (see MWN, J/F85). At the 1996 BEMS

conference, the team reported that a pilot study of 18 male railroad engine drivers exposed to a complex EMF environment showed significantly more chromosomal breaks, compared to controls (see MWN, J/A96). This year, they announced that a larger study (30 engine drivers and 30 controls) pointed to a doubling of chromosomal aberrations among engine drivers.

Mild cited the separate epidemiological studies by Drs. Lars Alfredsson and Birgitta Floderus, both of the Karolinska Institute in Stockholm, which have pointed to higher rates of leukemia among Swedish railway workers (see MWN, S/O92, M/J 94, S/O95 and J/A96). In addition, four different labs—in India, Sweden and the U.S.—have shown that low-frequency EMFs can increase DNA breaks (see MWN,N/D98 and M/J00).

Korenstein found many more chromosomal abnormalities in the blood cells of 21 men who worked near high-voltage power lines and substations than in 25 controls (p<10-4). He then exposed these same blood samples to 50 Hz pulses with an average (rms) intensity of 320 mG and once again found evidence of genetic changes. "The fact that I see the same effect in both in vivo and in vitro makes the evidence much stronger," Korenstein said. Exhibit 114

Microwaves from UMTS/GSM Mobile Phones Induce Long-Lasting Inhibition of 53BP1/ϒ-H2AX DNARepair Foci in Human Lymphocytes.

We have recently described frequency-dependent effects of mobile phone microwaves (MWs) of global system for mobile communication (GSM) on human lymphocytes from persons reporting hypersensitivity to electromagnetic fields and healthy persons. Contrary to GSM, universal global telecommunications system (UMTS) mobile phones emit wide-band MW signals. Hypothetically, UMTS MWs may result in higher biological effects compared to GSM signal because of eventual "effective" frequencies within the wideband. Here, we report for the first time that UMTSMWs affect chromatin and inhibit formation of DNA double-strand breaks co-localizing 53BP1/g-H2AX DNA repair foci in human lymphocytes from hypersensitive and healthy persons and confirm that effects of GSM MWs depend on carrier frequency. Remarkably, the effects of MWs on 53BP1/g-H2AX foci persisted up to 72 h following exposure of cells, even longer than the stress response following heat shock. The data are in line with the hypothesis that the type of signal, UMTS MWs, may have higher biological efficiency and possibly larger health risk effects compared to GSM radiation emissions. No significant differences in effects between groups of healthy and hypersensitive subjects were observed, except for the effects of UMTS MWs and GSM-915 MHz MWs on the formation of the DNA repair foci, which were different for hypersensitive (P<0.02[53BP1]//0.01[g-H2AX]) but not for control subjects (P>0.05). The non-parametric statistics used here did not indicate specificity of the differences revealed between the effects of GSM and UMTS MWs on cells from hypersensitive subjects and more data are needed to study the nature of these differences.

Mobile Phones, Cordless Phones and the Risk for Brain Tumours.

The Hardell-group conducted during 1997-2003 two case control studies on brain tumours including assessment of use of mobile phones and cordless phones. The questionnaire was answered by 905 (90%) cases with malignant brain tumours, 1,254 (88%) cases with benign tumours and 2,162 (89%) population-based controls. Cases were reported from the Swedish Cancer Registries. Anatomical area in the brain for the tumour was assessed and related to side of the head used for both types of wireless phones. In the current analysis we defined ipsilateral use (same side as the tumour) as ≥50% of the use and contralateral use (opposite side) as <50% of the calling time. We report now further results for use of mobile and cordless phones. Regarding astrocytoma we found highest risk for ipsilateral mobile phone use in the >10 year latency group, OR=3.3, 95% CI=2.0-5.4 and for cordless phone use OR=5.0, 95% CI=2.3-11. In total, the risk was highest for cases with first use <20 years age, for mobile phone OR=5.2, 95%

CI=2.2-12 and for cordless phone OR=4.4, 95% CI=1.9-10. For acoustic neuroma, the highest OR was found for ipsilateral use and >10 year latency, for mobile phone OR=3.0, 95% CI=1.4-6.2 and cordless phone OR=2.3, 95% CI=0.6-8.8. Overall highest OR for mobile phone use was found in subjects with first use at age <20 years, OR=5.0, 95% CI 1.5-16 whereas no association was found for cordless phone in that group, but based on only one exposed case. The annual age-adjusted incidence of astrocytoma for the age group >19 years increased significantly by +2.16%, 95% CI +0.25 to +4.10 during 2000-2007 in Sweden in spite of seemingly underreporting of cases to the Swedish Cancer Registry. A decreasing incidence was found for acoustic neuroma during the same period. However, the medical diagnosis and treatment of this tumour type has changed during recent years and underreporting from a single center would have a large impact for such a rare tumour. Exhibit 116

Microwaves from Mobile Phones Inhibit 53BP1 Focus Formation in Human Stem Cells More Strongly Than in Differentiated Cells: Possible Mechanistic Link to Cancer Risk.

Background: It is widely accepted that DNA double-strand breaks (DSBs) and their misrepair in stem cells are critical events in the multistage origination of various leukemias and tumors, including gliomas.

Objectives: We studied whether microwaves from mobile telephones of the Global System for Mobile Communication (GSM) and the Universal Global Telecommunications System (UMTS) induce DSBs or affect DSB repair in stem cells.

Methods: We analyzed tumor suppressor TP53 binding protein 1 (53BP1) foci that are typically formed at the sites of DSB location (referred to as DNA repair foci) by laser confocal microscopy.

Results: Microwaves from mobile phones inhibited formation of 53BP1 foci in human primary fibroblasts and mesenchymal stem cells. These data parallel our previous findings for human lymphocytes. Importantly, the same GSM carrier frequency (915 MHz) and UMTS frequency band (1947.4 MHz) were effective for all cell types. Exposure at 905 MHz did not inhibit 53BP1 foci in differentiated cells, either fibroblasts or lymphocytes, whereas some effects were seen in stem cells at 905 MHz. Contrary to fibroblasts, stem cells did not adapt to chronic exposure during 2 weeks.

Conclusions: The strongest microwave effects were always observed in stem cells. This result may suggest both significant misbalance in DSB repair and severe stress response. Our findings that stem cells are most sensitive to microwave exposure and react to more frequencies than do differentiated cells may be important for cancer risk assessment and indicate that stem cells are the most relevant cellular model for validating safe mobile communication signals. Exhibit 117

Mortality from Amyotrophic Lateral Sclerosis, Other Chronic Disorders, and Electric Shocks among Utility Workers.

Above-average exposure to electromagnetic fields has been associated with certain nonmalignant medical conditions such as amyotrophic lateral sclerosis, other neurologic diseases, depressive symptoms, and suicide. The authors conducted a nationwide mortality study in Denmark of 21,236 men employed in utility companies between 1900 and 1993. The causes of death were ascertained for January 1, 1974, through December 31, 1993, and cause-specific mortality was analyzed by latency and estimated levels of exposure to 50-Hz electromagnetic fields. Overall, 3,540 deaths were observed as compared with 3,709 expected from national

mortality rates, yielding a standardized mortality ratio of 0.96 (95% confidence interval 0.93-0.99). A slight excess in mortality from cancer was due to deaths from cancers of the lung and pleural cavity, probably because of exposure to asbestos. A twofold increase in mortality from amyotrophic lateral sclerosis and a tenfold increase in mortality from electrical accidents were seen on the basis of 14 and 10 deaths, respectively, the former increasing with time since first employment in a utility company. The excess mortality from amyotrophic lateral sclerosis seems to be associated with above-average levels of exposure to electromagnetic fields and may be due to repeated episodes with electric shocks. Exhibit 118

Nerve cell damages in mammalian brain due to microwaves. Presentation for an international conference entitled "Foundations of bioelectromagnetics: towards a new rationale for risk assessment and management"

Since 1988 our group has studied the effects upon the mammalian blood-brain barrier (BBB) in rats by non-thermal radio frequency electromagnetic fields (RF-EMF). These have been shown to cause significantly increased leakage of the rats' own blood albumin through the BBB of exposed rats as compared to non-exposed animals—in a total series of about two thousand animals (Salford et al. 1992, 1994, 1997, 2001, 2007; Persson et al. 1997; Nittby et al. submitted manuscript). One remarkable observation is the fact that the lowest energy levels give rise to the most pronounced albumin leakage. If mobile communication, even at extremely low energy levels, causes the users' own albumin to leak out through the BBB, also other unwanted and toxic molecules in the blood, may leak into the brain tissue and concentrate in - and damage - the neurons and glial cells of the brain.

In later studies we have shown that exposure to GSM 915 MHz at non- thermal levels, gives rise to significant neuronal damage ($p<0.002$) in the brains of rats examined 50 days after a 2 hour exposure at SAR values 200, 20 and 2 mW/kg (Salford et al. 2003). We have followed up this observation in a study where 96 animals were sacrificed 14 and 28 days respectively after an exposure for 2 hours to GSM mobile phone electromagnetic fields at SAR values: 0 (controls), 200, 20, 2 and now also 0.2 mW/kg (Eberhardt et al. Submitted manuscript). Significant neuronal damage is seen after 28 days ($p=0.01$) and albumin leakage after 14 days – albumin foci ($p=0.02$) and neuronal albumin uptake ($p=0.005$).

In our continued research, the non-thermal effects (histology, memory functions) of long-term exposure for 14 months (two hours per week, GSM 100 or 1 mW/kg) are studied. Significant reduction of episodic memory function is demonstrated in exposed animals (Nittby et al. 2007). We have also performed micro-array analysis of brains from rats to short term GSM both at 1,800 MHz and at 900MHz and have found significant effects upon gene expression of membrane associated genes as compared to control animals (Belyaev et al. 2006, Nittby et al. Submitted manuscript). Exhibit _____119

Non-Thermal Effects and Mechanisms of Interaction Between Electromagnetic Fields and Living Matter.

Globally more than four billion phones are in use, with more than half of all users believed to be children and young adults. Over the past two decades, models of the human head have been devised based on imaging studies and used to estimate the extent and rate of radiation energy absorption to the brain, the Specific Absorption Rate (SAR). IEEE and ICNIRP SAR recommendations rest solely on avoiding thermal effects on the adult male head under conditions of a six minute long call and do not take into account the long-term cell phone use, the length of

calls, non-thermal biological effects, the smaller size and greater physiological vulnerability and increased absorption to the heads of children and females. Currently recommended approaches by the IEEE calculate peak spatial average SAR for safety compliance testing of cell phones based on a physical model of an adult male head with an added 10 mm plastic spacer to model the ear (pinna). By incorporating such a spacer, the IEEE model assumes that the RF energy absorption in the ear (or pinna) may be treated like extremities of the body such as the legs and the arms that are not proximate to the brain. The 10 mm spacer artificially results in 2 to 4 times lower exposures to the head. Recent epidemiologic studies of adults from those few nations where cell phone use has been extensive for a decade or longer indicate significantly increased risk of a variety of brain tumors. These findings, together with the limitations of currently used head models and the growing use of phones by the young and females, indicate a clear and compelling need for improved, biologically-based models of the head in order to better estimate population-wide exposures of children and women to cell phones and provide the grounds for improved policies to reduce those exposures. Exhibit 120

Occupational Exposure to Electromagnetic Fields and the Occurrence of Brain Tumours.

To explore the association between occupation and the occurrence of brain tumor, an epidemiologic study was conducted using data from the death certificates of 951 adult white male Maryland residents who died of brain tumor during the period 1969 through 1982. Compared with the controls, men employed in electricity-related occupations, such as electrician, electric or electronic engineer, and utility company serviceman, were found to experience a significantly higher proportion of primary brain tumors An increase in the odds ratio for brain tumor was found to be positively related to electromagnetic (EM) field exposure levels. Furthermore, the mean age at death was found to be significantly younger among cases in the presumed high EM-exposure group. These findings suggest that EM exposure may be associated with the pathogenesis of brain tumors, particularly in the promoting stage. Exhibit 121

Occupational Exposure to Electromagnetic Fields in Relation to Leukemia and Brain Tumors: A Case-Control Study in Sweden.

Occupational exposure to low-frequency electromagnetic fields (EMF) was studied in 250 leukemia patients and 261 brain-tumor cases, diagnosed in 1983-87 and compared with a control group of 1,121 randomly selected men, from the mid-region of Sweden, 1983-87. We based the exposure assessment on measurements from 1,015 different workplaces. On the basis of the job held longest during the 10-year period before diagnosis, we found an association between the average, daily, mean level of EMF and chronic lymphocytic leukemia (CLL). The risk increased with increasing level of exposure. The odds ratios (OR) and the 95 percent confidence interval (CI) for three consecutive levels of exposure were: 1.1 (CI = 0.5-2.3); 2.2 (CI = 1.1-4.3); 3.0 (CI = 1.6-5.8), respectively. No association was observed for acute myeloid leukemia (OR= 1.0, CI = 0.5-1.8; OR= 0.8, CI = 0.4-1.6; OR= 1.0, CI = 0.6-1.9). For brain tumors, the corresponding risk estimates were 1.0 (CI = 0.7-1.6); 1.5 (CI = 1.0-2.2); 1.4 (CI = 0.9-2.1). Different EMF indices were tested. Tasks with frequent or large variations between high and low field-densities (high standard deviation) were more common among CLL subjects. For brain tumors, a prolonged high level (high median values) showed the strongest association. Confounding by place of residence, smoking, benzene, ionizing radiation, pesticides, and solvents was evaluated, and these factors did not seem to have a decisive influence on the associations. We also analyzed other potential sources of bias. For CLL, there were indications of an excess number of low-exposure subjects among non-

responders, which, to some extent, may have enhanced but not caused the risk estimates obtained. Our conclusion is that the study supports the hypothesis that occupational EMF exposure is a hazard in the development of certain cancers. Exhibit 122

Paternal Occupation and Brain Cancer in Offspring: A Mortality-Based Case-Control Study.

A mortality-based case-control study of selected risk factors for childhood brain tumors was undertaken. Ohio-born children who died from brain cancer during the 1959-1978 vicennium were compared to control children (of the same age, race, and sex) by using information obtained from the subjects' birth certificates. Differences between the case and the control children with respect to paternal occupation, the focus of the study, were examined. Controlling for the potentially confounding effects of several nonoccupational factors, case fathers were found more likely than control fathers to have been employed (at the time of birth of their children) in agriculture, in metal-related jobs, in structural work jobs in the construction industry, and in electrical assembling, installing, and repairing occupations in the machinery industry. Although the results must be interpreted with caution, the findings lend support to the hypothesis that parental occupation is a potential ***risk*** *factor for childhood brain tumors.* Exhibit 123

Physics and biology of mobile telephony.

GSM radiation does seem to affect non-thermally a variety of brain functions (including the neuroendocrine system), and health problems reported anecdotally do tend to be neurological, although formal confirmation of such reports, based on epidemiological studies, is still lacking. For example, reports of headache are consistent with the effect of the radiation on the dopamine-opiate system of the brain and the permeability of the blood-brain barrier, both of which have been connected to headache. Reports of sleep disruption are consistent with effects of the radiation on melatonin levels and on rapid-eye-movement sleep. Furthermore, since there is no reason to suppose that the seizure-inducing ability of a flashing visible light does not extend to microwave radiation (which can access the brain through the skull) flashing at a similarly low frequency, together with the fact that exposure to pulsed MWR can induce epileptic activity in rats, reports of epileptic activity in some children exposed to base-station radiation are perhaps not surprising. I have heard of one child whose seizures diminish when, unbeknown to her or her family, the mast is not functioning (or when she is away), only to increase again when the base-station is working again or when she returns home.

Finally, the significant increase (by a factor of between 2 and 3) in the incidence of neuroepithelial tumours (the laterality of which correlates with cell-phone use) found in a nationwide US study42 is consistent not only with the genotoxicity of GSM radiation, as indicated by increased DNA strand breaks28 and formation of chromosome aberrations and micronuclei but also with its promotional effect on tumour development.

Preadolescent children can be expected to be more vulnerable to any adverse health effects than adults because absorption of GSM microwaves is greatest in an object about the size of a child's head, because of the "head resonance" effect and the greater ease with which the radiation can penetrate the thinner skull of an infant. Also the multiframe repetition frequency of 8·34 Hz and the 2 Hz pulsing in the DTX mode of cellphones lie in the range of the alpha and delta brain-waves, respectively. In a child, alpha waves do not replace delta waves as a stable activity until the age of about 12 years. Furthermore, the immune system, whose efficacy is degraded by this kind of radiation, is less robust in children. This makes them less able to cope with any adverse health effect that might be provoked by chronic exposure, not only to the pulsed microwave

radiation but also to the more penetrating low-frequency magnetic fields associated with the current surges from the handset battery which can reach 40 _T (peak) near the back of the case.

In the context of base-station radiation, reports relating to animals are of particular value since it cannot here be claimed that the effects are psychosomatic. Of particular interest is a publication on cattle, recording severely reduced milk yields, emaciation, spontaneous abortions, and stillbirths. When cattle are removed to pastures well away from the mast, their condition improves, but it deteriorates once they are brought back. The adverse effects appeared only after GSM microwave antennae were installed on a tower formerly used to transmit only non-pulsed television and radio signals.

Finally, in support of the reality of an adverse health impact of non-thermal influences of the kind of radiation used today in mobile telephony, we should recall that during the "cold war" the Soviet irradiation of western embassies with microwave radiation (of an intensity intermediate between that in the vicinity of a handset and a base-station), done with the express intention of inducing adverse health effects, was quite successful. Exhibit 124

Pooled analysis of case-control studies on malignant brain tumours and the use of mobile and cordless phones including living and deceased subjects.

We studied the association between use of mobile and cordless phones and malignant brain tumours. Pooled analysis was performed of two case-control studies on patients with malignant brain tumours diagnosed during 1997-2003 and matched controls alive at the time of study inclusion and one case-control study on deceased patients and controls diagnosed during the same time period. Cases and controls or relatives to deceased subjects were interviewed using a structured questionnaire. Replies were obtained for 1,251 (85%) cases and 2,438 (84%) controls. The risk increased with latency period and cumulative use in hours for both mobile and cordless phones. Highest risk was found for the most common type of glioma, astrocytoma, yielding in the >10 year latency group for mobile phone use odds ratio (OR) = 2.7, 95% confidence interval (CI) = 1.9-3.7 and cordless phone use OR = 1.8, 95% CI = 1.2-2.9. In a separate analysis, these phone types were independent risk factors for glioma. The risk for astrocytoma was highest in the group with first use of a wireless phone before the age of 20; mobile phone use OR = 4.9, 95% CI = 2.2-11, cordless phone use OR = 3.9, 95% CI = 1.7-8.7. In conclusion, an increased risk was found for glioma and use of mobile or cordless phone. The risk increased with latency time and cumulative use in hours and was highest in subjects with first use before the age of 20. Exhibit 125

Possible Effects of Electric Blankets and Heated Waterbeds on Fetal Development.

Recent experimental work also indicates that ELF electromagnetic field exposure may sometimes affect fetal development in swine [Sikov et al, in press], chicks [Delgado et al, 1982; Sisken, 1983a,b], and rabbits [Hansson, 19811; and there is evidence that abnormal development sometimes occurs in human fetuses whose fathers work in high-voltage substations [Nordstrom et al, 1983]. Exhibit 126

Power quality affects teacher wellbeing and student behavior in three Minnesota Schools.

Another, less well understood, consequence of dirty electricity is ill health for those who have become electrically hypersensitive (EHS). Diabetics with EHS have higher plasma glucose levels

and require more medication, when exposed to this energy, and people with multiple sclerosis have a worsening of their symptoms (Havas 2006b). The most common complaints among self-proclaimed EHS include chronic fatigue, chronic pain, difficulty sleeping, mood disorders such as anxiety or depression, concentration and memory problems, dizziness, skin irritation, visual disturbances and ringing in the ears (Firstenberg 2001; Havas and Stetzer 2004; Schooneveld and Kuiper 2007). Exhibit 127

Public health implications of wireless technologies.

Abstract: Global exposures to emerging wireless technologies from applications including mobile phones, cordless phones, DECT phones, WI-FI, WLAN,WiMAX, wireless internet, baby monitors, and others may present serious public health consequences. Evidence supporting a public health risk is documented in the BioInitiative Report. New, biologically based public exposure standards for chronic exposure to low-intensity exposures are warranted. Existing safety standards are obsolete because they are based solely on thermal effects from acute exposures. The rapidly expanding development of new wireless technologies and the long latency for the development of such serious diseases as brain cancers means that failure to take immediate action to reduce risks may result in an epidemic of potentially fatal diseases in the future. Regardless of whether or not the associations are causal, the strengths of the associations are sufficiently strong that in the opinion of the authors, taking action to reduce exposures is imperative, especially for the fetus and children. Such action is fully compatible with the precautionary principle, as enunciated by the Rio Declaration, the European Constitution Principle on Health (Section 3.1) and the European Union Treaties Article 174. Exhibit 128

Radiofrequency Radiation-Induced Calcium Ion Efflux Enhancement from Human and Other Neuroblastoma Cells in Culture.

Abstract: To test the generality of radiofrequency radiation-induced changes in 4sCa2+ efflux from avian and feline brain tissues, human neuroblastoma cells were exposed to electromagnetic radiation at 147 MHz, amplitude-modulated (AM) at 16 Hz, at specific absorption rates (SAR) of 0.1, 0.05, 0.01, 0.005, 0.001, and 0.0005 W/kg. Significant 4sCa2+ efflux was obtained at SAR values of 0.05 and 0.005 Wikg. Enhanced efflux at 0.05 W/kg peaked at the 13-16 Hz and at the 57.5-60 Hz modulation ranges. A Chinese hamster-mouse hybrid neuroblastoma was also shown to exhibit enhanced radiation-induced "Ca2+ efflux at an SAR of 0.05 Wikg, using 147 MHz, AM at 16 Hz. These results confirm that amplitude-modulated radiofrequency radiation can induce responses in cells of nervous tissue origin from widely different animal species, including humans. The results are also consistent with the reports of similar findings in avian and feline brain tissues and indicate the general nature of the phenomenon. Exhibit 129

Reproductive Hazards Among High Voltage Substations Workers.

Abstract: A retrospective study on reproductive hazards was performed among 542 employees at Swedish power plants. Questionnaires were answered by 89% of the employees. Data on pregnancies were checked by studying hospital case records. There was a statistically significant, decreased frequency of "normal" pregnancy outcome, almost exclusively due to an increased frequency of congenital malformations, when the father was a high-voltage switchyard worker. The differences in pregnancy outcome could not be explained by any of the confounding factors analyzed. The total number of children with malformations (26) and the total number of pregnancies in this study, however, were very small. Exhibit 130

RF Guideline Issues. Letter to Richard Tell, Chair, IEEE SCC28 (SC4) Risk Assessment Work Group. Department of Health and Human Services (DHHS), National Institute for Occupational Safety and Health (NIOSH)

The C95.1 partial body (local) exposure limits are based on an assumed ratio of peak to whole body SAR; that is, they are dosimetrically, rather than biologically based. Instead of applying a dosimetric factor to the whole body SAR to obtain the local limits, an effort should be made to base local SAR limits on the differential sensitivity of tissues to electric fields and temperature increases. For example, it seems intuitive that the local limits for the brain and bone marrow should be lower than those for muscle, fat and fascia; this is not the case with the current limits which implicitly assume that all tissues are equally sensitive (except for eye and testicle). If no other data are available, differential tissue sensitivity to ionizing radiation should be considered.

There is a need to discuss and differentiate the criteria for guidelines for acute and chronic exposure conditions. The past approach of basing the exposure limits on acute effects data with an extrapolation to unlimited chronic exposure durations is problematic. There is an extensive data base on acute effects with animal data, human data (e.g. MRI information), and modeling to address thermal insult and associated adverse effects for acute exposure (e.g., less than one day). For lower level ("non-thermal"), chronic exposures, the effects of concern may be very different from those for acute exposure (e.g., epigenetic effects, tumor development, neurologic symptoms).

Studies continue to be published describing biological responses to nonthermal ELF-modulated and pulse-modulated RF radiation exposures that are not produced by CW (unmodulated) RF radiation. These studies have resulted in concern that exposure guidelines based on thermal effects, and using information and concepts (time-averaged dosimetry, uncertainty factors) that mask any differences between intensity-modulated RF radiation exposure and CW exposure, do not directly address public exposures, and therefore may not adequately protect the public. The parameter used to describe dose/dose rate and used as the basis for exposure limits is time-averaged SAR; time-averaging erases the unique characteristics of an intensity-modulated RF radiation that may be responsible for producing an effect. Exhibit 131

Verkasalo PK, Heikkila KV, Pukkala E, Hongisto MY, Valjus JE, Jarvinen PJ, Koskenvuo M. 1994. Letter to the Editor, Authors' Reply. BMJ 308:1163.

The pragmatic objective of our study was to estimate the excess cancer risk in children living close to overhead power lines of 110, 220, and 400 kV, presuming magnetic fields are the carcinogenic agent, and not to estimate the risk caused by magnetic fields from various sources. We did not exclude the possibility of a real cancer risk of magnetic fields in our paper, although the population attributable excess risk of childhood cancer due to the power lines apparently is small. If the data are analysed using higher cut off points of exposure, risk estimates seem to be higher but they pertain to a smaller fraction of the population. For example, the children and adolescents in our study with cumulative exposure of >/= 1.0 µT years contributed a total of 28400 person years. The corresponding standardised incidence ratios were 2.3 for total cancer (nine cases; 95% confidence interval 1.0 to 4.3), 2.8 for nervous system tumours (three cases; 0.6 to 8.1), 3.5 for leukaemia (three cases; 0.7 to 10), and 1.5 for other tumours (three cases; 0.3 to 4.3)--that is, the risk estimates for the small group of children with higher cumulative exposure seem to be relatively high, with wide confidence intervals. An analysis combining the results of the three recently published Nordic studies taken together supported the link between magnetic fields and childhood leukaemia. The emphasis should no longer be on blaming exposure misclassification for having decreased the observed relative risks but on further serious attempts to comprehend the effects of magnetic fields on human health. Exhibit 132

Recommendation to Americans with Disabilities Hearing Board. Document ID: DOJ-CRT-2010-0005-0001. Nondiscrimination on the Basis of Disability: Accessibility of Web Information and Services of State and Local Government Entities and Public Accommodations.

The Department of Justice ADA Program should immediately address the effect of chronic, pulsed radiofrequency radiation from smart (wireless) utility meters on sensitive populations. The ADA Program should formally recognize the serious limitations posed on people with RF-sensitive metal or medical implants, and support them with the necessary ADA classifications to provide a basis for opting-out of wireless utility meter installation.

The FCC's Grants of Authorization and other certification procedures for smart meters (wireless utility meters) do not ensure adequate safety to safeguard people under Department of Justice protection under the Americans with Disabilities Act.

People who have medical implants, particularly metal implants, may be more sensitive to spurious RF exposures for two reasons. Electromagnetic interference (EMI) with critical care medical equipment and medical implants is a potentially serious threat. Patients with deep-brain stimulators (Parkinson's disease patients) have reported adverse health effects due to RF from various environmental sources like security gates and RFID scanners. Patients with deep brain stimulators have reported the devices to be reprogramming or electrodes shut-down as a result of encounters with wireless RFID scanners. One manufacturer, Medtronics, has issued a warning for DBS implant patients to limit RF exposure to less than 0.1 W/Kg SAR (or sixteen times lower than for the general public) for MRI exposures.

This paper includes a detailed discussion of the effects and risks encountered by a Parkinson's patient with deep brain stimulation technology that helps control the symptoms (also known as a battery-operated brain). She is the Public Affairs Senior Advisor for the Parkinson's Action Network.

This paper also included a copy of a press release relating to a research paper titled "Published Paper on Wireless Interference with Critical Care Devices." The following comments were included in that press release:

Wireless systems used by many hospitals to keep track of medical equipment can cause potentially deadly breakdowns in lifesaving devices such as breathing and dialysis machines, researchers reported Tuesday in a study that warned hospitals to conduct safety tests.

Some of the microchip-based "smart" systems are touted as improving patient safety, but a Dutch study of equipment — without the patients —suggests the systems could actually cause harm.

A U.S. patient-safety expert said the study "is of urgent significance" and said hospitals should respond immediately to the "disturbing" results. The wireless systems send out radio waves that can interfere with equipment such as respirators, external pacemakers and kidney dialysis machines, according to the study.

Electromagnetic glitches occurred in almost 30 percent of the tests when microchip devices similar to those in many types of wireless medical equipment were placed within about one foot of the lifesaving machines. Nearly 20 percent of the cases involved hazardous malfunctions that would probably harm patients. These included breathing machines that switched off; mechanical syringe pumps that stopped delivering medication; and external pacemakers, which regulate the heart, that malfunctioned.

Consumers may experience electronic interference (electromagnetic interference or EMI) from smart meter wireless signals. Security systems, surveillance monitors and wireless intercoms may be rendered inoperable or unreliable. Some cordless telephones do not work reliably, or have substantial interference from smart meter RF emissions.

Electronic equipment and electrical appliances may be damaged or have to be replaced with other, newer equipment in order not to be subject to electromagnetic interference from smart meter RF bursts. Exhibit 133

Assessment of Radiofrequency Microwave Radiation Emissions from Smart Meters.

SUMMARY OF FINDINGS

This Report has been prepared to document radiofrequency radiation (RF) levels associated with wireless smart meters in various scenarios depicting common ways in which they are installed and operated.

The Report includes computer modeling of the range of possible smart meter RF levels that are occurring in the typical installation and operation of a single smart meter, and also multiple meters in California. It includes analysis of both two-antenna smart meters (the typical installation) and of three-antenna meters (the collector meters that relay RF signals from another 500 to 5000 homes in the area).

RF levels from the various scenarios depicting normal installation and operation, and possible FCC violations have been determined based on both time-averaged and peak power limits (Tables 1 - 14).

Potential violations of current FCC public safety standards for smart meters and/or collector meters in the manner installed and operated in California are predicted in this Report, based on computer modeling (Tables 10 – 17).

Tables 1 – 17 show power density data and possible conditions of violation of the FCC public safety limits, and Tables 18 – 33 show comparisons to health studies reporting adverse health impacts.

FCC compliance violations are likely to occur under normal conditions of installation and operation of smart meters and collector meters in California. Violations of FCC safety limits for uncontrolled public access are identified at distances within 6" of the meter. Exposure to the face is possible at this distance, in violation of the time-weighted average safety limits (Tables 10- 11). FCC violations are predicted to occur at 60% reflection (OET Equation 10 and 100% reflection (OET Equation 6) factors, both used in FCC OET 65 formulas for such calculations for time-weighted average limits. Peak power limits are not violated at the 6" distance (looking at the meter) but can be at 3" from the meter, if it is touched.*

This report has also assessed the potential for FCC violations based on two examples of RF exposures in a typical residence. RF levels have been calculated at distances of 11" (to represent a nursery or bedroom with a crib or bed against a wall opposite one or more meters); and at 28" (to represent a kitchen work space with one or more meters installed on the kitchen wall).

FCC compliance violations are identified at 11" in a nursery or bedroom setting using Equation 10 of the FCC OET 65 regulations (Tables 12-13). These violations are predicted to occur where there are multiple smart meters, or one collector meter, or one collector meter mounted together with several smart meters.*

FCC compliance violations are not predicted at 28" in the kitchen work space for 60% or for 100% reflection calculations. Violations of FCC public safety limits are predicted for higher reflection factors of 1000% and 2000%, which are not a part of FCC OET 65 formulas, but are included here to allow for situations where site-specific conditions (highly reflective environments, for example, galley-type kitchens with many highly reflective stainless steel or other metallic surfaces) may be warranted.

In addition to exceeding FCC public safety limits under some conditions of installation and operation, smart meters can produce excessively elevated RF exposures, depending on where they are installed. With respect to absolute RF exposure levels predicted for occupied space within dwellings, or outside areas like patios, gardens and walk-ways, RF levels are predicted to be substantially elevated within a few feet to within a few tens of feet from the meter(s).

For example, one smart meter at 11" from occupied space produces somewhere between 1.4 and 140 microwatts per centimeter squared (uW/cm2) depending on the duty cycle modeled (Table 12). Since FCC OET 65 specifies that continuous exposure be assumed where the public cannot be excluded (such as is applicable to one's home), this calculation produces an RF level of 140 uW/cm2 at 11" using the FCCs lowest reflection factor of 60%. Using the FCC's reflection factor of 100%, the figures rise to 2.2 uW/cm2 – 218 uW/cm2, where the continuous exposure calculation is 218 uW/cm2 (Table 12). These are very significantly elevated RF exposures in comparison to typical individual exposures in daily life. Multiple smart meters in the nursery/bedroom example at 11" are predicted to generate RF levels from about 5 to 481 uW/cm2 at the lowest (60%) reflection factor; and 7.5 to 751 uW/cm2 using the FCCs 100% reflection factor (Table 13). Such levels are far above typical public exposures. RF levels at 28" in the kitchen work space are also predicted to be significantly elevated with one or more smart meters (or a collector meter alone or in combination with multiple smart meters). At 28" distance, RF levels are predicted in the kitchen example to be as high as 21 uW/cm2 from a single meter and as high as 54.5 uW/cm2 with multiple smart meters using he lower of the FCCs reflection factor of 60% (Table 14). Using the FCCs higher reflection factor of 100%, the RF levels are predicted to be as high as 33.8 uW/cm2 for a single meter and as high as 85.8 uW/cm2 for multiple smart meters (Table 14). For a single collector meter, the range is 60.9 to 95.2 uW/cm2 (at 60% and 100% reflection factors, respectively) (from Table 15).

Table 16 illustrates predicted violations of peak power limit (4000 uW/cm2) at 3" from the surface of a meter. FCC violations of peak power limit are predicted to occur for a single collector meter at both 60% and 100% reflection factors. This situation might occur if someone touches a smart meter or stands directly in front.

Consumers may also have already increased their exposures to radiofrequency radiation in the home through the voluntary use of wireless devices (cell and cordless phones), PDAs like BlackBerry and iPhones, wireless routers for wireless internet access, wireless home security systems, wireless baby surveillance (baby monitors), and other emerging wireless applications.

Neither the FCC, the CPUC, the utility nor the consumer know what portion of the allowable public safety limit is already being used up or pre-empted by RF from other sources already present in the particular location a smart meter may be installed and operated.

Consumers, for whatever personal reason, choice or necessity who have already eliminated all possible wireless exposures from their property and lives, may now face excessively high RF exposures in their homes from smart meters on a 24-hour basis. This may force limitations on use of their otherwise occupied space, depending on how the meter is located, building materials in the structure, and how it is furnished.

People who are afforded special protection under the federal Americans with Disabilities Act are not sufficiently acknowledged nor protected. People who have medical and/or metal implants or other conditions rendering them vulnerable to health risks at lower levels than FCC RF limits may be particularly at risk (Tables 30-31). This is also likely to hold true for other subgroups, like children and people who are ill or taking medications, or are elderly, for they have different reactions to pulsed RF. Children's' tissues absorb RF differently and can absorb more RF than adults (Christ et al, 2010; Wiart et al, 2008). The elderly and those on some medications respond more acutely to some RF exposures.

Safety standards for peak exposure limits to radiofrequency have not been developed to take into account the particular sensitivity of the eyes, testes and other ball shaped organs. There are no peak power limits defined for the eyes and testes, and it is not unreasonable to imagine situations where either of these organs comes into close contact with smart meters and/or collector meters, particularly where they are installed in multiples (on walls of multi-family dwellings that are accessible as common areas).

In summary, no positive assertion of safety can be made by the FCC, nor relied upon by the CPUC, with respect to pulsed RF when exposures are chronic and occur in the general population. Indiscriminate exposure to environmentally ubiquitous pulsed RF from the rollout of millions of new RF sources (smart meters) will mean far greater general population exposures, and potential health consequences. Uncertainties about the existing RF environment (how much RF exposure already exists), what kind of interior reflective environments exist (reflection factor), how interior space is utilized near walls), and other characteristics of residents (age, medical condition, medical implants, relative health, reliance on critical care equipment that may be subject to electronic interference, etc) and unrestrained access to areas of property where meter is located all argue for caution. Exhibit 134

Sage response to the Electric Power Research Institute (EPRI) comments.

EPRI has presented no evidence of technical errors in the approach or calculations in the Sage Report, so the public and policy makers can rely on our conclusions and recommendations.

EPRI did not present calculations using the FCC OET Bulletin 65 equations that are fundamental to predicting RF levels. Thus, no apples-to-apples comparison can be made from their selective presentation of examples of RF levels. EPRI gave none of the basic information needed to check their figures. They provided no comprehensive assessment using the same FCC OET 65 equations, nor the range of possible duty cycles or reflection factors, nor specifying what power output, gain, effective radiated power (ERP) or other critical factors were used in their selected examples. The FCC's OET Bulletin 65 Equations provide the correct way to predict RF power density levels from smart meters, in advance of deployment.

EPRI's comment letter mischaracterizes information presented in the Sage Report, and then attacks its own mischaracterizations.

Neither the utilities involved, nor the CPUC, Division of Ratepayer Advocates or EPRI have provided their own studies on RF power density and compliance findings using FCC OET Bulletin 65 and specified equations, and adhering to the same requirements contained in that protocol. If they had done so, the calculations would be very similar or exactly that published in the Sage Report. None of these groups has found technical flaws in the Sage Report – which properly applied the FCC OET Bulletin 65 formulas. The Sage Report found many instances where wireless meters will violate FCC public safety limits in the manner they are installed and operated, and no evidence has been offered that demonstrates its conclusions to be in error.

The public is not well served, nor do policy-makers have sufficient information on impacts and adverse consequences of an enormously costly new wireless technology without full disclosure of RF emissions and resulting exposures to families in their own homes, schools, public buildings, businesses, hospitals, libraries, shopping, entertainment and transportation.

But, policy makers must not just look after the interests of industry, but take good public health planning principles into account. When there is reasonable evidence for risks from new technologies, it is not in the public interest, nor the economic interests of the State, to wait endlessly for all parties to agree there is "causal evidence or proof" position in order to take reasonable actions to protect public health. This is particularly true when considering the wisdom of widespread, involuntary public exposures to new technologies for which there is substantial evidence (but not yet proof) of possible health harm to millions of people. It could cost billions to fix in later years, result in economic harm to the State and its residents, and cause even deeper dissatisfaction with the State's regulatory agency performance.

Currently, the data made available by the utilities that are installing smart meters is non-existent, piecemeal and without sufficient basis to verify. In addition, there are different types of meters being deployed, so a full accounting of each one should be public information. Exhibit 135

Sensitivity of Calcium Binding in Cerebral Tissue to Weak Environmental Electric Fields Oscillating at Low Frequency. .

Abstract: Weak sinusoidal electric fields modify the calcium efflux from freshly isolated chick and cat cerebral tissues bathed in Ringer's solution, at 360. Following incubation (30 min) with radioactive calcium (45Ca2+), each sample, immersed in fresh solution, was exposed for 20 min to fields at 1, 6, 16, 32, or 75 Hz, with electric gradients of 5, 10, 56, and 100 V/m in air. 45Ca2+ efflux in the solution was then measured in 0.2 ml aliquots and compared with efflux from unex]posed control samples. Field exposures resulted in a general trend toward a reduction in the release of the preincubated 45Ca2+. Both frequency and amplitude sensitivities were observed. Maximum decreases occurred at 6 and 16 Hz (12-15%). Thresholds were around 10 and 56 V/m for chick and cat tissues, respectively. Similar but nonsignificant trends occurred during other field exposures. All results were statistically compared with matched samples of controls. Tissue gradients could not be measured, but estimates were of the order of 0.1 ,4V/cm. The susceptibility of the electrochemical equilibrium in the neuronal membrane to small extracellular perturbations is discussed and a possible role for weak intrinsic cerebral fields in neuronal excitability is suggested. Exhibit 136

Tumor promotion in a breast cancer model by exposure to a weak alternating magnetic field.

Summary: In view of the methodological problems of epidemiological studies on associations between exposures to 50160 Hz magnetic fields (MF) and increased incidence of cancers, laboratory studies are necessary to determine if 50160 Hz MF are cancer promoters or can progress cancers. The objective of the present study was to determine if an alternating MF of low flux density exerts tumor-promoting or co-promoting effects in a model of breast cancer in female rats. Mammary tumors were induced by the chemical carcinogen 7,12-dimethylbenz(a)anthracene (DMBA). A group of 99 rats was exposed to a homogeneous MF of 50 Hz, 100 PT (microtesla), for 24 h/day 7 day/week for a period of 91 days; another group of 99 rats was sham-exposed under the same environmental conditions as the MF-exposed rats. The exposure chambers were identical for MF-exposed and sham-exposed animals. DMBA was administered orally at a dose of 5 mgikg at the first day of exposure and at weekly intervals thereafter up to a total dose of 20 mg per rat. The animals were palpated once weekly to assess

the development of mammary tumors. In controls, DMBA induced tumors in about 40% of the animals within three months Exhibit 137

Tumour risk associated with use of cellular telephones or cordless desktop telephones.

Background: The use of cellular and cordless telephones has increased dramatically during the last decade. There is concern of health problems such as malignant diseases due to microwave exposure during the use of these devices. The brain is the main target organ.

Methods: Since the second part of the 1990's we have performed six case-control studies on this topic encompassing use of both cellular and cordless phones as well as other exposures. Three of the studies concerned brain tumours, one salivary gland tumours, one non-Hodgkin lymphoma (NHL) and one testicular cancer. Exposure was assessed by self-administered questionnaires.

Results: Regarding acoustic neuroma analogue cellular phones yielded odds ratio (OR) = 2.9, 95 % confidence interval (CI) = 2.0–4.3, digital cellular phones OR = 1.5, 95 % CI = 1.1–2.1 and cordless phones OR = 1.5, 95 % CI = 1.04–2.0. The corresponding results were for astrocytoma grade III-IV OR = 1.7, 95 % CI = 1.3–2.3; OR = 1.5, 95 % CI = 1.2–1.9 and OR = 1.5, 95 % CI = 1.1–1.9, respectively. The ORs increased with latency period with highest estimates using > 10 years' time period from first use of these phone types. Lower ORs were calculated for astrocytoma grade I-II. No association was found with salivary gland tumours, NHL or testicular cancer although an association with NHL of T-cell type could not be ruled out.

Conclusion: We found for all studied phone types an increased risk for brain tumours, mainly acoustic neuroma and malignant brain tumours. OR increased with latency period, especially for astrocytoma grade III-IV. No consistent pattern of an increased risk was found for salivary gland tumours, NHL, or testicular cancer. Exhibit 138

Numerous highly respected researchers have provided narratives on the health effects of these meters and why they need to be curtailed. Most of the reports are commentary on a commissioned report submitted to the California PUC, that has been discredit by researchers and medical professionals.

From David O. Carpenter, M.D. , Director, Institute for Health and the Environment University at Albany,

3. The statement "The potential for behavioral disruption from increase body tissue temperatures is the only biological health impact that has been consistently demonstrated and scientifically proven to result from absorbing RF within the band of the electromagnetic spectrum that smart meters use" is totally wrong. In the first place there are many adverse health effects other than "behavioral disruption" demonstrated as a result of tissue heating. The evidence for increased risk of brain tumors, acoustic neuromas and parotid gland tumors in individuals who have used a cell phone for 10 years or more is consistent, and the tumors occur only on the side of the head where the phone is used. There is also strong and consistent evidence for increased risk of leukemia in individuals who live near to high power AM radio transmission towers, even though this report characterizes such exposures as being "quite low" and show in Figure 7 that they are lower than the RF fields from smart meters.

4. The statement "The scientific consensus is that body temperatures must increase at least 1oC to lead to potential biological impacts from the heat" is totally wrong, and makes it obvious that no persons with medical or biological expertise participated in this report. Every enzyme system in the body is exquisitely sensitive to temperature, and increases activity by even a fraction of a degree increase in temperature. In fact all RF generates heat, and what is defined as "nonthermal" is only a function of our ability to measure the temperature increase.

5. The statement "While concerns of brain cancer associated with mobile phone usage persist, there is currently no definitive evidence linking cell phone usage with increased incidence of cancer" is incorrect. The evidence is strong and consistent among studies looking at long-term and intensive use of cell phones. The AM radio studies mentioned above are also relevant, particularly because
like smart phones radio transmission towers give whole body radiation, not just to the head.

6. The statement "There currently is no conclusive scientific evidence pointing to a non-thermal cause-and-effect between human exposure to RF emissions and negative health impacts is inaccurate, and depends totally on what one defines as "conclusive". In biology and medicine there is nothing that is 100% proven. We rely on statistical significance and weight of evidence when drawing conclusions about health effects. When one uses these definitions there is conclusive scientific evidence for adverse health effects in humans.

7. The evidence for adverse effects of radiofrequency radiation is currently strong and grows stronger with each new study. Wired meters with shielded cable do not increase exposure. The report clearly indicates that "smart meters could conceivably be adapted to non-wireless transmission of data. However, retrofitting millions of smart meters with hard-wired technology could be difficult and costly." Clearly the answer to this dilemma is not to install wireless smart meters to begin with. Exhibit 139

California Department of Public Health (CDPH) , technical comments on the CCST report, Health Impacts of Radio Frequency from Smart Meters, released January 11, 2011:

1).The reassurance that Smart Meters emit radio frequency emfs well below cell phones (see figure 1; page 5 of the report) and therefore should be considered safe, appears to be based upon an incorrect representation of cell phone emf strength that was calculated; not measured. Cell phones emit much lower emfs that are closer to those of the Smart Meters. Our measurements of emissions from many cell phones (directly next to the device) under a variety of weak and strong signal conditions all fall under 80 micro watts per square centimeter; often much lower. Frequently, these cell phone emissions are lower than the 40 micro watts per square centimeter shown for the smart meter at 3 feet.

2) The representation of Smart Meter emissions is based upon controlled conditions and not real world conditions. The same figure 1 on page 5 shows minimum and maximum values for a Smart Meter at 3 and 10 feet are the same; suggesting no variability. Our in-the-field measurements show appreciable variability. Also, it is not clear why 3 and 10 feet were chosen for the comparison. It would be useful to determine the percentage of people spending time closer than three feet to the meter and the percentage of their time within that radius.

The report states on page 4, point 3 under Other Considerations, "The California Public Utilities Commission should consider doing an independent review of the deployment of smart meters to determine if they are installed and operating consistent with the information provided to the consumer."

This is an important finding, and raises doubt about the strong reassurances provided in Key Findings in the absence of independent review of installed meters in the field.

3) CDPH suggests further review of the literature on non-thermal effects, which is complicated and controversial, but does not support a claim of no non-thermal health effects from radio frequency electromagnetic fields. Exhibit 140

Dr. Magda Havas, B.Sc., Ph.D., , ENVIRONMENTAL AND RESOURCE STUDIES PROGRAM, Trent University

Dr. Magda Havas is Associate Professor of Environmental and Resource Studies at Trent University (Canada) where she teaches and does research on the biological effects of electromagnetic radiation including radio frequency and microwave radiation, poor power quality, ground current, and low frequency electromagnetic fields. She has served as an expert witness in both Canada and the United States regarding health effects associated with electromagnetic exposure. She is currently science advisor on EMF-related issues to several non-profit organizations in Canada, U.S., U.K., and the Netherlands. Dr. Havas is currently reviewing documents given to her by a retired scientist, who worked for the U.S. military and the U.S. government on the biological effects of microwave radiation. These documents include declassified military reports, internal government reports, and translation from the European literature dating back to the 1930s.

In my opinion, the FCC standard for Smart Meters is not sufficient to protect public health.This is based on the following facts:

4.1 Thermal vs. Non-thermal Debate. *The* ***thermal vs. non-thermal debate is largely a red herring that has been perpetuated for decades and has influenced the type of research done in the United States. The FCC standard is based on a thermal effect. It was originally based on the amount of radiation that would heat an adult male in the US military exposed to radar. While the heating effect is not disputed, biological effects, some of which have adverse health consequences, occur well below the thermal guideline (Inglis 1970). As a consequence various countries in the world are opting for a "biologically" based guideline rather than a "thermal" guideline, which takes into account not only adult males in peak physical conditions but children, pregnant women, the elderly, and those who have developed electrohypersensitivity (EHS).***

4.2 Guidelines *in Russia, Switzerland, Poland, and China are well below the FCC standard (i.e. 10 vs. 1000 microW/cm2 or 1% of FCC guidelines). Some military and government insiders tried to get U.S. guidelines reduced decades ago but were not successful (Pollack and Healer 1967, Dodge 1969). Steneck et al. (1980) provides an excellent account of how the U.S. standards were established for radio frequency radiation.*

4.3 Our exposure to radio frequency radiation (RFR) is increasing exponentially *as we design more equipment that relies on higher frequencies in the electromagnetic spectrum. Prior to World War II, this type of radiation was negligible. Today we have radar (military, marine, aviation, and weather), we have cell phone antennas, radio and TV broadcast antennas, and a growing number of WiFi hotspots, citywide WiFi and Wi-Max antennas. Inside buildings we have cordless phones, many of which emit microwave radiation even when they are not being used; wireless alarm systems; wireless baby monitors, wireless computers, iPads, and Smart Phones that can connect to wireless internet or WiFi. More children are playing wireless video games than ever before and radio frequency identification devices (RFID) are placed into merchandise to provide information to the manufacturer about consumer habits.*

The "smart meter" is just another source of exposure that will be placed on every home and in every apartment. Smart meters are being used to monitor use of electricity, gas and water. As part of this system, appliances are being designed to communicate directly with smart meters, all in a wireless mode, which will ultimately increase levels of radiation in the home.

4.4** I work with people who have become **electrically hypersensitive** (EHS) and I have received emails and phone calls from those who have had smart meters placed on their homes. They complain of ill health and many are unable to use the room closest to the smart meter. These individuals have no place to "hide" from the growing levels of electrosmog especially in densely populated urban centers. **Sickness contributes to time off work and away from school, growing medical costs and a general poorer quality of life. Children are particularly vulnerable as are pregnant women and those with compromised immune systems. The presence of metal implants in the body (such as metal pins in bones) may concentrate the absorption of radiation at the location of implantation, inducing thermal effects from lower power densities than would ordinarily cause such harm (Massey 1979). Some implants, such as pace makers and deep brain stimulators for Parkinson's disease, may malfunction and this can be fatal. In Switzerland about 5% of the population has EHS. If the same fraction of the population has EHS in the US that would come to a staggering 15 million people! The symptoms following exposure to radio frequency radiation were labeled radiowave sickness and were first reported for those occupationally exposed in the former Soviet Union. These same symptoms are now referred to as electrohypersensitivity (EHS) and are experienced by a growing fraction of the population. They include . . .
". . . headache, eyestrain and tearing, fatigue and weakness, vertigo, sleeplessness at night and drowsiness during the day, moodiness, irritability, hypochondria, paranoia, either nervous tension or mental depression and memory impairment. After longer periods of exposure, additional complaints may include sluggishness, inability to make decisions, loss of hair, pain in muscles and in the heart region, breathlessness, sexual problems and even a decrease in lactation in nursing mothers. Clinically observed effects in persons voicing these complaints include trembling of the eyelids, fingers and tongue, increased perspiration of the extremities, [and] rashes . . ." (Massey, *1979).*

***4.5** In addition to sensitive people, Switzerland also identifies **Places of Sensitive Use** (German acronym is OMEN). These places include: living rooms; classrooms and kindergartens; hospitals and nursing homes; permanent jobs (where people spend more than 2.5 days per week); and playgrounds. For these OMEN sites, the Swiss government recommends that greater precaution be taken for long-term exposure to weak radiation. In these places, radiation from wireless microwave base stations (such as cordless phones or WLAN/WiFi) may exceed radiation from nearby cell phone base stations and hence these devices must generate emissions as low as possible. For more information visit http://www.bag.admin.ch/themen/strahlung/00053/index.html?lang=en .*

Massey, in a report published by Duke Law Journal in 1979, identifies nine variables that need to be considered when determining the impact of microwave radiation. These are "power density, intensity and relative phase of all field components, specific frequency ranges, waveform characteristics, exposure regimes, specific occupations, level of control over exposed populations, individual differences (age, sex, health, specific predisposing factors) and presence of other environmental stressors." The current FCC guidelines do NOT take these into consideration.

We have evidence that pulsed microwave frequencies, that are generated by WiFi and cordless phones are more harmful than continuous wave and yet this is not considered in the FCC guidelines (Reno 1975).

Wireless Internet (WiFi or WLan) is not as common in Europe as they are in North America. There they prefer using wired service in the form of fiber optic and Ethernet connections. Germany hotels ask that you bring an Ethernet cables with you, as they don't provide WiFi. The Swiss government is providing free fiber optics to schools provided they don't install wireless routers.

6. An additional point I would like to make relates to ***dirty electricity****. Wires can act like antennas and the radiation produced by radio frequency generating devices can flow along and reradiate from wires both inside and outside the home. This contributes to Havas, October 2010 Smart Meters: CCST page 5/6 dirty electricity and localized radiation exposure. Dirty electricity has been associated with cancers (Milham and Morgan 2008); health and behavior problems in schools (Havas and Olstad 2008); and both diabetes and multiple sclerosis (Havas 2006). From a human health perspective and to protect sensitive electronic equipment it is important to maintain good power quality and to prevent radiation from smart meters flowing along wires.*

I have great concern regarding the current levels of microwave radiation in North America. Instead of promoting wireless technology, we should be promoting wired technology and reserving wireless for situations where wired in not possible (while one is travelling for example). Shortly after X-rays were discovered, they were used in shoe stores to determine shoe-size for young children. Fortunately, we recognized that X-rays were harmful and we restricted their use to essential medical diagnoses. We need to recognize that microwaves are also harmful and we cannot use this technology in a frivolous manner. With more frequencies being used, with the levels of radiation increasing, and with so little research on the longterm, low-level effects of this technology we are creating a potential time bomb. If smart meters are placed on every home, they will contribute significantly to our exposure and this is both unwise and unsafe. Exhibit 141

Olle Johansson, Assoc. Prof., The Experimental Dermatology unit, Department of Neuroscience, Karolinska Institute, 171 77 Stockholm, Sweden & Professor, Royal Institute of Technology, 100 44 Stockholm, Sweden Exhibit 142

I work as an associate professor at the Karolinska Institute; we are world-famous for our Nobel Prize in Physiology or Medicine, which we many times have awarded to your fellow countrymen and –women. I also uphold a professorship at the Royal Institute of Technology; it being closely tied to the Nobel Prizes in Physics and Chemistry. For many years I have been studying health effects of wireless gadgets, such as Smart Meters.

Wireless communication is now being implemented in our daily life in a very fast way. At the same time, it is becoming more and more obvious that the exposure to electromagnetic fields may result in highly unwanted health effects. This has been demonstrated in a very large number of studies and includes cellular DNA-damage (which may lead to an initiation of cancer as well as mutations that carry down generations), disruptions and alterations of cellular functions like increases in intracellular stimulatory pathways and calcium handling, disruption of tissue structures like the blood-brain barrier (which may allow toxins to enter the brain), impact on vessel and immune functions, and loss of fertility. It should be noted that we are not the only species at jeopardy, practically all animals and plants may be at stake.

Because the effects are reproducibly observed and links to pathology can not be excluded, the precautionary principle should be in force in the implementation of this new technology within the society. Therefore, policy makers immediately should strictly control exposure by defining biologically-based maximal exposure guidelines also taking into account long-term, non-thermal effects, and including especially vulnerable groups, such as the elderly, the ill, the genetically and/or immunologically challenged, children and fetuses, and persons with the functional impairment electrohypersensitivity (which in Sweden is a fully recognized functional impairment, and therefore receives an annual governmental disability subsidy).

Prompted by all this, a group of international experts recently published a very important paper, The Seletun Scientific Statement (2011). Among its points are:

1) Low-intensity (non-thermal) bioeffects and adverse health effects are demonstrated at levels significantly below existing exposure standards.

2) ICNIRP/WHO and IEEE/FCC public safety limits are inadequate and obsolete with respect to prolonged, low-intensity exposures.

3) New, biologically-based public exposure standards are urgently needed to protect public health world-wide.

4) EMR exposures should be reduced now rather than waiting for proof of harm before acting. It is not in the public interest to wait.

5) There is a need for mandatory pre-market assessments of emissions and risks before deployment of new wireless technologies. There should be convincing evidence that products do not cause health harm before marketing.

6) The use of telephone lines (land-lines) or fiber optic cables for SmartGrid type energy conservation infrastructure is recommended. Utilities should choose options that do not create new, community-wide exposures from wireless components of SmartGrid-type projects. Future health risks from prolonged or repetitive wireless exposures of SmartGrid-type systems may be avoided by using fiber-optic cable. Energy conservation is endorsed but not at the risk of exposing millions of families in their homes to a new, involuntary source of wireless radiofrequency radiation, the effect of which on their health not yet known.

Many smart meters are close to beds, kitchens, playrooms, and similar locations. These wireless systems are never off, and the exposure is not voluntary. The smart meters are being forced on citizens everywhere. Based on this, the inauguration of smart meters with grudging and involuntary exposure of millions to billions of human beings to pulsed microwave radiation should immediately be prohibited until 'the red flag' can be hauled down once and for all.

The recent determination of the World Health Organization (WHO) to include radiofrequent radiation on the 2B list of carcinogens also applies to devices such as smart meters. Already September 4, 2008, the European Parliament voted 522 to 16 to recommend tighter safety standards for cell phones (Europ. Parl. resolution on the mid-term review of the European Environment and Health Action Plan 2004-2010). In light of the growing body of scientific evidence implicating cell phone use with brain tumors, the Parliament said, "The limits on exposure to electromagnetic fields [EMFs] which have been set for the general public are obsolete." The European Parliament "was greatly concerned at the Bioinitiative international report concerning EMFs, which summarises over 1500 studies on that topic and which points in its conclusions to the health risks posed by emissions from mobile-telephony devices such as mobile telephones, UMTS, WiFi, WiMax and Bluetooth, and also DECT landline telephones, and now it is again – and more firmly and seriously - repeated in the form of WHO's recent cancer classification.

Henry Lai, Ph.D. Department of Bioengineering, University of Washington

We also think the report lacks the scientific expertise and details to warrant serious consideration by those knowledgeable in this area of inquiry. The report reflects basic flaws in review perspective as well as simple factual errors that should never appear in a report such as this.

The basic question of whether the FCC's guidelines for radiofrequency radiation (RFR) exposure are met by smart meters is fundamentally beside the point regarding the task at hand required from CCST. Those guidelines in their current form are not sufficiently protective of human health, and likely never were. The present guidelines are obsolete, in need of substantive revision in both content and focus, and should be updated using far more recent research data. CCST had an opportunity to delve deeper into a potentially looming public health problem regarding the smart meter/grid buildout but unfortunately chose otherwise.

The FCC guidelines for the specific absorption rate (SAR) are based on narrow data from <u>one</u> set of experiments carried out in the 1980's (1, 2) which showed behavioral disruption in animals after exposure to RFR at a whole body specific absorption rate (SAR) of 4 W/kg. These studies have not been independently replicated yet are enshrined in the standards. Many other experiments since then have shown behavioral effects in animals at a SAR lower than 4 W/kg but no changes to the guidelines have been made (3).

It is misleading to discuss the guidelines based on thermal v. non-thermal effects. It is very difficult to scientifically differentiate between RFR-induced thermal and non-thermal biological

effects. An increase in temperature does not necessarily, or automatically, imply that an effect being observed is thermal in nature only. Guidelines should be based on the exposure levels (SAR or power density) at which biological effects have been observed.

Examples of factual errors in the report include:

- *In Fig 5, the vertical bar at around 900 MHz gives the power density of the maximum exposure from smart meters at 5%, 50%, 100% duty cycles, i.e., when the meter is on 5%, 50% and 100% of the time. The power density (which is the unit of the vertical y-axis) is shown to increase with increase in the duty cycle. This is inaccurate. Power density is a measure of the strength of the RFR field at a certain time point and it should not change with the time of measurement. An analogy would be when a car runs at a constant speed of 50 mph, the speed remains the same no matter how long one measures it. In that analogy, what Figure 5 says is that a car would be running at 50 mph when measured for a duration of 5 minutes; but at 500 mph when measured for 50 minutes; and at 5000 mph when measured for 500 minutes.*
- *This also applies to Figure 7 with the statement 'smart meter figures represent 100% duty cycle' (i.e., always on) as a hypothetical maximum use case' simply does not make sense at all.*

In a recent paper that we published in Environmental Reviews (4), one of the publications of Canada's National Research Council Press, we included a chart of 59 peer-reviewed studies showing various biological effects at low intensity RFR exposures (See attached chart below). Some of the works cited certainly apply to even the lowest intermittent exposures associated with smart meters. Smart meters therefore cannot be considered benign, despite adherence to FCC guidelines. The listed exposure levels at which biological/health effects have been observed are much lower than the FCC's 4 W/kg, and actually include levels that one would encounter in modern urban environments today.

Furthermore, exposure to smart meter RFR is chronic and unavoidable. There is not much data on the biological effects of chronic RFR exposure, although some does exist. There are research data showing that the effects of chronic low level exposures are different than those of acute short-term exposure such as the FCC guidelines. In fact, another set of similar experiments (5, 6) was carried out also in the 1980's to study the effects of repeated RFR exposures. The researchers concluded:

> *"…the threshold for behavioral and physiological effects of chronic (long-term) RFR exposure in the rat occurs between 0.5 mW/cm^2* ***(0.14 W/kg)*** *and 2.5 mW/cm^2* ***(0.7 W/kg)****."*

It appears that chronic exposure sensitized the animals to RFR. Thus, it is definitely insufficient to apply a guideline based on acute exposure to a chronic exposure situation such as would be experienced with smart grid/meter technology.

Another important question is whether RFR biological effects are cumulative? This applies to the discussion of smart meter duty cycles in the CCST report. There are some studies indicating that RFR effects can accumulate with repeated exposures (3). This is an important consideration in light of so many wireless devices in our midst today.

No agency takes cumulative exposures into consideration. Each device or new technology is considered a stand-alone. Most low-level RFR technologies are categorically excluded from FCC licensing or review if they meet certain exposure thresholds. Therefore, today's true exposures are unknown. What is certain, however, is that smart grid/meters will add a whole new layer of involuntary exposures to an ever-increasing background level of RFR.
An important missed opportunity in the report was a thorough discussion of the RFR emissions from 'access points' in the larger grid network. These points have significantly higher duty cycles in order to co-ordinate the signals from thousands of meters. In the very least, CCST should call for a cessation of the smart meter buildout until the emission levels from access points are known, setbacks are recommended from nearby residences, and a better assessment of cumulative exposures from meters, access points, and wireless components placed on or in appliances themselves can be determined. We recommend that CCST also advise the California legislature that more extensive assessment is needed regarding this technology before the state proceeds further. EXHIBIT 143

Comments on the Draft Report by the California Council on Science and Technology "Health Impacts of Radio Frequency from Smart Meters", by Daniel Hirsch

On 30 July 2010 Assemblymember Jared Huffman requested that CCST undertake an "independent, science-based study" of two questions: "whether FCC standards for SmartMeters are sufficiently protective of public health taking into account current exposure levels to radiofrequency and electromagnetic fields, and further to assess whether additional technology specific standards are needed for SmartMeters and other devices that are commonly found in and around homes, to ensure adequate protection from adverse health effects." Unfortunately, the Council draft report answers neither question.

Again, the Council's draft report provides little if any useful information or analysis of this matter. There is no mention or analysis of the specific studies that have suggested, for example, a cancer effect from RF exposure such as the large, international study funded by the cell phone industry, the Interphone study, that found a significant increase in brain cancers in people who used cell phones half an hour a day for ten years. Given the long latency period generally for solid cancers, such a finding gives pause as to what might be seen over the long
term. Some other studies have suggested an increased risk of brain cancer on the side of the head where the cellphone is normally used. Other studies, however, have not found an effect. Given the nature of the request from the elected officials for a review of this critical scientific issue—whether there is the potential for non-thermal health effects from cumulative, long-term exposure to RF radiation—one would have hoped that there would have been a more detailed analysis of this question in the report. The report is candid, however, that at present the issue is unresolved. But it goes on to then say there is no basis for changing the FCC standards which are based only on prompt, thermal effects. One could equally well say there is no basis for maintaining the FCC standards, given the uncertainties about latent, non-thermal effects.

What the CCST draft report does focus on, however, is the relative exposure from SmartMeters compared to other RF-emitting devices in common use. Here, again, the draft report disappoints. The elected officials cited claims made by the electric utility industry regarding safety of SmartMeters and purportedly relative low exposures compared to other common devices and requested "an independent, science-based study." However, the CCST draft report does not appear to include much if any independent work on the subject but rather merely pastes in a table taken from an 8-page pamphlet released a few weeks earlier by the Electric Power Research Institute (EPRI), an advocacy group for the electric power industry.2

The EPRI pamphlet is not a peer-reviewed scientific study. It is a brief item for an

advocacy group that is supported by industry. If the elected officials wanted the industry's views, it would have asked for them. Instead, it wished an independent, science-based study by an entity without the kinds of conflicts of interest EPRI has on this matter. But the CCST draft report is basically simply a cut-and-paste job from the EPRI brochure. Note also that the estimates for exposure from a single SmartMeter contained in the EPRI item and repeated in the CCST draft is not a measured value but estimated—how is not made clear. EPRI's measurements were for a bank of ten SmartMeters; it didn't measure one alone but somehow estimated for it, despite the difference in how exposure falls off from one versus ten. The latter is inverse of the distance, the former inverse square of the distance. One presumes the electeds wanted actual measured values from an independent source, not a calculated value from the electric industry, without even an explanation of how it is was calculated and without independent verification.

CCST does correct one error made in the EPRI brochure whereby it reduced the presumed power density estimates for the SmartMeter by duty cycles of 1 and 5%. CCST rightly indicated that future duty cycles could be much higher as "new applications and functionality are added to the meter's communication module in the future." For this reason, it assumed a 100% duty cycle in its calculations.

HOWEVER, CCST did not correct numerous other apparent errors from the EPRI brochure when it adopted EPRI's values. For example, for cell phone exposures, CCST did not correct for the presumed duty cycle of the cell phone (which CCST indicates on average is 1%). ***Nor did it convert the EPRI cell phone power density estimate into comparable units. EPRI (and thus CCST) compared a whole body average exposure to SmartMeter radiation to peak exposure to the ear for the cell phone. One needs to compare apples and apples, or whole body exposures to whole body exposures. Comparing the peak dose to the ear from a cell phone, when the rest of the body gets vastly less radiation, with a whole body exposure where all organs get roughly the same dose from a SmartMeter, doesn't seem appropriate. If there is a cancer effect, it is likely associated with the total RF energy the body receives.***

Three references are given in the EPRI report, although for which claim each applies is not made clear. The first reference, the ICNIRP report, does not in fact give measured values for microwave ovens, but instead reports what the legal limit for leakage is, generally reported to be orders of magnitude above what typical exposures from microwave ovens really are. The second reference is to a 1978 paper by PG&E's consultant, RA Tell. That paper CCST has not made available for review, but it is over three decades old, and thus of little relevance to today's microwave ovens. The third reference is merely to a personal communication with Tell, without any information as to the content of that communication. When one checks the values reported by EPRI and uncritically adopted by CCST, it appears that the first value, 5 mW/cm2 at 2 inches from the device, is in fact not a measured value of typical exposures but the vastly higher legal limit for leakage. The literature in fact indicates that 50% of microwave ovens produce less than 0.062 mW/cm2 at 5 cm, or two orders of magnitude below the value reported by EPRI and reproduced by CCST without question*. See, e.g., R, Mathes, "Radiation Emission from Microwave Ovens," Journal of Radiation Protection, Vol. 12, No. 3, September 1992. One presumes the leakage rate has been reduced even further since then.]*

One recognizes that if one is comparing to FCC existing standards based solely on acute, thermal effects that duty cycle might be treated differently. But if there is a cancer effect, which is what the electeds asked CCST to study, a likely key aspect of the dose-response relationship is the cumulative whole body dose. For ionizing radiation, about which I have spent much of my career, the determining factor is largely how much radiation energy the body has absorbed. [There are of course other factors, such as the relative biological effectiveness (RBE) of different types of ionizing radiation and varying sensitivity of different organs.) So, if the question were how does SmartMeter and cell phone RF radiation compare to FCC limits, duty cycle may be treated in a different fashion. But since

the question is what if FCC limits, based solely on thermal effects, may be inadequate to protect against cancer and other non-thermal effects, then the duty cycle—which determines the cumulative total exposure received—and whole body exposure must be factored in. My fundamental recommendation is that the draft report should be revised to correct for these two factors.

The value used for the peak cell phone power density for a cell phone held to the ear in the CCST draft report is taken directly from the EPRI pamphlet, without apparent independent review or correction. According to p. 6 of the EPRI pamphlet, the value it gives apparently is not a measured value but an estimate. How the estimate was arrived at is not detailed in the brochure. All that is said is in footnote 1, "Based on a 3-inch 250mW antenna emitting in a cylindrical wavefront." A quick calculation to try to reproduce what EPRI must have done indicates that if it merely assumed that all of the energy from a 250mW cell phone was transmitted by holding directly against the ear into a circular area with a 3 inch diameter, the power density in that small circular area around the ear would be 5 mW/cm2. That is precisely the upper value given by EPRI in its table. We don't know if that is what EPRI did, since it doesn't tell us what it did and CCST does not appear to have tried to confirm the asserted value. But in any case, 5 mW/cm2 from a 250mW cell phone would indeed appear to require that that power be deposited solely in that very small circular area.

Averaging over the full potentially exposed surface area of the body (presuming only half the body surface could be exposed to the cell phone from any one angle), the whole body exposure would be approximately on average 0.25 mW/cm2 given the maximum value to the ear of 5 mW/cm2 put forward by EPRI and the CCST draft report and correcting as well for the duty cycle. ***The SmartMeter thus would produce 160 times more cumulative whole body*** *exposure than the cell phone assuming this estimate for whole body exposure. This is shown in Figure 3.3*

Since the EPRI estimate for cell phone peak power density at the ear is unexplained as to its derivation, we have also made a very rough estimate of whole body exposure from a cell phone from an independent line of calculation. Taking the values EPRI (and thereby CCST) put forward for exposure at three feet from a 250 mW SmartMeter, and noting that EPRI assumed the cell phone would also be 250mW, one can make a rough estimate of power density for the whole body from a cell phone held at the head. The exposure at one's waist would be approximately three feet from the source, just as in the assumed case of the SmartMeter. Presuming that the dose falls off as the inverse square of the distance, a very rough estimate of power density averaged over half the surface of the whole body, and taking into account duty cycle, yields a cumulative cell phone whole body power density of roughly 0.75 µW/cm2. ***Using the cumulative whole body exposure as a cell phone*** Exhibit 144

International Agency for Research on Cancer

World Health Organization

PRESS RELEASE
N° 208

31 May 2011

IARC CLASSIFIES RADIOFREQUENCY ELECTROMAGNETIC FIELDS AS POSSIBLY CARCINOGENIC TO HUMANS

Lyon, France, May 31, 2011 -- The WHO/International Agency for Research on Cancer (IARC) has classified radiofrequency electromagnetic fields as possibly carcinogenic to humans (Group 2B), based on an increased risk for glioma, a malignant type of brain cancer[1], associated with wireless phone use.

Background

Over the last few years, there has been mounting concern about the possibility of adverse health effects resulting from exposure to radiofrequency electromagnetic fields, such as those emitted by wireless communication devices. The number of mobile phone subscriptions is estimated at 5 billion globally.

From May 24–31 2011, a Working Group of 31 scientists from 14 countries has been meeting at IARC in Lyon, France, to assess the potential carcinogenic hazards from exposure to radiofrequency electromagnetic fields. These assessments will be published as Volume 102 of the IARC *Monographs*, which will be the fifth volume in this series to focus on physical agents, after Volume 55 (Solar Radiation), Volume 75 and Volume 78 on ionizing radiation (X-rays, gamma-rays, neutrons, radio-nuclides), and Volume 80 on non-ionizing radiation (extremely low-frequency electromagnetic fields).

The IARC Monograph Working Group discussed the possibility that these exposures might induce long-term health effects, in particular an increased risk for cancer. This has relevance for public health, particularly for users of mobile phones, as the number of users is large and growing, particularly among young adults and children.

The IARC Monograph Working Group discussed and evaluated the available literature on the following exposure categories involving radiofrequency electromagnetic fields:

- occupational exposures to radar and to microwaves;
- environmental exposures associated with transmission of signals for radio, television and wireless telecommunication; and
- personal exposures associated with the use of wireless telephones.

International experts shared the complex task of tackling the exposure data, the studies of cancer in humans, the studies of cancer in experimental animals, and the mechanistic and other relevant data.

[1] 237 913 new cases of brain cancers (all types combined) occurred around the world in 2008 (gliomas represent 2/3 of these). Source: Globocan 2008

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Results

The evidence was reviewed critically, and overall evaluated as being *limited*[2] among users of wireless telephones for glioma and acoustic neuroma, and *inadequate*[3] to draw conclusions for other types of cancers. The evidence from the occupational and environmental exposures mentioned above was similarly judged inadequate. The Working Group did not quantitate the risk; however, one study of past cell phone use (up to the year 2004), showed a 40% increased risk for gliomas in the highest category of heavy users (reported average: 30 minutes per day over a 10-year period).

Conclusions

Dr Jonathan Samet (University of Southern California, USA), overall Chairman of the Working Group, indicated that "the evidence, while still accumulating, is strong enough to support a conclusion and the 2B classification. The conclusion means that there could be some risk, and therefore we need to keep a close watch for a link between cell phones and cancer risk."

"Given the potential consequences for public health of this classification and findings," said IARC Director Christopher Wild, "it is important that additional research be conducted into the long-term, heavy use of mobile phones. Pending the availability of such information, it is important to take pragmatic measures to reduce exposure such as hands-free devices or texting. "

The Working Group considered hundreds of scientific articles; the complete list will be published in the Monograph. It is noteworthy to mention that several recent in-press scientific articles[4] resulting from the Interphone study were made available to the working group shortly before it was due to convene, reflecting their acceptance for publication at that time, and were included in the evaluation.

A concise report summarizing the main conclusions of the IARC Working Group and the evaluations of the carcinogenic hazard from radiofrequency electromagnetic fields (including the use of mobile telephones) will be published in The Lancet Oncology in its July 1 issue, and in a few days online.

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[2] '***Limited evidence of carcinogenicity***': A positive association has been observed between exposure to the agent and cancer for which a causal interpretation is considered by the Working Group to be credible, but chance, bias or confounding could not be ruled out with reasonable confidence.

[3] '***Inadequate evidence of carcinogenicity***': The available studies are of insufficient quality, consistency or statistical power to permit a conclusion regarding the presence or absence of a causal association between exposure and cancer, or no data on cancer in humans are available.

[4] a. 'Acoustic neuroma risk in relation to mobile telephone use: results of the INTERPHONE international case-control study' (the Interphone Study Group, in Cancer Epidemiology, *in press*)
b. 'Estimation of RF energy absorbed in the brain from mobile phones in the Interphone study' (Cardis et al., Occupational and Environmental Medicine, *in press*)
c. 'Risk of brain tumours in relation to estimated RF dose from mobile phones – results from five Interphone countries' (Cardis et al., Occupational and Environmental Medicine, *in press*)
d. 'Location of Gliomas in Relation to Mobile Telephone Use: A Case-Case and Case-Specular Analysis' (American Journal of Epidemiology, May 24, 2011. [Epub ahead of print].

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Link to the **audio file** posted shortly after the briefing:
http://terrance.who.int/mediacentre/audio/press_briefings/

About IARC

The International Agency for Research on Cancer (IARC) is part of the World Health Organization. Its mission is to coordinate and conduct research on the causes of human cancer, the mechanisms of carcinogenesis, and to develop scientific strategies for cancer control. The Agency is involved in both epidemiological and laboratory research and disseminates scientific information through publications, meetings, courses, and fellowships.

If you wish your name to be removed from our press release e-mailing list, please write to com@iarc.fr.

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ABOUT THE IARC MONOGRAPHS

What are the IARC Monographs?

The *IARC Monographs* identify environmental factors that can increase the risk of human cancer. These include chemicals, complex mixtures, occupational exposures, physical and biological agents, and lifestyle factors. National health agencies use this information as scientific support for their actions to prevent exposure to potential carcinogens. Interdisciplinary working groups of expert scientists review the published studies and evaluate the weight of the evidence that an agent can increase the risk of cancer. The principles, procedures, and scientific criteria that guide the evaluations are described in the Preamble to the IARC Monographs.

Since 1971, more than 900 agents have been evaluated, of which approximately 400 have been identified as carcinogenic or potentially carcinogenic to humans.

Definitions

Group 1: The agent is *carcinogenic to humans*.

This category is used when there is *sufficient evidence of carcinogenicity* in humans. Exceptionally, an agent may be placed in this category when evidence of carcinogenicity in humans is less than *sufficient* but there is *sufficient evidence of carcinogenicity* in experimental animals and strong evidence in exposed humans that the agent acts through a relevant mechanism of carcinogenicity.

Group 2.

This category includes agents for which, at one extreme, the degree of evidence of carcinogenicity in humans is almost *sufficient*, as well as those for which, at the other extreme, there are no human data but for which there is evidence of carcinogenicity in experimental animals. Agents are assigned to either Group 2A (*probably carcinogenic to humans*) or Group 2B (*possibly carcinogenic to humans*) on the basis of epidemiological and experimental evidence of carcinogenicity and mechanistic and other relevant data. The terms *probably carcinogenic* and *possibly carcinogenic* have no quantitative significance and are used simply as descriptors of different levels of evidence of human carcinogenicity, with *probably carcinogenic* signifying a higher level of evidence than *possibly carcinogenic*.

Group 2A: The agent is *probably carcinogenic to humans*.

This category is used when there is *limited evidence of carcinogenicity* in humans and *sufficient evidence of carcinogenicity* in experimental animals. In some cases, an agent may be classified in this category when there is *inadequate evidence of carcinogenicity* in humans and *sufficient evidence of carcinogenicity* in experimental animals and strong evidence that the carcinogenesis is mediated by a mechanism that also operates in humans. Exceptionally, an agent may be classified in this category solely on the basis of *limited evidence of carcinogenicity* in humans. An agent may be assigned to this category if it clearly belongs, based on mechanistic considerations, to a class of agents for which one or more members have been classified in Group 1 or Group 2A.

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Group 2B: The agent is *possibly carcinogenic to humans*.

This category is used for agents for which there is *limited evidence of carcinogenicity* in humans and less than *sufficient evidence of carcinogenicity* in experimental animals. It may also be used when there is *inadequate evidence of carcinogenicity* in humans but there is *sufficient evidence of carcinogenicity* in experimental animals. In some instances, an agent for which there is *inadequate evidence of carcinogenicity* in humans and less than *sufficient evidence of carcinogenicity* in experimental animals together with supporting evidence from mechanistic and other relevant data may be placed in this group. An agent may be classified in this category solely on the basis of strong evidence from mechanistic and other relevant data.

Group 3: The agent is *not classifiable as to its carcinogenicity to humans*.

This category is used most commonly for agents for which the evidence of carcinogenicity is *inadequate* in humans and *inadequate* or *limited* in experimental animals.

Exceptionally, agents for which the evidence of carcinogenicity is *inadequate* in humans but *sufficient* in experimental animals may be placed in this category when there is strong evidence that the mechanism of carcinogenicity in experimental animals does not operate in humans.

Agents that do not fall into any other group are also placed in this category.

An evaluation in Group 3 is not a determination of non-carcinogenicity or overall safety. It often means that further research is needed, especially when exposures are widespread or the cancer data are consistent with differing interpretations.

Group 4: The agent is probably not carcinogenic to humans.

This category is used for agents for which there is *evidence suggesting lack of carcinogenicity* in humans and in experimental animals. In some instances, agents for which there is *inadequate evidence of carcinogenicity* in humans but *evidence suggesting lack of carcinogenicity* in experimental animals, consistently and strongly supported by a broad range of mechanistic and other relevant data, may be classified in this group.

Definitions of evidence, as used in IARC Monographs for studies in humans

The evidence relevant to carcinogenicity from studies in humans is classified into one of the following categories:

Sufficient evidence of carcinogenicity: The Working Group considers that a causal relationship has been established between exposure to the agent and human cancer. That is, a positive relationship has been observed between the exposure and cancer in studies in which chance, bias and confounding could be ruled out with reasonable confidence. A statement that there is *sufficient evidence* is followed by a separate sentence that identifies the target organ(s) or tissue(s) where an increased risk of cancer was observed in humans. Identification of a specific target organ or tissue does not preclude the possibility that the agent may cause cancer at other sites.

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Limited evidence of carcinogenicity: A positive association has been observed between exposure to the agent and cancer for which a causal interpretation is considered by the Working Group to be credible, but chance, bias or confounding could not be ruled out with reasonable confidence.

Inadequate evidence of carcinogenicity: The available studies are of insufficient quality, consistency or statistical power to permit a conclusion regarding the presence or absence of a causal association between exposure and cancer, or no data on cancer in humans are available.

Evidence suggesting lack of carcinogenicity: There are several adequate studies covering the full range of levels of exposure that humans are known to encounter, which are mutually consistent in not showing a positive association between exposure to the agent and any studied cancer at any observed level of exposure. The results from these studies alone or combined should have narrow confidence intervals with an upper limit close to the null value (e.g. a relative risk of 1.0). Bias and confounding should be ruled out with reasonable confidence, and the studies should have an adequate length of follow-up. A conclusion of *evidence suggesting lack of carcinogenicity* is inevitably limited to the cancer sites, conditions and levels of exposure, and length of observation covered by the available studies. In addition, the possibility of a very small risk at the levels of exposure studied can never be excluded.

In some instances, the above categories may be used to classify the degree of evidence related to carcinogenicity in specific organs or tissues.

Cindy Sage, MA, Sage Associates, Co-Editor, BioInitiative Report, Research Fellow, Department of Oncology, Orebro University Hospital, Orebro, Sweden

Conclusions Are Not Supported by Evidence of Compliance with FCC Safety Limits
There is no solid basis in the CCST report to conclude (or to support the contention) that FCC public safety limits are met for smart meters, in the manner installed and operated.

Conclusions Disregard Evidence in the Report for Possible Health Risk
The text of the report only partially documents potential health risks from low-level, chronic exposure to radiofrequency radiation. The conclusions ignore this discussion.

Conclusions Do Not Follow from Report
Conclusions of the report are inconsistent with the report's more balanced warnings about possible risks to health. The overall legitimacy of the report is cast into doubt as a result. CCST's report could equally well have concluded 'there is ample evidence to advise the California Legislature that, based on multiple studies of radiofrequency radiation below current FCC safety limits, it is advisable to issue a cautionary warning on the wireless component of smart meters until a full assessment of their effects is completed by independent experts. Further, it can be concluded that the continued rollout of wireless smart meters may increase public health risks on a widespread basis and should be reconsidered in light of the existing scientific evidence and public health warnings for such chronic exposures to pulsed RF.'

I was one of the expert reviewers invited by CCST to submit comments for the Committee. CCST asked several experts to answer two questions (see below). Since the Report conclusions apparently ignored much of the expert and committee input – only intervention by the final editor(s) to disregard key evidence explains how CCST's final conclusions could give rise to the "all clear" message.

Questions asked of Invited Expert Reviewers

1) Are the current FCC standards for smart meters sufficiently protective of public health, taking into account current exposure levels to radiofrequency (RF) and electromagnetic fields?

2) Are additional technology--specific standards needed for smart meters and other devices that are commonly found in and around homes, to ensure adequate protection from adverse health effects?

CCST Report Conclusions
1) "The FCC standard provides a currently accepted factor of safety against known thermally induced health impacts of smart meters and other electronic devices in the same range as RF emissions. Exposure levels from smart meters are well below the thresholds for such effects."

This conclusion presents a partial response to Question 1 – only that the FCCs thermal standards are adequate (these standards prevent only heating and burning of tissues, and shock hazard, however). The conclusion does not address nonthermal (or low-intensity) RF exposures, which is really the point. It also is silent on FCC violations of public safety limits, which have been calculated to occur.13

2) "There is no evidence that additional standards are needed to protect the public from smart meters."
By ignoring evidence for low-intensity RF adverse health effects, the Report essentially then dismissed the need for changes in public safety standards for pulsed RF. This conclusion simply cannot be reconciled with the evidence presented in the report (thin as it is), nor with the larger body of evidence known to experts in this field. That evidence is now widely discussed by international health and safety experts who find the existing thermal standards inadequate to protect public health. 1,2

FCC Violations and Excessively High RF Exposures are Ignored
Another report issued on January 1, 201is titled Assessment of Radiofrequency Microwave Radiation Emissions from Smart Meters by Sage Associates.13 It documents what RF levels may be expected. The Assessment seems not to have been considered either by the CCST experts nor the Committee.

The Assessment identified where and under what conditions smart meters can cause FCC violations of public safety limits as the meters are typically installed and operated. The CCST report concludes that all smart meter RF exposures will be well below the FCC safety limits, and this is erroneous.

To date, there have been no other studies that provide sufficient information to support the claim that smart meters comply with FCC regulations. In fact, there is solid evidence from a review of the FCC Grants of Authorization and attached FCC RF exposure studies that many thousands (perhaps millions) of meters are in clear violation of one or more of the explicit limitations noted on each FCC Grant of Authorization. The FCC Grants of Authorization are void unless meters are installed in compliance with every one of those

limitations.

The Assessment also shows many cases where, although the FCC safety limits may not be violated, excessively high RF levels from smart meters would be predicted to occur within the home or in other occupied space. In many instances, predicted RF levels are many times higher than those reported to cause adverse health effects. 5-12
Such exposures, if chronic, would reasonably be expected to result in increased disease and disability.

Misleading Comparisons Are Made to Cell Phones
CCST's report makes misleading comparisons of RF exposures from cell phone use and from smart meters, an apparent effort to minimize public health concern. If the FCC had thought smart meters would be held to the head in normal operation, they would have required smart meters to be tested for SAR compliance, not power density. These are not the same, and to compare them is wrong.

Cell phones produce a high, localized RF exposure at the head. They are presumed to be used within 20 centimeters (8") of the body. Smart meters, like cell towers, create wholebody exposure rather than localized exposure in most circumstances, and specific FCC compliance depends on keeping a 20 cm or greater distance from the meter. Cell phone use is voluntary; smart meter exposure is involuntary. Cell phone use is sporadic or intermittent, but smart meter exposure estimates are 'all over the map'. There is great uncertainty on this point, and as such, the outcome cannot be known; therefore, no assertion of safety or compliance can be given.

RF Levels from Smart Meters are Unreconciled and Need Assessment
PG&E's sole figure for RF exposure was given during ***CPUC proceedings as 1/6000th of the federal health (sic) limit. Nothing is given about the specific conditions under which this estimate might be true (antenna make and model, duty cycle, which FCC formula, what reflection factor, one meter or multiples, etc). However, from that single data point, we calculate that RF exposure to be 0.11 uW/cm2 at 10 feet (where the FCC safety limit is known to be 655 uW/cm2 at the frequencies 915 MHz and 2405 MHz). This means that at 10 feet from the meter, PG&E says the RF level will be 0.11 uW/cm2.***
Kundi and Hutter (Pathophysiology, 2009)2 say they don't yet find RF health impacts at levels below 0.05 to 0.1 uW/cm2" but do find consistent evidence of adverse health impacts at levels generally above that (based on at least eight cell tower studies conducted internationally). These figures were for healthy adult populations.
From the CCST Report, figures 1 and 7 (identical) give a comparison of RF levels from various sources, including two estimates for smart meters. They are 4 uW/cm2 at 10 feet, and 40 uW/cm2 at 3 feet away (no source is identified for these estimates, and again, the operational conditions are unspecified). Another estimate from CCST's report (pages 17 and 22) says that a 'worst case' RF estimate – a meter that transmits continuously – would produce 60% of the FCC limit (which is 655 uW/cm2 for the combined antenna frequencies), or 393 uW/cm2. However, the location at which this RF exposure level is calculated to occur is not given. The information is not useful. But, given the peerreviewed scientific literature, any of these estimates is too high for chronic exposure to pulsed RF*. 1,2*

No one can reconcile or separate reasonable from unreasonable RF predictions without some better, more systematic computer modeling of RF exposures.

Cumulative RF is Not Assessed Prior to Meter Installation
None of the PG&E or the EPRI estimates includes any provision for 'what amount of RF exists already' and does the smart meter's additional RF burden push that location over the FCC limit. The CCST report does not consider cumulative sources of RF (WI-FI,

nearby cell tower(s), AM, FM, TV, HAM transmitters, etc). The cumulative RF burden must be considered, including ongoing RF exposures from existing sources.

Further, since these meters are part of a radiofrequency surveillance and communications system that includes cell antennas (to relay RF signals to the utility) and eventually, power transmitters on/within appliances (to relay RF signals within the home to the smart meter), these critical omissions in the overall RF burden placed on people from the 'smart meter program' should be assessed. No one can install a smart meter and make a blanket assertion the environment still complies with public safety standards in the after condition, if the before condition is not known. RF exposures from multiple sources are additive. Exhibit 145

RAYMOND RICHARD NEUTRA M.D. Dr. PH

Public officials approached you with a very narrow framing of the issue asking you:
(a) if one could guarantee an absence of health effects if RF exposures were always below current thermally based standards.
(b) If other standards were needed to deal with non-thermal health effects

You answered:
1. The FCC standard provides a currently accepted factor of safety against known thermally induced health impacts of smart meters and other electronic devices in the same range of RF emissions. Exposure levels from smart meters are well below the thresholds for such effects.

2. There is no evidence that additional standards are needed to protect the public from smart meters. Your first answer doesn't respond to the official's first question at all, instead it states what all parties agree to, the standard protects against thermal effects and smart meters emit fields that are below the standard.

Your second answer is technically a falsehood. There is lots of evidence that would suggest that RF and ELF exposures well below the current standards may be capable of causing added lifetime risk that exceed the benchmark which triggers health based regulations (1 per hundred thousand). You could have turned your second answer into a true statement by saying something like this:

"When our panel, that included no epidemiologists, reviewed the extensive literature, epidemiological and non epidemiological on non-thermal RF exposures, we concluded that it is not beyond a reasonable doubt that non-thermal exposures are capable of adding life-time risks of regulatory concern. This is because we would require a clear understanding of the physical induction mechanism , the carcinogenic mechanism and toxicological and epidemiological effects well above the resolution power of the studies before we would say that non-thermal exposures can cause significant risk at the 'beyond a reasonable doubt level'."

A beyond a reasonable doubt standard is required in criminal proceedings and would be inappropriate in a civil proceeding, where only a "more likely than not" standard is required. We were all reminded of this in the famous OJ Simpson trials.

So, what certainty standard is applicable here? How certain to we have to be of how much risk before we move from the status quo to cheap and expensive measures to reduce smart phone exposures? On page 24 you say ".. retrofitting millions of smart meters with hard wired technology could be difficult and costly. Perhaps more importantly, retrofitting smart meters would not address thesignificantly greater challenge presented by the billions of mobile phones in use globally."

This sentence also includes important unstated assumptions:
a) If other actors are exposing you to harm more intensely than I, then I have no moral duty to remove my less intense harm until he removes his.
b) It would not be cost beneficial to switch to wired smart meters
c) It would raise utility rates substantially to switch to wired smart meters.
d) I have no moral duty to switch to a lower exposure meter, even if the impact on utility bills are minimal. EXHIBIT 146

Samuel Milham MD, MPH

My name is Samuel Milham. I am a physician /epidemiologist , specializing in occupational medicine and in the health effects of electromagnetic fields (EMF). I was the first to document the link between occupational electromagnetic field exposure and cancer. My website www.sammilham.com has links to my recent papers, to my CV and to my new book, Dirty Electricity which presents evidence that most of the so-called diseases of civilization are due to EMF exposure not lifestyle.

Your report, unfortunately, reads as if were written by PG and E or Edison, and pays no attention at all to a very important EMF exposure variable, dirty electricity (high frequency voltage transients and harmonics).

Smart meters transmit their data via radio frequency (RF) either through the air or on utility wiring. The electronics of all transmitters operate on direct current (DC), which is obtained using inverters and switching power supplies in the meter which interrupt the grid AC current flow and generate dirty electricity which flows back to the grid on the 60 Hz AC throughout the substation service area. Interrupting current flow generates dirty electricity. Stetzer Electric markets a plug-in meter which measures dV/dT, the average rate of change of voltage on the wiring between 2 and 100 KHz, and capacitive filters to reduce the dirty electricity levels.

The grid was originally built so that all the electricity which flowed from the substation returned through the neutral wires. When people started using computers and other electrical devices with non-linear loads, the existing neutrals couldn't handle the loads and fires resulted. The electrical building codes were revised to require more robust in-building neutrals, but the utilities got off the hook by instead of beefing up their neutrals, they simply tied the neutrals to the earth so that now, about 70% of the electricity delivered from the substation , returns there via the ground.

My hypothesis is easy enough to test. Dirty electricity levels measured in homes, offices and schools should increase after the meters are deployed. Dirty electricity levels measured in the utility drops and in the earth will also increase as the meters are deployed. Since dirty electricity is a potent carcinogen (see attached paper and pp. 78-80 in my book), and causes numerous other health problems, the only way to avoid a public health catastrophe is to send the smart meter information over existing telephone land lines or go back to the analog meters. I'm not making light of or ignoring the RF pollution caused by the smart meters, but think the dirty electricity may be a more serious and intractable problem. EXHIBIT 147

In summary, the public is being forced to subsidize the capital investment and expansion of privately owned utilities, in addition to being forced to pay a second time, as these same parasitic corporations recoup these same investments that were funded by the stimulus package to begin with.

The government knew over a decade ago, that radio frequency directed energy can have biological effects, which is analogous to what is being done now with the rf's from these s'meters. Exhibit 148.

The SMART GRID system is nothing more than a system of accelerated energy costs with accompanying tax increases. The system cannot and does not deliver more efficient use of energy and isn't meant to. The intent of the GRID and the meters is to pin energy rates to the ever fluctuating markets enabling the energy provider to charge the highest rate possible in any given period of time. Higher rates mean higher taxes. This isn't about energy conservation or any of the other nonsense put out as propaganda to foist these deadly meters upon an unsuspecting public: This is simply a business plan meant to unlawfully spy on private citizens while extorting the public for corporate profits.

The 'perceived' benefit to the customer is the 'ability to monitor and control their energy consumption', is speculative. There is no assurance that every customer has access to the internet to monitor their use, so that is an 'assumed' benefit. NVE wants to utilize 'behavior modifications' upon their customers, to 'adjust' how they consume energy. The public is cognitive enough to know that if they use more power, they will incur higher bills and on their 'own' can decide how they want to live their lives.

There are hidden financial 'perks' to NVE that is related to the consumer, but, not forwarded on to the consumer. Such as providing 'sales leads' to vendors for energy efficient appliances and scrap meter etc.

There have been no long term specific studies on the health effects of the 'low level' emissions emitted from these s'meters. There are a multitude of the population who have medical conditions that can be directly impacted by these meters, resulting in either further exacerbations or complete disability.

Research is proving that cell phones are not that 'neutral' regarding EMF and as such, using them as an analog for 'safety' of the s'meters is discrediting themselves even further.

Those who have medical conditions that can be impacted, most are covered under the Americans for Disability Act and afforded protection from both the state and the federal government.

NVE has not be transparent with their customers and used concerted deception with, threats and intimidation to gain acceptance of the s'meters. Intentionally violated federal law by not 'offering' the customer the choice to accept the meter, but instead used the government to promote the deployment of the s'meters.

I implore this honorable Commission to allow the customers the right to opt out, force NVE to get consent of the public for the meters, replace the analogs to

those who want them returned and have a public QUESTION & ANSWER forum to address this program, with a member of the Commission in attendance, to confirm that NVE is in fact providing factual information and full response to any and all public questions.

Provide to the customer, information that the s'meters have not been fully tested and the next test results will be concluded in 2014.

Provide information via the mail to every consumer who has a s'meter installed, and ask if they want to keep the s'meter. Any further notifications also have a notation that those with implanted medical devices or medical conditions to be aware there hasn't been any long term studies on said devices/conditions.

Require that a customer has to call to accept the s'meter, not the current protocol of having to call to refuse the s'meter, in accordance with federal law "ask the customer if they want the s'meter'.

That the replacement of s'meters, be the TRUE and actual analog, not any type of digital non transmitting meter, unless the customer specifically requests it.

That those who elect to utilize the analog meters not be forced to incur any costs to obtain the readings, as this s'meter program is completely voluntary.

Therefore, since NVE decided to jump the gun and fire meter readers, the customers should not be penalized for their over zealous vision to convert every customer in Nevada. Nor should this Commission even consider a rate hike to cover NVE operating costs to provide the same type of service that they have provided previously.

Nor should any customer who elects to keep the analog, should not be billed for 'any and all' taxes associated with this deployment.

The utility customers of Nevada rely upon this Commission to protect them and I feel that the information that I have provided, warrant protection from this program and force NVE to cover the costs associated with this 'futuristic' vision, and look internally on how to recover said operating costs.

Thank you,

/s Angel De Fazio, BSAT