MONTEREY COUNTY

THE BOARD OF SUPERVISORS

JANE PARKER, SUPERVISOR - FOURTH DISTRICT

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March 25, 2011

President Michael R. Peevey
California Public Utilities Commission
505 Van Ness Avenue
San Francisco, CA 94102

Re: Smart Meters

Dear President Peevey:

The Monterey County Board of Supervisors recently received a report (see attached) from our Health Officer, Dr. Hugh F. Stallworth, regarding the safety of Smart Meters. At that Board session, we received extensive testimony from the public expressing concerns. As a result, the Board voted to submit this letter to address the concerns brought forward by our constituents.

Monterey County supports your recent direction to Pacific Gas & Electric to set up a process that would allow customers to opt out of the installation of Smart Meters. Although available literature presented by our Health Officer indicates exposure to radio frequency from Smart Meters should be less than that experienced by routine mobile or cell phone use, there are admitted unknowns regarding these meters.

We also request that the Commission continue to support study, through independent experts, of the effects of long-term exposure to low level electromagnetic frequency, and report out findings to all county health departments in California

We thank you for your continued efforts to maintain a safe and energy efficient environment for the people of California.

Sincerely,

Jane B Parker

Jane Parker
4th District Supervisor

Cc: Monterey County Board of Supervisors

Encl: Report of Monterey County Health Department

Review of Health Issues Related to Smart Meters

MONTEREY COUNTY HEALTH DEPARTMENT, PUBLIC HEALTH BUREAU, EPIDEMIOLOGY AND EVALUATION

MARCH 2011

OVERVIEW

In late 2010, a request was made by members of the public to the Monterey County Board of Supervisors (the Board) to ban the use of smart meters in Monterey County due to concerns about potential adverse health effects. On January 11th, 2011, the Board requested that the Monterey County Health Department review the literature and produce a report summarizing scientific findings related to smart meters and any potential adverse health effects.

PROBLEM STATEMENT

1. What are smart meters and why are they being installed?
2. What does research tell us about the potential for adverse health effects from smart meters?
3. What are the options for addressing consumers' concerns about smart meters?

BACKGROUND

Smart meters are part of 'smart grid' technology, a digital method for utility companies to match utility consumption with generation. Many countries are implementing smart meter technology and grid networks for managing public utility usage. A 2007 United States Act of Congress directed states to encourage utility companies to implement smart meter technology and grid networks (CLEAN Energy Act, 2007). The California Public Utilities Commission (PUC) reviewed the federal directive and in 2009 amended their 2006 opinion on deployment of an advanced metering infrastructure, authorizing utility companies in California to begin to install smart meters as part of this deployment. Several consumer advocacy groups in California have expressed concern about the potential for adverse health effects from radio frequency (RF) emissions from smart meters.

This brief provides a summary overview from the literature on smart meter technology as it might relate to health, research into health effects associated with this or related technology, actions taken to regulate smart grid deployment in other jurisdictions, and options and recommendations for consideration by Monterey County senior policy makers regarding smart meter deployment in the county.

METHODOLOGY

For the purposes of this report, scientific, peer-reviewed literature, and documents produced by scientific groups and government agencies were reviewed to assess how smart meters function and the current state of the science on adverse health effects from smart meters or household equipment using similar technology, specifically electromagnetic frequencies (EMFs). Given the lack of research specific to smart meters, the literature review focused on potential adverse health effects from exposure to mobile phones because they also operate in the radio frequency (RF) band of non-ionizing radiation. These are frequencies on the electromagnetic field (EMF) spectrum below those of visible light and X-rays, and higher than those of power lines. Due to the large body of literature on health concerns related to mobile phone use, this review focused primarily on reports which used meta-analyses whereby large numbers of research papers on a topic are reviewed and results combined to determine if patterns or associations are developing across multiple studies. Sources were accessed through

Google Scholar, PubMed, the references cited by key literature, and from the websites for some scientific groups and government agencies.

LITERATURE REVIEW

Smart Meters - Background

- **Smart meters measure and transmit consumer usage (generally units of use for water, natural gas, electricity) of the utility companies' delivered product.** Smart meters replace traditional analog equipment for collecting home or business utility usage with a combination of wireless area network and digital technology.
- **Smart meters transmit information via wireless technology using electromagnetic frequencies (EMF).** Smart meters' emissions are in the radio frequency (RF) portion of the electromagnetic field (EMF) spectrum. The human body absorbs energy most efficiently in the range of 30-300 MHz and therefore, the corresponding Maximum Permissible Exposure (MPE) limits for RF emissions in this range are the most stringent (FCC, 2011). Smart meters operate in the frequency bands 902-928 MHz band and 2.4 GHz range (Tell, 2008), which is where the human body absorbs energy less efficiently, and the Maximum Permissible Exposure (MPE) limits for RF exposure are less restrictive (FCC, 2011). Cellular and cordless phones, microwave ovens, and wireless routers are other household electronic devices which produce RF emissions.
- Smart meters in households or businesses will generally transmit data to an access point (most usually on utility poles) once every four hours, for about 50 milliseconds at a time (Tell 2008). Once the smart grid is fully active, it is expected that smart meters will transmit more frequently than once every four hours resulting in a higher duty cycle. Exposure levels are expressed as $\mu W/cm^2$. There are few reports providing detailed modeling of the potential exposure patterns that may be associated with individual or arrays of smart meters. A recent report from the California Council on Science and Technology (CCST) presented a chart (Attachment 1; CCST, 2011) showing minimum and maximum exposure levels for various sources, including a smart meter that is always on and from two distances from the body (3 and 10 feet). The CCST concluded that RF exposure levels for smart meters in either scenario would be less than microwave ovens and considerably less than cell phones, but more than WiFi Routers or FM Radio/TV Broadcasts (CCST, 2011). A 2011 report from the Electric Power Research Institute (EPRI) assessed exposures in front of and behind smart meters. It determined that the average exposure levels from smart meters, measured near to a meter and to an array of meters, were at levels similar to those from other devices that produce RF in the home and surrounding environment (EPRI, 2011). While some of these findings are being contested (see Sage Associates at sagereports.com for more information) they provide a platform for investigating the literature on the association of adverse health outcomes and devices that use technology similar to smart meters.

Smart Meters - Potential Adverse Health Outcomes

- **Similar technology has been studied for adverse health outcome associations.** The association between adverse health outcomes and smart meters has not been studied. One option is to review research on potential adverse health effects from electronic devices that have similar or stronger RF emissions and which also rely on transmitting arrays or towers. In particular, there have been numerous studies of the potential for adverse health effects of electromagnetic frequencies (EMFs) for people employed in industries that use radiofrequencies (RFs), people who live in proximity to EMF transmitters, and those who use mobile phones. This report focuses primarily on research related to the association of potential adverse health effects and mobile or cell phone use. Mobile phones are used more in proximity to the body and RF exposure from them is generally in the same range of frequencies used by smart meters (CCST, 2011). The power of mobile phones is also generally higher than smart meters, thus the concern for the health effects from the use of smart meters would have some substantiation if there were found to be consistent patterns of health effects from exposure to and use of mobile phones.
- **Concerns for the health effects of smart meters and similar RF technology focus on thermal and non thermal effects and related outcomes.**

  Thermal Effects:

- Exposure levels to electromagnetic waves (EMF) from smart meters even at close range are well below the limits known to result in health effects from the heat generated by EMF (D'Andrea et al. 2003).
- Limits on power densities from smart meters set by the Federal Communications Commission (FCC) are well below levels where animal studies indicate biological impacts can occur (CCST, 2011). However, concerns are that these limits are for acute and not long-term exposure (Sage and Carpenter, 2011).

Non Thermal Effects:

- Concerns have been expressed in the literature that RF absorption by human beings may disrupt communication between human cells, leading to impacts on cell function and health and there are studies which have found that non-ionizing radiation affects communication channels across cell membranes by inhibiting or closing gap junctions (Lipman et al. 1988; Ye et al., 2002). A recent study found changes in glucose activity in the area of the brain adjacent to the antenna of mobile phones held next to the ear, but it is not known if these effects have long-term consequences (Volkow et al., 2011).
- **Various adverse health outcomes are postulated to be linked to exposure to electromagnetic radiation**. These include the effects of electromagnetic radiation on neuronal electrical activity, energy metabolism, genomic responses, neurotransmitter balance, blood–brain barrier permeability, cognitive function, sleep, and various health effects, especially in relation to mobile phone use and brain diseases such as brain tumors. Several reviews indicate the reported effects were small as long as the radiation intensity remained in the nonthermal range, and generally mechanisms are still poorly understood (Hossman and Hermann, 2003). Further research on the potential biological mechanisms for non-thermal adverse health effects from mobile phone use is needed (NRC, 2008).
- **Recent epidemiological reviews or articles in leading peer-reviewed journals found that while a variety of studies have found some association between the outcome and the RF being studied, there is no consistent or convincing evidence of causal links between non thermal RF exposure and any adverse health effects, including cancer, cardiovascular disease, adverse reproductive outcome, and cataracts** (Ahlbom et al., 2004) **and specifically mobile phone use or mobile phone base stations and cancer** (Ahlbom et al., 2009; Cooke et al., 2010; Elliott et al., 2010; The INTERPHONE Study Group, 2010). In general, adverse health outcomes found by some studies were not able to be replicated by subsequent studies or the results were questioned due to poor study design.
- Two meta-analyses of mobile phone use and the risk of brain tumors found a small increased risk associated with mobile phone use in particular for certain types of tumors using a $\geq$10 year latency period Hardell et al., 2008; Myung et al., 2010). However, the methodology used by the most recently published of these two meta-analyses has been called into question by researchers in the field of oncology (Stang et al., 2010; Samkange-Zeeb et al., 2010).
- Reviewers point out that the strength of the conclusions in studies of the association of adverse health outcomes and RF exposure from mobile phone use are limited due to issues surrounding how RF exposure is measured, how biases have been controlled for, and the insufficient length of time required to study cancers and other outcomes that may take decades to manifest (Ahlbom et al., 2004; Saracci and Samet, 2010).
- If mobile phone use causes cancers of the brain, as some suggest, brain cancer incidence data in the United States would be expected to reflect an increase in cases due to the ubiquitous use of mobile phones over the past 15 years. A recent study of brain cancer incidence in the United States between 1992 and 2006 found that "incidence data do not provide support to the view that cellular phone use causes brain cancer." (Inskip et al., 2010).
- Most reviewers call for more research to answer the question of health risks from RFs, in particular the need for longer term cohort studies (NRC 2008). This is due to the long induction periods for some of the types of brain cancers of concern or if effects are confined to long term users of mobile phones. Other authors call for studies to determine if there are adverse health affects associated with RF exposure in younger age groups, in particular that from mobile phone

use. This is due to the potential for an increased susceptibility to adverse health effects among mobile phone users of a younger age due to their developing systems (NRC, 2008; Sage and Carpenter, 2011).

- **People have also raised concerns about adverse health effects other than cancers.** A recent development of low-grade adverse health effects is those grouped into "electromagnetic hypersensitivity." Some researchers contend that the variety of symptoms reported today, ranging from headaches, skin rashes, sleep disturbances, decreased libido, concentration problems, dizziness, increased risk of cancer, and neurophysiological effects in populations near base stations are similar to those of classic microwave sickness, first described in 1978 (Levitt and Lai, 2010). According to the World Health Organization (2005, 2006), "some individuals have reported that they experience non-specific symptoms upon exposure to RF fields emitted from base stations and other EMF devices." As recognized in a recent WHO fact sheet "Electromagnetic Hypersensitivity," EMF has not been shown to cause such symptoms (WHO, 2005). Nonetheless, it is important to recognize the plight of people suffering from these symptoms. A meta-analysis of studies using blind or double-blind controlled experiments found in over 24 studies that "electromagnetically hypersensitive" participants could not detect low level EMFs nor did their symptoms worsen when exposed to active versus sham EMF exposures (Rubin et al., 2005).
- **Concerns have been raised about adverse health effects from the additive component of living near lots of meters.** Again, a potentially similar situation might be living in proximity to cell phone towers. According to the World Health Organization (2006): "Over the past 15 years, studies examining a potential relationship between RF transmitters and cancer have been published. These studies have not provided evidence that RF exposure from the transmitters increases the risk of cancer. Likewise, long-term animal studies have not established an increased risk of cancer from exposure to RF fields, even at levels that are much higher than produced by base stations and wireless networks."
- General consensus by reviewers regarding the potential association of mobile phone use and other EMF devices and adverse health effects is that more research is required, studies need improvement in their quality of assessment of RF exposure and broadening of outcomes, and more longitudinal studies are needed.
- **Lastly, concerns have been expressed that electromagnetic energy can interfere with proper functioning of implanted medical devices and other electronic medical equipment, such as electronic wheelchairs.** The United States Food and Drug Administration conducts testing of electronic devices and electromagnetic interference and has provided guidelines for ensuring electromagnetic compatibility of medical equipment and electronics that use RF (US FDA, 2000). They have developed a "standard [that] will allow manufacturers to ensure that cardiac pacemakers and defibrillators are safe from cell phone electromagnetic interference." (US FDA, 2011).

Non-Scientific Literature

- There are several documents which are often used by advocates against smart meters but which may be considered non-scientific although they may reference a variety of scientific studies. One such commonly used document is the Bioinitiative Report which was put together with the stated intent of documenting reasons why current exposure standards for EMF are not stringent enough to prevent health effects from EMF (Carpenter and Sage, 2007). The report does not use standard scientific method for a review. Concerns about this report that have been raised by reputable review organizations include that there was an apparent biased selection of studies from the literature, numerous sections were written independently and with no input on the overall summary, there was little to no peer review process, and there is a lack of objectivity and balance regarding the current state of scientific knowledge about the potential health effects of electromagnetic fields (see Literature Cited under Bioinitiative Report for listing of various institutional critiques of this report).
- Thus this report should be used cautiously as a review document when evaluating the potential for adverse health effects from EMFs.

Actions by Other Jurisdictions

- Several California jurisdictions have circulating petitions calling for a ban on smart meters installation, including Sonoma, San Francisco, San Luis Obispo, Humboldt, Santa Cruz, and Alameda Counties.
- In early January 2011, the Marin Board of Supervisors enacted a one-year moratorium on the use of Smart meters in Marin County, though they do not have authority to enact such a ban as the meters fall under the jurisdiction of the California Public Utilities Commission (KQED News accessed on February 24th at: http://blogs.kqed.org/newsfix/2011/01/12/california-council-on-science-and-technology-smartmeter-report/).
- According to a recent report by the Environmental Working Group, concerns about exposure to EMFs from mobile phones have prompted several countries, including Germany, Switzerland, Israel, United Kingdom, France, and Finland, to recommend limiting exposure to it, especially for children, as based on the Precautionary Principle, rather than on scientific certainty (Dreyfuss, 2010).
- The WHO reported that education programs as well as effective communications and involvement of the public and other stakeholders at appropriate stages of the decision process before installing RF sources can enhance public confidence and acceptability (WHO, 2006).

Other Considerations not Addressed in this Brief

- The deployment of smart meters and the development of smart grids are presented as having benefits for consumers (cost savings, transparency of information collection, improved response for power outages), the environment (improved power grid usage and reductions in energy usage), utilities (improved efficiencies and reliability), and the economy (reductions in foreign energy products). However, it is early in the process of deploying smart grids and a literature review did not find any published studies documenting benefits resulting from their use.
- Numerous developed countries are deploying smart meters with various time frames and approaches. Non-health issues that have developed which are not addressed in this brief include the difficulties of deploying a wireless communication system across varying geographies, neglecting to include small-scale energy companies, methods for "selling back" to the grid, excessive costs, having the two-way communication options in deployed Smart meters, the ability of Smart meters technology to interfere with operations of other electronic devices in the homes, and concerns about privacy issues and vulnerability of the grid to computer viruses.

ALTERNATIVES TO SMART METERS

- Some countries have provided alternative hard-wired meters as an option for consumers who do not want wireless smart meters installed on their premises and others have implemented the lower exposure limits based on the Precautionary Principle.
- The World Health Organization (2007) presented the following recommendations for approaching developing guidelines for EMF exposures:
  - When constructing new facilities and designing new equipment, including appliances, low-cost ways of reducing exposures may be explored. Appropriate exposure reduction measures will vary from one country to another. However, policies based on the adoption of arbitrary low exposure limits are not warranted.

CONCLUSIONS

- Currently available literature indicates that exposure to RF energy from smart meters should be less than that experienced by routine mobile or cell phone use.

- Based on the data available at the time of this review, the current Federal Communications Commission standard provides an adequate factor of safety against known thermally induced health impacts of existing common household electronic devices and smart meters.
- Despite extensive studies, there is no consistency of findings across studies regarding an association between non-thermal adverse health effects and exposure to EMFs from mobile phones.
- Due to various factors, further study is warranted to understand the potential for long-term adverse non-thermal health effects of RF energy from sources such as mobile phones.
- The lower exposure levels likely to be experienced from the deployment of smart meters compared to mobile phones should provide consumers some reassurance that there is a lower potential for adverse non-thermal health effects from the operation of smart meters.
- Some countries have adopted different exposure limits for EMF or placement of EMF arrays and towers in relation to certain populations based on the Precautionary Principle rather than on scientific certainty.

OPTIONS FOR CONSIDERATION BY THE MONTEREY COUNTY BOARD OF SUPERVISORS

The Monterey County Board of Supervisors has a wide range of options for consideration in relation to the current smart meter deployment in the county. The Board may:

- Allow the deployment to occur without taking any position.
- Direct staff to send a letter to the PUC requesting the PUC continues to study through independent experts the effects of long-term exposure to low level EMFs and report out findings to all county health departments.
- Adopt a resolution that would support the passage of legislation to allow an opt-out strategy by consumers from the installation of digital smart meters on their property.
- Execute a letter to the PUC requesting that it suspend the smart meters deployment in Monterey County pending further review, research, and reporting by independent non-ionizing radiation researchers regarding the potential for health and safety impacts from smart meter deployment.
- Adopt a smart meter moratorium for smart meter deployment in Monterey County.

It is the recommendation of the Monterey County Health Department that the Board of Supervisors direct staff to send a letter to the PUC requesting the PUC continue to study through independent experts the effects of long-term exposure to low level EMFs and report out findings to all county health departments.

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Attachment 1. Figure 1 and Table 2 from California Council on Science and Technology Report (2011) on Smart Meters: Comparison of Radio-Frequency Levels from Various Sources in $\mu W/cm^2$

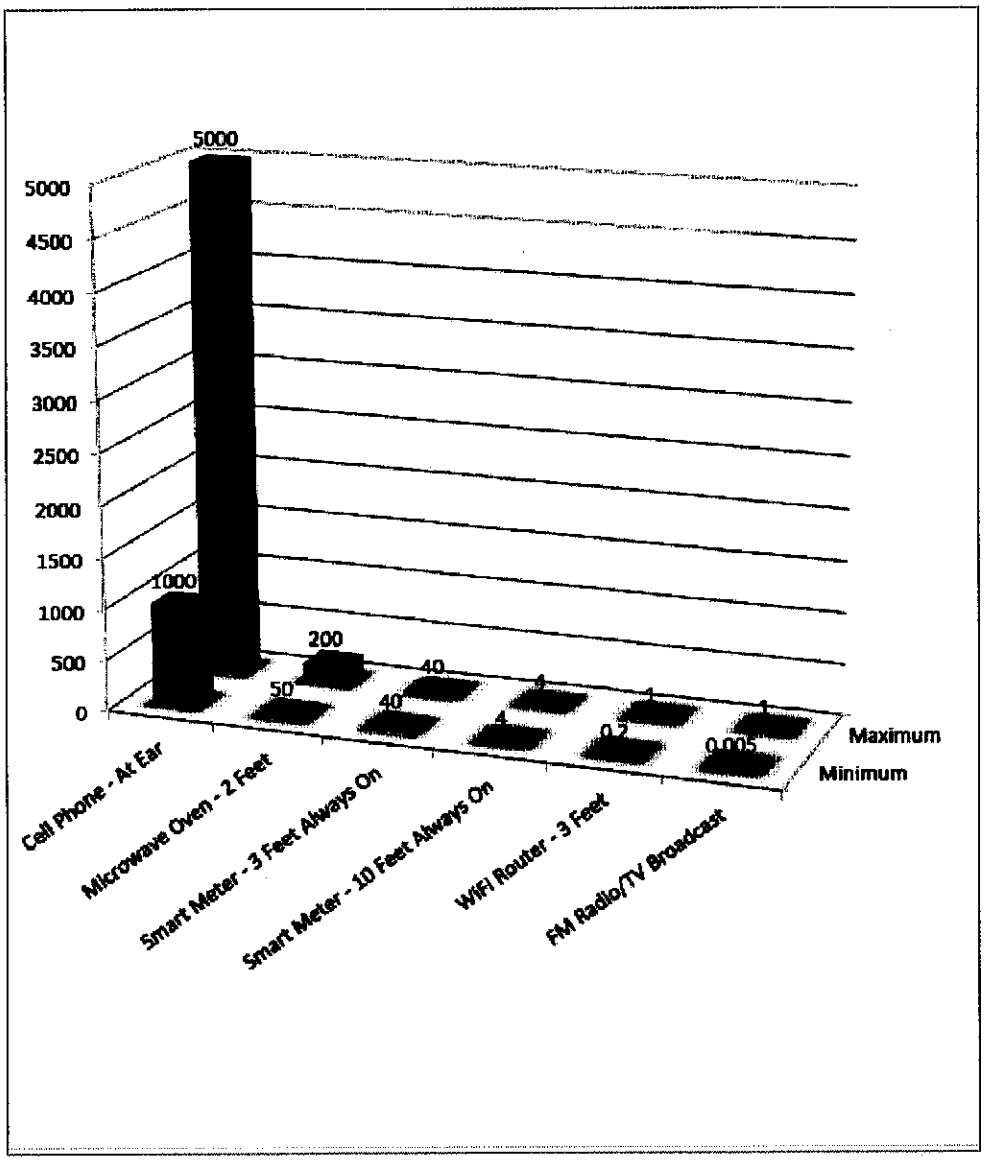

Figure 1. Comparison of Radio-Frequency Levels from Various Sources in $\mu W/cm^2$

Note: Exposure levels in $\mu W/cm^2$ obtained from Table 2 and converted from mW/cm^2. Smart meter figures represent 100% duty cycle (i.e., always on) as hypothetical maximum use case.

Table 2: Radio-Frequency Levels from Various Sources

Source	Frequency	Exposure Level (mW/cm^2)	Distance	Time	Spatial Characteristic
Mobile phone	900 MHz, 1800 MHz	1—5	At ear	During call	Highly localized
Mobile phone base station	900 MHz, 1800 MHz	0.000005—0.002	10s to a few thousand feet	Constant	Relatively uniform
Microwave oven	2450 MHz	~50.05-0.2	2 inches2 feet	During use	Localized, non-uniform
Local area networks	2.4—5 GHz	0.0002—0.001 0.000005—0.0002	3 feet	Constant when nearby	Localized, non-uniform
Radio/TV broadcast	Wide spectrum	0.001 (highest 1% of population) 0.000005 (50% of population)	Far from source (in most cases)	Constant	Relatively uniform
Smart meter	900 MHz, 2400 MHz	0.0001 (250 mW, 1% duty cycle) 0.002 (1 W, 5% duty cycle) 0.000009 (250 mW, 1% duty cycle) 0.0002 (1 W, 5% duty cycle)	3 feet 10 feet	When in proximity during transmission	Localized, non-uniform

Source: Electric Power Research Institute (EPRI), Radio Frequency Exposure Levels from Smart Meters (November 2010)

From: California Council on Science and Technology. 2011. Health impacts of radio frequency from Smart meters. California Council on Science and Technology, Sacramento, CA. 49 pp.