



Smart Meters Health and Safety Issues

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Roger Levy
Levy Associates
Smart Grid Technical Advisory Project

Janie Page
Science / Engineering Associate
Environmental Energy Technologies Division
Lawrence Berkeley National Laboratory

Chuck Goldman, Project Manager
Electricity Markets and Policy Group
Lawrence Berkeley National Laboratory

Conclusion

While scientific evidence overwhelmingly concludes there are no problems related to smart meter RF exposure, health science cannot conclude that individuals will not experience negative side effects.

- Many anti-smart meter arguments reflect a lack of trust in regulatory and utility organizations.
- Many anti-smart meter arguments incorrectly attempt to extend all RF research results to smart meters.
- Some anti-smart meter arguments demand health and safety certifications from research that is beyond what science can support, even for common every-day products, services, food, and behaviors.
- Rational arguments and what might otherwise be considered a rational solution will not necessarily prevail under these conditions.



Briefing Outline

- 1. The problem**
- 2. Radiation: Ionizing vs. Non-Ionizing**
- 3. Electromagnetic Fields**
- 4. Thermal vs. Non-Thermal Effects**
- 5. IARC Classification**
- 6. Other Health Issues**
- 7. Summary Conclusions**



1.0 There is no problem.

RF Radiation levels from advanced and smart meters do not pose a health hazard

- ❑ “Even if an AMI unit were to continuously operate it would still have exposures in a home far below FCC limits for the public.”¹
- ❑ “smart meters ... result in much smaller levels of ... exposure than many ... household ... devices, ... cell phones and microwave ovens”²
- ❑ “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.”³
- ❑ “Irrespective of duty cycle,even multiple units or banks of meters in the same location will be compliant with the public exposure limits.”⁴

1. A Perspective on Radio-Frequency Exposure Associated with Residential Automatic Meter Reading Technology, EPRI, February 2010, <http://www.sdge.com/documents/smartmeter/EPRI%20Paper%20on%20RF%20Exposure%20and%20AMR.pdf>
2. Health Impacts of Radio Frequency from Smart Meters, California Council on Science and Technology, January 2011, <http://www.ccst.us/publications/2011/2011smartA.pdf>
3. Electromagnetic fields and public health, World Health Organization, Fact Sheet N 296, December 2005, <http://www.who.int/mediacentre/factsheets/fs296/en/index.html#>
4. FCC letter to Cindy Sage, Compliance Review Request of March 15, 2010, Smart Meter RF Exposure Limits, August 6, 2010.



1.1 There is a problem.

RF Radiation levels from advanced and smart meters pose a health hazard

Arizona
California
Connecticut
Hawaii
Maine
Texas
Wyoming

Ontario and BC,
Canada
Victoria, Australia

- ❑ "There's no relief from these signals going through the human body."¹
- ❑ "Smart Meters expose all of us to dangerous microwave like EMF/RF frequency on a continuous basis, that among other things can disrupt the brain, nervous system, endocrine system, immune system and hormones."²
- ❑ "Plants that grow beside Smart Meters die."²
- ❑ "FCC compliance violations are likely to occur under normal conditions of installation and operation of smart meters and collector meters in California."³
- ❑ "There is a huge body of evidence to refute the claim ... that there are no effects from sub-thermal exposures"⁴

1. "Smart Meter Made Me Sick, Mesa Woman Claims", KPHO CBS 5 News, February 22, 2011, <http://www.kpho.com/valleynews/26946007/detail.html>
2. "Worried About Smart Meters", Planet Thrive, February 14, 2011, <http://planetthrive.com/2011/02/worried-about-smart-meters/>
3. "Assessment of Radiofrequency Microwave Radiation Emissions from Smart Meters", Sage Consulting, <http://sagereports.com/smart-meter-rf/>
4. Eilihu Richt, M.D., M.P.H. Hebrew University-Hadassah, Letter to CCST, January 26, 2011, <http://sagereports.com/smart-meter-rf/?p=278>



1.2 Key Points

- **Smart Meters RF differs from cell phones and other sources**
- There is a strong body of research on effects from radio frequencies in general, but
 - RF emissions encompass a wide range of parameters that go far beyond anything attributed to smart meters
 - No biologically active components, if any, has been identified in any prior research -
- No extensive health studies have been conducted for Smart Meters except for measurements of associated fields
- Most anti smart meter concerns are not backed by scientific studies, existing research is misassociated with smart meters, and technical terms are often misused.



2.0 Radiation: Ionizing vs. Non-Ionizing

- ❑ **Radiation:** energy emitted from a source
- ❑ **Non-ionizing Radiation:** radiation with enough energy to “move atoms in a molecule or cause them to vibrate, but not enough to remove electrons”¹
Examples – sound waves, visible light and microwaves.
- ❑ **Ionizing Radiation:** “radiation that has enough energy to remove tightly bound electrons from atoms, thus creating ions.”¹ Examples – generate electric power, kill cancer cells, etc.

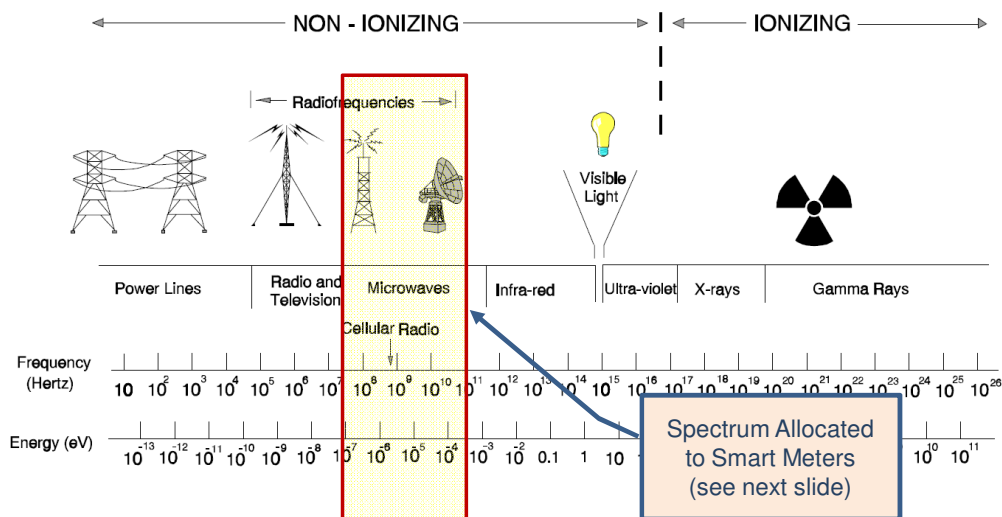
What does this mean for smart meters?

Radio Frequency (RF) from smart meters, no matter how long it is applied or at what intensity, is **not** ionizing radiation.



1. U.S. Environmental Protection Agency, Ionizing & Non-Ionizing Radiation,
http://www.epa.gov/radiation/understand/ionize_nonionize.html

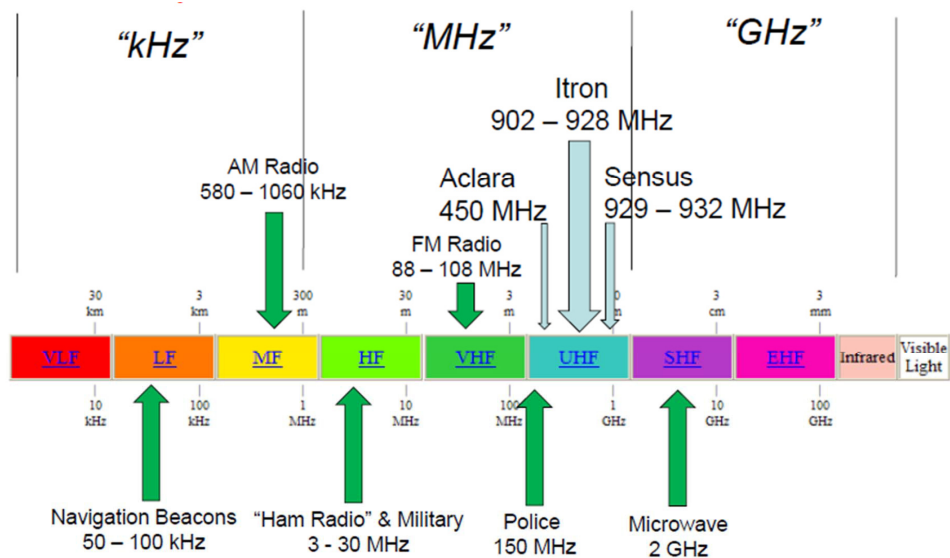
2.1 Radiation: Meter Spectrum Allocation



Source: Federal Communication Commission OET Bulletin 56, 4th Edition, August 1999
http://transition.fcc.gov/Bureaus/Engineering_Technology/Documents/bulletins/oet56/oet56e4.pdf



2.2 Radiation: Meter Spectrum Allocation



Utilities Telecom Council, Smart Meters and RF Safety, Presentation, K.Bender, April 9, 2012

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2.3 Radiation: Many common devices use RF

- ❑ **1.7 MHz** – Early analog cordless phones (no longer in production).
- ❑ **46 MHz - 47 MHz** - Low-power walk-talkies and some baby monitors.
- ❑ **300-400 MHz** – Most garage door openers, some keyless remotes, and some temperature and humidity sensors. Some smart meters also operate in this band.
- ❑ **902 MHz - 928 MHz** – Newer cordless phones, office phone headsets, wireless speakers, video game controllers, E-ZPass (highway toll tags), some baby monitors, temperature and humidity sensors, and some cell phones. Some smart meters also operate in this band.
- ❑ **1800 MHz (1.8 GHz)** – Some cell phones
- ❑ **2.45 GHz** Bluetooth, WiFi
- ❑ **2.7 GHz** – Some recent cordless phone models

What does this mean for smart meters?

Smart meters generally operate with lower duty cycles in bands also populated with other common consumer devices that create more direct, longer duration exposure.



3.0 Electromagnetic Fields

RF electromagnetic fields are not a single factor but are distinguished by several operating characteristics:

- ❑ **Intensity** - measured in Watts, sometimes given in terms of W/cm^2 to indicate power density or W/kg to indicate Specific Absorption Rate
- ❑ **Frequency** – smart meters operate over a range of frequencies and according to research human bodies and other biological systems appear to respond differently to different frequencies.
- ❑ **Duration and Duty Cycle** – research indicates that smart meters operate in short bursts, for brief durations of time (less than 1 minute total per day). The transmission time for Smart Meter will almost always be less than for cell phones.
- ❑ **Modulation** – some meter systems vary transmission between certain frequencies to improve their reliability.

What does this mean for smart meters?

Scientific study results for other devices or sources of RF are only relevant if the applied fields have similar characteristics to smart meters.



3.1 Electromagnetic Fields - Meters are not Cell Phones

- All studies to date focus on cell phone RF signals
- Cell phones held close to ear (brain & head)
- Different field characteristics in terms of modulation and duty cycles

What does this mean for smart meters?

Scientific study results for other devices or sources of RF are only relevant if the applied fields have similar characteristics to smart meters.



3.2 Electromagnetic Fields - Distance

- Smart Meters preferentially radiate outwards
 - Measurements confirm more than 10 times reduction at 8 inches behind meter face compared with field in front of meter (moving away from house)*.
 - The energy emerging from the source radiates out, so it's intensity falls off as $1/R^2$

What does this mean for smart meters?

- Measurements of field strength taken in front of a meter will read higher than a comparable measurement inside the home.
- Since field strength declines so rapidly from the source, it is extremely small at any reasonable distance from the meter.
- Measurement in back of the meter within the home will be reduced substantially by the service panel and wall material which act to reduce field strength.

* Characterization of Radio Frequency Emissions from Two Models of Wireless Smart Meters, EPRI Report 1021829, December 2011



3.3 Electromagnetic Fields - Exposure

RF emissions from wireless smart meters are

- constrained by the low power of the transmitter's power and the antenna's gain
- "in measurements performed [in California homes], peak values were less than 0.8% of FCC MPE [maximum permissible exposure]
- for general public with 90% of the measured values being less than 0.1% of the FCC MPE."¹
- FCC guidelines for human exposure to RF Electromagnetic Fields (OET 65, 1997) are met by all Smart Meter equipment as a condition of operating agreement ^{2, 3}

What does this mean for smart meters?

Measurements confirm that extremely low intensity fields associated with Smart Meters are compliant with stringent FCC rules.

¹ Characterization of Radio Frequency Emissions from Two Models of Wireless Smart Meters, EPRI Report 1021829, December 2011

² A Discussion of Smart Meter and RF Exposure Issues, Edison Electric Institute and Association of Edison Illuminating Companies, March 2011

³ Characterization of Radio Frequency Emissions from Two Models of Wireless Smart Meters, EPRI Report 1021829, December 2011



4.0 Thermal vs. Non-Thermal Effects

- ❑ Thermal effects look at energy deposition in tissue with a focus on power, SAR (specific absorption rate)
- ❑ Non-thermal effects appear to be specific signals recognized by particular biological systems, which may involve resonances, specific field modulations, or co-factors.

What does this mean for smart meters?

Thermal and non-thermal effects are generally covered or regulated under FCC exposure standards.



5.0 IARC: Meter RF as a 2B Possible Carcinogen

- ❑ The International Agency for Research on Cancer (IARC) is part of the [World Health Organization](#).
- ❑ IARC conclusions reflect a group ranking that considered environmental, occupational, and personal devices as sources of exposure, but focused only on cell phones studies. No new studies were conducted.
- ❑ IARC rankings reflect the state of science, not scientific proof.
- ❑ *In the forty year history of the IARC monograph program, more than 900 agents have been evaluated¹: and classified:*
 - 107 have been put in group 1 (known carcinogen),
 - 61 in group 2A (probable carcinogen)
 - **269 in group 2B (possible carcinogen)**
 - 508 deemed to be unclassifiable, group 3
 - Only one agent specifically classified as non-carcinogenic

What does this mean for smart meters?

The IARC 2B classification reflects the group opinion regarding the state of science. It is not a declaration that RF causes cancer.



¹<http://monographs.iarc.fr/ENG/Classification/index.php>

5.1 IARC: Actual Working Group Conclusions*

- ❑ “There is *limited* evidence in humans for the carcinogenicity of RF-EMF, based on positive associations between glioma and acoustic neuroma and exposure to RF-EMF from wireless telephones.”
- ❑ “There is limited evidence in experimental animals for the carcinogenicity of RF-EMF.”
- ❑ “. . . Reviewed many studies with endpoints relevant to mechanisms of carcinogenesis . . . The results provided only weak mechanistic evidence relevant to RF-EMF-induced cancer in humans.”

* monographs.iarc.fr/ENG/Publications/REF_Poster2012.ppt



5.2 IARC: Different Professional Responses

- ❑ Vermont Department of Health memo
 - *Current standards sufficient to protect public health*
- ❑ Monterey County Public Health
 - *Encouraged more studies*
- ❑ California Council on Science and Technology
 - *FCC guidelines sufficient for thermal effects; insufficient information on non-thermal effects to make recommendations*
- ❑ Santa Cruz County Health Department
 - *Concerns about universal and involuntary exposure*
- ❑ American Academy of Environmental Medicine
 - *Smart Meter RF is “a preventable environmental hazard”*

What does this mean for smart meters?

Health professionals come to different conclusions based on the available information, their interpretation, and their personal beliefs.



6.0 Other Health Issues

- ❑ **DNA breaks**
 - DNA breaks found with exposure to 2450 MHz RF and 60 Hz EMF. ¹
 - Not relevant to smart meters - these are different frequencies than employed for smart or advanced meters.
- ❑ **Cancer** - details on Slide 6.1
 - Not relevant to smart meters - results limited and applicable only to cell phones placed directly next to head. ²
- ❑ **Enhanced glucose production in brain** - details on Slide 6.2
 - Not relevant to smart meters - required longer exposure and greater proximity to brain than is possible from Smart Meter. ³
- ❑ **Sleep disturbances** – details on Slide 6.3
 - Uncertain relevance to smart meters - numerous studies report no effect on sleep use operating modes very similar to that for Smart Meters. ⁴

¹ [Pathophysiology](#). 2009 Aug;16(2-3):79-88; [Environ Health Perspect](#). 2004 May;112(6):687-94; [Mutat Res](#). 1998 May 25;400(1-2):313-20.

² <http://interphone.iarc.fr>

³ *JAMA*. 2011;305(8):808-813. doi: 10.1001/jama.2011.186

⁴ Electromagnetic Biology and Medicine, Early Online: 1–5, 2012



6.1 Other Health Issues: Cancer

- ❑ Large, international set of case-control studies in 13 countries around the world focusing on four types of tumors in tissues that most absorb RF energy emitted by mobile phones including users with at least 10 years of exposure.
- ❑ Results suggest “an increased risk of glioma, and much less so meningioma, [only] in the highest decile of cumulative call time, in subjects who reported usual phone use on the same side of the head as their tumour and, for glioma, for tumours in the temporal lobe.”
- ❑ Authors note that “biases and errors limit the strength of the conclusions that can be drawn from these analyses and prevent a causal interpretation.”

What does this mean for smart meters?

Not relevant to smart meters - results limited and applicable only to cell phones placed directly next to head.*



* <http://interphone.iarc.fr>

6.2 Other Health Issues: Enhanced Glucose Production in Brain

- ❑ Single report*, studied 47 healthy participants
- ❑ Whole-brain metabolism did not differ between on and off conditions. In contrast, metabolism in the region closest to the antenna was significantly higher for on than off conditions.
- ❑ Effect seen after **50-minute cell phone exposure** was associated with increased brain glucose metabolism in the **region closest to the antenna**.
- ❑ Authors noted that “This finding is of unknown clinical significance.”

What does this mean for smart meters?

Not relevant to smart meters - required longer exposure and greater proximity to brain than is possible from Smart Meter.*



* *JAMA*. 2011;305(8):808-813. doi: 10.1001/jama.2011.186

6.3 Other Health Issues: Sleep Disturbances

- ❑ Sleep disturbances found in limited studies using cell phone RF; other study results differ*
- ❑ A recent report suggests the distinction comes from inappropriate assumptions about dosimetry: in “no effect” cases, cell phone was effectively off, operating in a state more like Smart Meters in normal operation**

What does this mean for smart meters?

Uncertain relevance to smart meters - numerous studies report no effect on sleep use operating modes very similar to that for Smart Meters.*

* See for example, Neuroscience Letters 2007 Jun 21;421(1):82-6 (<http://www.ncbi.nlm.nih.gov/pubmed/18259868>) which reports differential effects based on modulation, in contrast with J. Sleep Res. 2011 Mar;20(1 Pt 1):73-81 (<http://www.ncbi.nlm.nih.gov/pubmed/20561179>) which reports no effect on an extensive list of sleep parameters

** Electromagnetic Biology and Medicine, Early Online: 1–5, 2012



7.0 Conclusions

- ❑ Essentially all studies done to date consider effects from cell phone fields, not smart meter fields. Key distinctions include:
 - proximity to head (cell phones closer to brain when used)
 - duty cycle (cell phones have higher duty cycle when used)
- ❑ Measurements confirm relatively low emissions from Smart Meters, preferentially directed away from the home to which it is attached.
- ❑ Thermal effects covered by exposure guidelines. Non-thermal effects require specific field characteristics (not “more is worse”), require more study to isolate key characteristics.

What does this mean for smart meters?

- **Smart Meters are one small part of the overall RF environment.**
- **Conclusions drawn for cell phones not relevant to Smart Meters.**
- **Smart Meters are inherently low power devices whose emissions are well below established FCC Guidelines.**



Contact Information



- ❑ **Chuck Goldman**
Lawrence Berkeley National Laboratory
CAGoldman@lbl.gov
510 486-4637
- ❑ **Roger Levy**
Smart Grid Technical Advisory Project
RogerL47@aol.com
916 487-0227
- ❑ **Janie Page**
Lawrence Berkeley National Laboratory
JPage@lbl.gov
510 486-7015

