April 12, 2012

To: Patrick Hudson, Michigan Public Service Commission

From: Roger Levy and Janie Page, Smart Grid Technical Advisory Project, Lawrence Berkeley National Laboratory[1]

Subject: Review of the January 13, 2012 County of Santa Cruz Health Services Agency memorandum: Health Risks Associated with Smart Meters[2]

In response to your request on March 20, 2012, we reviewed and include comments in the remainder of this memo regarding the substance and accuracy of the Santa Cruz Health Services Agency (Agency) memorandum. Our review focused on the primary objective of the Agency memorandum, the consistency of the cited references with Agency established peer review criteria, and clarification of several technical claims or assumptions. We did not review or comment on the subject matter, relevance, or accuracy of any references cited in the Agency memorandum with the exception of what is referred to as the Hirsch document. Additional detailed comments are provided in an EPRI evaluation[3] which we've attached.

Summary:

In response to a December 13, 2011 request by the Santa Cruz County Board of Supervisors, Health Officer Poki Stewart Namkung of the County of Santa Cruz Health Services Agency (Agency) issued a ten-page memorandum on January 13, 2012 entitled "Health Risks Associated With Smart Meters"[1]. The County Board of Supervisors asked the Agency to report back and identify potential smart meter health effects and possible mitigation measures. While we have to presume the objective of this request was to look at the issues from the point of view of public health, the Agency memorandum does not appear to provide a balanced representation of the research, the risks, or mitigation options. Instead the Agency memorandum is largely focused on scientifically unsupported claims related to "electromagnetic hypersensitivity" (EHS). It is important to note at the outset that while individuals with EHS report real symptoms, health research has been unable to consistently attribute those symptoms to EMF exposure. For example, a World Health Organization examination concluded the following:

> "*The majority of studies indicate that EHS individuals cannot detect EMF exposure any more accurately than non-EHS individuals. Well controlled and conducted double-blind studies have shown that symptoms were not correlated with EMF exposure.*"
>
> *"Physicians: Treatment of affected individuals should focus on the health symptoms and the clinical picture, and not on the person's perceived need for reducing or eliminating EMF in the workplace or home."*

[1] The Smart Grid Technical Advisory Project provides technical assistance and training to state regulatory commissions on topics related to Smart Grid. The Smart Grid Technical Advisory Project does not get involved in litigated or contested regulatory or other proceedings.
[2] http://emfsafetynetwork.org/wp-content/uploads/2009/11/Health-Risks-Associated-With-SmartMeters.pdf
[3] Additional discussion of issues with the Santa Cruz Health Services Agency memo are covered in "EPRI Comments: A Perspective on Two Smart Meter Memoranda," EPRI Report 1024952, February 2012.

"Governments: Governments should provide appropriately targeted and balanced information about potential health hazards of EMF to EHS individuals, health-care professionals and employers. The information should include a clear statement that no scientific basis currently exists for a connection between EHS and exposure to EMF." [4]

Specific Comments

Besides the focus on EHS, the Agency memorandum is characterized by two additional major problems. First, the Agency memorandum appears to be based largely on limited information obtained from a special issue of a single journal[5] (Pathophysiology), with limited acknowledgement to other relevant scientific, health, or other industry sources. Second, the Agency memorandum addresses EMF exposure concerns by reference to a five-page document[6] authored by Daniel Hirsch. The Hirsch document critiques a California Council on Science and Technology (CCST) report[7] prepared in support of a smart meter investigation initiated by the California Public Utilities Commission (CPUC). The Hirsch document is a private submittal to the CPUC, not a formal report. Unfortunately, the Hirsch report is severely flawed on several dimensions. Our specific comments on each of these problems are outlined below.

1. County of Santa Cruz Health Services Agency, January 13, 2012 Memorandum: Health Risks Associated with SmartMeters

Under the paragraph on page 3 (see below) labeled Evidence-based Health Risks of EMFs, the Agency memorandum sets forth (1) its basic assumption regarding EMF impacts from Smart Meters and (2) its criteria for identifying the scientific research relevant to its memorandum. Unfortunately, there are fundamental conflicts between the Agency stated criteria and the substance of its memorandum, specifically: (1) the Agency does not provide a balanced review or perspective on EMF impacts, and; (2) the resource references cited in the memorandum do not adhere to their own "peer review" criteria and instead overemphasize a single reference source.

"There is no scientific literature on the health risks of SmartMeters in particular as they are a new technology. However, there is a large body of research on the health risks of EMFs. Much of the data is concentrated on cell phone usage and as SmartMeters occupy the same energy spectrum as cell phones and depending on conditions, can exceed the whole body radiation exposure of cell phones (see Attachment B1, Figure 4). In terms of health risks, the causal factor under study is RF radiation whether it be from cell phones, Wi-Fi routers, cordless phones, or SmartMeters. Therefore all available, peer reviewed, scientific research data can be extrapolated to apply to SmartMeters, taking into consideration the magnitude and the intensity of the exposure." [8]

[4] World Health Organization, 'Electromagnetic fields and public health', Electromagnetic hypersentivity, Fact Sheet N ^{0}296, December 2005. http://www.who.int/mediacentre/factsheets/fs296/en/
[5] sciencedirect.com/science/journal/09284680/16/2-3
[6] Comments on the Draft Report by the California Council on Science and Technology, "Health Impacts of Radio Frequency from Smart Meters", Daniel Hirsch, January 31, 2011, http://www.ccst.us/projects/smart2/documents/letter8hirsch.pdf
[7] Health Impacts of Radio Frequency from Smart Meters, Final Report, California Council on Science and Technology, April 2011, http://www.ccst.us/publications/2011/2011smartA.pdf
[8] IBID 1, page 3

- The Agency memorandum includes 51 citations to support its findings. We excluded three - a CPUC opt-out scoping memo, the CCST report, and the Santa Cruz Board of Supervisor moratorium on the installation of smart meters. Of the 48 remaining "technical" citations (classifications listed below) only 24 (or 50%) meet the peer review criteria identified by the Agency as valid sources and 12 of those references (50% of 24) come from a single issue of the Pathophysiology journal (see attachment to this memo).
    - <u>Peer Reviewed Citations (24 citations)</u>
        - 12 references (25% - marked with a yellow highlight) are from two issues of the Pathophysiology journal, 11 which of which are from a single issue,
        - 12 citations (25%) are from non-Pathophysiology peer reviewed sources.
    - <u>Non-Peer Reviewed Citations (24 citations)</u>
        - 19 citations (40% - marked with a red 'x') are from sources that are not peer reviewed but are in fact commentary or opinion articles representative of anti-smart meter positions,
        - 5 citations (10%) reference web sites whose material is difficult to classify as research.

- There is no scientific or other basis to justify the Agency statement in the quoted paragraph above that "...the causal factor under study is RF" and therefore "... all available, peer reviewed, scientific research data can be extrapolated to SmartMeters". This statement is technically and scientifically incorrect and not supported by any research. "RF radiation" is not a single agent. Established science shows that biological effects, when observed, change depending on the state of the biological system, the field intensity, the field frequency, the duration of exposure, and a variety of other variables.
- In the Background section the Santa Cruz memo notes that Smart Meters will use pulsed frequencies in a wide range of "800 MHz – 2400 MHz". This is incorrect. Wireless radio-based Smart Meters use the 900 MHz band (nominally 902 MHz – 928 MHz) for communication with the utility back end systems. Frequencies in the 2405 MHz – 2483 MHz range are typically reserved for <u>optional</u> (and in most cases, not currently operational) Home Area Networks.
- The Agency memorandum concludes by noting that "..there is no scientific data to determine if there is a safe RF exposure level." As a practical matter, the environment in which we live typically includes a number of RF sources, many beyond our control, that have higher emissions (in terms of intensity) than do Smart Meters. These include wireless routers in public and private spaces, radio and TV broadcasts, baby monitors, remote control devices, etc.[9] Science can work to understand the causes of effects, when observed, but it has never been able to categorically declare anything completely safe.

2. Comments on the Draft Report by the California Council on Science and Technology, "Health Impacts of Radio Frequency on Smart Meters", Daniel Hirsch, January 31, 2011

[9] "Smart Meters, Household Equipment, and the General Environment," City of Naperville, Naperville Smart Grid Initiative (NSGI), Pilot 2 RF Emissions Testing – Summary Report – V2.0, November 10, 2011.

Under the paragraph on page 3 labeled Evidence-based Health Risks of EMFs, the Agency memorandum makes reference to the Hirsch document as its "peer-reviewed" source for quantifying that SmartMeter whole-body radiation exceeds that from cell phones. There are several critical deficiencies and problems with the Agency reference to and use of the Hirsch document, specifically:

- The Hirsch document is a privately prepared set of comments, not a peer-reviewed scientific study; consequently it does not meet the Agency's own standard for reference.
- We were unable to identify any educational or professional credentials for Daniel Hirsch or either of the two "research assistants" identified in his document that might qualify them to comment on EMF radiation, health, or SmartMeter operations.[10]
- There are critical errors in the Hirsch document. Specifically Figure 4 claims to correct for two problems with the CCST report: (1) meters operating at 100% duty cycles and (2) whole body exposures.
    - The Hirsch document modifies results from the CCST report based on a number of assumptions that arbitrarily decrease cell phone and microwave oven exposures and thereby appear to enhance smart meter exposures. We provide two examples:

        Example 1.
        "Comparing the peak dose to the ear from a cell phone, when the rest of the body gets vastly less radiation, with a whole body exposure where all organs get roughly the same dose from a SmartMeter, doesn't seem appropriate. If there is a cancer effect, it is likely associated with the total RF energy the body receives."[11]

    We agree with the first part of this statement, specifically, much of the cell phone RF research logically focuses on potential effects to the ear, brain and regions of the body in proximity to cell phone emissions, not the whole body. Likewise, it would also be appropriate to challenge the assumption that smart meters will operate in an "always on" mode when actual field measurements document much lower operating conditions.

    Hirsch's apparent method for extrapolating the exposure to the whole body by simply multiplying original values by a factor of 200[12] is further flawed because it does not take into account the fundamental physics of any radiating source whose strength declines as the square of the distance from the source. Unfortunately, Hirsch can't arbitrarily make assumptions and change results for some but not all sources of exposure just because he thinks it ". . . doesn't seem appropriate."

[10] Mr. Hirsch, who identifies himself as "a lecturer and expert in nuclear policy at UCSC" is in fact a lecturer in social policy at UCSC and, separately, heads an organization called "Committee to Bridge the Gap" whose stated goal is "revealing and correcting government misconduct in the control of nuclear and related hazardous materials that pose significant threats to public health and security if not carefully regulated". The only credentials available for the research assistants listed in the Hirsch document were for Bailey Hall – which identified her as a student at UCSC, an Intern at the Committee to Bridge the Gap, and as a "Level 3" employee at In-N-Out Burger.
[11] IBID 5, page 4
[12] No further explanation is given by Hirsch for this correction factor.

Example 2.

"In other words, the chart (original CCST Figure 1) compares a SmartMeter that is always on with a cell phone or microwave oven when they are being used, even though 99% of the time they are not in use. This overestimates the cumulative exposure by a factor of 100 for the cell phone and microwave oven, and dramatically skews the comparison."[13]

As a result of this comment Hirsch modified and reduced the results in Figure 4 to better reflect what he believes is a more realistic duty cycle for cell phones and microwave ovens. This same adjustment for Smart Meters was not deemed necessary, even though (as stated above) the documented and measured duty cycle for Smart Meters is consistently less than for cell phones and microwave ovens[14].

- The Hirsch Figure 4 fails to note that the CCST report already accounts for the duty cycle issue[15] . The CCST report increased the Smart Meter EMF emissions reported in the original EPRI report by a factor of 20 (to extrapolate the EPRI reported 5% duty cycle to 100%) and used the highest possible (and unlikely) power setting of 1 Watt. This resulted in a "hypothetical maximum use case" that is well in excess of at least two independent measurements of actual Smart Meter operations[16] but still within the FCC safety margins. The CCST report further notes that the actual Smart Meter duty cycle will most likely be in the <1% to 5% range. FCC testing results[17] and additional field measurements[18], show that transmitters may actually not always operate at their rated power but more likely in a range from 0.25 to 0.5 watt. As a result the CCST reported values at 100% duty cycle are already substantially higher than is physically possible with the Smart Meters – thus any further Hirsh correction would be inappropriate because the values are already overstated. The 40 $\mu W/cm^2$ exposure level at 3 feet represented in Figure 4 assumes a 100% duty cycle and full power operation, neither of which is a reasonable operating assumption. More on duty cycle measure is included in Attachment A.
- Second, the issue of whole body exposure vs. localized exposure (e.g. cell phone) in the Hirsch report is inconsistent with extensive scientific research on RF which shows that body tissues respond differentially based on the type of cell involved and the proximity to a source of RF emissions, duration of the exposure, and other specific exposure

[13] IBID 5, page 4

[14] "Smart Meters, Household Equipment, and the General Environment," City of Naperville, Naperville Smart Grid Initiative (NSGI), Pilot 2 RF Emissions Testing – Summary Report – V2.0, November 10, 2011, Tables 9 and 10, and (independently) "Characterization of Radio Frequency Emissions From Two Models of Wireless Smart Meters", EPRI report 1021829, December 2011.

[15] This duty cycle correction is noted in text immediately following the figure both times it appears in the CCST report (as Figure 1, page 5, and Figure 7, page 20) and can be easily seen by comparing the graph in the CCST report with the data from which it was derived in Table 2 that appears on page 21 of the CCST report.

[16] "Smart Meters, Household Equipment, and the General Environment," City of Naperville, Naperville Smart Grid Initiative (NSGI), Pilot 2 RF Emissions Testing – Summary Report – V2.0, November 10, 2011 and "Characterization of Radio Frequency Emissions From Two Models of Wireless Smart Meters", EPRI report 1021829, December 2011.

[17] "An Investigation of Radiofrequency Fields Associated with the Itron Smart Meter", EPRI report 1021126, December 2010.

[18] "Radio-Frequency Exposure Levels from Smart Meters: A Case Study of One Model", EPRI report 1022270, February 2011.

characteristics.[19] In addition, a cell phone placed close to the head provides less distance for the fields to decline before they reach brain (or any other) tissue whereas a smart meter is not likely to be used in such close proximity to a brain. Even if a person is sleeping on the other side of the wall from a smart meter, detailed measurements[20] show that the exposure to whatever portion of the body is coincidentally closest to the meter will experience vastly reduced emissions compared with those from a device with a similar radio used close to the body. RF emissions into the home are shielded in part by the back of the meter, the electrical service panel, exterior and interior walls of the premise, and any furniture or other items in the path between the meter and subject.

[19] See for example Eugene M. Goodman, Ben Greenebaum, Michael T. Marron, Effects of Electromagnetic Fields on Molecules and Cells, In: Kwang W. Jeon and Jonathan Jarvik, Editor(s), International Review of Cytology, Academic Press, 1995, Volume 158, Pages 279-338, ISSN 0074-7696, ISBN 9780123645616, 10.1016/S0074-7696(08)62489-4. (http://www.sciencedirect.com/science/article/pii/S0074769608624894)
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[20] "Smart Meters, Household Equipment, and the General Environment," City of Naperville, Naperville Smart Grid Initiative (NSGI), Pilot 2 RF Emissions Testing – Summary Report – V2.0, November 10, 2011 and "Characterization of Radio Frequency Emissions From Two Models of Wireless Smart Meters", EPRI report 1021829, December 2011.

Attachment A. The Duty Cycle Question.

Much has been made of the question of appropriate duty cycles when reporting exposure. Typically, the higher the duty cycle, the greater the reported emissions. FCC guidelines (OET65) do not require 100% duty cycle for emitters that are not ever likely to run at 100% duty cycle. Here is an excerpt from the FCC document[21] to support this:

> Before beginning a measurement survey it is important to characterize the exposure situation as much as possible. An attempt should be made to determine:
>
> (1) The frequency and maximum power of the RF source(s) in question, as well as any nearby sources.
>
> (2) Duty factor, if applicable, of the source(s).
>
> (3) Areas that are accessible to either workers or the general public.
>
> (4) The location of any nearby reflecting surfaces or conductive objects that could produce regions of field intensification ("hot spots").
>
> (5) For pulsed sources, such as radar, the pulse width and repetition rate and the antenna scanning rate.
>
> (6) If appropriate, antenna gain and vertical and horizontal radiation patterns.
>
> (7) Type of modulation of the source(s).
>
> (8) Polarization of the antenna(s).
>
> (9) Whether measurements are to be made in the near-field, in close proximity to a leakage source, or under plane-wave conditions. The type of measurement needed can influence the type of survey probe, calibration conditions and techniques used.
>
> If possible, one should estimate the maximum expected field levels, in order to facilitate the selection of an appropriate survey instrument. For safety purposes, the electric field (or the far-field equivalent power density derived from the E-field) should be measured first because the body absorbs more energy from the electric field, and it is potentially more hazardous. In many cases it may be best to begin by using a broadband instrument capable of accurately measuring the total field from all sources in all directions. If the total field does not exceed the relevant exposure guideline in accessible areas, and if the measurement technique employed is sufficiently accurate, such a determination would constitute a showing of compliance with that particular guideline, and further measurements would be unnecessary.

[21] Federal Communications Commission, Office of Engineering and Technology, "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields", OET Bulletin 65, Edition 97-01, August 1997, page 49.

EPRI Comments: A Perspective on Two Smart Meter Memoranda

EMF and RF Health Assessment and Safety

Introduction

In January 2012, two separate memoranda – one from the Santa Cruz (CA) County Health Officer[1] and another from the American Academy of Environmental Medicine (AAEM)[2] – were issued indicating views that the radio-frequency (RF) electromagnetic fields emitted from smart meters pose a health risk. The purpose of these EPRI Comments is to offer additional perspectives on the issues raised in these two memoranda.

The two memoranda assert that the Federal Communications Commission (FCC) rule issued in 1997 (see FCC OET Bulletin 65[3] and Code of Federal Regulations 47 CFR § 1.1310) that sets enforceable limits on human RF exposure is protective of only adverse thermal effects, and does not address non-thermal effects. Neither the Santa Cruz nor the AAEM documents took into account the vast wealth of research on RF conducted over nearly half a century, as well as the "weight-of-evidence" approach taken by any number of expert groups and panels convened over the years to evaluate the RF health science literature.

Background

By way of historical perspective, the 1997 FCC rule was adopted from two previous guidelines, one published by the National Council on Radiation Protection and Measurements (NCRP Report No. 86) in 1986, and the other by the Institute for Electrical and Electronic Engineers (IEEE C95.1) in 1991. Both had extensively reviewed the biological and health literature, regardless of whether or not the research had been conducted at non-thermal levels of exposure. NCRP and IEEE both concluded that the only established effects were associated with tissue heating, and that there were no confirmed adverse effects from RF exposure levels below an exposure threshold associated with an elevation in body temperature of about 1 degree centigrade (1.8 degrees Fahrenheit).

Prior to its publication, the FCC rule received endorsements from the U.S. Environmental Protection Agency (EPA), the U.S. Food and Drug Administration (FDA), and the U.S. Occupational Safety and Health Administration (OSHA). The EPA reaffirmed its opinion in letters written in 1999 and 2002. The expanding body of scientific evidence concerning potential health effects from RF exposure has been re-visited since the FCC rulemaking, but the basic conclusions have remained consistent with the position taken by the FCC in 1997. The International Commission on Non-Ionizing Radiation Protection (ICNIRP, 1998 reaffirmed in 2009) and the IEEE (2005) published exposure limits very similar to the FCC's following a comprehensive review of the scientific literature.

References to reviews and comments about RF health by a variety of scientific and governmental institutions are included at the end of this commentary. They reflect a consensus that adverse effects from RF exposure have not been established below the thresholds that serve as the basis for published exposure limits.

Concerns about RF exposures received significant visibility in Spring 2011 when the International Agency for Research on Cancer (IARC) released the results of its expert panel's evaluation of potential cancer risks from radiofrequency exposures.[4] Based on "limited"[5] epidemiologic evidence in studies of cell phones and "limited"[6] evidence from a small

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[1] http://sccounty01.co.santa-cruz.ca.us/bds/Govstream/BDSvData/non_legacy/agendas/2012/20120124/PDF/041.pdf

[2] http://aaemonline.org/images/CaliforniaPublicUtilitiesCommission.pdf

[3] http://transition.fcc.gov/Bureaus/Engineering_Technology/Documents/bulletins/oet65/oet65.pdf

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

[5] "A positive association has been observed between exposure to the agent and cancer for which a causal interpretation is considered by the Working Group to be credible, but chance, bias or confounding could not be ruled out with reasonable confidence." (from: IARC)

[6] "The data suggest a carcinogenic effect but are limited for making a definitive evaluation because, e.g. (a) the evidence of carcinogenicity is restricted to a single experiment; (b) there are unresolved questions regarding the adequacy of the design, conduct or interpretation of the studies; (c) the agent increases the incidence only of benign neoplasms or lesions of uncertain neoplastic potential; or (d) the evidence of carcinogenicity is

fraction of all reported animal experiments, IARC classified radiofrequency electromagnetic fields as a "possible" or a Group 2B carcinogen. The hierarchy of IARC categories consists of: Group 1, Carcinogenic to humans (i.e., sufficient evidence); Group 2A, Probably carcinogenic (less than sufficient evidence); Group 2B, Possibly carcinogenic (limited evidence, less supportive evidence than 2A); and Group 3, Not classifiable (inadequate and/or insufficient evidence for classification).[7] With reference to Group 2, IARC states,

> The terms probably carcinogenic and possibly carcinogenic have no quantitative significance and are used simply as descriptors of different levels of evidence of human carcinogenicity, with probably carcinogenic signifying a higher level of evidence than possibly carcinogenic.

Thus, the IARC 2B classification provides for a range of qualitative interpretations concerning potential carcinogenicity of radiofrequency electromagnetic fields. This classification carries an indication that more research information would be required for a more definitive statement in either direction, but as of the present the weight of evidence does not provide a basis for concluding that RF can be considered even "probably" carcinogenic. IARC is a part of the World Health Organization (WHO), which is planning in the near term to evaluate the potential effects of RF on all health endpoints, including cancer.

In light of the scientific uncertainties with respect to cancer and all other potential health effects from RF fields, similar to those emitted by smart meters and other technologies, the Electric Power Research Institute (EPRI) held two workshops in 2011. The first of these was designed to more specifically identify emerging technologies within the electric utility industry whose operation would result in electromagnetic field emissions. Such emissions may occur by design for communication purposes or may be a by-product of a technology, such as emissions from appliances powered with variable speed drives. The second workshop was a meeting of internationally-convened health scientists to review the state of knowledge with respect to potential health effects of RF. The workshop covered all aspects of RF science including epidemiology, exposure assessment, laboratory studies (humans and animals), and biophysical mechanisms. A report describing both workshops is available to the public.[8]

Specific Comments

The AAEM includes the statement that "the US NIEHS National Toxicology Program in 1999 cited radiofrequency radiation as a potential carcinogen." In 1999, RF was nominated to the National Toxicology Program (NTP) by the FDA's Center for Devices and Radiological Health (CDRH) as an exposure to be tested in a long-term cancer study in animals, an experiment that's termed a bioassay. The CDRH did not offer a conclusion regarding RF carcinogenicity, and a nomination is based on many factors that include scientific uncertainty among other considerations. The nomination's executive summary concluded, "[t]here is currently insufficient scientific basis for concluding either that wireless communication technologies are safe or that they pose a risk to millions of users. A significant research effort, involving large well-planned animal experiments is needed to provide the basis to assess the risk to human health of wireless communications devices." After a delay of several years, the experiment is presently in progress with results expected in the 2014 time frame.

The AAEM also stated that "[e]xisting safety limits for pulsed RF were termed 'not protective of public health' by the Radiofrequency Interagency Working Group [RFIAWG] (a federal interagency working group including the FDA, FCC, OSHA, the EPA and others)". On a formal basis the agencies named had endorsed the FCC rule (see above). However, the RFIAWG's purpose was to raise critical issues with respect to RF exposure limits. The group transmitted a list of 14 questions to the chair of the IEEE Risk Assessment Work Group in June 1999, with the qualification that, "[t]he views expressed in this correspondence are those of the members of the Radiofrequency Interagency Work Group and do not represent the official policy or position of the respective agencies." The exact quote from the AAEM memorandum could not be found or verified, but one of the group's questions concerned pulsed fields (and may have formed the basis for the AAEM statement), as follows:

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restricted to studies that demonstrate only promoting activity in a narrow range of tissues or organs." (from: IARC)

[7] The parenthetical descriptions are encapsulated thumbnails for quick reference only. The full IARC methodology is at http://monographs.iarc.fr/ENG/Preamble/CurrentPreamble.pdf

[8] Visit http://www.epri.com and type "1024737" in the search box to retrieve the workshop summary.

> These studies have resulted in concern that exposure guidelines based on thermal effects, and using information and concepts (time-averaged dosimetry, uncertainty factors) that mask any differences between intensity-modulated RF radiation exposure and CW [continuous wave] exposure, do not directly address public exposures, and therefore *may not adequately protect the public*." (emphasis added)

The IEEE Work Group transmitted a response to all of the RFIAWG's questions and with reference to pulsed fields stated,

> There are no reliable studies that provide convincing evidence of adverse, nonthermal effects, occurring at exposure levels below the current guidelines. To be convincing and reliable, claims of adverse, non-thermal effects must be repeatable by other capable and interested laboratories. Potentially significant in vitro studies demonstrating low level RF induced effects have not been substantiated, and either found upon review after publication to have technical problems, and/or are overwhelmed by a body of evidence which demonstrates a consistent absence of the initial reported effect.

Thus, the RFIAWG was not asserting that the FCC's limits were not protective, but was asking the IEEE Work Group to give its questions serious consideration (which it did).

The transmittal from the Santa Cruz County health officer reflected a misunderstanding of several terms and concepts, including some of the basic principles of how smart meters work. For example, the piece identified sunlight as a source of extremely-low-frequency (ELF) electromagnetic fields. In fact, sun's emissions span the spectrum from ultra-violet to infrared. The frequencies of the sun's emissions are at least 12 orders of magnitude (a thousand billion) times greater than the power frequency, which is 60 Hz and located within the ELF range. As another example, the author identifies x- and gamma-rays as "extremely high frequency," or EHF, which is a label reserved for the frequency band from 30 gigahertz (GHz) to 300 GHz. A GHz is a thousand million Hz and the EHF band is a part of the spectrum that is "non-ionizing," in other words, EHF exposure (unlike x- and gamma-rays) does not directly damage genes. Emissions from smart meters are at frequencies ten or more times lower than EHF, and therefore, also do not directly break molecules (such as DNA) or damage genes.

With respect to smart meter operation, the Santa Cruz memorandum stated,

> It has been aptly demonstrated by computer modeling and real measurement of existing meters that SmartMeters emit frequencies almost continuously, day and night, seven days a week. Furthermore, it is not possible to program them to not operate at 100% of a duty cycle (continuously) and therefore it should not be possible to state that SmartMeters do not exceed the time-averaged exposure limit.

In fact, smart meters transmit for a very small fraction of the time (the fraction of time transmitting is called the duty cycle), usually 1% or much less, with a handful of exceptions that are higher. For example, a recent analysis of data from 88,296 meters in the Pacific Gas and Electric service territory reported that 0.2% of the meters transmitted for 1% or more of the time (EPRI Technical Report 1021829). The results were similar in a study of the Southern California Edison and San Diego Gas and Electric service territories in which, respectively, 0.1% and 0.0% of meters sampled had duty cycles greater than 1% (EPRI Technical Report 1021126).

Though we live in a digital age with a proliferation of wireless technologies, exposure to RF has been ever present indoors and outdoors since the 1920s with the advent of the AM radio broadcast industry (~1 MHz), the 1930s with the introduction of FM radio (~100 MHz), and the 1940s and 1950s with, respectively, the great expansion of VHF TV (~50 to 200 MHz) and UHF TV (~400 to 900 MHz). The range of exposure levels from these broadcast technologies is not much different from those in the near vicinity (~10 feet) of smart meters (see EPRI White Paper, 1022270). The exposure levels from smart meters are very small because they transmit at power levels no greater than about 1 watt, about the same power used by a small flashlight bulb. Although they transmit in all directions, the research to date indicates that the exposure levels are relatively lower behind the meter than in front (EPRI Technical Reports 1021829 and 1021126), a factor that becomes relevant to concerns about exposure in a room directly behind the meter.

Finally, the Santa Cruz memo refers to the following point apparently sourced from another article,

> …most research carried out by independent non-government or non-industry affiliated researchers suggests potentially serious effects from many non-ionizing radiation exposures [, and] research funded by industry and some governments seems to cast doubt on the potential for harm.

With regard to this statement two points are appropriate to mention. First, the gold standard for including a piece of research in a formal risk evaluation is whether it has been published in the peer-reviewed literature, not who the source of funding happened to be. Second, government institutions and industry have a responsibility to address environmental health issues that may touch either or both the general public or occupational groups. One could justifiably point to a lack of support from public institutions or industry as an abrogation of their responsibility to the common good. The Santa Cruz memo refers to a very limited segment of published research instead of citing the full record of published science that forms the basis for formal risk assessments.

Conclusion

In conclusion, smart meters offer consumers the means with which to economically optimize and plan their use of electricity, while providing the electric utility the information to more efficiently operate the system, pinpointing issues with local service in real time. Smart meters deployed in California and many other states across the U.S. communicate wirelessly, meaning that they both receive and emit RF electromagnetic fields. The smart meters studied in California operate at a power of 1 watt or less, producing fields that are very small compared to the exposure limits published by the FCC, ICNIRP and IEEE, even at very close distances to the meter face. The data collected to date indicate that, with very few exceptions, the meters transmit with a duty cycle of one percent or less (about 14 minutes or less per day). For purposes of assessing compliance, the measured field is multiplied by the duty cycle to derive an average exposure level, which would usually lower the total exposure value by a hundred-fold or more. The exposure limits published by the FCC, ICNIRP and IEEE were the product of careful and thorough evaluations of the scientific literature at all levels of exposure (above and below thermal thresholds). All of these limits are based on a consensus that there is no evidence for adverse effects of RF exposure below the level documented in laboratory experiments that caused tissue heating accompanied by behavioral disruption. To remain conservative, the three organizations added safety factors of 10 to the behavioral threshold for occupational groups (i.e., trained personnel), and 50 for the general public. On the basis largely of studies addressing RF exposures from cellular telephones, IARC classified RF electromagnetic fields a "possible" (Group 2B) carcinogen, meaning the existing research information is "limited" leaving uncertainties that further study could lessen. However, the designation fell below the threshold for IARC to conclude that RF is "probably" carcinogenic (Group 2A). For 30-plus years, the Electric Power Research Institute has taken an active role in characterizing electromagnetic environments associated with power frequency transmission and distribution systems, and more recently with RF from smart meters. The results of these recent RF investigations have been shared with the regulatory/policy and industry communities as well as with the general public in the interest of fostering a common understanding of these environments.

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