

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 Officer¹ 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 65³ 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

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

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>

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:

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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