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September 23, 2010

Ms. Lora Lee Martin
Director, Science & Technology Policy Fellowship
Director, Sacramento Office
California Council on Science & Technology
1130 K Street, Suite 280
Sacramento, CA 95814-3965

Dear Ms. Martin:

This responds to your request for input related to assessment of safety of Smart Meters. I am now finishing a term as member of the EPRI scientific advisory committee for EMF research; but I received no funding from EPRI or any other source to prepare this response. I do not speak on behalf of any organization including my own university or EPRI.

The two questions you wanted addressed are:

1. *Whether FCC standards for Smart Meters are sufficiently protective of public health taking into account current exposure levels to radiofrequency (RF) and electromagnetic fields.*

The FCC exposure limits¹ were designed to protect against all known hazards of RF energy. They were developed following the standard Federal rulemaking process, including review at several levels and ample opportunity for public comment. These limits have gained the support of federal health agencies, and have withstood legal challenge. Consequently, I consider these limits to be scientifically and legally robust.

While the current FCC limits are now more than ten years old, they are similar to more recent guidelines as well: IEEE C95.1-2005² and those of the International Commission on Nonionizing Radiation Protection (ICNIRP)³. Both limits were developed through an extensive review and evaluation of the scientific evidence related to possible health risks of RF fields. The ICNIRP limits, in particular, underlie the RF exposure limits in many countries.

Major health agencies have expressed the view that these limits are protective against all known hazards of RF energy. For example, the EMF Project of the World Health Organization issued the statement that included: "To date, all expert reviews on the health effects of exposure to RF fields have reached the same conclusion: There have been no adverse health consequences established from exposure to RF fields at levels below the international guidelines on exposure limits published by the International Commission on Non-Ionizing Radiation Protection".⁴ Another WHO communication stated: "The main conclusion from the WHO reviews [of RF bioeffects data] is that EMF exposures below the limits recommended in the ICNIRP international guidelines do not appear to have any known consequence on health."⁵ Health agencies in Ireland, the UK, The Netherlands, and a panel under the auspices of the European Union⁶ have issued similar statements, attesting to the high level of credibility of these two recent standards.

A citizen's exposure to RF energy from Smart Meters under any conceivable circumstance is a *very tiny fraction* of the IEEE, ICNIRP, and FCC exposure limits⁷. Smart Meters transmit at similar maximum power levels as ordinary mobile phone handsets, but at a very low duty cycle (the devices transmit for a very small fraction of the time). Roughly speaking, the RF exposure to a resident of a house from a Smart Meter is comparable to that produced by operation of a mobile phone at the same location as the Smart Meter for a few seconds a day. This level of exposure is entirely trivial with respect to FCC, IEEE and ICNIRP guidelines. It is also trivial compared to other exposures to RF energy that a citizen routinely experience in the course of a day from other technologies that emit RF energy, including use of mobile phone handsets.

Smart Meters are a new technology, but they employ RF energy at about 900 MHz, similar to two of the most-studied frequency ranges for RF bioeffects (a major cell phone band and the Industrial-Scientific-Medical band). From my own study of the field extending back for more than 40 years, I am aware of no reason to anticipate any special features of emissions from Smart Meters that would make them more biologically active than other forms of RF energy in this same frequency range. I have a high level of confidence that the IEEE and ICNIRP limits, and by extension the older FCC limits, are highly protective against possible hazards from RF energy emitted by Smart Meter, as they are against emissions from other sources of RF energy in this frequency range.

To be sure, there has been public controversy surrounding IEEE and ICNIRP exposure limits, although little controversy is evident in pronouncements by health agencies themselves. This controversy has two main sources:

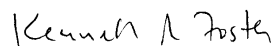
- a. Electrical hypersensitivity Some individuals believe that they are “electrically sensitive” to RF fields at rather low levels – although in provocation studies “a causal relation between EMF exposure and symptoms has never been demonstrated”⁸.
 - b. Fear of the unknown There have been calls for reduction in exposure limits to levels far below ICNIRP limits, due to fears that some as-yet undemonstrated hazard may exist from exposure to RF energy at low levels. The WHO emphatically discourages the “arbitrary adjustments to the limit values to account for the extent of scientific uncertainty,”⁹ which this approach exemplifies.
2. *Whether additional technology specific standards are needed for Smart Meters and other devices that are commonly found in and around homes, to ensure adequate protection from adverse health effects.*

It would be extremely difficult, if not impossible, to implement additional technology specific standards for Smart Meters, for two reasons:

- a. Lack of identification of hazard. According to WHO and other health agencies, there is no credible evidence for adverse health effects from RF exposures at levels below present international limits (ICNIRP), and consequently none at the very much lower exposure levels from Smart Meters. In the absence of credible scientific evidence for a potential hazard or understanding of the exposure conditions at which the hazard exists, there is no rationale for developing exposure standards.
- b. Consistency Any standard that would limit exposures to RF fields at the low exposure levels produced by Smart Meters would, if consistently applied, have serious and unpredictable consequences to other technologies that use the RF spectrum in this general frequency range, some of which are important for health and safety. Applications of the RF spectrum near 900 MHz (the frequency range used by Smart Meters) range from high-powered industrial, scientific and medical equipment, to low-powered devices such as cordless phones and household sensors incorporating RF telemetry (which may produce field levels at the location of their users that exceed those from Smart Meters). Ordinary mobile handsets operate in this general frequency range and operate at far higher time-averaged power levels than Smart Meters, taking into account their higher duty cycles of transmission. Other applications in this general frequency range include personal-area networks, some radar applications, an amateur radio band, and (in the 800 MHz band) public safety radio. There is a very real danger that exposure guidelines that are intended to address public fears about this one low-powered technology will adversely impact other, possibly vitally important, technologies that operate in the same general frequency range.

In an important Communication, the European Commission indicated that collecting and evaluating information and conducting further research can be a valid application of the Precautionary Principle as a risk management tool to address undefined or unproven technological risks¹⁰. The same EC Communication also cautioned against taking arbitrary measures not in proportion to those taken in otherwise similar circumstances (in this case setting RF exposure limits for other sources of RF energy). I suggest that this might be a constructive approach for Smart Meters as well.

Sincerely yours,



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SUMMARY RESUME

NAME Kenneth R. Foster

DATE/PLACE OF BIRTH July 21, 1945
Baltimore, Maryland

NATIONALITY United States Citizen

EDUCATION 1967 B.S.(Honors) Physics
Michigan State University
1971 Ph.D. (Physics)
Indiana University
Professional Engineer in the State of Pennsylvania
(Certificate Number: PE-030018-E).

EMPLOYMENT

Lieutenant, Medical Service Corps, USNR 1971-6
Department of Bioengineering
University of Pennsylvania 1976-present
Postdoctoral Fellow (1976-7)
Assistant Professor (1977-83)
Associate Professor (1983-present)
Professor (1999-)
Consultant, World Health Organization EMF Project, Geneva, Switzerland 2000 (sabbatical leave from the University of Pennsylvania)

HONORS/DISTINCTIONS

Indiana University Physics Department Award for Excellence in Teaching, 1970.
Defense Nuclear Agency Certificate of Achievement, 1976.
Fellow, Institute of Electrical and Electronics Engineers, 1988.
Fellow, American Institute of Medical and Biological Engineering, 1991

PROFESSIONAL SERVICE

AdCom, IEEE Engineering in Medicine and Biology Society, 1984-6, 1988-
Associate Editor, IEEE Transactions on Biomedical Engineering, 1985-1989
Program Chair, 1987 IEEE EMBS Annual Meeting (1200 papers presented)
Conference Chair, 13th Annual Northeast Bioengineering Conference, 1987
Chair, IEEE Committee on Man and Radiation 1997-9
Chair, IEEE EMBS Ethics and Professional Responsibility Committee, 1989-1993
President, IEEE Society on Social Implications of Technology 1996-8
President, Philadelphia Society for Risk Analysis 1996-7
President, IEEE Society on Social Implications of Technology, 1996-8
Member, IEEE/ANSI C95.1 (sets exposure standards for RF energy) 1998-
Member, National Council on Radiation Protection and Measurements 2000 – 2004
Editor in Chief, BioMedical Engineering Online 2006-

RESEARCH EXPERIENCE AND DIRECTION

Since receipt of the Ph.D. in 1971, Dr. Foster has been engaged in studies on the interaction of nonionizing radiation and biological systems, with more than 100 papers in peer-reviewed journals on topics including biophysical mechanisms of interaction, electrical properties of biological materials, and medical applications. In addition he has written widely about the public controversy surrounding these issues. He is coauthor or coeditor of two books on risk assessment and the law.

References

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- ¹ FCC Bulletin 65, "Evaluating compliance with FCC guidelines for human exposure to radiofrequency electromagnetic fields", Washington DC 1997.
 - ² Institute of Electrical and Electronics Engineers IEEE Std C95.1–2005. IEEE standard for safety levels with respect to human exposure to radio frequency electromagnetic fields, 3 kHz to 300 GHz.
 - ³ International Commission on Non-Ionizing Radiation Protection – ICNIRP. Statement on the "Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (up to 300 GHz)", 2009.
 - ⁴ WHO: Children and mobile phones: clarification statement. Available on the Internet at http://www.who.int/peh-emf/meetings/ottawa_june05/en/index4.html.
 - ⁵ <http://www.who.int/peh-emf/standards/en/>
 - ⁶ Committee on Man and Radiation, COMAR Technical Information Statement: Expert reviews on potential health effects of radiofrequency electromagnetic fields and comments on The Bioinitiative Report, Health Physics 97(4):348-356 (2009).
 - ⁷ EPRI, a perspective on radio-frequency exposure associated with residential automatic meter reading technology, Feb 2010.
 - ⁸ E. van Rongen et al, Effects of radiofrequency electromagnetic fields on the human nervous system, J. Toxic. Env. Health Part B-Critical Reviews 12 (8),572-597 (2009).
 - ⁹ WHO EMF Project Fact Sheet "Electromagnetic Fields and Public Health Cautionary Policies" available on the internet at http://www.who.int/docstore/peh-emf/publications/facts_press/EMF-Precaution.htm.
 - ¹⁰ K. R. Foster, P. Vecchia, M. H. Repacholi, Science and the precautionary principle. Science 288: 979-980 (2000).