

Health Effects of Smart Meters

By

Global Indoor Health Network



Global Indoor Health Network
PO Box 777308
Henderson, NV 89077-7308

globalindoorhealthnetwork.com

OVERVIEW (Highlights of this report)

The first thing to know about smart meters is that “**Smart meters are NOT mandatory**” (even though the utility companies act as if they are mandatory and force them on consumers).

Despite what you are told by utility companies, smart meters are NOT mandatory. In many states, consumers spoke out and were able to get an opt-out through their public utility commission. An opt-out allows you to choose to have an electro-mechanical, non-transmitting, non-digital, analog meter.

On February 1, 2011, press officer Thomas Welch of the U.S. Department of Energy press officer responded to questions about whether the federal government has made the installation of wireless smart meters mandatory. He wrote:

No. The Federal government, including DOE, does not have any role in regulating the installation of smart meters, nor does it have a policy about the mandatory adoption of smart meters.

On July 16, 2009, FERC issued a Policy Statement on Smart Grid Policy that acknowledged that EISA does not make any such standards mandatory and gave FERC no new authority to enforce such standards. Smart Grid Policy Statement, 128 F.E.R.C. ¶61,337, at 61,060–359 (July 16, 2009).

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 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.

Barrier Trower, a retired British Secret Service Microwave Weapons specialist, states:

“The paradox is how Radio Frequency/microwave radiation can be used as a weapon to cause impairment, illness and death; and at the same time be used as a communications instrument [such as in smart meters].”

Trower continues, “By 1971, we knew everything that needed to be known.”

“A 1976 document summarizing U.S. Defense Intelligence research lists all of the health hazards caused by wireless devices and concludes: This should be kept secret to preserve industrial profit.”

Jerry Flynn, is a retired Canadian Armed Forces captain with specialized training and 22 years of experience in Electronic Warfare and Signals Intelligence.

Flynn has worked with U.S. and NATO armies in this specialized capacity. He writes:

“The U.S. military has known for decades that the RF/microwave frequencies most harmful to man are those within the band 900 MHz to 5 GHz. These frequencies penetrate all organs of the body, thus putting all human organ systems at risk. Smart meters emit these precise frequencies which, when combined with certain pulsed modulation characteristics and power densities, are most harmful to the brain, central nervous system, immune system, and can cause cancers. This is precisely why these frequencies are used in Microwave weapons of war.”

Flynn’s summary on smart meter dangers:

“Pulsed non-thermal radiation, which is emitted by smart meters, is far more damaging at the body’s cellular level to all life forms than any other technology ever devised by man. Militaries of the world have known for more than 50 years that RF/microwaves are the perfect weapon. Today, democratic governments are knowingly and callously authorizing untested (for safety) smart meters to operate (emitting pulsed non-thermal radiation) at the most lethal frequencies known to man.”

Comments from Dr. Vini G. Khurana, Associate Professor of Neurosurgery, June 11, 2012, in an article titled "Smart Meters: Correcting the Gross Misinformation."

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

The 2012 report of the BioInitiative Working Group.

The range of possible health effects that are adverse with chronic exposures has broadened. The most serious health endpoints that have been reported to be associated with extremely low frequency (ELF) and/or radio frequency radiation (RFR) include childhood and adult leukemia, childhood and adult brain tumors, and increased risk of 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, pathological leakage of the blood–brain barrier, altered immune

function including increased allergic and inflammatory responses, miscarriage, and some cardiovascular effects. Insomnia is reported in studies of people living in very low-intensity RFR environments with Wi-Fi and cell tower-level exposures.

September 22, 2014, letter from the BioInitiative Working Group.

Epidemiological studies show links between radiofrequency radiation (RFR) exposure and cancers, neurological disorders, hormonal changes, symptoms of electrical hypersensitivity (EHS) and more. Laboratory studies show that RFR exposure increases risk of cancer, abnormal sperm, learning and memory deficits, and heart irregularities. Fetal exposures in both animal and human studies result in altered brain development in the young offspring, with disruption in learning, memory and behavior. The brain development of a fetus can be impaired by in-utero exposure to a pregnant woman. The evidence for these statements is based on hundreds of published, peer-reviewed scientific studies that report adverse effects at levels much lower than current FCC public safety limits.

Myths told by Utility Companies

The utility companies have used a variety of “marketing tools” (also known as “myths”) to convince the public that smart meters are safe. Here is one of the myths told by the utility companies:

The utility companies claim that the exposure level of smart meters is "lower than the average RF exposure of a cellular phone, cordless phone, microwave oven, Wi-Fi system to the human body." This is a "marketing spin" by the utility companies. The truth is:

The figures for RF exposure given by utilities are time-averaged numbers which hide the peak power of the “smart” meter, and disguise the fairly continuous nature of the pulses. “Smart” meters are unlike cell phones or WiFi in their bizarre pattern of sharp spikes of RF.

At least 90% of the RF emitted by the “smart” meters is NOT transmitting your electrical usage data, but is part of the “mesh network” talking to itself, and includes a lot of redundant “chatter” between your meter and other meters. This is for the convenience of your utility, and its effects on you (and other living things) apparently were not even considered when they were designing the mesh network.

Industry Propaganda (Richard H. Conrad, Ph.D. Biochemist. Report for Legislators on Wireless Smart Meters: Health and Safety Issues, May 12, 2014)

Industry has woven a superficially convincing propaganda network of extremely dishonest hype. Their spin includes such statements as: “there are no harmful non-thermal effects”. But research strongly suggests otherwise. From Itron literature: “The total RF exposure from multiple meters in meter banks is

effectively no greater than that of a single meter". This is absolutely incorrect. Itron also writes that smart meters do not emit "pulsed RF", rather they transmit "packets". But they are RF pulses nonetheless.

PG&E has said "SmartMeters communicate intermittently. These intermittent signals total, on average, 45 seconds per day. For the other 23 hours and 59 minutes of the day, the meter is not transmitting any RF." This is misleading because numerous pulses are emitted every minute around the clock, and PG&E was forced to admit to about 10,000 pulses per day on average, with some smart meters emitting up to a maximum of 190,000 pulses per day (which when divided by the number of minutes in a day equals over 100 pulses per minute).

The old analog electromechanical meters emit no RF, are safe, secure, private, accurate, efficient and reliable and should be the reference standard that any new system should match or exceed in all its parameters.

Expert Witnesses Used by Utility Companies

Utility companies used "expert witnesses" to support their claims that smart meters are not harmful. One of the organizations that provided "expert witness" testimony is a company called Exponent.

It is well known throughout the world that Exponent is a "bought and paid for" expert witness firm used by corporations to deny the health effects caused by their products.

To learn more about Exponent, read the book "Doubt is Their Product" by David Michaels. Excerpts from the book are provided in this document.

The World Health Organization's International Agency for Research on Cancer (IARC) lists radiofrequency electromagnetic fields as a Class 2B carcinogen.

This is the first time in history that a known carcinogen has been mandated (by the government) to be placed on all homes, schools and buildings.

Worthington, Amy. 2007. The Radiation Poisoning of America. Centre for Research on Globalization.

Dr. Robert Becker, noted for decades of research on the effects of electromagnetic radiation, has warned: "Even if we survive the chemical and atomic threats to our existence, there is the strong possibility that increasing electropollution could set in motion irreversible changes leading to our extinction before we are even aware of them. All life pulsates in time to the earth and our artificial fields cause abnormal reactions in all organisms."

Research Papers, Reports and Articles

Despite what you are told by utility companies, **smart meters are NOT mandatory**. In many states, consumers spoke out and were able to get an opt-out through their public utility commission. An opt-out allows you to choose to have an electro-mechanical, non-transmitting, non-digital, analog meter.

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World Health Organization press release issued May 31, 2011.

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Source: http://www.iarc.fr/en/media-centre/pr/2011/pdfs/pr208_E.pdf

Article titled Smart Meter Dangers, Who Knew and Did Not Sound the Alarm? April 20, 2016.

Commonwealth Edison (ComEd) is pushing for the deployment of 4,000,000 smart meters despite the fact that government agencies and the military have known for decades that Radio Frequency/microwaves can cause serious health effects.

The RF/microwave emissions from smart meters are listed by the World Health Organization's International Agency for Research on Cancer 'IARC' as a Class 2B Carcinogen. That makes this the first time in history a known carcinogen has been mandated on ALL homes, schools, and government buildings.

Barrier Trower, a retired British Secret Service Microwave Weapons specialist, states:

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Trower continues, **“By 1971, we knew everything that needed to be known.”** [See the 1971 report by the Naval Medical Research Institute (NMRI), included after this article]

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ComEd smart meters contain two transmitters emitting high-intensity pulsed signals every few seconds in two frequencies within the “most harmful” range mentioned by Flynn. One frequency is 900 MHz used for the wireless network that relays data from the smart meter on one house to the smart meter on another house and then on to a collector which sends the data to ComEd. The second frequency, 2.45 GHz, is used for appliances inside the house to transmit data to the smart meter.

It is these around-the-clock, high-intensity pulses within the frequency range “most harmful” to humans that make smart meters so damaging. Consider 4,000,000 ComEd smart meters blanketing Illinois with billions of pulses in these frequencies being emitted every day, forever.

In the late 1980s, the EPA radiation division, staffed with practicing biologists and epidemiologists, decided on a safe limit for human exposure. Before the announcement was made, industry intervened, federal funding for that division of the EPA was cut, and the FCC was given the task of setting the RF/microwave guidelines for the public. The FCC, made up of bureaucrats and engineers, had no experience or training in setting “health related” guidelines. Therefore, from the beginning, FCC guidelines were set at a limit that was too lenient to protect the general population.

Government agencies respond to the FCC guidelines

- Environmental Protection Agency (EPA), 1990: “FCC exposure standards are seriously flawed.” In fact, 40 EPA scientists released a 393-page report titled, “An Evaluation of the Potential Carcinogenicity of Electromagnetic Fields (EMF’s)”, which proposed classifying EMF’s as a “probable” carcinogen and Radio Frequency and microwave radiation as a “possible” carcinogen.

- Food and Drug Administration (FDA), 1993: “FCC rules do not address the issue of long-term chronic exposure to Radio Frequency fields. Data strongly suggests that RF/microwaves can accelerate the development of cancer.”
- National Institute for Occupational Safety and Health (NIOSH)—a division of the Center for Disease Control (CDC), 1994: “FCC’s standard is inadequate because it is only based on adverse health effects caused by body tissue heating (which means thermal).”
- U.S. Consumer Affairs Commission, 1999: “Current thermal guidelines associated with Electromagnetic Radiation (EMR) are irrelevant. Cancer and Alzheimer’s are associated with non-thermal EMR effects.”
- Environmental Protection Agency, 2002: “FCC’s current Radio Frequency/microwave exposure guidelines are thermally based, and do not apply to chronic, non-thermal exposure situations.” Norbert Hankin, Director, Radiation Protection Division

Which authorities knew or should have known of RF/microwave harm?

The U.S. military and intelligence agencies: As early as the 1950’s, the military and intelligence agencies were aware of the health effects from RF/microwaves. From 1,000 classified studies, it was apparent that even low-level RF/microwaves could create bio-effects that could be used to disrupt the enemy in covert, or battlefield operations. RF/microwaves could be utilized to create confusion, slow reaction time, create nausea, and shock adversaries in the field.

NASA: This space agency has been studying the health effects for years to facilitate protection from electromagnetic radiation for astronauts traveling in space.

Government Health Departments: These departments are charged with protecting public health and have a responsibility to keep up on studies. At this time, there are thousands of peer-reviewed studies showing adverse biological and health effects.

The Department of Energy: It is the duty of this agency to investigate negative health effects before launching such an expansive national project. No health data was considered before deployment of billions of smart meters in wireless networks.

The World Health Organization: In 2011 the International Agency for Research on Cancer ‘IARC’ categorized Radio Frequency emissions from all wireless devices as a Class 2B Carcinogen. ComEd’s wireless smart meters fall into this category. Although the IARC classification has been known for five years, the deployment of 4,000,000 ComEd smart meters is still being mandated.

The Telecom executives: Two decades ago Dr. George Carlo, who was in charge of the Wireless Technology Research (WTR) project in 1993 informed the Telecom executives. He reported the results of the research which revealed an alarming increase in tumors and many other health related problems.

Lloyd’s of London: This well-known insurance underwriter now specifically “excludes liability coverage for claims directly or indirectly resulting from electromagnetic radiation and illnesses caused by continuous, long-term, (non-thermal) radiation exposure.” ComEd’s wireless smart meters will inflict continuous, long-term, (non-thermal) radiation exposure on all life forms.

What scientists recognize about “the emerging public health crisis”

The International EMF Scientist Appeal has been signed by 190 scientists from 39 nations. These scientists have collectively published over 2,000 peer-reviewed papers on the biological or health effects of non-thermal radiation and are calling upon the United Nations, World Health Organization, and UN member states to:

1. Address the emerging public health crisis related to wireless devices, wireless utility meters [smart meters] and wireless infrastructure.
2. Urge that UN Environmental Program initiate an assessment of current exposure standards [in order] to substantially lower human exposures to non-thermal radiation.
3. Take a planetary view of potential for harm that EMF pollution presents to biology—the evolution, health, well-being and very survival of all living organisms worldwide.

They knew, they did not tell us, where do we go from here?

Flynn’s summary on smart meter dangers:

“Pulsed non-thermal radiation, which is emitted by smart meters, is far more damaging at the body’s cellular level to all life forms than any other technology ever devised by man. Militaries of the world have known for more than 50 years that RF/microwaves are the perfect weapon. Today, democratic governments are knowingly and callously authorizing untested (for safety) smart meters to operate (emitting pulsed non-thermal radiation) at the most lethal frequencies known to man.”

Source: <http://blog.heartland.org/2016/04/smart-meter-dangers-who-knew-and-did-not-sound-the-alarm/>

Health Effects of Radiofrequency Radiation in a report from the Naval Medical Research Institute (NRMI), October 4, 1971.

From a 1971 report by the Naval Medical Research Institute (NRMI) titled:

Biography of Reported Biological Phenomena (Effects) and Clinics Manifestations Attributed to Microwave and Radiofrequency Radiation

This report lists numerous health effects caused by radiofrequency (RF) radiation and includes references to more than 2,300 published research papers on the biological responses to radiofrequency and microwave radiation. Here is a partial list:

- Heating of organs (skin, bone, genitalia, brain, sinuses, metal implants)
- Changes in physiologic function (muscle contraction, alteration of diameter of blood vessels, changes in oxidative processes, liver enlargement, decreased sperm, altered menstrual activity and fetal development, decreased lactation, increased electrical resistance of skin, altered blood flow rate, EKG changes, sensitivity to light, sound and olfactory stimuli, changes in the eyes, necrosis, hemorrhage in lungs, liver, gut and brain, degeneration of body tissue, loss of anatomical parts, dehydration, death)

- Central nervous system (headaches, insomnia, restlessness, EEG changes, cranial nerve disorders, vagomimetic action of the heart, seizures, convulsions)
- Autonomic nervous system (fatigue, neuro-vegetative disorders, structural alterations in the synapses of the vagus nerve, inhibition of the sympathetic nervous system)
- Peripheral nervous system (effects on locomotor nerves)
- Psychological disorders (depression, impotence, anxiety, lack of concentration, dizziness, insomnia, loss of memory, chest pain, tremor of the hands)
- Behavioral changes (reflexive, operant, avoidance and discrimination behaviors)
- Blood disorders (changes in blood, bone marrow, hemolysis, sedimentation rate, blood glucose concentration, cholesterol and lipids, number of eosinophils, albumin/globulin ratio)
- Vascular disorders (thrombosis, hypertension)
- Enzyme and other biochemical changes (changes in activity of cholinesterase, phosphatase, transaminase and amylase, protein denaturation; toxin, fungus and virus inactivation; tissue cultures killed, alteration in rate of cell division, increase concentration of RNA in lymphocytes and decreased concentration in brain, liver and spleen)
- Metabolic disorders (sugar in urine, increase in urinary phenol, alteration of rate of metabolic enzymatic processes)
- Gastro-intestinal disorders (anorexia, loss of appetite, epigastric pain, constipation, altered secretion of stomach digestive juices)
- Endocrine gland changes (altered pituitary function, hyperthyroidism, thyroid enlargement, increased uptake of radioactive iodine by thyroid gland, altered adrenal cortex activity, decreased corticosteroids in blood, hypogonadism)
- Histological changes (changes in tubular epithelium of testicles, gross changes)
- Genetic and chromosomal changes (chromosome aberrations, mutations, mongolism, somatic alterations, tumors)
- Pearl chain effect (intracellular orientation of subcellular particles and orientation of cellular and other non-biologic particles)
- Miscellaneous effects (sparking between dental fillings; metallic taste in mouth; changes in optical activity; loss of hair; brittleness of hair; sensations of buzzing, vibrations, pulsations about the head and ears; copious perspiration, salivation and protrusion of tongue; changes in the operation of implanted cardiac pacemakers; changes in circadian rhythms)

Source: http://www.magdahavas.com/wordpress/wp-content/uploads/2010/06/Navy_Radiowave_Brief.pdf

Expert Witnesses Used by Utility Companies

Utility companies used "expert witnesses" to support their claims that smart meters are not harmful. One of the organizations that provided "expert witness" testimony is a company called Exponent.

It is well known throughout the world that Exponent is a "bought and paid for" expert witness firm used by corporations to deny the health effects caused by their products.

Here are two excerpts from the book:

The practices perfected (by the tobacco industry) are alive and well and ubiquitous today. We see this growing trend that disingenuously demands proof over precaution in the realm of public health. In field after field, year after year, conclusions that might support regulation are always disputed. Animal data are deemed not relevant, human data not representative, and exposure data not reliable. Whatever the story—global warming, sugar and obesity, secondhand smoke—scientists in what I call the “product defense industry” prepare for the release of unfavorable studies even before the studies are published. Public relations experts feed these for-hire scientists contrarian sound bites that play well with reporters, who are mired in the trap of believing there must be two sides to every story. Maybe there are two sides—and maybe one has been bought and paid for.

Having cut their teeth manufacturing uncertainty for Big Tobacco, scientists at ChemRisk, the Weinberg Group, Exponent, Inc., and other consulting firms now battle the regulatory agencies on behalf of the manufacturers of benzene, beryllium, chromium, MTBE (methyl tertiary-butyl ether), perchlorates, phthalates, and virtually every other toxic chemical in the news today. Their business model is straightforward. They profit by helping corporations minimize public health and environmental protection and fight claims of injury and illness. In field after field, year after year, this same handful of individuals and companies comes up again and again.

As David Michaels said in his book:

Exponent’s scientists are prolific writers of scientific reports and papers. While some may exist, I have yet to see an Exponent study that does not support the conclusion needed by the corporation or trade association that is paying the bill.

To learn more about Exponent, read the book "Doubt is Their Product" by David Michaels.

Because Exponent is a product defense firm with a decades-long history of writing reports that support the position of corporations who are looking to deny the health effects of their products, their testimony should not have been allowed.

Source: <http://www.globalindoorhealthnetwork.com/smart-meters>

Comments from Dr. Vini G. Khurana, Associate Professor of Neurosurgery, June 11, 2012, article titled "Smart Meters: Correcting the Gross Misinformation."

Adverse neurological effects have been reported in people who sustain close proximity to wireless meters, especially under 10 feet (3 metres).

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

Wireless smart meters typically produce atypical, relatively potent and very short pulsed RF/microwaves whose biological effects have never been fully tested. They emit these millisecond-long RF bursts on average 9,600 times a day with a maximum of 190,000 daily transmissions and a peak level emission two and a half times higher than the stated safety signal, as the California utility Pacific Gas & Electric recognized before that State's Public Utilities Commission. Thus people in proximity to a smart meter are at risk of significantly greater aggregate of RF/microwave exposure than with a cell phone, not to mention the cumulative exposure received by people living near multiple meters mounted together, pole-mounted routers or utility collector meters using a third antenna to relay RF signals from 500 to 5,000 homes.

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

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

Source: <http://www.stopsmartmetersbc.com/letters/smart-meters-correcting-the-gross-misinformation-david-carpenter-full/>

Report titled "Cell Phone Radiation Study Confirms Cancer Risk," Orebro University, Sweden. May 31, 2016.

Cell phones are harmful and cause cancer.

The National Toxicology Program under the National Institutes of Health has completed the largest-ever animal study on cell phone radiation and cancer. The results confirm that cell phone radiation exposure levels within the currently allowable safety limits are the “likely cause” of brain and heart cancers in these animals, according to Dr. John Bucher, Associate Director of the NTP. One in twelve (12) male rats developed either malignant cancer (brain and rare heart tumors) or pre-cancerous lesions that can lead to cancer. Tumors called schwannomas were induced in the heart, in the same kind of cells in the brain that have led to acoustic neuromas seen in human studies. The NTP says it is important to release these completed findings now given the implications to global health. No cancers occurred in the control group.

Lennart Hardell, MD, PhD of Orebro University says “(T)he animal study confirms our findings in epidemiological studies of an increased risk for glioma and acoustic neuroma among people that use wireless phones, both cell phones and cordless phones (DECT). Acoustic neuroma is a type of Schwannoma, so interestingly this study confirms findings in humans of increased risk for glioma and acoustic neuroma.

In 2013 we called for upgrading the risk in humans to Group 1, the agent is carcinogenic to humans. It is now time to re-evaluate both the cancer risk and other potential health effects in humans from radiofrequency radiation and also inform the public.” says Hardell. “This NTP evidence is greatly strengthening the evidence of risk, is sufficient to reclassify cell phone radiation as a known cancer-causing agent, and confirms the inadequacy of existing public safety limits.”

The World Health Organization’s 10-year study of human use of mobile phones concluded there is an increased risk for malignant brain tumors among the heavier mobile phone users, particularly where it is used mostly on one side of the head. The 2010 Interphone mega-study of cancer in humans using mobile phones found higher cancer risk, but at that time there was little animal testing to support the risks identified in humans.

Now, this NTP study has shown statistically significant risks with a dose-response relationship to the amount of exposure. It proves that non-ionizing radiation can plausibly cause cancer, not just ionizing radiation like x-rays and puts to rest the traditional scientific argument that cell phone radiation can’t do harm.

Dr. Bucher said the animals’ exposure was about the same as for people who are heavy users of cell phones. He also confirmed that the exposure of 1.5 W/Kg is lower than currently allowed under FCC public safety limits. Testing on rats is standard in predicting human cancers.

The BioInitiative Report (2014) documents nervous system effects in 68% of studies on radiofrequency radiation (144 of 211 studies). This has increased from 63% in 2012 (93 of 150 studies). Genetic effects (damage to DNA) from radiofrequency radiation is reported in 65% (74 of 114 studies); and 83% (49 of 59 studies) of extremely-low frequency studies.

Dr. Christopher Portier, formerly with the NTP commented this is not just an associated finding—but that the relationship between radiation exposure and cancer is clear.

"I would call it a causative study, absolutely. They controlled everything in the study. It’s [the cancer] because of the exposure. This is by far—far and away—the most carefully done cell phone bioassay, a biological assessment. This is a classic study that is done for trying to understand cancers in humans."

Metabolic and Genetic Screening of Electromagnetic Hypersensitive Subjects as a Feasible Tool for Diagnostics and Intervention, De Luca, C, et al. Mediators of Inflammation, Volume 2014, Article ID 924184, 14 pages.

Growing numbers of “electromagnetic hypersensitive” (EHS) people worldwide self-report severely disabling, multi-organ, non-specific symptoms when exposed to low-dose electromagnetic radiations, often associated with symptoms of multiple chemical sensitivity (MCS) and/or other environmental “sensitivity-related illnesses” (SRI). This cluster of chronic inflammatory disorders still lacks validated pathogenetic mechanism, diagnostic biomarkers, and management guidelines. We hypothesized that SRI, not being merely psychogenic, may share organic determinants of impaired detoxification of common physico-chemical stressors. Based on our previous MCS studies, we tested a panel of 12 metabolic blood redox-related parameters and of selected drug-metabolizing-enzyme gene polymorphisms, on 153 EHS, 147 MCS, and 132 control Italians, confirming MCS altered -0.0001 glutathione-(GSH), GSH-peroxidase/S-transferase, and catalase erythrocyte activities. We first described comparable—though milder—metabolic pro-oxidant/proinflammatory alterations in EHS with distinctively increased plasma coenzyme-Q10 oxidation ratio. Severe depletion of erythrocyte membrane polyunsaturated fatty acids with increased $\omega 6/\omega 3$ ratio was confirmed in MCS, but not in EHS. We also identified significantly altered distribution-versus-control of the CYP2C19*1/*2 SNP variants in EHS, and a 9.7-fold increased risk (OR: 95% C.—74.5) of developing EHS for the haplotype (null)GSTT1 + (null)GSTM1 variants. Altogether, results on MCS and EHS strengthen our proposal to adopt this blood metabolic/genetic biomarkers’ panel as suitable diagnostic tool for SRI.

Source: <https://www.hindawi.com/journals/mi/2014/924184/>

Report by the Parliamentary Assembly, Council of Europe. The Potential Dangers of Electromagnetic Fields and Their Effect on the Environment. May 2011.

Excerpts from the report:

4. Non-ionising frequencies, whether from extremely low frequencies, power lines or certain high frequency waves used in the fields of radar, telecommunications and mobile telephony, appear to have more or less potentially harmful, non-thermal, biological effects on plants, insects and animals as well as the human body, even when exposed to levels that are below the official threshold values.

5. As regards standards or threshold values for emissions of electromagnetic fields of all types and frequencies, the Assembly strongly recommends that the ALARA (as low as reasonably achievable) principle is applied, covering both the so-called thermal effects and the athermic or biological effects of electromagnetic emissions or radiation. Moreover, the precautionary principle should be applied when scientific evaluation does not allow the risk to be determined with sufficient certainty. Given the context of growing exposure of the population, in particular that of vulnerable groups such as young people and children, there could be extremely high human and economic costs if early warnings are neglected.

6. The Assembly regrets that, despite calls for the respect of the precautionary principle and despite all the recommendations, declarations and a number of statutory and legislative advances, there is still a lack of reaction to known or emerging environmental and health risks and virtually systematic delays in adopting and implementing effective preventive measures. Waiting for high levels of scientific and clinical proof before taking action to prevent well-known risks can lead to very high health and economic costs, as was the case with asbestos, leaded petrol and tobacco.

In light of the above considerations, the Assembly recommends that the member states of the Council of Europe:

8.1. in general terms:

8.1.1. take all reasonable measures to reduce exposure to electromagnetic fields, especially to radio frequencies from mobile phones, and particularly the exposure to children and young people who seem to be most at risk from head tumours;

8.1.2. reconsider the scientific basis for the present standards on exposure to electromagnetic fields set by the International Commission on Non-Ionising Radiation Protection, which have serious limitations, and apply ALARA principles, covering both thermal effects and the athermic or biological effects of electromagnetic emissions or radiation;

8.1.3. put in place information and awareness-raising campaigns on the risks of potentially harmful long-term biological effects on the environment and on human health, especially targeting children, teenagers and young people of reproductive age;

8.1.4. pay particular attention to “electrosensitive” people who suffer from a syndrome of intolerance to electromagnetic fields and introduce special measures to protect them, including the creation of wave-free areas not covered by the wireless network;

8.1.5. in order to reduce costs, save energy, and protect the environment and human health, step up research on new types of antenna, mobile phone and DECT-type device, and encourage research to develop telecommunication based on other technologies which are just as efficient but whose effects are less negative on the environment and health;

8.2. concerning the private use of mobile phones, DECT wireless phones, WiFi, WLAN and WIMAX for computers and other wireless devices such as baby monitors:

8.2.1. set preventive thresholds for levels of long-term exposure to microwaves in all indoor areas, in accordance with the precautionary principle, not exceeding 0.6 volts per metre, and in the medium term to reduce it to 0.2 volts per metre;

8.2.2. undertake appropriate risk-assessment procedures for all new types of device prior to licensing;

8.2.3. introduce clear labelling indicating the presence of microwaves or electromagnetic fields, the transmitting power or the specific absorption rate (SAR) of the device and any health risks connected with its use;

8.2.4. raise awareness on potential health risks of DECT wireless telephones, baby monitors and other domestic appliances which emit continuous pulse waves, if all electrical equipment is left permanently on standby, and recommend the use of wired, fixed telephones at home or, failing that, models which do not permanently emit pulse waves;

8.3. concerning the protection of children:

8.3.1. develop within different ministries (education, environment and health) targeted information campaigns aimed at teachers, parents and children to alert them to the specific risks of early, ill-considered and prolonged use of mobiles and other devices emitting microwaves;

8.3.2. for children in general, and particularly in schools and classrooms, give preference to wired Internet connections, and strictly regulate the use of mobile phones by schoolchildren on school premises;

Source: <http://assembly.coe.int/nw/xml/XRef/Xref-XML2HTML-en.asp?fileid=17994>

Guideline of the Austrian Medical Association for the Diagnosis and Treatment of EMF-Related Health Problems and Illnesses. EMF Syndrome. 2012.

This report provides guidance to physicians who are treating patients with EMF-related health problems. It starts with a comprehensive patient history and assessment of their exposure to EMF.

It also lists specific diagnostic tests that should be performed including laboratory tests, 24-hour ECG, 24-hour heart rate variability, blood, urine, saliva, etc. and treatment protocols.

We recommend that the code Z58.4 (Exposure to radiation) under the International Classification of Diseases (ICD-10) be used for EMF syndrome.

The report also provides information on prevention or reduction of EMF exposure.

Source: <http://www.magdahavas.com/wordpress/wp-content/uploads/2012/06/Austrian-EMF-Guidelines-2012.pdf>

Article titled Smart Meters: Correcting the Gross Misinformation. Letter from David O. Carpenter (former founding dean of the University of Albany, New York, School of Public Health, and more than fifty international experts in response to a May 24, 2012, saying that wireless smart meters pose no risk to public health. June 11, 2012.

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

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

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

phone who have been exposed to microwaves for at least ten years. Children and youths are especially vulnerable (2). For example, the 2009 Hardell-Carlberg study reported a consistent association between use of mobile or cordless phones and two types of head tumors, astrocytoma grade I-IV and acoustic neuroma. The authors found an especially high risk for persons that started use of mobile or cordless phones before the age of 20 years, although based on low numbers ».

Brain Cancer Rates

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

In May 2011, after reviewing the published scientific literature regarding cancers affecting cell phone users, the International Agency for Research on Cancer (IARC) classified radiofrequency radiation as a 2B, possible human carcinogen. Despite the absence of scientific consensus, the evidence is sufficiently compelling for any cautious parent to want to reduce their loved one's exposure to RF/microwave emissions as much as possible, as recommended by various countries such as Austria, Belgium, Germany, Russia and the United Kingdom.

Electrosensitivity

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

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

While there is no consensus on the origins and mechanisms of EHS, many physicians and other specialists around the world have become aware that EHS symptoms (neurological dermatological, acoustical, etc.) seem to be triggered by exposure to EMF levels well below current international exposure limits, which are established solely on short-term thermal effects (3). Organizations such as the Austrian Medical Association and the American Academy of Environmental Medicine have recognized that the ideal way to treat of EHS is to reduce EMF exposure.

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

Well-known bioeffects

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

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

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

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

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

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

Early warning scientists attacked

In recommending that the Precautionary Principle be applied in EMF matters, the European Environment Agency's Director Jacqueline McGlade wrote in 2009: “We have noted from previous health hazard histories such as that of lead in petrol, and methyl mercury, that ‘early

warning' scientists frequently suffer from discrimination, from loss of research funds, and from unduly personal attacks on their scientific integrity. It would be surprising if this is not already a feature of the present EMF controversy... » Such unfortunate consequences have indeed occurred.

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

Smart meters

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

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

Wireless smart meters typically produce atypical, relatively potent and very short pulsed RF/microwaves whose biological effects have never been fully tested. They emit these millisecond-long RF bursts on average 9,600 times a day with a maximum of 190,000 daily transmissions and a peak level emission two and a half times higher than the stated safety signal, as the California utility Pacific Gas & Electric recognized before that State's Public Utilities Commission. Thus people in proximity to a smart meter are at risk of significantly greater aggregate of RF/microwave exposure than with a cell phone, not to mention the cumulative exposure received by people living near multiple meters mounted together, pole-mounted routers or utility collector meters using a third antenna to relay RF signals from 500 to 5,000 homes.

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

In addition to the erratic bursts of modulated microwaves emitted by wireless smart meters transferring usage data to electric, gas and water utilities, wireless as well as wired smart (powerline communication) meters are also a major source of "dirty electricity" (electrical interference of high frequency voltage transients typically of kilohertz frequencies). Some

scientists, such as American epidemiologist Sam Milham, believe that many of the health complaints about smart meters may also be caused by dirty electricity generated by the « switching » power supply activating all smart meters. Since the installation of filters to reduce dirty electricity circulating on house wiring has been found to relieve symptoms of EHS in some people, this method should be considered among the priorities aimed at reducing potential adverse impacts. Indeed, the Salzburg State (Austria) Public Health Department confirms its concern about the potential public health risk when in coming years almost every electric wire and device will emit such transient electric fields in the kilohertz-range due to wired smart meters.

Rather be safe than sorry

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

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

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

Source: <http://www.stopsmartmetersbc.com/letters/smart-meters-correcting-the-gross-misinformation-david-carpenter-full/>

Report by Richard H. Conrad, Ph.D. Biochemist. For Legislators on Wireless Smart Meters: Health and Safety Issues, May 12, 2014.

I am well qualified to write about this subject because I have a Ph.D. in biochemistry from Johns Hopkins University and did postdoctoral research at the Institute of Molecular Biophysics of Florida State University and in the Department of Biochemistry of Cornell University. I have ten U.S. Patents, including three for electronic devices. I am the main author of a “Smart Meter Health Effects Survey,” and am an expert witness in the Maine, USA smart meters case where the Judge ruled that the Maine PUC must demonstrate that the smart meter system already deployed in that state is safe for human health.

Excerpts from Dr. Conrad’s report:

The pulsed microwave emissions from wireless smart meters being used in grid modernization systems result in involuntary household microwave exposure, and:

- are not adequately regulated by the FCC (this has been confirmed by the EPA)
- have been classified as a possible human carcinogen by the WHO

- have not been tested for human safety
- have been the cause of unusual and severe insomnia, headaches, tinnitus and heart arrhythmias in thousands of persons
- peer-reviewed research publications from all over the world have shown that similar emissions have potentially hazardous effects
- smart meters utilizing wireless communications present an extremely dangerous combination of open portals, wireless hacking, power cutoff switches and adverse health effects
- safe alternatives do exist.

From the EPA: “The FCC's current (radio frequency/microwave) exposure guidelines, as well as those of the Institute of Electrical and Electronics Engineers (IEEE) and the International Commission on Non-ionizing Radiation Protection, are thermally based, and do not apply to chronic, non-thermal exposure situations.....the generalization by many that the guidelines protect human beings from harm by any or all mechanisms is not justified.” Norbert Hankin of the EPA’s Office of Air and Radiation, Center for Science and Risk Assessment, Radiation Protection Division, July 16, 2002.

The FCC’s guidelines can show a device to be unsafe, but cannot prove that a device is safe. Non-thermal levels of exposure are simply not regulated by the FCC. There are thousands of peer-reviewed studies showing potentially harmful biological effects of non-thermal levels of microwave radiation. Some of these studies were done with humans, and most were on mammals with nervous systems and biochemistry nearly identical to humans. The sheer volume of these studies is cause to strongly infer human risk until proven otherwise, especially since some of the studies done directly on humans do show harm. Furthermore, the World Health Organization has classified low level non-thermal microwave emissions, specifically including that emitted by (wireless) smart meters, as a possible human carcinogen.

No research or testing has been done on the effects of smart meter emissions on humans, with the exception of three different surveys which report human sensitization to smart meter emissions resulting in unusual and severe: insomnia, headaches, tinnitus and heart arrhythmias.

Opting out is not a solution. Even if a homeowner is allowed to opt out, they are still involuntarily irradiated 24/7 by neighbors’ smart meters, especially when there are whole banks of smart meters nearby.

Most PUCs and utilities have accepted the propaganda that has been fed to them. This propaganda is not merely biased, but includes willful omissions of facts, misleading claims and statements that are not true.

Emission from Wireless Smart Meters is Classified a Group 2B Human Carcinogen The World Health Organization’s International Agency for Research on Cancer (IARC) has classified microwave radiation, specifically including that emitted by smart meters, as a Group 2B human carcinogen. This means that in order to continue to receive electrical power, people are forced to live with a device on their homes that emits possibly carcinogenic microwaves 24/7. The public remains unprotected, and at the mercy of industry’s rapidly proliferating technology.

Industry’s Propaganda

Industry has woven a superficially convincing propaganda network of extremely dishonest hype. Their spin includes such statements as: “there are no harmful non-thermal effects”. But research strongly suggests otherwise. From Itron literature: “The total RF exposure from multiple meters in meter banks is effectively no greater than that of a single meter”. This is absolutely incorrect. Itron also writes that smart meters do not emit “pulsed RF”, rather they transmit “packets”. But they are RF pulses nonetheless. PG&E has said “SmartMeters communicate intermittently. These intermittent signals total, on average, 45 seconds per day. For the other 23 hours and 59 minutes of the day, the meter is not transmitting any RF.” This is misleading because numerous pulses are emitted every minute around the clock, and PG&E was forced to admit to about 10,000 pulses per day on average, with some smart meters emitting up to a maximum of 190,000 pulses per day (which when divided by the number of minutes in a day equals over 100 pulses per minute).

You may hear arguments from the IEEE and industry that the microwave emissions from wireless smart meters are so minuscule they are insignificant compared to ambient Wi-Fi and cell phone signals. But in fact smart meters are turning out to be one of the strongest sensitizers of Electrical Sensitivity (see “Adverse Health Effects” below). Industry’s comparison charts of RF energy levels emitted from smart meters versus cell phones and other devices pretend to show that cell phones cause up to 500 times more exposure than smart meters. The levels reported are false [5], as well as their claim of “natural RF from the human body” (no radio frequencies are emitted by the body).

Industry proclaims repeatedly: “smart meters are safe”. This statement parrots what certain agencies such as the WHO have said on the basis of what the IEEE and FCC have said; the latter are engineers not biologists, and have done no research. Industry claims: “Scientific study from credible third party health and research organizations has shown that smart meters are safe.” But there has never been any smart meter testing on animals or humans, not by anyone.

The old analog electromechanical meters emit no RF, are safe, secure, private, accurate, efficient and reliable and should be the reference standard that any new system should match or exceed in all its parameters.

Adverse Health Effects

Wireless smart meters and wireless mesh systems do affect human biology and health. See articles by Ronald M. Powell, Ph.D. in applied physics [7], [8], [9]. In most places they are installed, wireless smart meters create a minor epidemic of Electrical Sensitivity (ES) [2], [10], [11]. ES is a kind of physical allergy to electromagnetic fields (EMF). Smart meters seem to be the worst of the sensitizers that initiate ES in previously normal people. We don’t know why yet because there has been no research, but what causes sensitization may not be the intensity of the microwave signal, but its particular type of pulsing and modulation (see “The Devil may be in the Details” in the Notes section at the end of this article). After the initial sensitization, smart meter exposure continues to re-trigger disabling symptoms, including unusual and severe: insomnia, headaches, tinnitus, heart arrhythmias and other symptoms characteristic of ES. Because of these symptoms, persons who develop ES cannot any longer use Wi-Fi or the cell phones they need for their work. Nor is it possible for most of them to remain productive members of society, or even to find a place that is safe for them to live. Many are astute professional people, including Ph.D.s, M.D.s, engineers and programmers. They want to work.

From the few studies that have been done on humans, pulses similar to that from smart meters cause changes in brainwaves even in persons without ES [12]. From thousands of biological studies on the effects of low levels of EMF [4], it is highly likely that emissions from smart

meters affect even the general population. The most noticeable effects in the short-term may be anxiety and insomnia. Also likely are subliminal changes in neuropsychological functions, leakage of the blood-brain barrier, increased oxidative damage including DNA breakage, and susceptibility to auto-immune diseases and cancer.

Safeguards

There has been an enormous amount of deception by smart meter manufacturers, utilities and installers, and also strong-arm tactics on the part of utilities and installers: using the police to force installation in Naperville (Illinois) and arresting homeowners who resisted; disregarding City Council bans on smart meters in California and continuing to install; disguising a smart meter as a mechanical analog meter; cutting off a homeowner's power if they refuse a smart meter or refuse to pay opt-out fees or if they re-install their own analog meter etc. Therefore safeguards to prevent these violations of human rights must be included in legislation.

Excerpts from the Conclusion

To any honest scientist who reads the research literature, especially the results of European studies, it becomes clear that non-thermal levels of pulsed microwaves definitely pose a risk to human beings. Many non-thermal effects have been found that should raise red flags, but instead these are ignored by our regulatory bodies as if they simply do not exist.

The smart meter industry and utilities are playing a shell game with the facts, and you are the ones who can call them on it.

Source: <http://www.conradbiologic.com/articles/letter-for-legislators-on-wireless-smart-meters.html>

Report by Richard H. Conrad, Ph.D. Biochemist. Exhibit D: Smart Meter Health Effects Survey and Report.

Cell Phone, Computer and WiFi Use Before and After Smart Meters

In order to ascertain the effect smart meter installation had on respondents' ability to use common electronic devices: cell phones, wifi and computers, we looked at device use before and after smart meters. We found very clear evidence that smart meter exposure adversely affected respondents' ability to use other RF devices without incurring harmful symptoms. In the survey, computer use is addressed in questions 4 and 29, wifi in questions 5 and 30 and cell phones in questions 6 and 31 (Appendix 7).

Computer Use:

Before smart meters, nearly 79% of respondents were using computers without symptoms while about 20% were using computers despite having symptoms from computer use. Following smart meter exposure, those able to operate a computer without symptoms dropped (from 79%) to 39% (about one-half of before), while those showing symptoms from computer use nearly tripled (from 20%) to 57%.

WiFi Use:

Before smart meters, about 40% of respondents were using wifi without symptoms. 11% were using wifi but with symptoms from it, and 17% were not using wifi because it had caused symptoms in the past. Following smart meter exposure, those able to use wifi without symptoms dropped (from 40%) to 18% (less than one-half of before) while those continuing to use wifi but with symptoms from it nearly tripled (from 11%) to 28%. The number of respondents who could not use wifi at all because of symptoms more than doubled (from 17%) to 41%.

Cell Phone Use:

Before smart meters 50% of respondents were using cell phones without symptoms, while 18% used cell phones but with symptoms. 14% of respondents did not use cell phones because of symptoms. Following smart meters, those able to use cell phones without symptoms dropped (from 50%) to 24% (about one-half of before), and those with symptoms from cell phone use more than doubled (from 18%) to 39%. After smart meters, those who did not use cell phones at all because of symptoms nearly doubled (from 14%) to 26%.

Obviously the inability to use these modern tools severely inhibits our respondents in their personal and economic lives. Their ability to live normal lives in the 21st century has been severely compromised. This change in ability to use these devices is directly correlated to smart meter exposure.

Source: <http://www.mainecoalitiontostopsmartmeters.org/wp-content/uploads/2013/01/Exhibit-10-Smart-Meter-Health-Effects-Report-Survey2.pdf>

Comments from Dr. William Rea, Thoracic and Cardiovascular Surgeon, Environmental Medicine. WEEP News article, January 31, 2012.

Dr. William Rea shared insights about electrical hypersensitivity gleaned from nearly thirty years of working with environmentally ill patients.

Rea opened by saying that human beings are all antennas with different levels of sensitivity, and finding safe places for sensitive people is like trying to "reinvent the cave."

He has observed a high correlation with sensitivity to metals like zinc, copper, stainless steel, titanium, molybdenum, manganese, and magnesium. Metal implants like dental fillings, metal jaws, shoulder joints, etc. will contribute to electrical sensitivity, because they act as antennas.

Source: <http://weepnews.blogspot.com/2012/01/weep-news.html>

A Critical Review of Smart Grid Industry Comparisons of Cell Phones with Smart Meters, February 7, 2014.

When you want to promote the safety of a product, it is common to compare the relative safety of "your" product as compared with other similar products. Unfortunately, you are sometimes forced to compare "apples with oranges" in these endeavors and depending on your level of bias and the assumptions that you make, two different organizations can arrive at completely different

versions of reality. Such is the case where the smart grid industry has compared smart meter radiofrequency (RF) emissions with those of other common wireless devices in use by our society. Usually the most extreme comparison made is between smart meter exposures and cell phone exposures.

This blog posting will demonstrate, contrary to City of Naperville claims, that exposure to RF emissions from a smart meter over the course of a 24-hour period at distances of three (3) and ten (10) feet could easily exceed the exposure received from making a 3-minute cellular phone call.

It is also asserted that the analysis presented in this blog posting is significantly more appropriate (and objective) in terms of assessing potential health risks associated with smart meter exposures than anything you will find disseminated from smart grid industry sources.

City of Naperville Comparison Between Cell Phones and Smart Meters

The Public Utility Commission of Texas (PUCT) issued a report in December 2012 that purports to address concerns over the potential health effects of exposure to the radiofrequency emissions from the wireless technology of advanced metering. Page 43 of that report highlights the fact that the City of Naperville, Illinois, has issued a public relations flyer that states:

“...a person sitting 10 feet in front of their smart meter would have to be there for more than 100 years to receive the same RF energy that they would receive from a 3-minute cell phone call. If a person were sitting inside their home 3 feet from the back of a smart meter, they would have to be there for more than 200 years to receive the same RF energy as they would from a 3-minute cell phone call.”

Additionally, the City of Naperville documents assumptions in footnotes as follows:

1. Smart Meter Specification: duty cycle of 0.1%; 250 mW EIRP; maximum antenna gain in front of meter is 3.66; antenna gain drops by 20 times behind meter and inside the home.
2. Cell Phone Specification: duty cycle 45%; peak transmitter power after antenna is 600 mW EIRP; distance 1 cm.

The PUCT report characterizes the Naperville device comparisons as an attempt “to put RF EMF emissions from its smart meters into perspective.”

Technically Meaningless Comparisons and What Is Actually Relevant

First of all, the above Naperville comparison includes a false premise that assumes there is technical relevance in making a comparison between the “RF energy” of one type of device (a cell phone) with the “RF energy” of a totally different device such as a wireless smart meter. Such comparisons may be warranted when considering short-term thermal effects of radiofrequency (RF) exposure but are not likely of major significance when considering the possible effects of chronic exposure to pulsed RF radiation emitted from smart meters.

As described in The BioInitiative Report 2012: “There is increasing reason to believe that the critical factor for biologic significance is the intermittent pulse of RF, not the time-averaged SAR [specific absorption rate]. ... Real-world experience is revealing worrisome evidence that ... people can be adversely affected by placing new wireless pulsed RFR transmitters (utility meters on the sides or interiors of homes), even when the time-weighted average for RFR is miniscule.”

Due to evidence of observed biological effects from RF radiation at extremely low levels, The BioInitiative Report 2012 established precautionary action levels within the range of 0.0003 to 0.0006 microwatts/cm² for chronic exposure to pulsed RF radiation.

Finally, although one may perform an exercise in an attempt to compare possible exposures between a cell phone and a smart meter, the results of such calculations are nearly impossible to evaluate in terms of an “apples upon apples” comparison. A calculated exposure for a cell phone placed near the head is a localized exposure. The exposure calculated for a smart meter at a greater distance is more uniform in nature to the whole body. Thus, more surface area of the whole body is exposed to the RF field strength values calculated for the smart meter than is for the cell phone. For that reason, such calculations inherently underestimate the potential exposures due to wireless emissions from the smart meter (at least when plotted on the same graph with cell phone values representing localized exposures).

In actuality, based upon the appropriate and reasonable assumptions made as part of this analysis, one can conclude the following:

- A person can receive twice as much RF energy from exposure to a Naperville smart meter over the course of a day at a distance of 10 feet as compared to the localized exposure received from making a 3-minute cellular phone call.
- A person can receive 20 times more RF energy from exposure to a Naperville smart meter over the course of a day at a distance of 3 feet as compared to the localized exposure received from making a 3-minute cellular phone call.

Summary

It has been shown that the statements made by the City of Naperville regarding smart meter exposures and cell phones are based upon erroneous and inappropriate assumptions. Correcting those assumptions, the actual calculated field strength values in microwatts/cm² can be shown to be quite similar for the two types of devices. In fact, it has been demonstrated that the RF field strength values for a smart meter averaged over a period of 24 hours can well exceed the localized exposure received from intermittent cell phone use for that same 24 hour period. Beyond that, however, the comparisons are of little technical relevance since field strength intensity is only part of the information necessary to evaluate potential effects. Biological effects likely vary based upon frequency and modulation of a signal such that a very weak signal may have a significant biological effect.

Finally, it must be considered that mandated smart meter exposure is chronic and involuntary in nature. The smart meter field intensity values calculated in this paper exceed The BioInitiative 2012 Report action levels based upon the fact that they are pulsed and chronic in nature. It is one thing for an adult to engage in a voluntary 3-minute cell phone call. It is quite another to allow an infant child to sleep in a crib or live in a room (for an indefinite period of time) located a few feet from a wireless smart meter. Put another way, the pulsed and chronic RF emissions exposure from forced smart meter installations cannot be fairly compared to an individual's voluntary and intermittent use of a cell phone. Such a comparison represents deceptive industry spin.

To read more details, go to the following link:

Source: <https://smartgridawareness.org/2014/02/07/review-of-smart-meter-and-cell-phone-comparisons/>

American Academy of Environmental Medicine, Letter to the Federal Communications Commission, Request for review of radiofrequency exposure limits. August 30, 2013.

The American Academy of Environmental Medicine is writing to request that the FCC review radiofrequency (RF) exposure limits (reference is made to the FCC's NOI sections 48, 51, 52, 53, 56, 60, 65 and 69), recognize non-thermal effects of RF exposure (NOI sections 66 and 69), and lower limits of RF exposure to protect the public from the adverse health effects of radiofrequency emissions (NOI sections 48, 52, 54, 65 and 71).

It became clear to AAEM physicians that by the mid 1990's patients were experiencing adverse health reactions and disease as a result of exposure to electromagnetic fields. In the last five years with the advent of wireless devices, there has been an exponential increase in the number of patients with radiofrequency induced disease and hypersensitivity.

Numerous peer-reviewed, published studies correlate radiofrequency exposure with a wide range of health conditions and diseases. (NOI sections 54, 59, 60 and 65) These include neurological and neurodegenerative diseases such as Parkinson's Disease, ALS, paresthesias, dizziness, headaches and sleep disruption as well as cardiac, gastrointestinal and immune disease, cancer, developmental and reproductive disorders, and electromagnetic sensitivity. The World Health Organization has classified RF emissions as a group 2 B carcinogen. This research is reviewed and cited in the following attached documents: AAEM Electromagnetic and Radiofrequency Fields Effect on Human Health and AAEM Recommendations Regarding Electromagnetic and Radiofrequency Exposure.

The scientific literature proves that non-thermal adverse effects of RF exposure exist and negatively impact health and physiology. New guidelines based on measurements of non-thermal effects and lowering limits of exposure are needed and critical to protect public health.

In fact, electromagnetic sensitivity and the health effects of low level RF exposure have already been acknowledged by the federal government. In 2002, the Architectural and Transportation Barriers Compliance Board stated:

"The Board recognizes...electromagnetic sensitivities may be considered disabilities under the ADA if they so severely impair the neurological, respiratory or other functions on an individual that it substantially limits one or more of the individual's major life activities"

Additionally, in 2005, the National Institute of Building Sciences, an organization established by the U.S. Congress in 1974, issued an Indoor Environmental Quality Report which concluded:

"For people who are electromagnetically sensitive, the presence of cell phones and towers, portable telephones, computers... wireless devices, security and scanning equipment, microwave ovens, electric ranges and numerous other electrical appliances can make a building inaccessible."

By recognizing electromagnetic sensitivity, the federal government and affiliated organizations are clearly acknowledging the existence of non-thermal effects. The AAEM urges the FCC to recognize that non-thermal effects of RF exposure exist and cause symptoms and disease. (NOI sections 66 and 69) The AAEM also requests that the FCC base guidelines of RF exposure on

measurements of non-thermal effects and lower the limits of RF exposure to protect the health of the public. (NOI sections 48, 52, 54, 65 and 71).

Source: <https://aaemonline.org/pdf/FCCLtr.pdf>

American Academy of Environmental Medicine, Recommendations Regarding Electromagnetic and Radiofrequency Exposure. July 12, 2012.

Physicians of the American Academy of Environmental Medicine recognize that patients are being adversely impacted by electromagnetic frequency (EMF) and radiofrequency (RF) fields and are becoming more electromagnetically sensitive.

The AAEM recommends that physicians consider patients' total electromagnetic exposure in their diagnosis and treatment, as well as recognition that electromagnetic and radiofrequency field exposure may be an underlying cause of a patient's disease process.

Based on double-blinded, placebo controlled research in humans, medical conditions and disabilities that would more than likely benefit from avoiding electromagnetic and radiofrequency exposure include, but are not limited to:

- Neurological conditions such as paresthesias, somnolence, cephalgia, dizziness, unconsciousness, depression
- Musculoskeletal effects including pain, muscle tightness, spasm, fibrillation
- Heart disease and vascular effects including arrhythmia, tachycardia, flushing, edema
- Pulmonary conditions including chest tightness, dyspnea, decreased pulmonary function
- Gastrointestinal conditions including nausea, belching
- Ocular (burning)
- Oral (pressure in ears, tooth pain)
- Dermal (itching, burning, pain)
- Autonomic nervous system dysfunction (dysautonomia).

Based on numerous studies showing harmful biological effects from EMF and RF exposure, medical conditions and disabilities that would more than likely benefit from avoiding exposure include, but are not limited to:

- Neurodegenerative diseases (Parkinson's Disease, Alzheimer's Disease, and Amyotrophic Lateral Sclerosis).
- Neurological conditions (Headaches, depression, sleep disruption, fatigue, dizziness, tremors, autonomic nervous system dysfunction, decreased memory, attention deficit disorder, anxiety, visual disruption).
- Fetal abnormalities and pregnancy.
- Genetic defects and cancer.
- Liver disease and genitourinary disease.

Because Smart Meters produce Radiofrequency emissions, it is recommended that patients with the above conditions and disabilities be accommodated to protect their health. The AAEM recommends: that no Smart Meters be on these patients' homes, that Smart Meters be removed within a reasonable distance of patients' homes depending on the patients' perception and/or

symptoms, and that no collection meters be placed near patients' homes depending on patients' perception and/or symptoms.

Source: <https://aaemonline.org/pdf/AAEMEMFmedicalconditions.pdf>

Report titled “Smart Meters—Not So Smart.” How Dangerous and Expensive Became “Smart” – An Expose' of the “Smart Grid.” January 19, 2015.

Electric “smart” meters were installed in Cindy deBac’s Scottsdale, Arizona, neighborhood in 2012. She recalls the day a new meter was mounted on her home as a sort of digital Pearl Harbor attack. “I’ve never been so sick in my life,” she says. “Nausea, a crushing migraine headache, and painful heart palpitations laid me low right away.”

Healthy and exuberant before the installation, deBac became unable to sleep normally. She soon became exhausted and tearfully anxious as she struggled with rashes and a chronically racing heart. For respite she spent nights away in her car. One of her dogs died of cancer within six months of the meter’s installation and the other developed large tumors. Today Cindy leads a global educational crusade to warn others about the myriad devastating health effects that electromagnetic radiation can unleash.

Across the U.S. installers continue to replace comparatively safe analog (mechanical) utility meters with digital “smart” meters for electrical, gas and water services. Most of the new meters are wireless two-way transmitters that pulse signals to communicate continuously between your home, school, or workplace and utility companies miles away. The new meters are part of a nationwide project dubbed Advanced Metering Infrastructure (AMI). Most folks call this evolving make-over the “smart grid.”

The AMI “smart” meter below records electrical consumption data and sends the information wirelessly to energy system managers. “Smart” meters can be programmed to read and transmit data monthly, or up to every fifteen seconds. Data may be relayed by systems similar to mobile phones or Wi-Fi. Or information may be relayed via fiber optics (thin, transparent cables that carry signals by pulsing light). Of these methods, fiber optics may offer the safest transmission.

AMI is nested within the American Recovery and Investment Act of 2009, and the Obama Administration has shoveled an estimated eleven billion dollars into incentive programs for utilities that participate. “Smart” grid advocates insist that the new two-way meters will reduce national energy consumption and allow consumers to make better choices about their energy needs.

AMI is calibrated to expose all Americans to three new and powerful sources of microwave radiation: “smart” meters, “smart” appliances, and a ubiquitous network of antennas on utility poles and cell towers in urban and rural neighborhoods. Neither the federal government nor grid profiteers have undertaken a single public health study about the long-term health effects of exposure to electromagnetic radiation (EMR) from “smart” meters. Yet medical literature is now loaded with peer-reviewed studies about the non-thermal biological effects of exposure to EMR. Peer-reviewed studies report DNA damage, abnormal genetic and hormonal changes, sperm damage, pregnancy complications, weakening of the blood-brain barrier, disturbance of voltage-gated calcium channels (for example, in the heart), degradation of immunity, and certain types of cancers.

Especially worrisome, says AAEM, is mounting evidence that inescapable electromagnetic fields exposure from smart meters places children at particular risk for altered brain development and for impaired learning and behavior. These concerns are corroborated by the blockbuster BioInitiative Report 2012. Produced by twenty-nine medical and public health experts from ten countries, the BioInitiative Report offers a meta-analysis of over eighteen hundred new scientific studies showing that chronic exposure to both ELF and microwaves poses a serious health hazard. At highest risk are the most vulnerable of our population: children, pregnant mothers, the elderly and the immunocompromised.

Canary Sickness and Media Fallout

A group of concerned medical doctors in Eugene, Oregon, reports: “PG&E’s approach to the AMI rollout didn’t involve a lot of public education. They just switched out the meters. And some people found that they were having trouble sleeping, or experiencing headaches, ringing in the ears, vertigo or other symptoms that hadn’t been bothering them before. Soon the Internet was awash with anecdotal reports and commentary about these adverse effects. . . Finally PG&E was served with a court order to provide clearer documentation of what the meters were actually doing. In response to that court order, PG&E provided documentation from the manufacturer of the meters that the average meter in the mesh network transmitted data signals to the utility six times a day, network management signals fifteen times a day, timing signals three hundred sixty times a day and beacon signals to the mesh network nine thousand six hundred times a day....This penciled out to roughly seven transmissions per minute, twenty-four hours a day, coming out of every meter in the community.”

Since microwaves easily flow through most construction materials, “smart” meters attached to the outside of homes (or huge banks of them on multi-unit dwellings) broadcast a perpetual barrage of Group 2B radiation directly into the interior of inhabited buildings and right through all human flesh within range.

In addition, some residents within AMI mesh networks may also have “Medusa” meters on their property. One investigator reports: “A utility whistle blower told us about a special smart meter—a mini cell phone tower. This collection device receives data and more radiation from five hundred to seven hundred surrounding meters and uses the customer’s premises to serve as a relay station to transmit other neighbors’ data along the mesh network to collection points. These Medusa meters are deployed upon properties without the owner’s knowledge or consent. The utilities select a property for this meter based upon easy meter access to the street, no locked gates or dogs and good customer payment history. . . Utilities reward good customers with a Medusa meter and bathe their homes with additional toxic radiation.”

The Problems with Exposure to Man-Made EMR

In a study conducted by chiropractic physician Dr. Frank Springob, “smart” meter radiation exposure quickly produced almost instant blood abnormalities in human test subjects.¹⁴ Volunteers had their blood examined as normal, then stood within one foot of a transmitting “smart” meter for only two minutes. A post-exposure examination with dark field microscopy showed that all volunteers had developed one of these blood pathologies:

- Marked degradation of cells with some cell walls broken;
- Corrugated formation in which blood cells become crimped like bottle caps;

- A rouleaux condition in which the red blood cells clump abnormally together. Dietrich Klinghardt, MD, PhD, who practices medicine in Washington State, says, “It is our experience as doctors that everybody is equally electro-sensitive.” Dr. Klinghardt finds the same inflammatory markers in the blood of every EMR-exposed person, both those who feel bad from exposure and those who notice no preliminary ill effects.

The Pay-Us-Not-To-Hurt-You Racket

Due to public uproar, some utility companies unleashing “smart” meter systems are offering opt-out programs. Opt-out often requires those who refuse “smart” meters to pay one or more fees for the right to keep their older and safer analog meters. Some complain that the fees are reminiscent of extortion from old-time protection thugs.

2B

Requesting an opt-out is definitely a first step to protecting one’s own home from harmful, microwave emissions. But it does not address exposure to EMR from neighboring meters, or from mesh pole transmitters on the grid. EMR from some meters can be measured over three hundred feet away. A single-family home in a residential community can be well within three hundred feet of several near and next-nearest neighbors. Thus, even at the distance of a football field, EMR from many surrounding meters could prove biologically significant, even for those who retain their analog meters. Residents of townhouses, condos and apartment buildings may be especially vulnerable when ten or twenty meters or more are installed on one wall.

Also, an opt-out does not resolve the hazards of dirty electricity polluting a neighborhood loaded with AMI meters. Nor does it protect people who don’t have enough information to request an opt-out, but who may one day develop illnesses from EMR exposure.

Living in rural areas does not solve the problem. Some rural utilities serving mountainous and/or forested areas may choose to deploy AMI metering solutions like those provided by Tantalus Systems Corp. Tantalus creates hybrid “smart” antenna systems, utilizing a variety of frequency signals that can travel through and around obstacles in their quest to “connect.”¹⁸ As with other frequency fields deployed by AMI, no studies of the biological effects of such public exposure have been conducted.

REFLECTIONS ON OUR PRIORITIES

The formidable challenges presented by AMI smart technology lead back to the dilemma of national priorities. How much money and wellbeing should we sacrifice to achieve a tiny reduction in national energy consumption fifteen years from now?

Media sources continually report on many people suffering from electro-hypersensitivity (EHS) who have fled their smart-metered homes in desperate search of habitation that does not cause heart palpitations, rashes, severe tinnitus and/neurological disabilities. Electro-sensitivity appears to be a sort of auto-immune condition developed by a growing number of victims, usually after acute exposure to electromagnetic radiation.

Sandi Aders of Idaho has been debilitated since a “smart” meter was installed on her home. Unaware of any hazard, she and her husband used a bedroom where a transmitting digital meter was mounted on an outside wall directly opposite their bed. Day by day after the meter’s installation they grew sicker and more exhausted. They tried to cope with rashes and odd nerve disorders. Simultaneously they developed the symptoms of glaucoma. They finally hit the road to

seek relief from a house that made them cruelly sick, but the damage has proven irreversible. Sandi is now so electrosensitive that she lives without electricity, phones or computers. No physician has found a solution to the low, pulsed radio frequency hum and droning sounds that she hears constantly, especially when she is near electrical power lines. Due to the nerve damage she says she acquired after her “smart” meter exposure, Sandi endures the same audio-torture being reported by many other people nationwide from similar exposures.³⁰

Dr. Andrew Goldsworthy, British biologist and expert on the bio-effects of microwave radiation, explains: “The duration of the radiation seems to be more important than its strength, with the effects being cumulative as more and more cells are damaged. Interestingly, DNA damage from cell phone radiation is greater when the exposure is intermittent (five minutes on, ten minutes off) than when continuous (Diem et al., 2005). This may be because the cells are constantly adapting and using energy to defend themselves; they drop their guard during the off period and are caught unawares when it goes on again....“Smart” meters, which operate 24/7 and radiate modulated microwaves intermittently, can therefore be expected to be particularly harmful to DNA.”³¹

The National Institutes of Health confirms the fact that all cancer begins with damaged DNA. In a nation with fourteen million cancer victims and 1.6 million new cancer cases diagnosed each year (not counting millions of skin cancers), exposure to EMR from wireless technologies matters to everyone’s health.

Surely the welfare of pregnant women and children is of utmost importance to our society. EMR from “smart” meters and other electronics has the potential to damage the entire human reproductive system. This was already reported in 1971 by the Naval Medical Research Institute (NMRI) at Bethesda, Maryland, which collected over twenty-three hundred studies to document the impacts of non-ionizing radiation on human health. Dr. Zorach R. Glaser, Ph.D., compiled these studies. Among deleterious effects listed in Dr. Glaser’s report are altered menstrual activity, male impotence, altered sex ratio of births (more girls), and decreased lactation in nursing mothers.³²

Today, medical science offers much additional confirmation that EMR emissions from AMI meters and their support infrastructure have the potential to damage ovaries and ova cells, harm the fetus, cause low birth weight, and even induce premature delivery.³³ There is also increasing evidence that EMR emissions may be linked to America’s epidemic of autistic spectrum disorders.³⁴

Public awareness is a first step toward forging solutions to the many challenges of the “smart” grid conundrum. We need citizens, legislators and regulators concerned about health. We need “smart” meters recalled and analog mechanical meters restored. We need to stop deploying any new technologies until they are proven harmless.

In its scathing letter to the Massachusetts Department of Public Utilities, Northeast Utilities has stated that achievement of grid modernization objectives “does not require the implementation of AMI, despite the Department’s suggestion that it does.” This letter contains sensible alternative recommendations for cost-effective grid modernization, fully achievable without noxious AMI radiation hazards.³⁵

It is truly wise to become educated on all of these vital issues. We must be proactive in order to understand what utility companies are planning for our individual neighborhoods and for our states.

In these challenging times, vigilance and reliable information empower us to prevent suffering and protect everyone's health.

SIDEBARS to the report:

THE 2012 BIOINITIATIVE REPORT OVERVIEW: Implications for Health from the Rollout of "Smart" Meters

BY CINDY SAGE, CO-EDITOR

The BioInitiative Report 2012 updates the last five years (2007-2012) of science, public health, public policy and global response to the growing health issue of chronic exposure to electromagnetic fields and radio frequency radiation in the daily life of billions of people around the world. The Report has been prepared by 29 authors from ten countries, including ten medical doctors, twenty-one PhDs, and three MsC, MA, or MPHs. Among the authors are three former presidents of the Bioelectromagnetics Society (BEMS), and five full members of BEMS. One distinguished author is the chair of the Russian National Committee on Non-Ionizing Radiation. Another is a senior advisor to the European Environmental Agency.

The great strength of the BioInitiative Report (www.bioinitiative.org) is that it has been carried out independently of governments, existing bodies and industry professional societies. Precisely because of this, the BioInitiative Report presents a solid scientific and public health policy assessment that is evidence-based.

The global conversation on why public safety limits for electromagnetic and radio frequency fields remain thousands of times higher than exposure levels that health studies consistently show to be associated with serious health impacts has intensified since 2007. Roughly eighteen new studies have been published in the last five years reporting effects at exposure levels ten to hundreds or thousands of times lower than allowed under safety limits in most countries. Yet no government has instituted comprehensive reforms. Some actions have been taken that highlight partial solutions. The Global Actions chapter presents milestone events that characterize the international "sea change" of opinion that has taken place, and reports on precautionary advice and actions from around the world.

The world's populations—from children to the general public to scientists and physicians—face an intensifying barrage from corporate marketing propaganda that urges the insertion of the latest wireless devices into their everyday lives. This occurs even while even an elementary understanding of the possible health consequences of using these devices is beyond the ability of most people to grasp. Exposures are invisible and testing meters are expensive and technically difficult to operate. The technology industry promotes new gadgets and generates massive advertising and lobbying campaigns that silence debate, while the reliable, non-wireless versions are discontinued against public will. There is little labeling, and little or no informed choice. In fact, there is often not even the choice to stay with safer, wired solutions, as in the case of the "smart grid" and "smart" wireless utility metering, an extreme example of a failed corporate-governmental partnership strategy, ostensibly initiated for energy conservation.

A collision of the wireless technology rollout and the costs of choosing unwisely has begun and will grow. The groundwork for this collision is being laid as a result of increased exposure, especially to radio frequency fields, in education, housing, commerce, communications and entertainment, medical technologies and imaging, and in public and private transportation by air, bus, train and motor vehicles. Special concerns are the care of the fetus and newborn, the care for

children with learning disabilities, and consideration of people under protection of the Americans with Disabilities Act, which includes people who have become sensitized and physiologically intolerant of chronic exposures. The 2012 report now addresses these issues and presents an update of issues previously discussed in the BioInitiative Report 2007.

WHY SHOULD WE CARE?

The stakes are very high. Human beings are bioelectrical systems. Our hearts and brains are regulated by internal bioelectrical signals. Environmental exposures to artificial EMRs can interact with fundamental biological processes in the human body. In some cases, this may cause discomfort, sleep disruption, loss of wellbeing (impaired mental functioning and impaired metabolism), or sometimes a dread disease like cancer or Alzheimer's disease. It may interfere with fertility or successful full-term pregnancy, or result in brain development changes that harm the child. It may be these exposures play a role in causing long-term impairments to normal growth and development in children, jeopardizing their futures as healthy, productive adults. We have good evidence that these exposures can damage our health, or that of children of the future who will be born to parents now immersed in wireless exposures.

DO WE KNOW ENOUGH TO TAKE ACTION?

There is more evidence than we need. Over the last five years, new scientific studies indicate the situation is much worse than in 2007 and yet people around the world have so much more daily exposure than even five years ago. Exposures are linked to a variety of adverse health outcomes that may have significant public health consequences. When considering billions of people worldwide, no argument to maintain the status quo can be persuasive now. In twenty-one technical chapters of the BioInitiative Report 2012 update, the contributing authors discuss the content and implications of 1800 new studies. Overall, there is reinforced scientific evidence of risk where there is chronic exposure to low-intensity electromagnetic fields and to wireless technologies (radio frequency radiation including microwave radiation).

There is more evidence in 2012 that such exposures damage DNA, interfere with DNA repair, and are hazardous to the nervous system. More and better studies on the effects of mobile phone base stations (wireless antenna facilities or cell towers) report lower RFR levels over time can result in adverse health outcomes. An increasing number of studies have examined the effects of wireless laptops as well as cell phones worn on the belt or in the pocket of men on sperm quality, motility, and sperm death. A dozen new studies focus on the fetus, infant and young child, and child-in-school.

The levels of exposure we face in 2012 are higher, and have crept into everyday life, even for children. The levels at which undesirable effects on health and well-being are seen is much lower. There is much greater involuntary exposure, and it is nearly unavoidable even for people who choose not to "go wireless" via second-hand radiation effects. Safe forms of communication by land-line telephone are being phased out without general public knowledge or agreement. There is no informed consent for consumers (warning labels on cell phones, for example, have been defeated by telecom industry lobby groups). It is still difficult or impossible for consumers to get reliable information on levels of exposure from wireless devices. It is simply beyond the reach of people to identify where excessively high levels of exposure occur in their communities, and it is very rare for a county or state health department to accommodate requests for information or provide measurements.

The range of possible health effects that are adverse with chronic exposures has broadened. The most serious health endpoints that have been reported to be associated with extremely low frequency (ELF) and/or radio frequency radiation (RFR) include childhood and adult leukemia, childhood and adult brain tumors, and increased risk of 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, pathological leakage of the blood–brain barrier, altered immune function including increased allergic and inflammatory responses, miscarriage, and some cardiovascular effects. Insomnia is reported in studies of people living in very low-intensity RFR environments with Wi-Fi and cell tower-level exposures.

We could do otherwise. Each wireless version had a wired counterpart with none of the wireless-associated health effects. It is time to re-think the wireless tsunami and educate people about health, privacy and security risks. It is past time to develop new safety standards. Now we must look to less harmful ways to communicate, move ourselves from place to place, shop, sleep, recreate, save energy and educate our children in school.

Source: <https://www.westonaprice.org/health-topics/environmental-toxins/smart-meters-not-so-smart/>

Report from the European Economic and Social Committee, Opinion of the Section for Transport, Energy, Infrastructure and Information Society on Electromagnetic hypersensitivity, TEN/559 Electromagnetic hypersensitivity, Brussels, 13 January 2015.

Exposure to electromagnetic fields has been increasing in recent years, following the expansion of technologies. In addition to health problems, this can result in limited access to many public or private facilities (libraries, hospitals or even public transport), especially in buildings where devices have been installed for transmitting wireless technology. These people may sometimes suffer the incomprehension and skepticism of doctors who do not deal with this syndrome professionally and therefore fail to offer proper diagnosis and treatment. This is without considering all those other people who might be unaware of the possible reasons for their current health problems.

The EU should assist currently affected groups and limit exposure fields in light of the recommendations set out in this opinion, especially with respect to recognising this exposure as a cause of functional disability and environmental illness. Steps should also be taken to prevent the number of sufferers from gradually increasing in the future due to the expansion of devices using these technologies.

The possible symptoms (of electromagnetic hypersensitivity) include headaches, chronic fatigue, recurring infections, difficulties concentrating, memory loss, inexplicable unhappiness, dermatological symptoms, irritability or sleeplessness, heart problems, poor blood circulation, disorientation, nasal congestion, reduced libido, thyroid disorders, eye discomfort, tinnitus, increased need to urinate, listlessness, capillary fragility, cold hands and feet, and stiff muscles. These may occur or get worse in the vicinity of electrical appliances, transformers, mobile phone antennas and other sources of radiation.

Source: <http://www.stopumts.nl/pdf/EESC-2014-05117-00-00-PA-TRA-EN.pdf>

Biological and Health Effects of Microwave Radio Frequency Transmission – A Review of the Research Literature. A Report to the Staff and Directors of the Eugene Water and Electric Board. June 4, 2013. Comments on Notice of Inquiry, ET Docket No. 13-84.

PREFACE

This paper represents the efforts of a group of physicians who have been in private practice in Eugene for decades. Our concerns are for the health of our patients as well as for our community as a whole.

When EWEB proposed installing a “mesh” smart meter network we became concerned. We know that there are people in this community who are highly sensitive to electromagnetic fields. The installation of the smart meter mesh would make Eugene a much more hostile environment for these individuals.

We also know that chronic exposures to microwave radio frequency (RF) transmissions can produce adverse long term physiological effects, even in individuals who do not consciously experience acute symptoms from exposure to such electromagnetic fields.

The FCC regulations for permissible exposures to microwave radio frequency (RF) transmissions are only designed to protect against the thermal effects of high exposure levels. Representatives of the telecommunications industry usually assert that there is “no clear or conclusive” scientific evidence regarding the biological effects of low level or “nonthermal” RF exposures. But in actuality, a large body of scientific research documents that RF exposures at low levels can produce adverse biological or health effects.

From the Introduction:

EWEB’s Elster MESH AMI Trial

In 2010 EWEB set up a trial of AMI infrastructure, using the Elster REX2 Smart Meter. Like the Silver Springs meter used by PG&E in California, the REX2 operates on a mesh network. The meters upload usage data to a central collection meter 4 to 6 times a day, but transmit short beacon signals to the network several times a minute.

EWEB stated on their website that these meters transmit “less than 10 seconds a day”. But they were unable to state how frequently transmissions actually occurred. In our communications with their public relations staff, we were told that Elster was unwilling to release this information. Information on the power output of these meters is available on the ELSTER website. (TUV Rheinland, 2010) But Elster does not discuss the actual frequency of transmission of the meters.

In January 2012 we used a Gigahertz Solutions HF35C analyzer to evaluate the output of one of these Elster meters in a residential neighborhood in Eugene.

Background RF signals coming through the neighborhood were measured in a 360 degree circle around the monitoring position. The background RF averaged around 4 microwatts/square meter ($\mu\text{W}/\text{m}^2$), increasing to 8 or 10 $\mu\text{W}/\text{m}^2$ when we aimed our directional antenna at the radio towers on Blanton Heights or at a distant cell phone tower.

The Elster meter's transmission rate was variable. In our observations, they are definitely transmitting several times a minute, sometimes 4 or 5 times a minute, and occasionally in bursts of significantly higher frequency.

At 5 feet from the smart meter, the peak strength of the beacon signal coming off the meter measured from 3800 to 11,000 $\mu\text{W}/\text{m}^2$. At 20 feet from the meter, the power density of the signal ranged from 362 to 493 $\mu\text{W}/\text{m}^2$, with occasional bursts at higher power output.

This means that at a distance of 20 feet the power of the signal coming out of the Elster meter was about 100 times the power of the ambient background signal coming from any specific direction in the residential neighborhood.

This power density of 300+ to 400+ $\mu\text{W}/\text{m}^2$ was greater than the signal strength of the cell phone tower at 29th and Amazon, measured from about 200 meters away. So filling a neighborhood with a mesh network of the Elster smart meters would be similar to placing every house in that neighborhood closer than 200 meters from a cell phone tower, each house constantly being pinged by the chatter of multiple beacon signals from the mesh.

This was disconcerting, since recent research has shown that people living within 500 meters of a cell phone tower have increased incidence of headache, concentration difficulties, and sleep disorders, and also a significantly increased risk of some types of cancer. (Khurana et al., 2010) (Levitt and Lai, 2010) (Yakymenko et al., 2011) (Altpeter et al., 2006) (Abdel-Rassoul et al., 2007)

When you put these facts together, it is not so surprising that the installation of mesh smart meter networks in residential neighborhoods in California last year was followed by a surge of anecdotal evidence regarding headaches, insomnia and other health complaints. From a medical perspective, based on a familiarity with current research on the biological effects of RF, this was a predictable consequence of PG&E's smart meter MESH network rollout.

From the Executive Summary:

ELECTROHYPERSENSITIVITY (EHS)

Microwave RF exposures can produce acute symptoms in some individuals. These symptoms can include headache, sleep disturbance, difficulty in concentration, memory disturbance, fatigue, depression, irritability, dizziness, malaise, tinnitus, burning and flushed skin, digestive disturbance, tremor, and cardiac irregularities. This syndrome was described by Russian researchers in the 1950s, who called it "microwave sickness." Between 1953 and 1978 the Russian government purposefully targeted the U.S. embassy in Moscow with beams of microwave RF, producing symptoms of microwave sickness in many embassy employees

In recent years, the buildout of the wireless telecommunications infrastructure has greatly increased the exposure of the general public to microwave RF, and this has led to an increased number of individuals experiencing symptoms that are now referred to as Electrohypersensitivity Syndrome (EHS). Multiple research studies have shown a correlation between these symptoms and residential exposure to radio, radar, and cell tower transmissions.

ALTERED PHYSIOLOGY

Laboratory research in animal and human subjects has shown that “nonthermal” levels of RF exposure can alter EEG, immune function, and hormone levels including adrenal and thyroid hormones, testosterone, prolactin, progesterone.

Research shows that low levels of microwave RF exposure can reduce melatonin levels in humans, and that some individuals are more sensitive than others to this effect. The adverse effects of nighttime RF exposure on melatonin secretion are particularly disturbing. The nocturnal rise in melatonin levels supports the natural function of sleep, and disrupting this cycle can produce insomnia. Melatonin is an extremely potent antioxidant, and helps to repair damaged DNA and heal the body from other effects of oxidant stress.

Melatonin is also protective against the growth of cancer cells, and disruption of the circadian melatonin cycle has been shown to lead to increased tumor growth in a variety of cancer types. Women who have lower levels of nocturnal melatonin are at greater risk for developing breast cancer. Reduced melatonin levels may also increase the incidence of prostate cancer.

OXIDATIVE STRESS AND DAMAGED DNA

In contrast with Xrays and gamma rays, Microwave radiation does not have sufficient power to directly break covalent bonds in DNA molecules. But microwave RF can produce resonance interactions with ions and with charged macromolecules, and such interactions can significantly alter biochemical functions. A large body of research has shown that microwave RF causes an increased production of free radicals and reactive oxidant species in living tissues, and that this increased oxidant stress damages DNA. This damage can and does occur at power levels well below those levels that could produce damage by thermal mechanisms.

Any chronic exposure to conditions that damage DNA can lead to an increased risk of cancer. Evidence of increased risk of certain types of cancer has been demonstrated in groups with occupational exposure to microwave RF, including radio technicians in private industry, military personnel, commercial airline pilots, and ham radio operators. Elevated levels of cancer have been demonstrated in populations with increased residential exposure to radio transmission towers. And in the last ten years, studies from Israel, Germany, Austria, and Brazil have documented significant increased in breast cancer and other cancers in individuals living less than 500 meters from cell phone towers, with measured exposure levels much lower than those permitted by current FCC guidelines.

Research has also shown that RF exposure levels well within current guidelines can cause DNA damage and reduced fertility in insects, birds, amphibians and mammals, and can lower sperm counts, sperm motility, and sperm motility in human beings.

CONCLUSIONS

Existing scientific research offers strong evidence that the chronic exposure of the public to microwave RF transmissions produces serious acute and chronic health effects in a significant portion of the population.

Source: <https://skyvisionsolutions.files.wordpress.com/2013/11/paul-dart-md-lead-author-report-to-eweb-june-2013.pdf>

2013 Documentary film by Josh del Sol titled "Take Back Your Power"

Josh del Sol's award winning documentary investigates so-called "smart" utility meters, uncovering shocking evidence of in-home privacy invasions, increased utility bills, health & environmental harm, fires and unprecedented hacking vulnerability... and lights the path toward solutions.

Excerpts from the website:

Based upon my review of peer-reviewed literature over the past few years, one of the studies that helped convince me that exposure to low-level electromagnetic fields (EMFs) could indeed be harmful included "Electromagnetic Hypersensitivity: Evidence for a Novel Neurological Syndrome." One of the authors of that study was Andrew A. Marino, Ph.D. [1]

The authors concluded that "EMF hypersensitivity can occur as a bona fide environmentally inducible neurological syndrome."

The abstract of this paper by Dr. Marino can be found here:

<https://www.ncbi.nlm.nih.gov/pubmed/21793784>

Recently, it is my understanding that Dr. Marino submitted an "expert report" as part of a case before the Pennsylvania PUC. In this proceeding several consumers have alleged that their health is being negatively affected by smart meters installed by PECO Energy Company [2].

The conclusions reached by Dr. Andrew Marino and presented in his expert report (dated August 8, 2016) are as follows:

"First, [there] is a reasonable basis in established science for the Complainants' concern regarding risks to human health caused by man-made electromagnetic energy in the environment, including the type of electromagnetic energy emitted by smart meters. These health risks are heightened in the very young, the very old, and in those with preexisting diseases or disorders.

Second, electromagnetic hypersensitivity is a documented neurological condition in which the affected person experiences musculoskeletal, immunological, and/or neurological symptoms that noticeably flare or intensify upon exposure to man-made electromagnetic energy in the environment. About 5-10% of the general public are self-reported to suffer from this disorder.

Third, the Complainants were forced into the almost impossible position of conducting experiment[s] on themselves to prove to PECO's satisfaction that their claims of a link between their symptoms and electromagnetic energy from smart meters were sufficiently credible as to warrant some remediable action by PECO.

Fourth, there is no justifiable reason for PECO to doubt the reality of the Complainants' symptoms, to question their intentions in seeking relief, or to not respect and implement the advice they received from their physicians that exposure to smart-meter energy should be avoided.

Fifth, chronic exposure to the electromagnetic energy from smart meters causes risks to human health that go far beyond the capability of the energy to trigger hypersensitivity

reactions in sensitive persons. A large literature in experimental biology indicates that man-made electromagnetic energy, including that from smart meters, causes biological effects involving every essentially physiological process that occurs in living organisms. A large literature in nonexperimental biology shows that man-made electromagnetic energy, including that from smart meters, is associated with a plethora of human diseases. People who suffer from pre-existing conditions are particularly vulnerable, and all the Complainants suffer from such conditions.

Sixth, PECO's claim that the FCC has pronounced smart meter safe is spurious because the FCC has made that statement only with regard to the heating and cooking effects of electromagnetic energy. The Complainants have made no claims that smart meters are like microwave ovens.

Seventh, PECO has claimed that expert committees have pronounced smart meters safe, but PECO has not acknowledged the blatant conflicts-of interests that infect such committees nor the serious limitations on their reports, such as the failure to address much of the relevant literature.

Eighth, PECO proposes to expose human beings to smart-meter electromagnetic energy over their objection under conditions that would not be acceptable to any institution in the United States where human experimentation can lawfully be performed. Consequently, coercing the Complainants to endure the risks and uncertainties of such exposure is unwarranted, unjustified, and would amount to involuntary human experimentation by PECO."

Regarding the exposure guidelines of the Federal Communications Commission (FCC), Dr. Marino states that:

"According to the FCC, smart meters and cellphones are safe when manufactured according to the presently mandated emission levels. But the FCC defines an emission level as 'safe' if it doesn't result in adverse biological effects caused by heating or cooking of the exposed subject. Nowhere does the FCC say that smart meters are safe with regard to physiological changes [caused] by physical processes other than heating or cooking. That claim is unsupportable and counter-scientific, and has not been made by the FCC."

To the contrary:

"There is a very large data base of empirical studies in experimental biology that demonstrates beyond reasonable doubt that biological effects can occur at levels of man-made electromagnetic energy actually present in the environment."

And that:

"Consequently [there is] no rational basis to argue that PECO's energy [levels for smart meters] is too small to matter."

Regarding the symptomatology of the Complainants in the PUC proceeding, Dr. Marino states that:

“There is a sound basis in experimental biology that supports their concerns regarding the consequences to their health that have occurred and that may occur due to future chronic exposure to the electromagnetic energy emitted by smart meters. Under the conditions pertinent to the conditions of this case, coercing the Complainants to endure these risks and uncertainties is unwarranted, unjustified, and would amount to involuntary human experimentation by PECO.”

Source: http://andrewamarino.com/PDFs/testimony-AAM_Report.pdf

Source: <https://takebackyourpower.net/>

Connection between non-ionizing radiation and bio-contaminants including mold.

The research is fascinating on this topic. At the forefront is Dr. Dietrich Klinghardt, MD., PhD., noted for his successful treatment of neurological illness and chronic pain. In his video, Dr. Klinghardt talks about a mold plate experiment which compared a mold plate shielded from electromagnetic fields to an unprotected mold plate exposed to ambient electromagnetic fields.

The unprotected mold plate showed a dramatic increase in the number of biotoxins produced – more than 600 times. Dr. Klinghardt concludes that indoor mold contaminants as well as other biotoxins are highly sensitive to electromagnetic fields. EMFs therefore easily step up neurotoxin production and have a major impact on the immune system.

Note that Dr. Klinghardt points out cell phone radiation in one cubic inch of air is millions of times higher than it was ten years ago.

Dr. Thomas Rau, medical director of the Paracelsus Clinic in Switzerland, shares his assessment of the microbial connection with EMFs in an interview featured on the website Electromagnetic Health. Not only do the artificially produced electromagnetic waves cause toxic mold to grow faster, they suppress the production of beneficial microbes.

We have more organisms than cells in our bodies. Cultures of normal human endogenous bacterial cultures grow much less when exposed to EMR. They grow less when they are around a mobile phone, a tower or cordless phone.

Growing less good bacteria in your body means you will have an overgrowth of bad bacteria.

Toxic mold in homes grows much faster under the load of high electromagnetic loads. They grow much faster in a disturbed milieu.

There are other studies that highlight the connection between electromagnetic radiation and microbial multiplication.

- Researchers at NYC’s Albert Einstein College of Medicine of Yeshiva University found evidence that certain types of fungi have the ability to use radioactivity as an energy source for growth.
- Russian scientists report that EMR induces growth in a certain yeast strain. (See Effect of Radio-Frequency Electromagnetic Radiation on Psychological Features of *Saccharomyces Cerevisiae* Strain UCM Y-517.)

- A completely different study shows a similar relationship between this strain and EMR. (See Preliminary Results on the Non-Thermal Effects of 200-350 GHz Radiation on the Growth Rate of *S. Cerevisiae* Cells in Microcolonies.)

Source: <http://it-takes-time.com/2015/07/10/microbial-growth-and-electromagnetic-radiation/>

BioInitiative Working Group. 2007. BioInitiative Report: A Rationale for a Biologically-based Public Exposure Standard for Electromagnetic Fields (ELF and RF).

Summary for the Public

You cannot see it, taste it or smell it, but it is one of the most pervasive environmental exposures in industrialized countries today. Electromagnetic radiation (EMR) or electromagnetic fields (EMFs) are the terms that broadly describe exposures created by the vast array of wired and wireless technologies that have altered the landscape of our lives in countless beneficial ways. However, these technologies were designed to maximize energy efficiency and convenience; not with biological effects on people in mind. Based on new studies, there is growing evidence among scientists and the public about possible health risks associated with these technologies.

Human beings are bioelectrical systems. Our hearts and brains are regulated by internal bioelectrical signals. Environmental exposures to artificial EMFs can interact with fundamental biological processes in the human body. In some cases, this can cause discomfort and disease. Since World War II, the background level of EMF from electrical sources has risen exponentially, most recently by the soaring popularity of wireless technologies such as cell phones (two billion and counting in 2006), cordless phones, WI-FI and WI-MAX networks. Several decades of international scientific research confirm that EMFs are biologically active in animals and in humans, which could have major public health consequences.

Additional information from the report:

Eleven (11) chapters that document key scientific studies and reviews identifying low-intensity effects of electromagnetic fields have been written by members of the BioInitiative Working Group. Section 16 and 17 have been prepared by public health and policy experts. These sections discuss the standard of evidence which should be applied in public health planning, how the scientific information should be evaluated in the context of prudent public health policy, and identifies the basis for taking precautionary and preventative actions that are proportionate to the knowledge at hand. They also evaluate the evidence for ELF that leads to a recommendation for new public safety limits (not precautionary or preventative actions, as need is demonstrated).

The clear consensus of the BioInitiative Working Group members is that the existing public safety limits are inadequate for both ELF and RF.

It appears it is the INFORMATION conveyed by electromagnetic radiation (rather than heat) that causes biological changes - some of these biological changes may lead to loss of wellbeing, disease and even death.

There may be no lower limit at which exposures do not affect us. Until we know if there is a lower limit below which bioeffects and adverse health impacts do not occur, it is unwise from a

public health perspective to continue “business-as-usual” deploying new technologies that increase ELF and RF exposures, particularly involuntary exposures.

There is little doubt that exposure to ELF causes childhood leukemia. Children who have leukemia and are in recovery have poorer survival rates if their ELF exposure at home (or where they are recovering) is between 1mG and 2 mG in one study; over 3 mG in another study.

The evidence from studies on women in the workplace rather strongly suggests that ELF is a risk factor for breast cancer for women with long-term exposures of 10 mG and higher.

Alzheimer’s disease is a disease of the nervous system. There is strong evidence that long-term exposure to ELF is a risk factor for Alzheimer’s disease.

The European research program (REFLEX) documented many changes in normal biological functioning in tests on DNA (3). The significance of these results is that such effects are directly related to the question of whether human health risks might occur, when these changes in genes and DNA happen. This large research effort produced information on EMFs effects from more than a dozen different researchers. Some of the key findings included:

“Gene mutations, cell proliferation and apoptosis are caused by or result in altered gene and protein expression profiles. The convergence of these events is required for the development of all chronic diseases.”

“Genotoxic effects and a modified expression of numerous genes and proteins after EMF exposure could be demonstrated with great certainty.”

“RF-EMF produced genotoxic effects in fibroblasts, HL-60 cells, granulosa cells of rats and neural progenitor cells derived from mouse embryonic stem cells.”

“Cells responded to RF exposure between SAR levels of 0.3 and 2 W/Kg with a significant increase in single- and double-strand DNA breaks and in micronuclei frequency.”

“In HL-60 cells an increase in intracellular generation of free radicals accompanying RF-EMF exposure could clearly be demonstrated.”

“The induced DNA damage was not based on thermal effects and arouses consideration about the environmental safety limits for ELF-EMF exposure.”

“The effects were clearly more pronounced in cells from older donors, which could point to an age-related decrease of DNA repair efficiency of ELF-EMF induced DNA strand breaks.”

Both ELF and RF exposures can be considered genotoxic (will damage DNA) under certain conditions of exposure, including exposure levels that are lower than existing safety limits.

Very low-level ELF and RF exposures can cause cells to produce stress proteins, meaning that the cell recognizes ELF and RF exposures as harmful.

There is substantial evidence that ELF and RF can cause inflammatory reactions, allergy reactions and change normal immune function at levels allowed by current public safety standards.

Note: The Bioinitiative Working Group updated their report in 2012. Excerpts from the 2012 report were provided earlier in this document.

California Public Utilities Commission. September 29, 2011. Assigned Commissioner's Ruling Concerning Customer Requests to Delay Installation of a Smart Meter.

This Assigned Commissioner's Ruling establishes certain requirements that must be included in the procedures adopted by Pacific Gas and Electric Company, Southern California Edison Company, and San Diego Gas & Electric Company to allow customers who currently have an analog meter and have asked to be on the utility delay list to keep their analog meter while the Commission considers an opt-out program.

IT IS RULED that no later than three business days after the mailing date of this Assigned Commissioner's Ruling, Pacific Gas and Electric Company, Southern California Edison Company, and San Diego Gas & Electric Company shall include the following requirements as part of their procedures for customers who currently have analog meters and wish to delay installation of a smart meter:

1. The investor-owned utility (IOU) shall provide information on its website that if a customer currently has an analog meter, the customer may request a delay in the installation of a smart meter. The information shall include instructions for how the customer may make such a request.
2. The IOU shall provide the customer sufficient advance notice that a smart meter will be installed so that the customer may request that installation be delayed.
3. Any customer who currently has an analog meter and requests a delay in the installation of a smart meter shall be placed immediately on a "delay list."
4. Once a customer has been placed on the delay list, a smart meter shall not be installed at the customer's location unless:
 - a) The customer contacts the IOU and requests that he/she be removed from the delay list; or
 - b) The IOU sends a letter to the Commission's Executive Director for authority to install a smart meter at the customer's location. A copy of that letter shall also be sent to the affected customer. The IOU must receive written authorization from the Executive Director before installing a smart meter at any customer account on the IOU's delay list.

Tomenius L. 1986. 50-Hz Electromagnetic Environment and the Incidence of Childhood Tumors in Stockholm County. Bioelectromagnetics 7:191-207.

Abstract: 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 *0.0004* 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.

Worthington, Amy. 2007. The Radiation Poisoning of America. Centre for Research on Globalization.

Dr. Robert Becker, noted for decades of research on the effects of electromagnetic radiation, has warned: "Even if we survive the chemical and atomic threats to our existence, there is the strong possibility that increasing electropollution could set in motion irreversible changes leading to our extinction before we are even aware of them. All life pulsates in time to the earth and our artificial fields cause abnormal reactions in all organisms. These energies are too dangerous to entrust forever to politicians, military leaders and their lapdog researchers."

Source: <http://www.globalresearch.ca/index.php?context=va&aid=7025>

Milham S, Morgan LL. 2008. A New Electromagnetic Exposure Metric: High Frequency Voltage Transients Associated With Increased Cancer Incidence in Teachers in a California School. American Journal of Industrial Medicine 51:579–586.

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.

Wiert J, Hadjem A, Wong MF, Bloch I. 2008. Analysis of RF exposure in the head tissues of children and adults. *Physics in Medicine and Biology* 53:3681–3695.

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, Wiert *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, Wiert *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.

Diagnose-funk.org. 2009. 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.

National Institute of Standards and Technology. The Smart Grid Interoperability Panel – Cyber Security Working Group. 2010. NISTR 7628. Guidelines for Smart Grid Cyber Security: Vol. 2, Privacy and the Smart Grid.

This document provides detailed information regarding the four dimensions of privacy that need to be considered, information about current state laws, and a list of specific recommendations.

The Smart Grid brings with it many new data collection, communication, and information sharing capabilities related to energy usage, and these technologies in turn introduce concerns about privacy. *Privacy* relates to individuals. Four dimensions of privacy are considered: (1) *personal information*—any information relating to an individual, who can be identified, directly or indirectly, by that information and in particular by reference to an identification number or to one or more factors specific to his or her physical, physiological, mental, economic, cultural, locational or social identity; (2) *personal privacy*—the right to control the integrity of one’s own body; (3) *behavioral privacy*—the right of individuals to make their own choices about what they do and to keep certain personal behaviors from being shared with others; and (4) *personal communications privacy*—the right to communicate without undue surveillance, monitoring, or censorship.

Most Smart Grid entities directly address the first dimension, because privacy of personal information is what most data protection laws and regulations cover. However, the other three dimensions are important privacy considerations as well and should be considered by Smart Grid entities.

When considering how existing laws may deal with privacy issues within the Smart Grid, and likewise the potential influence of other laws that explicitly apply to the Smart Grid, it is important to note that while Smart Grid privacy concerns may not be expressly addressed,

existing laws and regulations may still be applicable. Nevertheless, the innovative technologies of the Smart Grid pose new issues for protecting consumers' privacy that will have to be tackled by law or by other means.

Kaleta, Paul. October 8, 2010. NV Energy Smart Grid: Opportunities and State Regulatory Challenges. 2010 EEI Fall Legal Conference.

PUCN identified eight major issues with regard to ASD (a/k/a smart meters):

-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?

As noted in Mr. Kaleta's presentation:

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."

British Columbia, Canada, Council Meeting. 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/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.
- 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).

- 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> .
- 6) 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 digital 2.4 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.

- 7) 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 is 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 April 27, 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).

Hardell L, Sage C. 2008. Biological effects from electromagnetic field exposure and public exposure standards. *Biomedicine & Pharmacotherapy* 62:104-109.

Abstract: 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.

Levitt BB, Lai H. 2010. Biological effects from exposure to electromagnetic radiation emitted by cell tower base stations and other antenna arrays. *Environmental Review* 18:369–395.

Abstract: 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 dermatographism, 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 dermatographism — 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.

Szmigielski S. 1996. Cancer morbidity in subjects occupationally exposed to high frequency (radiofrequency and microwave) electromagnetic radiation. *The Science of the Total Environment* 180:9-17.

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’ (O) 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 [1]. 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 leukaemigenic 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.

Sato Y, Akiba S, Kubo O, Yamaguchi N. 2010. A Case Study of Mobile Phone Use and Acoustic Neuroma Risk in Japan. Bioelectromagnetics pp 1-9.

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.

Massey KA. 1979. The Challenge of Nonionizing Radiation: A Proposal for Legislation. Duke Law Journal pp 105-189.

Adverse Effects of Electromagnetic Radiation on Man and His Environment (includes the following excerpts):

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 lymphocyte 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 mW/cm² range, changes in electroencephalogram (EEG) patterns.

Green LM, Miller AB, Agnewz DA, Greenberg ML, Li J, Villeneuve PJ, Tibshirani R. 1999. Childhood leukemia and personal monitoring of residential exposures to electric and magnetic fields in Ontario, Canada. *Cancer Causes and Control* 10:233-243.

Abstract:

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 (IT). 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.

Wilson BW. 1988. Chronic Exposure to ELF Fields May Induce Depression. Bioelectromagnetics 9:195-205.

Abstract: 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., 1963]; 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., 1980]. 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., 1968].

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 Magadleno [1975].

Landgrebe M, Frick U, Hauser S, Langguth B, Rosner R, Hajak G, Eichhammer P. 2008. Cognitive and neurobiological alterations in electromagnetic hypersensitive patients: results of a case-control study. *Psychological Medicine* pp 1-11.

Abstract:

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.

Michaelis J, Schuz J, Meinert R, Zemmann E, Grigat J, Kaatsch P, Kaletsch U, Miesner A, Brinkmann K, Kalkner W, Karner H. 1997. Combined Risk Estimates for Two German Population-Based Case-Control Studies on Residential Magnetic Fields and Childhood Acute Leukemia. *Epidemiology* 9(1):92-94.

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.

D'Ambrosio G, Massa R, Scarfi MR, Zeni O. 2002. Cytogenetic Damage in Human Lymphocytes Following GSMK Phase Modulated Microwave Exposure. *Bioelectromagnetics* 23:7-13.

Abstract: 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, GSMK) 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 (GSMK), 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 GSMK 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.

U.S. Department of Energy. 2010. Communications Requirements of Smart Grid Technologies.

Smart meters are NOT mandatory.

On July 16, 2009, FERC issued a Policy Statement on Smart Grid Policy that acknowledged that EISA does not make any such standards mandatory and gave FERC no new authority to enforce such standards. Smart Grid Policy Statement, 128 F.E.R.C. ¶61,337, at 61,060–359 (Jul. 16, 2009).

Havas M, Stetzer D. 2004. Dirty Electricity and Electrical Hypersensitivity: Five Case Studies. World Health Organization Workshop on Electrical Hypersensitivity.

Abstract: 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.

Johansson O. 2009. 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. Pathophysiology 16:157-177.

Abstract: 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”).

Tynes T. 1993. Electromagnetic fields and male breast cancer. *Biomed & Pharmacother* 47:425-427.

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.

Blackman CF, Benane SG, House DE, Joines WT. 1985. Effects of ELF (1-120 Hz) and Modulated (50 Hz) RF Fields on the Efflux of Calcium Ions From Brain Tissue In Vitro. *Bioelectromagnetics* 6:1-11.

Abstract: We have previously shown that 16-Hz 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_{rms}/m. Alternatively, 1-Hz and 30-Hz fields at 40 V_{rms}/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 V_p/m, a 45-Hz field causes enhanced efflux in an intensity range around 40 V_{rms}/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 V_p/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_{rms}/m, intensities slightly lower than those that are effective at 50 Hz. Finally, exposures over a series of frequencies at 42.5 V_{rms}/m reveal two frequency regions that elicit enhanced efflux—one centered on 15 Hz, the other extending from 45 to 105 Hz.

**Johansson O. 2006. Electrohypersensitivity: State-of-the-Art of a Functional Impairment
Electromagnetic Biology and Medicine, 25:245–258.**

Abstract: 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 electrohypersensitivity 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.

Blank M, Goodman R. 2009. Electromagnetic fields stress living cells. *Pathophysiology* 16:71-78.

Abstract: 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.

Havas M. 2006. Electromagnetic Hypersensitivity: Biological Effects of Dirty Electricity with Emphasis on Diabetes and Multiple Sclerosis. *Electromagnetic Biology and Medicine*, 25:259–268.

Abstract: 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.

Free MJ, Kaune WT, Phillips RD, Cheng H. 1981. Endocrinological Effects of Strong 60-Hz Electric Fields on Rats. *Bioelectromagnetics* 2:105-121.

Abstract: Adult male rats were exposed or sham-exposed to 60Hz 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 kV/m. 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.

Harland JD, Liburdy RP. 1997. Environmental Magnetic Fields Inhibit the Antiproliferative Action of Tamoxifen and Melatonin in a Human Breast Cancer Cell Line. *Bioelectromagnetics* 18:555-562.

Abstract: 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.

Wilson BW, Wright CW, Morris JE, Buschbom RL, Brown DP, Miller DL, Sommers-Flannigan R, Anderson LE. 1990. Evidence for an Effect of ELF Electromagnetic Fields on Human Pineal Gland Function. *Journal of Pineal Research* 9:259-269.

Abstract: 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.

U.S. Federal Energy Regulatory Commission. July 16, 2009. FERC Policy Statement: Smart Grid Policy, Docket No. PL 09-4-00.

EISA, however, does not make any standards mandatory and does not give the Commission authority to make or enforce any such standards.

Shin E, Nguyen XT, Nguyen TL, Pham DT, Kim HC. 2011. Exposure to Extremely Low Frequency Magnetic Fields Induces Fos-Related Antigen-Immunoreactivity Via Activation of Dopaminergic D1 Receptor. *Experimental Neurobiology* 3:130-136.

Abstract: 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.

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. 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.

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 osteoporosis 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.

Havas M. 2007. 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, pp 1-51.

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 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.

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 actual 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.

Havas M. 2008. 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 pain, 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 affected 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.

Coleman MP, Bell CMJ, Taylor HL, Primic-Zakelj MP. 1989. Leukaemia and residence near electricity transmission equipment: a case-control study. Br. J. Cancer 60:793-798.

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 risk 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).

Beniashvili DS, Bilanishvili VG, Menabde MZ. 1991. Low-frequency electromagnetic radiation enhances the induction of rat mammary tumors by nitrosomethyl urea. Cancer Letters 61:75-79.

Abstract: 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 variable (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.

Burbank ACTION (Against Cell Towers in Our Neighborhood).

<https://sites.google.com/site/nocelltowerinourneighborhood/home/wireless-smart-meter-concerns/first-and-foremost-are-wireless-meters-mandatory>

The federal government does NOT mandate the installation of smart meters, or even wireless smart meters.

On February 1, 2011, press officer Thomas Welch of the U.S. Department of Energy press officer responded to questions about whether the federal government has made the installation of wireless smart meters mandatory. He wrote:

No. The Federal government, including DOE, does not have any role in regulating the installation of smart meters, nor does it have a policy about the mandatory adoption of smart meters.

Maret K. 2011. Commentary on the California Council on Science and Technology Report “Health Impacts of Radio Frequency from Smart Meters” pp 1-15.

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.

2. 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 in 1998 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.

3. 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.”*

4. The lack of information about the impact of pulsed radiation from Smart Meters

There is a 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.

5. 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 the 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.

Nordenson I, Mild KH. More Evidence of EMF Genotoxicity. A Report on Non-Ionizing Radiation. 2000. Microwave News.

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.

Hardell L, Carlberg M. 2009. Mobile Phones, Cordless Phones and the Risk for Brain Tumours. *International Journal of Oncology* 35:5-17.

Abstract: 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 $\geq 50\%$ 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.

Markova E, Malmgren LO, Belyaev IY. 2010. Microwaves from Mobile Phones Inhibit 53BP1 Focus Formation in Human Stem Cells More Strongly Than in Differentiated Cells: Possible Mechanistic Link to Cancer Risk. *Environmental Health Perspectives* 118(3):394-399.

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.

Johansen C, Olsen JH. 1998. Mortality from Amyotrophic Lateral Sclerosis, Other Chronic Disorders, and Electric Shocks among Utility Workers. *American Journal of Epidemiology* 148(4):362-368.

Abstract: 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.

Salford, LG. 2007. 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” convened by the International Commission for Electromagnetic Safety with cosponsors, the Italian Government Worker Safety Program.

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).

Giulani L, Soffritti M. 2010. Non-Thermal Effects and Mechanisms of Interaction Between Electromagnetic Fields and Living Matter. *European Journal of Oncology* 5:301-318.

Abstract: 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.

Hyland GJ. 2000. Physics and biology of mobile telephony. *The Lancet* 356:1833-1836.

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 μ 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.

Hardell L, Carlberg C, Hansson K. 2011. Pooled analysis of case-control studies on malignant brain tumours and the use of mobile and cordless phones including living and deceased subjects. *International Journal of Oncology* 38:1465-1474.

Abstract: 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.

Havas M, Olstad A. 2008. Power quality affects teacher wellbeing and student behavior in three Minnesota Schools. *Science of the Total Environment*, pp 1-6.

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).

Sage C, Carpenter D. 2009. Public health implications of wireless technologies. *Pathophysiology* 603:1-14.

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.

Dutta SK, Ghosh B, Blackman CF. 1989. Radiofrequency Radiation-Induced Calcium Ion Efflux Enhancement from Human and Other Neuroblastoma Cells in Culture. Bioelectromagnetics 10:197-202.

Abstract: To test the generality of radiofrequency radiation-induced changes in $4sCa^{2+}$ 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 $4sCa^{2+}$ efflux was obtained at SAR values of 0.05 and 0.005 W/kg. 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 " Ca^{2+} efflux at an SAR of 0.05 W/kg, 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.

Sage C. 2011. 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, Medtronic, 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.

Sage C. 2011. Assessment of Radiofrequency Microwave Radiation Emissions from Smart Meters. pp 1-100.

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 FCC’s 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 FCC’s 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 the lower of the FCC's reflection factor of 60% (Table 14). Using the FCC's 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.

Sage C. 2011. Sage response to the Electric Power Research Institute (EPRI) comments. pp 1-4.

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.

Loscher W, Mevissen M, Lehmacher W, Stamm A. 1993. Tumor promotion in a breast cancer model by exposure to a weak alternating magnetic field. Cancer Letters 71:75-81.

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 mg/kg 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

Hardell L, Mild KH, Carlberg M, Soderqvist F. 2006. Tumour risk associated with use of cellular telephones or cordless desktop telephones. World Journal of Surgical Oncology 4:74.

Abstract:

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.

WiFi should not be used in schools

The BioInitiative Working Group issued a September 22, 2014, response to a July 7, 2014, letter from CEOs of technology companies (Google, Dell, Apple, Adobe, eBay, Facebook, the George Lucas Educational Foundation and others) to the FCC regarding wireless technologies in schools.

On behalf of the BioInitiative Working Group, we are writing to express our concern about the views expressed by CEOs from Google, Dell, Apple, Adobe, eBay, Facebook, the George Lucas Educational Foundation and others to the FCC supporting wireless technologies in schools.

Your letter to the FCC dated July 7, 2014 titled Education Superhighway, states:

“Today, we are writing to you to urge swift bi-partisan action at your July 11, 2014 meeting to adopt the E-Rate modernization proposal set forth by Chairman Wheeler.”

“By responsibly investing \$2 billion of unused funds and providing predictable ongoing support for Wi-Fi, the plan will make dramatic progress in bringing high-speed connectivity to our classrooms.”

No one denies that bringing high-speed connectivity to our classrooms is important. But it can be a wired connection and does not have to be WiFi. It does not reflect well on the ethics of your corporations to encourage the FCC to provide \$2 billion dollars for new wireless classroom infrastructure and devices for school children, knowing that wireless emissions have been classified as a Possible Human Carcinogen by the World Health Organization’s International Agency for Research on Cancer (2011). To promote wireless technologies in schools is to deliberately and knowingly disregard current health warnings from international science and public health experts.

Saturating schools with wireless technology will likely create unnecessary liability for municipalities and result in a loss of public trust and confidence in the corporations that push their wireless products with a blind eye toward health concerns.

Epidemiological studies show links between radiofrequency radiation (RFR) exposure and cancers, neurological disorders, hormonal changes, symptoms of electrical hypersensitivity (EHS) and more. Laboratory studies show that RFR exposure increases risk of cancer, abnormal sperm, learning and memory deficits, and heart irregularities. Fetal exposures in both animal and human studies result in altered brain development in the young offspring, with disruption in learning, memory and behavior. The brain development of a fetus can be impaired by in-utero exposure to a pregnant woman. The evidence for these statements is based on hundreds of published, peer-reviewed scientific studies that report adverse effects at levels much lower than

current FCC public safety limits. WiFi in schools, in contrast to wired internet connections, will increase risk of neurologic impairment and long-term risk of cancer in students. Corporations cannot avoid responsibility simply by asserting compliance with existing legal, but outdated and inadequate FCC public safety limits.

Today, corporations that deal with educational technology should be looking forward and helping school administrators and municipal leaders to access safe, wired solutions. Your corporations can reasonably foresee and offer alternatives to potentially hazardous exposures to wireless radiation by choosing to support wired educational technologies.

Source: September 22, 2014, response to a July 7, 2014, letter from CEOs of technology companies (Google, Dell, Apple, Adobe, eBay, Facebook, the George Lucas Educational Foundation and others) to the FCC supporting wireless technologies in schools. [Click here](#).