From:	Mark Humphrey
To:	UTC DL Records Center
Subject:	Objections to Advanced Metering Infrastructure Policy, Docket U-180117
Date:	Wednesday, March 7, 2018 11:35:27 PM
Attachments:	Smart-Meter-Health-14000-to-190000.pdf Health-Risks-Associated-With-SmartMeters.pdf

To whom it may concern:

I am opting out of the AMI meter deployment by PSE, but do not want a digital meter at all. I demand that UTC block PSE continued deployment of AMI meters and provide an analog meter option. It is becoming known, because of testimony in the Michigan House and Senate, that AMI meters are a significant cyber security threat, and that even the non-radio transmitting meters are inferior to analog meters and pose a risk to my health, safety, security and privacy.

An analog meter option exists in a number of states, like Austin Power in Austin, TX where SCL GM Larry Weis oversaw that opt-out policy.
Analog meters are safer for electrical equipment, appliances, and aged wiring.
Analog meters are as accurate as digital meters and may be more accurate in extreme weather.
Analog meters last for over 40 years, whereas the opt-out meter will only last 15 years at most.
As a PSE customer I am already paying through my rates for the AMI, and will be penalized for opting out and forced to pay a per billing cycle fee for a new digital meter that may incorrectly increase my usage through internal computer errors that cannot be audited or appealed.
An analog meter will protect my privacy. The new meters collect granular electricity usage data that can reveal intimate details about what is going on inside a person's home that third-party entities have access to. The ACLU has detailed these issues and neither PSE nor UTC has adequately recognized the issues or mitigated them, violating constitutional rights without the consent or knowledge of the public.
I herby request to be notified before the date of my scheduled meter replacement & that I will have the option to retain my analog meter.

I request that the UTC block any further implementation of Smart Meters or the AMI meter that PSE is continuing to install on homes here in Washington State.

There are many public available documenting the many health affects of these devices that the UTC should be reviewing with regards to public safety. Please see attached documents below.

Regards,

Mark J, Humphrey in Renton WA

The following information is to inform the UTC of the health and safety concerns of Smart Meters or the AMI meters being installed by PSE and other utilities in the Seattle area.

I've measured the RF Microwave Radiation with the "Gigahertz Solutions" Test equipment

and these power meters are giving off large RF spikes well over 200 uW/m^2 and at times well over 2000 uW/m^2. Please see attachments..

AMI Meter Deployment has Begun

"Smart" meters, now called the new "standard" electric meters, are starting to roll out in the Puget Sound Energy (PSE) territories, causing a resurgence of the discussion about the Advanced Metering Infrastructure (AMI) project and all of its implications. This newsletter will review the main reasons to cancel the project and to demand an analog meter option.

PSE Revenue Shortfall & AMI Deployment Cost Overruns

Recently, PSE has been under scrutiny for issues related to revenue shortfalls for the past 5 years and cost overruns of the AMI Deployment project. These issues are related. For PSE, the AMI Deployment is about dramatically cutting operational costs to offset the decreasing revenue trend, which is expected to continue. PSE customers have already seen increased rates over the last several years to primarily enable the AMI implementation projects. None of the operational savings that PSE will create will be passed on to the customer; on the contrary they are now looking into how to restructure their billing to counter the decreasing retail electricity demand and still maintain revenue. We will be watching this discussion closely.

ACLU Against Seattle's AMI Deployment

ACLU sent a letter to Seattle City Council on May 26, 2017 over privacy concerns. ACLU is demanding stronger privacy safeguards around the data collection and third-party access to that data. They are also concerned that SCL customers have not been adequately informed about the AMI deployment to enable their actual consent and that the Opt-Out Policy is meaningless and expensive. These are my concern as well that PSE has no safeguards in-place to protect personnel information that is being gathered with these AMI meters!!

Opt-Out and Demand Analog Option

Michigan has introduced a bill, HB 4220, that would allow citizens to opt-out of the state's AMI program and retain their analog meters. Hearings have been held and several state Senators and Representatives have testified on the lack of value from the "smart" meter deployment and the significant risk to safety and security; Michigan State Senator Patrick Colbeck is one of the proponents of this bill, we can provide this testimony... if necessary!!

The AMI project from PSE does not provide any benefit to the customer either, only detriment, in higher rates and greater risk. The only way that UTC or PSE will change their direction is if enough constituents and customers stand up and speak out. PSE has NOT offered an opt-out from the new microwave emitting "standard" meters, but that does not adequately protect the customers or community. The opt-out plan will need to provide customer with Truly non-transmitting (non-microwave) new "standard" meter. Though the

non-transmitting meter is better than the transmitting one, it does not alleviate the increased costs nor the bulk of risks associated with a digital meter. I demand the option to have an analog meter it's the ONLY solution safe enough for human heath.

- Larry Weis, General Manager at SCL, said he would make analog meters available for people who opt-out in a meeting with SUMA-NW on April 4, 2016. I asked a PSE meter maintenance worker if they had any more Analog meters, he said they only have the FOCUS brand digital meter. PSE is now saying that they cannot provide analog meters anymore. The meter industry has killed the analog market to secure the demand for inferior digital meters that need to be replaced more frequently. "Analog meters are no longer available," is a contrived story. Austin Power in Austin, TX, where Mr. Weis was the former CEO, has an analog meter opt-out policy as do other places in the US. Austin Power uses refurbished analog meters from Hialeah Meter Company in Florida to satisfy the opt-out policy. They are equal or better than new. PSE's claim that digital meters are more accurate than analog meters is also a myth.
- The payment burden for deploying the AMI system is born by the customers and opt-out customers will pay twice, rates have already increased, electricity bills will increase, and they will pay an opt-out fee and an additional per billing cycle charge. See Michigan Representative Gary Glenn testimony.
- The following table shows the comparison of digital meters to analog meters. The AMI meter will be an RF transmission meter and the Opt-Out will be a plain digital meter without RF transmission.

Digital Meters	**Analog Meters**
Electricity usage is calculated (not measured) and probably time averaged, which will cause usage to be higher see Engineer William Bathgate's explanation.*	Electromechanical measurement as accurate as digital meters.**
Weather conditions like temperature and humidity can affect accuracy.	Not susceptible to weather conditions.
Use electricity to operate thereby increasing electricity usage that costs you more.	Does not use electricity.
Meter readers are replaced with 24/7 AMI IT staff	Implementing self-reading program will save on meter readers.***
Does not reduce overall CO_2.	Zero impact on environment.
Increased fire hazard, especially with RF transmission.	Not known to cause fires.
Transmitting meters pose cyber security threat. (Cynthia Ayers is a national security threat analyst testifies for the Michigan House Committee.)	Do not pose a cyber security threat.
Are hackable.	Not hackable.

Creates privacy breach through the collection of granular electricity usage data that can reveal intimate details about what is going on inside a person's home that thrid-party entities have access to.	No data collection.
Subject to catastrophic failures, such as power surges, lightning strike.	Not subject to catastrophic failures.
Creates electromagnetic interference (EMI) which places a destructive burden on appliances (refrigerator) and electronics (computer) on a circuit. **Not** compliant to FCC rules for "conducted" emissions (EMI/RFI) class A or B.	No EMI.
Life span of 5-15 years, AMI 5-9 years, non-transmitting digital can last 15 years	Last for over 40 years.
Remote disconnect and outage detection features have been benched (for transmission meters only) because of project cost overruns. The default will be the same as for analog meters. The remote disconnect, if and when implemented will increase the fire hazard.	Outage detection by phone (still the primary method in AMI areas) and disconnects done manually. Outage detection at substations are currently effective and sufficient.

*This report specifically addresses the specific meters to be deployed in the SCL area, and thoroughly explains Accuracy, EMI/RFI, and Security/Privacy issues. It is my understanding that the FOCUS brand meter (installed by PSE) is very similar to the meters deployed by SCL. And therefore exposes us to harmful EMI & RF Microwave Radiation!!

**Both Analog and digital meters must comply to the same standards, ANSI C12, therefore meet same specifications for accuracy. It has been proven that digital meters are not as accurate.

***If meter readers are too costly, then implement a self-reading program as is done in most rural areas for those who prefer an analog meter.

The AMI meter is the Landis & Gyr FOCUS RXR-SD, the Opt-Out meter is the L&G FOCUS AXR. Ideally, an Analog meter would be the safest option. For further clarification of the different meters and their electromagnetic profiles click here.

Meter Model	**EMR/Microwave /RF**	**EMI/RFI – Electric Fields from Interference**
FOCUS RXR-SD	YES	YES
FOCUS AXR	NO	YES

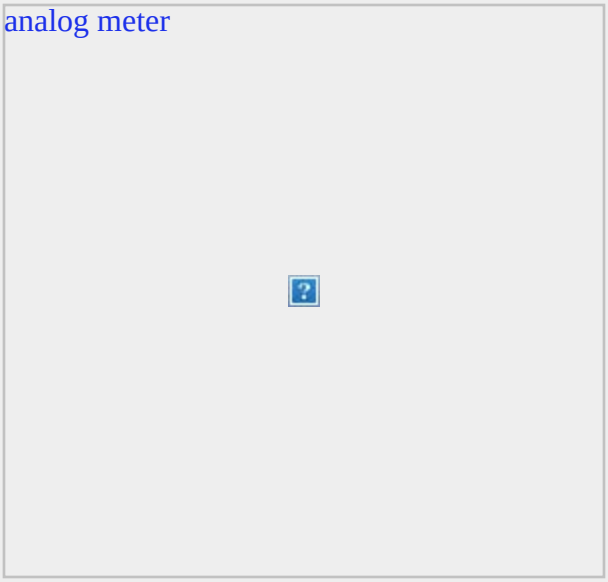
Analog	NO	NO

Meter EMF Clarification Notes

Posted on **June 26, 2017**

Digital vs. Analog meters

- Digital meter
  - electronic (has a circuit board and an SMPS – Switching Mode Power Supply)
  - sensitive to environmental conditions (temperature, humidity)
  - cause EMI
  - life span – 5 to 15 years (AMI meters have a shorter life span than non-communicating meters)
  - increased fire risk
- Analog meter
  - electromechanical
  - life span – 40 to 75 years



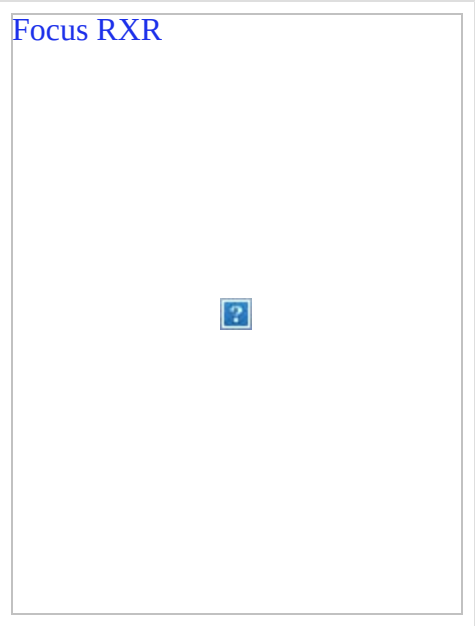
Analog Meter

AMI vs. AMR meters

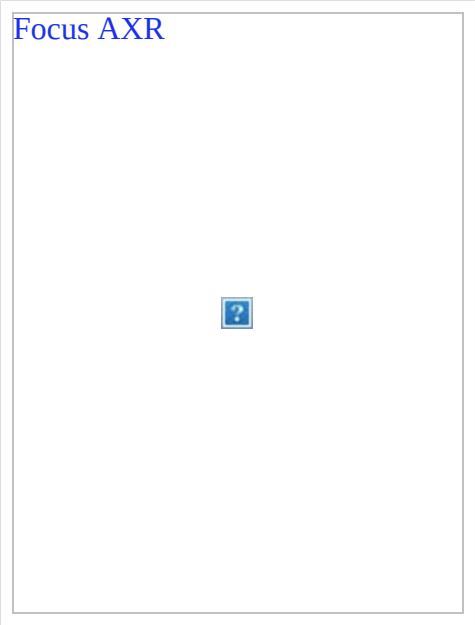
- Advanced Metering Infrastructure (wireless)
  - 2-way communication using microwave band frequencies
  - Electricity usage meters
  - Able to disconnect remotely
  - Gas meters may be able to use network
- Automated Meter Reading (can be digital or analog)
  - 1-way communication
  - Requires meter reader to drive by with receiver to capture data
  - Used for gas, water and electricity metering
- Both meters based on pager technology from the 1980's

New Standard meter for Seattle City Light

- Transmitting meter – Landis & Gyr FOCUS RXR-SD



- Non-transmitting – Landis & Gyr FOCUS AXR



- Descriptions of all models:
  - FOCUS AX – A solid state energy and demand meter.
  - FOCUS AXR – The FOCUS AX meter with an internal pulse recorder.
  - FOCUS AX-SD – The FOCUS AX meter with a service disconnect switch.
  - FOCUS AXR-SD – The FOCUS AX meter with an internal pulse recorder and service disconnect.
  - FOCUS RXR – The FOCUS AXR meter programmed with a second energy function (kvarh or kVAh). The meter is only capable of displaying one approved demand function.

- FOCUS RXR-SD – The FOCUS AXR meter programmed with a second energy function (kvarh or kVAh) and service disconnect. The meter is only capable of displaying one approved demand function.

Electromagnetic Profiles

- Electromagnetic Radiation (EMR) is also called Radio Frequency (RF) or microwave radiation

    - The FOCUS RXR-SD transmits at 900MHz and 2.5GHz (like a wireless modem or router)
    - AMI is a Wi-Fi network (wireless, like an Internet modem) and is similar to cell phone networks.
    - High intensity, pulsed EMR measured at 2000 microWatts per meter squared and higher spikes every few seconds.
    - Studies indicate DNA damage and biological cell interference (as in the link to brain cancer from cell phone use) see Dr. Martin Pall's work, or the World Health Organization metadata report BioInitiative Report

- Magnetic and Electric Fields (EMF)
    - The power panel (fuse box) has high magnetic and electrical fields, but these fields dissipate quickly relative to distance. Other high EMF sources are refrigerators, inductive ovens/stoves, and radiant heaters.
    - Electromagnetic Interference or Radio Frequency Interference (EMI/RFI) are electric fields generated by motors or Switching Mode Power Supplies (SMPS) that are plugged into your home wiring outlet. This EMI (also known as Conductive Emissions or Dirty Electricity) is emitted from the wires throughout your house. The RFI is a little different in that it is added to the wiring from outside EMR sources because the wiring is like an antenna, and this is referred to as inductive.
    - Digital meters use SMPS's and therefore add EMI to the house wiring at the ingress. (Note: there is one meter, that we've heard of, that does not add EMI because it is either properly grounded or filtered.) Other devices in the house can be unplugged or turned off say at night, the digital meter is just on adding EMI 24/7.
        - There is speculation about whether the EMI has a different quality or character from digital meters versus other SMPS devices. At this point, there is no evidence to suggest that adding the digital meter will add any measurable difference to the wiring than all the appliances and electronics already plugged in (i.e. refrigerator, TV, computer, air conditioner, fan, …).
    - Health impacts:
        - Magnetic Fields
            - Suppression of immune and endocrine systems causing neurotransmitter imbalances, such as melatonin needed for sleep
            - Reference Dr. Li, Dr. David Carpenter "Biological Effects of Electric and Magnetic Fields: Beneficial and Harmful …"
        - Electric Fields such as EMI/RFI
            - Interference with medical devices (pacemakers, hearing aids, …)
            - Studies are complicated to conduct on EMI/RFI effects; but there is a

growing body of evidence (anecdotal and epidemiological) that these fields cause interruption and irritation of the body's electrochemical processes.

- See Dr. Samuel Milham's site or Dr. Magda Havas has some indicative case studies in this report

Meter Model	EMR/Microwave /RF	EMI/RFI – Electric Fields from Interference	Magnetic Field from electricity connection panel
FOCUS RXR-SD	YES	YES	YES
FOCUS AXR	NO	YES	YES
Analog	NO	NO	YES

BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

Application of Pacific Gas and Electric Company for Approval of Modifications to its SmartMeter™ Program and Increased Revenue Requirements to Recover the Costs of the Modifications (U 39 M)	Application 11-03-014 (Filed March 24, 2011) (**NOT CONSOLIDATED**)
Application of Utility Consumers' Action Network for Modification of Decision 07-04-043 so as to Not Force Residential Customers to Use Smart Meters.	Application 11-03-015 (Filed March 24, 2011) (**NOT CONSOLIDATED**
Application of Consumers Power Alliance, Public Citizen, Coalition of Energy Users, Eagle Forum of California, Neighborhood Defense League of California, Santa Barbara Tea Party, Concerned Citizens of La Quinta, Citizens Review Association, Palm Springs Patriots Coalition Desert Valley Tea Party, Menifee Tea Party - Hemet Tea Party – Temecula Tea Party, Rove Enterprises, Inc., Schooner Enterprises, Inc., Eagle Forum of San Diego, Southern Californians For Wired Solutions To Smart Meters, and Burbank Action For Modification of D.08-09-039 and A Commission Order Requiring Southern California Edison Company (U338E) To File An Application For Approval of A Smart Meter Opt- Out Plan.	Application 11-07-020 (Filed July 26, 2011) (**NOT CONSOLIDATED**

PACIFIC GAS AND ELECTRIC COMPANY'S RESPONSE TO ADMINISTRATIVE LAW JUDGE'S OCTOBER 18, 2011 RULING DIRECTING IT TO FILE CLARIFYING RADIO FREQUENCY INFORMATION

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Dated: November 1, 2011

BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

Application of Pacific Gas and Electric Company for Approval of Modifications to its SmartMeter™ Program and Increased Revenue Requirements to Recover the Costs of the Modifications (U 39 M)	Application 11-03-014 (March 24, 2011)

PACIFIC GAS AND ELECTRIC COMPANY'S RESPONSE TO ADMINISTRATIVE LAW JUDGE'S OCTOBER 18, 2011 RULING DIRECTING IT TO FILE CLARIFYING RADIO FREQUENCY INFORMATION

I. INTRODUCTION

On October 18, 2011, Administrative Law Judge (ALJ) Yip-Kikugawa issued *Administrative Law Judge's Ruling Seeking Clarification* from Pacific Gas and Electric Company (PG&E), San Diego Gas & Electric Company (SDG&E), Southern California Edison Company (SCE) and Southern California Gas Company (SoCalGas) (collectively, the utilities or IOUs), in the above-captioned proceeding. Specifically, the Ruling directs the utilities to file clarifying information concerning the frequency and duration of radio frequency (RF) emissions from wireless smart meters by November 1, 2011. PG&E hereby timely responds to the Ruling.

II. PG&E'S SMARTMETERS™ COMPLY WITH FEDERAL COMMUNICATIONS COMMISSION (FCC) RADIO FREQUENCY (RF) EMISSIONS STANDARDS

PG&E's SmartMeters™ RF emissions are substantially below the Federal Communications Commission's (FCC) limits for radio transmitters of all types, including SmartMeters™. Indeed, and as PG&E noted in its Response to the Division of Ratepayer Advocates' *Motion to Amend the Scope of the Proceeding to Include Data on RF Emissions and to Order PG&E To Serve Supplemental Testimony on the Costs of an Analog Meter*, "the CPUC has previously found that PG&E's SmartMeters™ comply with FCC RF emissions standards. Specifically, the Commission found that '[a]ll radio devices in PG&E's SmartMeters™ are

licensed or certified by the FCC and comply with all FCC requirements.'[1] Further, the FCC itself has articulated that PG&E's SmartMeters™ comply with RF emissions levels."[2] (*See, PG&E's Opposition to DRA's Motion, p.3)(August 8, 2011*);(*see also, FCC letters, Attachments A and B*).

PG&E continues to recommend and support its proposed radio-off SmartMeter™ as the most feasible alternative to its SmartMeter™ Program, as fully described in Application (A.) 11-03-014 and supporting Testimony. PG&E's radio-off proposal provides an opt-out alternative with no wireless RF communications for customers who want to limit wireless telecommunications technology in their lives.

III. PG&E's RESPONSES TO THE CLARIFYING QUESTIONS IN THE OCTOBER 18, 2011 ALJ RULING

On September 14, 2011, ALJ Yip-Kikugawa held a combined workshop to consider alternatives for customers who may wish to opt-out of receiving wireless smart meters. During the workshop, various parties raised questions and made comments concerning the frequency and duration of the RF-transmissions from the wireless smart meters. The ALJ subsequently requested that the utilities respond to eleven RF-related questions as set forth below.

Each of PG&E's SmartMeter™ vendors – Silver Springs Network (SSN), General Electric (GE), Landis + Gyr (L+G), and Aclara – has confirmed that their SmartMeter™ products fully comply with applicable FCC regulations. PG&E's SmartMeter™ vendors provided the below RF-related data, as applicable to their respective products, in response to the ALJ Ruling.

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1 CPUC Decision 10-12-001, Finding of Fact 2.

2 FCC Letters to Cindy Sage, dated August 6, 2010, and the Honorable Lynn C. Woolsey, dated April 21, 2011

Question 1:

What is an average duration (in seconds) that a residential smart meter transmits in a 24 hour period?

Response 1:

Electric: As PG&E has described many times previously, both in this proceeding and publicly, a typical PG&E electric SmartMeter™ communicates intermittently throughout the day for a total cumulative period of approximately 45 seconds per 24-hour period. This typical cumulative communication period is comprised of thousands of very brief communications.

This reflects the findings of a detailed SSN study in which SSN collected actual field data from 88,000 deployed meters and compared the number of transmissions per meter for roughly 30 minutes each in order to determine that half of the meters transmitted for less than 45 seconds-per-day and half of the meters transmitted for longer than 45 seconds-per-day. In the study, a small number of electric SmartMeters™ in the outer range of the population communicated somewhat longer than 45 seconds-per-day, which resulted in an overall mean duration of approximately 62 seconds.[3]

Gas: The PG&E gas SmartMeter Module (MTU) has a single radio that utilizes the licensed 450-470 MHz band. The module is a one way transmitter; i.e., it sends but does not receive signals. The average duration that a gas SmartMeter™ Module transmits in a 24-hour period is 0.676 seconds. This is a calculated value based on observed individual transmission rates of 0.16 seconds each, and the designed transmission frequency of between 4.15 and 4.35 transmissions per day.

Question 1.a.:

How is this average computed or measured?

Response 1.a.:

Electric: SSN supplies PG&E with the "chipset" contained in the electric SmartMeters™ that GE and L+G supply to PG&E. The chipset, referred to as a "Network Interface Card" or "NIC," processes and stores the data and provides the radio communication back to PG&E. SSN has conducted several studies on these data to compute the type and duration of these transmissions.

In the SSN study referenced in Response 1, SSN calculated the median transmission-time by collecting actual field data from 88,000 deployed meters. By checking the number of transmissions per meter for roughly 30 minutes each, SSN computed the length of these

[3] PG&E's electric SmartMeters™ have two radios installed: 1) a radio that utilizes the licensed 902-928 megahertz (MHz) band for connection to the PG&E back office, and 2) a 2.4 gigahertz (GHz) radio to transmit to devices in the customer premises. The transmissions measured and addressed in this Response relate to the 900 MHz radio. Currently, PG&E does not have any SmartMeters™ utilizing the 2.4 GHz radio.

transmissions per 24-hour day. In another study, SSN worked with PG&E to evaluate the transmissions of roughly 50,000 meters over a 48-hour period to similarly compute these numbers.

Gas: The duration of each transmission from the gas SmartMeter™ Module is less than 0.16 seconds. Using the typical transmission rate of 4.228 transmissions per 24 hours, the average duration over a 24-hour period is approximately 0.676 seconds (4.228 x 0.16 = 0.676).

Question 2:

How many times in total (average and maximum) is a smart meter scheduled to transmit during a 24-hour period?

Response 2:

Electric: Table 2-1 presents scheduled electric SmartMeter™ system messages and their durations. As noted in Response 1, the information presented applies only to the 900 MHz radio. Table 2-1 presents data for all "scheduled" messages; i.e., those inherently required to sustain communications in the network that occur routinely without user intervention. "Non-Scheduled" messages created only at non-recurring times are addressed in Response 3.

TABLE 2-1

Electric System Message Type	**Transmission Frequency Per 24-Hour Period: Average**	**Transmission Frequency Per 24-Hour Period: Maximum (99.9th Percentile)**
[a]	[b]	[c]
Meter Read Data	6	6
Network Management	15	30
Time Synch	360	360
Mesh Network Message Management	9,600	190,000
Weighted Average Duty Cycle	45.3 Seconds[4]	875.0 Seconds

The electric system message types are defined as:

- Meter Read Data refers to the messages generated by each meter to transmit energy usage data.
- Network Management refers to network tasks that need to be performed to maintain the health of the network (e.g., route establishment).
- Time Synch refers to network administration messages needed to update the internal clock in the NIC.
- Mesh Network Message Management refers to activities required to forward routed messages.

Gas: Table 2-2 presents scheduled gas SmartMeter™ system messages and their durations.

TABLE 2-2

Gas System Message Type	**Transmission Frequency Per 24-Hour Period: Average**	**Transmission Frequency Per 24-Hour Period: Maximum**
[a]	[b]	[c]
Meter Read Data	4.228	4.305
Weighted Average Duty Cycle	0.676 Seconds	0.689 Seconds

[4] As stated in Response 1, a small number of electric SmartMeters™ communicate somewhat longer than 45 seconds-per-day, which resulted in an overall mean duration of approximately 62 seconds.

Question 2.a.:
How many of those times (average and maximum) are to transmit electric usage information?

Response 2.a.:

Electric: Generally, the Meter Read Data messages shown in Table 2-1 transmit electric usage data from the meter generating the data. Mesh Network Message Management messages also transmit electric usage data from neighbor meters.

Gas: In Table 2-2, the Meter Read Data messages transmit gas usage data.

Question 2.b.:
How many of those times (average and maximum) are for other purposes? What are those other purposes? Please specify number of times (average and maximum) by type/category of transmission.

Response 2.b.:

Electric: The scheduled electric messages are shown in Table 2-1 and defined in Response 2. The Network Management and Time Synch messages are for administration and mesh maintenance, as explained in Response 2. They are required to sustain the routing capability of the mesh network.

Gas: There are no other standard messages than the usage data transmission.

Question 3:
Under what scenarios does a meter transmit outside of the daily schedule, i.e., unscheduled transmission such as on-demand read, tamper/theft alert, last gasp, firmware upgrade etc.?

Response 3:

Electric: For purposes of providing this data, PG&E is using data for all messages that inherently are required to sustain communications in the network, and occur routinely without user intervention as "scheduled"; messages created only at non-recurring times such as startup or to satisfy non-typical events or user requests are considered "non-scheduled".

Table 3-1 shows the categories of electric messages generated outside of the daily schedule. These messages are event-driven and are not predictable on any given day.

TABLE 3-1

Electric Message Type	Scenario
Interrogation for network (Initial)	Initial attempt to discover network availability or after an outage restoration
Interrogation for network (Extended)	Infrequent polling when network discovery is not immediate
Network Activation	Upon successful discovery of network route either upon initial startup or outage restoration
Last gasp	Upon loss of power
On-demand read	Request from PG&E back-office user
Firmware upgrade	Pushed from PG&E back-office user
Power status check	Request from PG&E back-office user
Other 'as-triggered' alarms	Sent as needed (e.g., power restored)
Meter disconnect or reconnect	Request from PG&E back-office user

Gas: The only unscheduled transmission would be for a tamper alarm. Tamper alarms are rare.

Question 4:
Typically, how much of the communication between the customer's meter and the utility is unscheduled vs. scheduled?

Response 4:

Electric: Typically, the majority of the communication between the customer's electric SmartMeter™ and PG&E is scheduled. SSN estimates that very little of the overall electric SmartMeter™ transmission time would be for unscheduled transmissions.

Gas: Aclara estimates that effectively 100 percent of the transmissions are due to scheduled activity. Tamper alarms are rare.

Question 5:
Are there any other factors that go into determining duration and/or frequency of meter transmissions (e.g., if a meter can't access the network when it's trying to send data, type of a meter etc.)? If yes, please identify these factors.

Response 5:

Electric: With respect to PG&E's electric SmartMeter™ system, there are no other factors that go into determining the duration or frequency of the electric meter system transmission other than those discussed in Responses 2 and 3.

Gas: With respect to PG&E's gas SmartMeter™ system, there are no other factors that go into determining the duration or frequency of the gas meter system transmission other than those discussed in Responses 2 and 3.

Question 6:
What is the amount of RF emission at the source when a meter is transmitting data (instantaneous maximum peak level, averaged over 30 minutes)?

Response 6:

Table 6-1 provides the requested data for electric SmartMeters™ and gas SmartMeter™ Modules.

TABLE 6-1[5]

Radio Type	Transmit Power	Antenna Gain (Decibel Isotropic)	Instantaneous Peak Level (Effective Isotropic Radiated Power)	Average Exposure Over 30 Minutes	Percent of FCC Allowable RF Emissions
[a]	[b]	[c]	[d]	[e]	[f]
Electric 900 MHz	1000 mW	4.0 dBi	2500 mW	0.35 µW/cm2	0.058%
Electric 2.4 GHz[6]	125 mW	None	125 mW	N/A	N/A
Gas Standard Module	132 mW	None	132 mW	0.01µW/cm2	0.0033%
Gas Extended Range Module	794 mW	None	794 mW	0.059µW/cm2	0.02%

[5] Average electric exposure has been calculated from duty cycles consistent with field observations at a distance of 20 centimeters. Average gas exposure has been calculated based on system specifications.

[6] As stated in Response 1, the 2.4 GHz radio is not currently in use in PG&E's SmartMeter™ system.

Question 7:
Does the amount of RF emission vary depending on duration of transmission/volume of data being sent? For example, are RF emissions higher when there is a larger volume of data to be transmitted?

Response 7:

Electric: While the power-level in PG&E's electric SmartMeters™ is fixed, the total RF energy varies based on the duration of the communication. When a larger volume of data is transmitted, the duration of the communication may increase, resulting in a greater emission of RF energy.

Gas: The usage read data messages are fixed in length and fixed in scheduled transmissions. Only tamper alarms are sent outside of scheduled transmissions. As noted earlier, tamper alarms are very rare.

Question 8:
Are there any other factors that impact the amount of RF emissions? If so, please identify the factor(s) and its impact on RF emissions.

Response 8:

Electric: PG&E is not aware of any other factors that affect the amount of RF emissions at the electric endpoint, i.e., at the customer's premises.[7]

Gas: PG&E is not aware of any other factors that affect the amount of RF emissions at the gas endpoint, i.e., at the customer's premises.[8]

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[7] PG&E notes that in addition to electric meters, there are network devices – generally mounted on PG&E distribution facilities at 25 feet or higher above the ground – called Relays or Access Points that receive the data from electric meters and forward the data over a public network cellular back haul (850 MHz or 1900 MHz) to the PG&E data center.

[8] PG&E notes that in addition to gas meters, there are network devices – generally mounted on PG&E distribution facilities at 25 feet or higher above the ground – called Data Collection Units (DCUs) which receive the data from the gas SmartMeter™ Modules and forward the data over a public network cellular back haul (850 MHz or 1900 MHz) to the PG&E data center. The DCUs also send out one network administration message per day over the 450-470 MHz band.

Question 9:
Is there RF emission when the meter is not transmitting? If yes, what is the amount of RF emission?

Response 9:

Yes, all digital circuitry – from that contained in clocks, in stereo equipment, or in answering machines – emits de minimus RF that is governed by FCC limits for unintentional RF emissions.[9]

Table 9-1 provides the requested data for electric SmartMeters™ and gas SmartMeter™ Modules.

TABLE 9-1

Meter Type	RF Measured Value With Radio Off	FCC Allowable RF Emissions
[a]	[b]	[c]
Electric: GE	39.3 dBμV/m	49.0 dBμV/m
Electric: L+G	24.7 dBμV/m	49.0 dBμV/m
Gas: Aclara	No discernable emissions	40.0 – 54.0 dBμV/m

Electric: Note that PG&E's electric system communications equipment is installed inside of either of two SmartMeters™, one manufactured by GE and the other manufactured by L+G. Both of these meters are tested during meter certification testing and have been shown to emit de minimus RF when the SSN communications radio is turned off. The radio-off RF emissions are below FCC limits for unintentional RF emissions.

Gas: With respect to PG&E's gas SmartMeter™ Modules, there are no RF emissions when the Module is not transmitting.

[9] See Code of Federal Regulations, Title 47, Part 15, for a Class B digital device.

Question 10:

Is there a difference in the amount of RF emissions for a wireless smart meter with the radio off and a smart meter with the radio out? If yes, what is that difference and how is it calculated?

Response 10:

Table 10-1 provides the requested data for electric SmartMeters™ and gas SmartMeter™ Modules.

TABLE 10-1

Meter Type	RF Measured Value With Radio Out	RF Measured Value With Radio Off	FCC Allowable RF Emissions
[a]	[b]	[c]	[d]
Electric: GE	38.3 dBμV/m	39.3 dBμV/m	49.0 dBμV/m
Electric: L+G	31.3 dBμV/m	24.7 dBμV/m	49.0 dBμV/m
Gas: Aclara	No discernable emissions	No discernable emissions	40.0 – 54.0 dBμV/m

Electric: Both of PG&E's electric SmartMeter™ manufacturers test the meters without any communications radio installed during meter certification. The information provided in Table 10-1 reflects the measured values of the RF emissions from the electric SmartMeters™ with the radio out.

Note that the difference between the radio-out RF-emissions shown in Table 10-1 and the radio-off RF-emissions presented in Table 9-1 (and re-presented in Table 10-1 for comparison purposes) are de minimus.

Gas: With respect to PG&E's gas SmartMeter™ Modules, there are no discernable RF emissions when the radio is off.

Question 11:

Is there a difference in the amount of RF emissions for a wireless smart meter with the radio off and an analog meter? If yes, what is that difference and how is it calculated?

Response 11:

Electromechanical meters emit no RF. Therefore, there is a de minimus difference in RF between radio-off and an analog meter. Please also see PG&E's Response to Question 9.

IV. CONCLUSION

PG&E respectfully submits the requested clarifying information concerning the frequency and duration of RF emissions from its electric and gas SmartMeter™ technology.

Respectfully Submitted,

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Dated: November 1, 2011

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Poki Stewart Namkung, M.D., M.P.H.
Health Officer
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Memorandum

Date: January 13, 2012

To: Santa Cruz County Board of Supervisors

From: Poki Stewart Namkung, M.D., M.P.H. PSN
Health Officer

Subject: Health Risks Associated With SmartMeters

Overview

On December 13, 2011, Santa Cruz County Board of Supervisors directed the Public Health Officer to return on January 24, 2012, with an analysis of the research on the health effects of SmartMeters.

Background

In order to analyze the potential health risks associated with SmartMeters, the following questions should be asked:

1) What is the SmartMeter system and what is the potential radiation exposure from the system?
2) What scientific evidence exists about the potential health risks associated with SmartMeters?
3) Are there actions that the public might take to mitigate any potential harm from SmartMeters?

SmartMeters are a new type of electrical meter that will measure consumer energy usage and send the information back to the utility by a wireless signal in the form of pulsed frequencies within the 800 MHz to 2400MHz range, contained in the microwave portion of the electromagnetic spectrum. SmartMeters are considered part of 'smart grid' technology that includes: a) a mesh network or series of pole-mounted wireless antennas at the neighborhood level to collect and transmit wireless information from all SmartMeters in that area back to the utility; b) collector meters, which are a special type of SmartMeter that collects the radiofrequency or microwave radiation signals from many surrounding

buildings (500-5000 homes or buildings) and sends the information back to the utility; and c) proposed for the future, a power transmitter to measure the energy use of individual appliances (e.g. washing machines, clothes dryers, dishwasher, etc) and send information via wireless radio frequency signal back to the SmartMeter. The primary rationale for SmartMeters and grid networks is to more accurately monitor and direct energy usage.

The public health issue of concern in regard to SmartMeters is the involuntary exposure of individuals and households to electromagnetic field (EMF) radiation. EMFs are everywhere, coming from both natural and man-made sources. The three broad classes of EMF are:

- extremely low frequency, ELF (from the sun or powerlines)
- radio frequency, RF (from communication devices, wireless devices, and SmartMeters)
- extremely high frequency, known as ionizing radiation (x-rays and gamma rays)

Much of this exposure is beyond our control and is a matter of personal choice; however, public exposure to RF fields is growing exponentially due to the proliferation of cell phones, and wireless fidelity (Wi-Fi) technology. To understand the relationship between EMF from SmartMeters and other sources, it is helpful to view the electromagnetic spectrum:

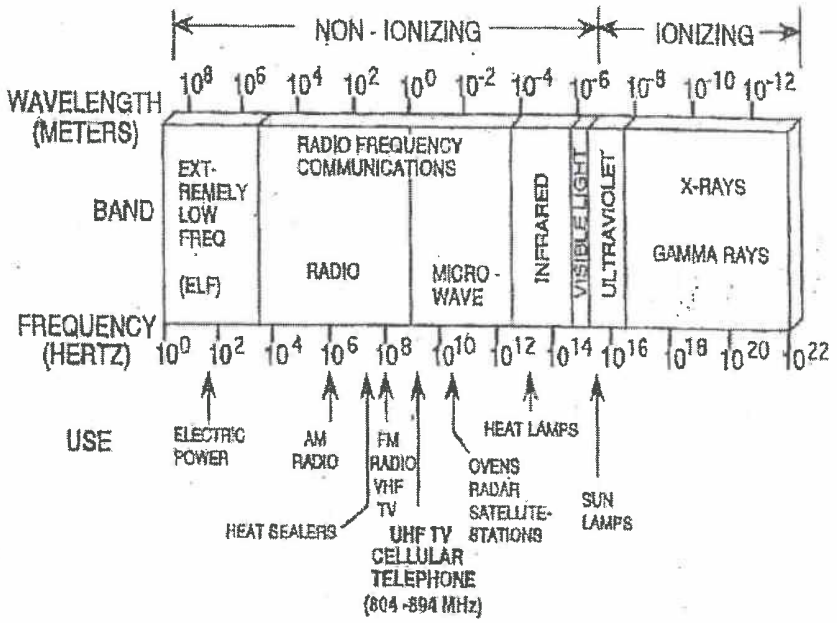

Fig. 1: The electromagnetic spectrum, showing the relation s between ELF and RF fields, wavelength and frequency, and the ionizing and non-ionizing portions of the spectrum.

The Federal Communications Commission (FCC) has adopted limits for Maximum Permissable Exposure (MPE) that are based on exposure guidelines published by the National Council on Radiation Protection and Measurements (NCRP). The limits vary with

the frequency of the electromagnetic radiation and are expressed in units of microwatts per centimeter squared. A SmartMeter contains two antennas whose combined time-averaged public safety limit of exposure is 655μW/cm² (Sage, 2011). According to the California Council on Science and Technology (CCST) Report (2011), within distances of three to ten feet, SmartMeters would not exceed this limit. However, CCST did not account for the frequency of transmissions, reflection factors, banks of SmartMeters firing simultaneously, and distances closer than three feet. There are numerous situations in which the distance between the SmartMeters and humans is less than three feet on an ongoing basis, e.g. a SmartMeter mounted on the external wall to a bedroom with the bed placed adjacent to that mounting next to the internal wall. That distance is estimated to be one foot. The CCST Report also states that SmartMeters will generally transmit data once every four hours, and once the grid is fully functional, may transmit "more frequently." 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. Additionally, exposure is additive and consumers may have already increased their exposures to radiofrequency radiation in the home through the voluntary use of wireless devices such as cell and cordless phones, personal digital assistants (PDAs), routers for internet access, home security systems, wireless baby surveillance (baby monitors) and other emerging devices. It would be impossible to know how close a consumer might be to their limit, making safety a uncertainty with the installation of a mandatory SmartMeter.

This report will focus on the documented health risks of EMF in general, the relevance of that data to SmartMeters exposure, the established guidelines for RF safety to the public at large, and then provide recommendations to ameliorate the risk to the public's health.

Evidence-based Health Risks of EMFs

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 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.

Since the mid-1990's the use of cellular and wireless devices has increased exponentially exposing the public to massively increased levels of RF. There is however, debate regarding the health risks posed to the public given these increased levels of radiation. It must be noted that there is little basic science funding for this type of research and it is largely funded by industry. An intriguing divide, noted by Genuis, 2011 is that most

research carried out by independent non-government or non-industry affiliated researchers suggests potentially serious effects from many non-ionizing radiation exposures; most research carried out by independent non-government or non-industry affiliated researchers suggests potentially serious effects from many non-ionizing radiation exposures research funded by industry and some governments seems to cast doubt on the potential for harm. Elements of the controversy stem from inability to replicate findings consistently in laboratory animal studies. However, analysis of many of the conflicting studies is not valid as the methodology used is not comparable. Despite this controversy, evidence is accumulating on the results of exposure to RF at non-thermal levels including increased permeability of the blood-brain barrier in the head (Eberhardt, 2008), harmful effects on sperm, double strand breaks in DNA which could lead to cancer genesis (Phillips, 2011), stress gene activation indicating an exposure to a toxin (Blank, 2011), and alterations in brain glucose metabolism (Volkow, 2011).

In terms of meta-analyzed epidemiological studies, all case–control epidemiological studies covering >10 years of cell phone use have reported an increased risk of brain tumors from the use of mobile phones (Hallberg, 2011). Other studies have pointed to an increasing risk of acoustic neuroma, salivary gland tumors, and eye cancer after several years of cell phone use and the tumors occur predominantly on the same side of the head as the phone is used. The analysis of brain cancer statistics since the mid 20th century in several countries reveals that brain tumor formation has a long latency time, an average of over 30 years to develop from initial damage.(Hallberg, 2011). Therefore using studies such as the Interphone Study which looked as shorter latency periods for the development of specific brain cancers will result in inconclusive data.

Another potential health risk related to EMF exposure, whose legitimacy as a phenomen remains contentious, is electromagnetic hypersensitivity (EHS). In the 1950's, various centers in Eastern Europe began to describe and treat thousands of workers, generally employed in jobs involving microwave transmission. The afflicted individuals often presented with symptoms such as headaches, weakness, sleep disturbance, emotional instability, dizziness, memory impairment, fatigue, and heart palpitations. Clinical research to verify the physiological nature of this condition did not begin in earnest until the 1990's and found that the EMF involved was usually within the non-ionizing range of the electromagnetic spectrum. In the early 2000's, estimates of the occurrence of EHS began to swell with studies estimating the prevalence of this condition to be about 1.5% of the population of Sweden (Hilleert et al., 2002), 3.2% in California (Levallios et al., 2002), and 8% in Germany (infas Institut fur angewandte Sozialwissenschaft GmbH, 2003).

In 2004, WHO declared EHS "a phenomenon where individuals experience adverse health effect while using or being in the vicinity of devices emanating electric, magnetic, or electromagnetic fields (EMFs)...Whatever its cause, EHS is a real and sometimes debilitating problem for the affected persons (Mild et al., 2004)."

Currently, research has demonstrated objective evidence to support the EHS diagnosis, defining pathophysiological mechanisms including immune dysregulation in vitro, with

increased production of selected cytokines and disruption and dysregulation of catecholamine physiology (Genuis, 2011).

Until recently, the diagnosis of EHS has not received much support from the medical community due to lack of objective evidence. In an effort to determine the legitimacy of EHS as a neurological disorder, however, a collection of scientists and physicians recently conducted a double-blinded research study that concluded that "EMF hypersensitivity can occur as a bona fide environmentally-inducible neurological syndrome (McCarty et al., 2011).

Safety Guidelines

The guidelines currently used by the FCC were adopted in 1996, are thermally based, and are believed to protect against injury that may be caused by acute exposures that result in tissue heating or electric shock. FCC guidelines have a much lower certainty of safety than standards. Meeting the current FCC guidelines only assures that one should not have heat damage from SmartMeter exposure. It says nothing about safety from the risk of many chronic diseases that the public is most concerned about such as cancer, miscarriage, birth defects, semen quality, autoimmune diseases, etc. Therefore, when it comes to nonthermal effects of RF, FCC guidelines are irrelevant and cannot be used for any claims of SmartMeter safety unless heat damage is involved (Li, 2011).

There are no current, relevant public safety standards for pulsed RF involving chronic exposure of the public, nor of sensitive populations, nor of people with metal and medical implants that can be affected both by localized heating and by electromagnetic interference (EMI) for medical wireless implanted devices. Many other countries (9) have significantly lower RF/MW exposure standards ranging from 0.001 to 50 $\mu W/cm^2$ as compared with the US guideline of 200-1000 $\mu W/cm^2$. Note that these recommended levels are considerably lower that the approximately 600 $\mu W/cm^2$. (time-averaged) allowed for the RFR from SmartMeters operating in the low 900 MHz band mandated by the FCC based on only thermal consideration.

In summary, there is no scientific data to determine if there is a safe RF exposure level regarding its non-thermal effects. The question for governmental agencies is that given the uncertainty of safety, the evidence of existing and potential harm, should we err on the side of safety and take the precautionary avoidance measures? The two unique features of SmartMeter exposure are: 1) universal exposure thus far because of mandatory installation ensuring that virtually every household is exposed; 2) involuntary exposure whether one has a SmartMeter on their home or not due to the already ubiquitous saturation of installation in Santa Cruz County. Governmental agencies for protecting public health and safety should be much more vigilant towards involuntary environmental exposures because governmental agencies are the only defense against such involuntary exposure. Examples of actions that the public might take to limit exposure to electromagnetic radiation can be found in Attachment B2.

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Figure 4 from Hirsch; 2011

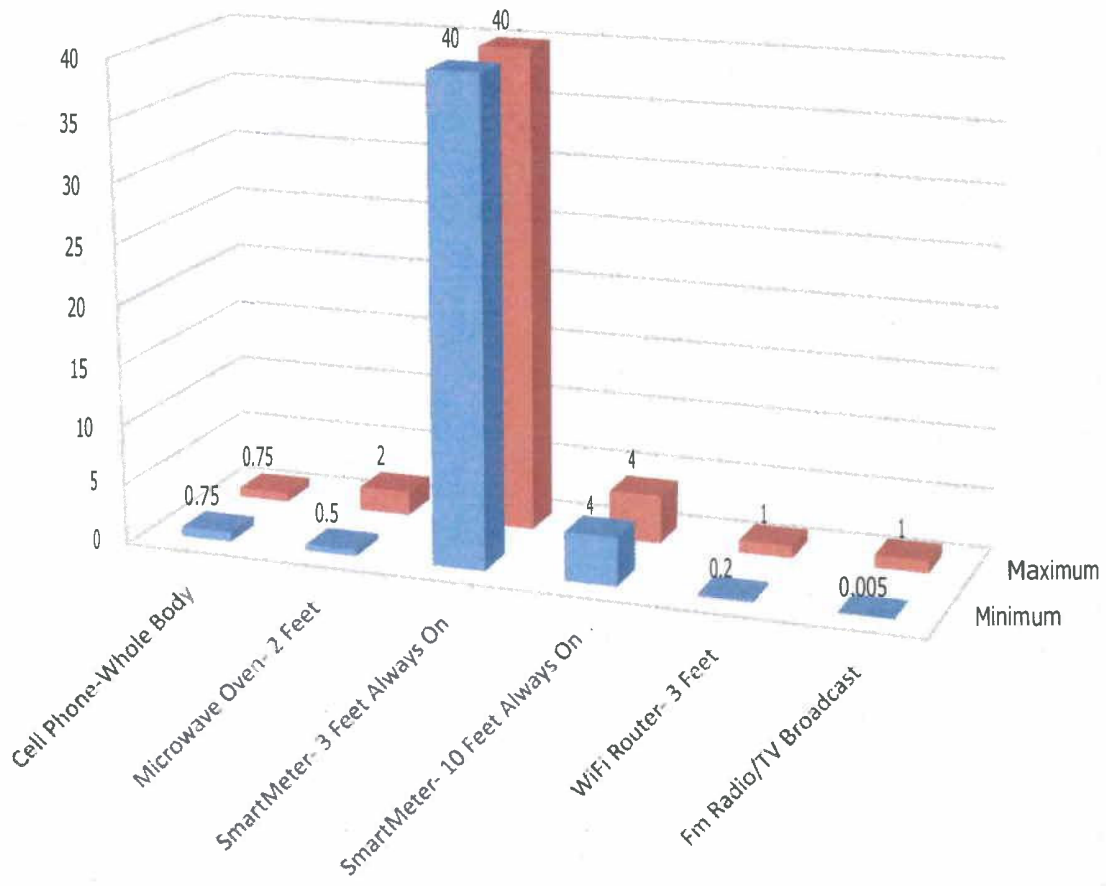

Figure 4. Comparison of Radio-Frequency Levels to the Whole Body from Various Sources in μ W/cm^2 over time [corrected for assumed duty cycle and whole body exposure extrapolated fro m EPRI/CCST SmartMeter estimated levels at 3 feet].

Examples of strategies to reduce electromagnetic radiation. (Genuis SJ, 2011)

Sources of adverse EMR	Considerations to reduce EMR exposure
Cell phones and cordless phones	• Minimize use of cell and cordless phones and *use* speaker phones when possible • Leave cell or cordless phone away from the body rather than in pocket or attached at the hip.
Wireless internet	• Use wired internet • Turn off the internet router when not in use (e.g. night-time) • Use power line network kits to achieve internet access by using existing wiring and avoiding wireless emissions.
Computers releasing high EMR	• Limit the amount of time spent working on a computer • Avoid setting a laptop computer on the lap • Increase the distance from the transformer. • Stay a reasonable distance away from the computer
Handheld electronics (electric toothbrush, hair dryer, Smart phone, electronic tablets, etc.)	• Limit the use of electronics and/or revert to using power-free devices • Turn devices off before going to sleep • Minimize electronics in bedrooms
Fluorescent lights	• Consider using alternate lighting such as incandescent (Uncertainty exists about the safety of LED lights) • Rely on natural sunlight for reading
Household power	• Measure levels of EMR and modify exposures as possible • Avoid sleeping near sites of elevated EMR • Filters can be used to mitigate dirty power
High voltage power lines substations, transmission towers, and emitters (cell phone tower, radar, etc.)	• Consider relocating to an area not in close proximity to high voltage power lines • Maintain considerable distance from emitters • Consider forms of shielding (shielding paints; grounded metal sheets)
Utility neutral-to-ground bonded to water pipes	• Increase size of neutral-wire to substation and install dielectric coupling in water pipe.


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888