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ORIGINAL

BEFORE THE ARIZONA CORPORATION COMMISSION

1 COMMISSIONERS

2 DOUG LITTLE Chairman

3 BOB STUMP

4 BOB BURNS

5 TOM FORESE

6 ANDY TOBIN

Arizona Corporation Commission

DOCKETED

MAY 06 2016

DOCKETED BY *YK*

RECEIVED

2016 MAY -6 P 4: 06

AZ CORP COMMISSION
DOCKET CONTROL

7 IN THE MATTER OF THE COMMISSION'S
8 INVESTIGATION OF VALUE AND
9 COST OF DISTRIBUTED GENERATION

E-00000J-14-0023
Testimony of Patricia Ferre
Intervener

10
11
12 Q Please state your name for the record.

13 A Patricia Christensen Ferre

14
15 Q Please describe yourself briefly with relation to this docket.

16 A I am an electro-hypersensitive (EHS) APS solar customer with two
17 standard non-detent analog meters operating my solar system.

18
19 Q Did you have any difficulty obtaining an analog meter for your solar
20 system?

21 A Not when my solar system was installed in February 2006. My
22 original analog utility billing meter and my original analog solar
23 production meter were both *safe standard non-detent analog meters*. I
24 am told that *standard non-detent analog meters* were the meters chosen
25 for all homes: they were our *default meters*. I took these wonderful
26 meters for granted: they were sturdy, safe and free from the *hornet nest*
27 of AMI problems that were yet to come.

28 Q What interested you in this docket?

1 A Chairman Doug Little suggested perceiving THE MATTER OF THE
2 COMMISSION'S INVESTIGATION OF VALUE AND COST OF DISTRIBUTED
3 GENERATION in this docket, relative to a "**7 Core Cost and Benefit**
4 **Categories**" chart.

- 5 ○ The *sixth category*, **Environmental Benefits**, is a major reason
6 why I purchased my solar system in February 2006.
- 7 ○ The *sixth category*, **Environmental Costs**, is a concern for all of us
8 from the point of view of our biological health and survival. If our
9 utilities require biotoxic AMI Pulsed Microwave Meters on private
10 homes it places residents at risk.¹ The massive biotoxic mesh
11 network grid exposure from the continuously pulsing utility mesh
12 network and from all of our AMI neighbors, also places us at risk.
13 Biotoxic AMI environments that harm humans also harm our living
14 environment.
- 15 ○ An otherwise biologically positive Arizona solar industry is often
16 saddled with hazardous polluting AMI technology due to the
17 insistence of electrical service providers. Hazardous AMI pollution
18 exposure of solar customers and their environments is utility
19 generated and may be punitive, unfairly hazardous and
20 discriminatory.
- 21 ○ Compared to non-solar customers who usually have one utility
22 billing meter, solar utility customers usually have two meters: a
23 utility billing meter and a solar production meter. **Solar Customer**
24 **Discrimination**² becomes an issue, if the electric service provider
25 requires biotoxic AMI pulsed microwave meters or implements
26 discriminatory regulations or discriminatory activity.
- 27 ○ What is the point of so much environmental injustice? Who has
28 saddled the State of Arizona with this biological and environmental
abuse? Is this *only* motivated by corporate greed and graft or is it
part of a depopulation agenda?

26 ¹ Contrary to the provisions of: **A.R.S.40-361.B**, page 2.

27 <http://images.edocket.azcc.gov/docketpdf/0000169712.pdf>

28 ² Ibid. A.R.s.40-334.Discrimination, A and B, page 2.

BEFORE THE ARIZONA CORPORATION COMMISSION

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- Some solar companies have unsafe inverters that produce heavy dirty electricity loads. Solar companies are responsible to provide safe properly filtered, non-polluting inverters.
 - **A.R.S.40-361.B** and **ORDER 69736** are not compatible. We can not mandate an unmonitored, unregulated pulsed microwave technology that is used in weapons, on a civilian populations and consider them "safe" for all populations, including our most vulnerable populations.
 - AMI has not been proven safe by a NEPA, or equivalent, Environmental Impact Study.
 - Perhaps the four Commissioners that voted for **ORDER 69736** were not properly informed about our Arizona statutes or the new experimental technology. Our Arizona statute is not ambiguous: "Every public service corporation shall furnish and maintain such service, equipment and facilities as will promote the safety, health, comfort and convenience of its patrons, employees and the public, and as will be in all respects adequate, efficient and reasonable."
 - Our statewide use of an unregulated pulsed microwave radiation technology used in weapons is not appropriate for civilian populations.³
 - On April 30, 2015, our Commission, in Decision No. **75047** rescinded and abrogated their earlier 12/18/2014 Decision No. **74871**. No reason was given, although both decisions related to AMI and AMI solar customer discrimination.

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³ **Chart blue line:** Biological Effects from RF Radiation at Low--Intensity Exposure, based on the BioInitiative 2012 Report, and the Implications for Smart Meters and Smart Appliances, Ronald M. Powell, Ph.D. <http://emfsafetynetwork.org/wp-content/uploads/2013/08/Biological-Effects-From-RF-Radiation-and-Implications-for-Smart-Meters-June-5-2013-2.pdf>

BEFORE THE ARIZONA CORPORATION COMMISSION

- 1 ○ What was already done once can hopefully be repeated by rescinding
2 ORDER **69736** and returning Arizona to safe metering solutions for our
3 people and for our environment. There is no solar customer
4 discrimination if we all have non-hazardous analog meters. We already
5 know standard non-detent analog meters are safe for humans and for
6 our environment. I purchased a box of 4 such meters for \$15. each,
7 from a vendor that claimed to also sell meters to APS. Standard non-
8 detent analog meters are an inexpensive solution for the people of
9 Arizona. It might help our state to save on medical costs and may
10 save us further environmental hardship.
- 11 ○ Biotoxic AMI pulsed microwave emissions and massive pollution
12 grids do not comply with the public good: not for humans and not
13 for our living environment. Biotoxic AMI pulsed microwave
14 emissions can be lethal to sensitive populations, such as a pregnant
15 woman and her unborn child and faults in that way can lead to fetal
16 death, genetic damage and other forms of biological harm.
- 17 ○ I request the Commission consider the immediate BAN of biotoxic
18 pulsed microwave radiation by utilities in Arizona. The savage
19 unregulated exposure of Arizona civilians with biotoxic AMI pulsed
20 microwave radiation has been termed "**COVERT GENOCYDE.**"⁴⁵

21 *Patricia Ferre*

22 Respectfully Submitted,

23 Patricia Ferre

24 ⁴ **Military Electronic Warfare Expert Warns of Covert Genocide,**

25 [https://chemtrailsplanet.net/2015/05/02/military-electronic-warfare-expert-](https://chemtrailsplanet.net/2015/05/02/military-electronic-warfare-expert-warns-of-covert-genocide/)
26 [warns-of-covert-genocide/](https://chemtrailsplanet.net/2015/05/02/military-electronic-warfare-expert-warns-of-covert-genocide/)

27 ⁵ **AMI COVERT GENOCYDE,**

28 <http://images.edocket.azcc.gov/docketpdf/0000162045.pdf>

**MORE THAN 2000 DOCUMENTS PRIOR TO 1972 ON
BIOEFFECTS OF RADIO FREQUENCY RADIATION¹**

**Zorach R. Glaser,
Ph.D. LT, MSC, USNR**

NAVAL MEDICAL RESEARCH INSTITUTE



Bibliography of reported biological phenomena ('effects:') and clinical manifestations attributed to microwave and radio- frequency radiation. Naval Medical Research Institute MF12.54.015-004B, Report No. 2, revised.' 106 pp. [NOTE: this document was shorted to 25 pages so we could post it here and does not contain all the 2311 references.]

ABSTRACT

More than 2000 references on the biological responses to radio frequency and microwave radiation, published up to June 1971, are included in the bibliography.* Particular attention has been paid to the effects on man of non-ionizing radiation at these frequencies. The citations are arranged alphabetically by author, and contain as much information as possible so as to assure effective retrieval of the original documents. An outline of the effects which have been attributed to radio frequency and microwave radiation is also part of the report.

¹ <http://www.magdahavas.com/pick-of-the-week-1-more-than-2000-documents-prior-to-1972-on-bioeffects-of-radio-frequency-radiation/>

1 *Three supplementary listings bring the number of citations to more
2 than 2,300.

3 Note: This document is "unclassified" and "has been approved for
4 public release and sale; its distribution is unlimited."
5

6 **SIGNIFICANCE . . .**

7 The value of the Glaser 1972 document is to counter the statements
8 that "credible" research does not exist showing non-thermal effects.

9 This is a false statement promoted by those who are either unaware
10 of the literature or unwilling to admit this radiation, at levels to which
11 we are currently exposed, can be harmful.
12

13 Credible research does exist; it has been around for decades; and it
14 has been largely ignored by those responsible for public and
15 occupational health.

16 **COMMENTS . . .**

17
18 This is one of the first large scale reviews of the literature on the
19 biological effects of microwave and radio frequency radiation and it
20 first appeared in 1971. The author classified the biological effects, into
21 17 categories (see below). These categories include heating (thermal
22 effects); changes in physiologic function; alterations of the central,
23 autonomic and peripheral nervous systems; psychological disorders;
24 behavioral changes (animal studies); blood and vascular disorders;
25 enzyme and other biochemical changes; metabolic, gastro-intestinal,
26 and hormonal disorders; histological changes; genetic and
27 chromosomal effects; the pearl-change effect (related to orientation in
28 bacteria and animals); and a miscellaneous group of symptoms that
didn't fit into the above categories.

1 While it is clear that radiation that causes heating can also cause
2 secondary effects, not all the effects listed above are heat-related.
3 Indeed, much of the literature at the lower exposure levels is
4 unrelated to heating. This is the type of research that helped
5 regulators to formulate their microwave guidelines. The non-thermal
6 studies have been ignored by the World Health Organization, upon
7 which many countries look for guidance, and hence the guidelines
8 differ by orders of magnitude from the lowest in Salzburg, Austria (0.1
9 microW/cm²) to the highest (5,000 microW/cm² for occupational
10 exposure) established by ICNIRP (International Commission on Non-
11 Ionizing Radiation). This is a 50,000 times difference!

12 **One way to interpret this is that we have two guidelines, one to**
13 **prevent heating and, a more restrictive guideline, to prevent**
14 **biological effects, some of which can have serious health**
15 **consequences.**

16
17 What is striking is that what we used to call ***microwave sickness***
18 (group of symptoms associated with radar workers) has been
19 called ***neuroasthenia*** (feeling unwell) and is now
20 called ***electrohypersensitivity***. In all cases the symptoms are
21 associated with exposure to radio frequency radiation initially radar;
22 then RF heat sealers and computers; and more recently various
23 sources of wireless technology including mobile phone, broadcast, and
24 WiFi or WiMax antennas, wireless routers, smart meters, etc.

1 The specific biological and health effects, provided in Glaser 1972, are
2 listed below:

3 **A. Heating of Organs* (Applications: Diathermy, Electrotomy,
4 Electrosurgery, Electrocoagulation, Electrodesiccation)**

5
6 **B. Changes in Physiologic Function**

7 **C. Central Nervous System Effects**

8
9 **D. Autonomic Nervous System Effects**

10 **E. Peripheral Nervous System Effects**

11 **F. Psychological Disorders**

12
13 **G. Behavioral Changes in Animals Studies**

14
15 **H. Blood Disorders**

16 **I. Vascular Disorders**

17 **J. Enzyme and Other Biochemical Changes (in vitro)**

18
19 **K. Metabolic Disorders**

20 **L. Gastro-Intestinal Disorders**

21
22 **M. Endocrine Gland Changes**

23 **N. Histological Changes**

24
25 **O. Genetic and Chromosomal Changes**

26 **P. Pearl Chain Effect**

27
28 **Q. Miscellaneous Effects**

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July 12, 2012

The Honorable Julius Genachowski
Commissioner
Federal Communications Commission
445 12th Street SW
Washington, DC 20554

Dear Chairman Genachowski:

The American Academy of Pediatrics (AAP), a non-profit professional organization of 60,000 primary care pediatricians, pediatric medical subspecialists, and pediatric surgical specialists dedicated to the health, safety and well-being of infants, children, adolescents, and young adults strongly supports the proposal for a formal inquiry into radiation standards for cell phones and other wireless products. The Academy encourages the Federal Communications Commission (FCC) to vote to move forward with this inquiry in an expeditious manner.

The FCC has not assessed the standard for cell phone radiation since 1996. According to industry groups, approximately 44 million people had mobile phones when the standard was set; today, there are more than 300 million mobile phones in use in the United States. While the prevalence of wireless phones and other devices has sky-rocketed, the behaviors around cell phone uses have changed as well. The number of mobile phone calls per day, the length of each cell phone call, and the amount of time people use mobile phones has increased, while cell phone and wireless technology has undergone substantial changes. Many more people, especially adolescents and young adults, now use cell phones as their only phone line and they begin using wireless phones at much younger ages.

The FCC standard for maximum radiation-exposure levels are based on the heat emitted by mobile phones. These guidelines specify exposure limits for hand-held wireless devices in terms of the Specific Absorption Rate (SAR), which measures the rate the body absorbs radiofrequency (RF). The current allowable SAR limit is 1.6 watts per kilogram (W/kg), as averaged over one gram of tissue. Although wireless devices sold in the United States must ensure that they do not exceed the maximum allowable SAR limit when operating at the device's highest possible power level, concerns have been raised that long-term RF exposure at this level affects the brain and other tissues and may be connected to types of brain cancer, including glioma and meningioma.

In the past few years, a number of American and international health and scientific bodies have contributed to the debate over cell phone radiation and its possible link to cancer. The International Agency for Research on Cancer (IARC), part of the

United Nations' World Health Organization, said in June 2011 that a family of frequencies that includes mobile-phone emissions is "possibly carcinogenic to humans." The National Cancer Institute has stated that although studies have not demonstrated that RF energy from cell phones definitively causes cancer, more research is needed because cell phone technology and cell phone use are changing rapidly. While a definitive link between cell phone radiation and brain cancer has not been established, these studies and others clearly demonstrate the need for further research into this area and highlight the importance of reassessing the current SAR to determine if it is protective of human health.

The AAP believes the inquiry to reassess the radiation standard presents an opportunity to review its impacts on children's health and well-being. In the past, such standards have generally been based on the impact of exposure on an adult male. Children, however, are not little adults and are disproportionately impacted by all environmental exposures, including cell phone radiation. In fact, according to IARC, when used by children, the average RF energy deposition is two times higher in the brain and 10 times higher in the bone marrow of the skull, compared with mobile phone use by adults. While the Academy appreciates that the FCC is considering investigating whether the emission standards should be different for devices primarily used by children, it is essential that any new standard for cell phones or other wireless devices be based on protecting the youngest and most vulnerable populations to ensure they are safeguarded throughout their lifetimes.

Finally, in reviewing the SAR standard, the FCC has the opportunity to highlight the importance of limiting media use among children. The Academy has found potentially negative effects and no known positive effects of media use by children under the age of two, including television, computers, cell phones, and other handheld wireless devices. In addition, studies consistently show that older children and adolescents utilize media at incredibly high rates, which potentially contributes to obesity and other health and developmental risks. In reviewing the SAR limit, the FCC has the opportunity to improve the health of our nation by highlighting the importance of limiting screen time and media use for children and adolescents.

The AAP supports the proposal for a formal inquiry into radiation standards for cell phones and other wireless products and the Academy encourages the FCC to vote in favor of moving forward with this investigation. If you have questions or concerns, please contact Kristen Mizzi in the AAP's Washington Office at 202/347-8600.

Sincerely,

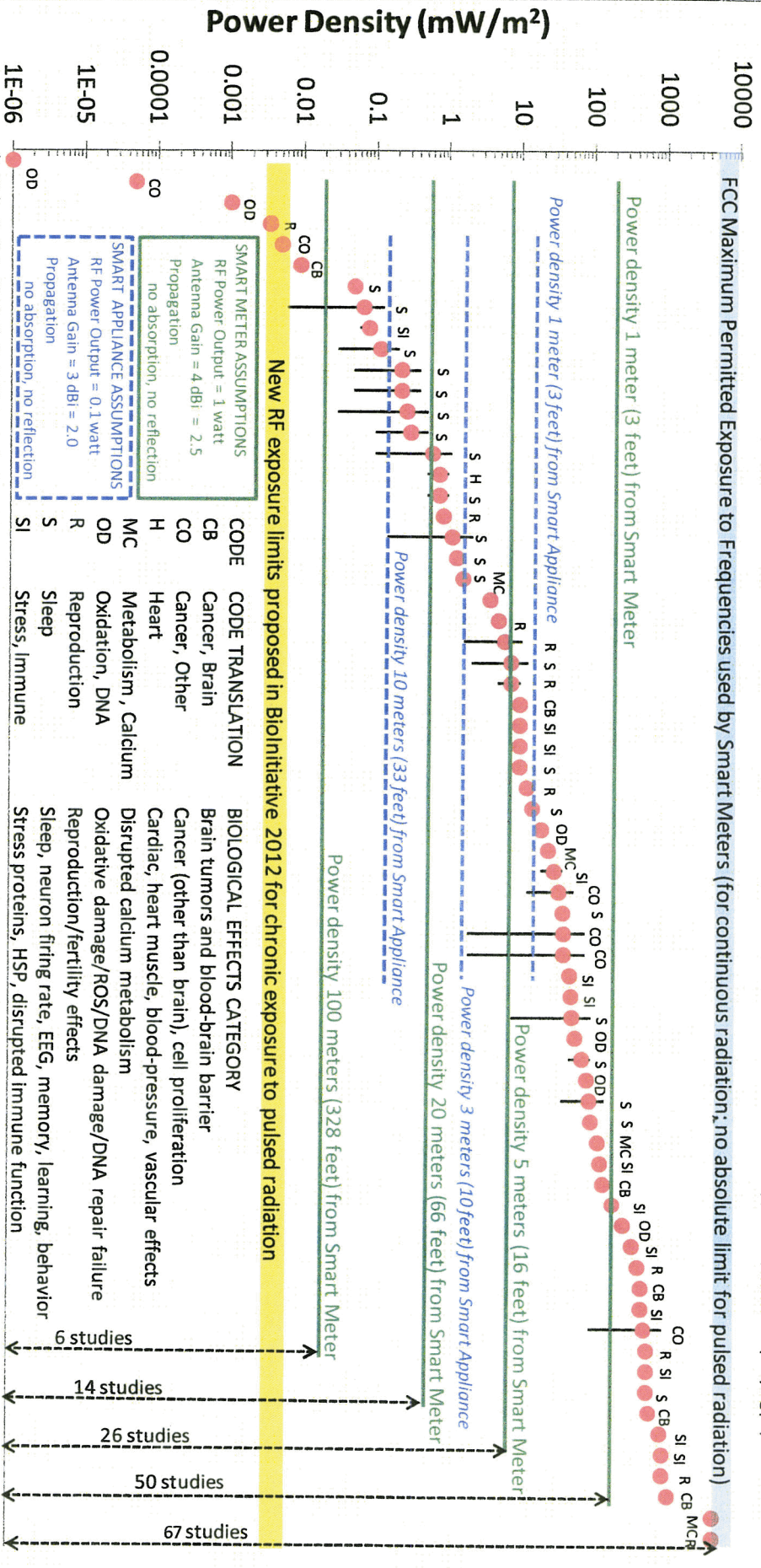


Robert W. Block, MD FAAP
President

RWB/km

Reported Biological Effects from RF Radiation at Low-Intensity Exposure in Each of the 67 Studies Referenced in the "BioInitiative 2012" Report (Cell Tower, Wi-Fi, Wireless Laptop, and Smart Meter Power Densities)

Reference for data dots (red), data range indicators (vertical black lines through red dots), biological effects categories for the red dots, and new proposed limits (yellow line): BioInitiative Working Group, Cindy Sage and David O. Carpenter, Editors. BioInitiative Report: A Rationale for Biologically-based Public Exposure Standards for Electromagnetic Radiation at www.bioinitiative.org, December 31, 2012. For references for other information on this chart, including the FCC Maximum Permitted Exposure limits, and the power densities of Smart Meters and Smart Appliances, see accompanying paper.



Principal Investigator of Study, and Year of Publication

Biological Effects from RF Radiation at Low-Intensity Exposure, based on the BioInitiative 2012 Report, and the Implications for Smart Meters and Smart Appliances

Introduction and Conclusions

The Biological Effects Chart, at the end of this document, has been produced using data from a massive new review of the medical research literature on the biological effects of electromagnetic fields. That review is called the BioInitiative 2012 Report.² The purpose of the Biological Effects Chart is to show the radiofrequency (RF) exposure levels at which biological effects were found in 67 studies from the RF Color Charts of the BioInitiative 2012 Report, and then to compare those exposure levels to the following:

- (1) current FCC Maximum Permitted Exposure (MPE) limits that govern Smart Meters and Smart Appliances in the United States
- (2) new biologically based RF exposure limits proposed in the BioInitiative 2012 Report
- (3) calculated RF exposure levels produced by a single Smart Meter at various distances
- (4) calculated RF exposure levels produced by a single Smart Appliance at various distances

This comparison is based on RF exposure levels expressed as the RF power density (RF power per unit area). This comparison does not address other potentially important factors such as carrier continuity (continuous versus pulsed radiation) and modulation technique (the method used to impress information on the carrier), among others. The purpose is to identify what biological effects arise from exposure to RF power density levels like those produced by Smart Meters and Smart Appliances.

This comparison indicates the following:

- (1) The current FCC Maximum Permitted Exposure (MPE) limits are so high that they provide no protection for the public from the biological effects found in any of the 67 studies.
- (2) New biologically based RF exposure limits proposed in the BioInitiative 2012 Report are 1 million times lower than current FCC limits and would protect against the biological effects found in nearly all of the 67 studies.
- (3) A single Smart Meter on a home can produce RF exposure levels that caused the biological effects found in either most or many of the 67 studies, depending on the distance from the Smart Meter.
- (4) A single Smart Appliance in the home can produce RF exposure levels that caused the biological effects found in nearly half or fewer of the 67 studies, depending on the distance from the Smart Appliance. Multiple Smart Appliances in a home multiply the total exposure.

¹ The author holds a Ph.D. in Applied Physics from Harvard University, 1975.

² BioInitiative Working Group, Cindy Sage and David O. Carpenter, Editors, BioInitiative Report: A Rationale for Biologically-based Public Exposure Standards for Electromagnetic Radiation, December 31, 2012 (<http://www.bioinitiative.org>).

(5) A single Smart Meter on a nearest neighbor's home can produce RF exposure levels that caused the biological effects found in many of the 67 studies. A given home may have one to eight nearest neighbors, each with a Smart Meter, multiplying the total exposure in the given home.

Other observations:

(1) Most biological effects of RF exposure cannot be sensed by human beings. Examples are the onset of cancer, DNA damage, and fertility effects. One category of effects that can often be sensed includes neurological effects on sleep, memory, learning, and behavior.

(2) Unborn and very young children may be more affected by RF exposure than adults.

This document provides background information, an explanation of each feature of the Biological Effects Chart, and a detailed discussion of each of the conclusions and observations summarized above. That discussion begins on page 11.

Figure 1, on page 9 in this document, and the Biological Effects Chart, at the end of this document, are in color, and are most easily understood when viewed in color. But they can also be understood in black and white. To make that possible, key lines in Figure 1 and in the Biological Effects Chart are identified not only by color but also by line thickness and line style (solid versus dashed).

Terminology for Parts of the Electromagnetic Spectrum

Electromagnetic fields occur over a wide range of frequencies, referred to as the electromagnetic spectrum.³ But the terms used for parts of that spectrum are not consistently named or defined. The BioInitiative 2012 Report uses the following definitions for two key parts of the electromagnetic spectrum:

extra low frequency (ELF): electromagnetic fields with frequencies from 1 to 300 Hz⁴
radiofrequency (RF): electromagnetic fields with frequencies from 100 kHz to 300 GHz⁵

Within the *radiofrequencies* lie the *microwave* frequencies. Microwaves, too, are variously defined. Here are two common definitions:

microwaves: electromagnetic fields with frequencies from 300 MHz to 300 GHz⁶
microwaves: electromagnetic fields with frequencies from 1 GHz to 100 GHz⁷

This document focuses on the biological effects of the frequencies at which the following devices operate. Those frequencies are shown in round numbers.

³ Explanation of units of measure for frequency: 1 hertz is 1 cycle per second. 1 kilohertz is equivalent to 1000 hertz. 1 megahertz is equivalent to 1000 kilohertz and to 1,000,000 hertz. 1 gigahertz is equivalent to 1000 megahertz and to 1,000,000 kilohertz and to 1,000,000,000 hertz. These units are abbreviated as follows: hertz (Hz), kilohertz (kHz), megahertz (MHz), and gigahertz (GHz).

⁴ BioInitiative 2012 Report cited in footnote 2 on page 1, Section 26, Glossary of Terms and Abbreviations, page 3. The Report notes that the term Extremely Low Frequency is used in Europe and the term Extra Low Frequency is used in the United States. Wikipedia uses the term Extremely Low Frequency to refer to 3 to 300 hertz
(http://en.wikipedia.org/wiki/Extremely_low_frequency).

⁵ BioInitiative 2012 Report cited in footnote 2 on page 1, Section 26, Glossary of Terms and Abbreviations, page 5.

⁶ (<http://en.wikipedia.org/wiki/Microwaves>)

⁷ (<http://en.wikipedia.org/wiki/Microwaves>)

cell towers ⁸	300, 400, 700, 800, 900, 950, 1800, 1900, 2100 MHz
Wi-Fi (most common type of WLAN) ⁹	2400, 2500 MHz (predominant) 2600, 3600, 5000 MHz (emerging)
wireless laptops ¹⁰	2400 MHz (predominant) 5000 MHz (emerging)
Smart Meters ¹¹	900, 2400 MHz (Smart Meters and Collector Smart Meters) 850 MHz (Collector Smart Meters only)
Smart Appliances ¹²	2400 MHz

Note that that all of these devices operate at frequencies between 300 MHz and 5000 MHz. The frequencies at which Smart Meters and Smart Appliances operate are right in the middle of this range. According to one or more of the definitions given above, all of these frequencies may be referred to as either *radiofrequencies (RF)* or *microwaves*. Since the BioInitiative 2012 Report refers to these frequencies as *radiofrequencies (RF)*, that term will be used here. But the term *microwaves* could have been used just as well.

The BioInitiative 2012 Report

The BioInitiative 2012 Report was developed by an international group of 29 individuals with expertise on the biological effects of electromagnetic fields, or on the related public-health issues.¹³ As a group, these experts hold 20 PhD degrees, one DrSc degree, 9 MD degrees, one DVM degree, and four degrees of MSc, MA, MPH, or MSPAS. These experts come from ten countries, each with the following number of participants:

USA	10	India	2
Sweden	6	Italy	2
Austria	2	Denmark	1
Canada	2	Russia	1
Greece	2	Slovak Republic	1

The goal of the BioInitiative Report is to present “a solid scientific and public health policy assessment that is evidence-based.” The report was prepared “independent of governments, existing bodies and industry professional societies that have clung to old standards.”¹⁴

⁸ (http://en.wikipedia.org/wiki/Cellular_network), (http://en.wikipedia.org/wiki/GSM_frequency_bands), and (http://en.wikipedia.org/wiki/UMTS_frequency_bands)

⁹ (<http://en.wikipedia.org/wiki/Wi-Fi>) and (http://en.wikipedia.org/wiki/List_of_WLAN_channels)

¹⁰ (http://en.wikipedia.org/wiki/Wireless_LAN)

¹¹ Both the Landis-Gyr FOCUS AXR-SD and the General Electric I-210+c Smart Meters, being installed in Maryland, have FCC ID OWS-NIC514. They send and receive information in two microwave frequency ranges: (1) 902.3 to 926.9 MHz, and (2) 2405.8 to 2480.9 MHz (<http://stopsmartmeters.org/wp-content/uploads/2012/01/OWS-NIC514-FCC-specifications.pdf>). Collector Smart Meters have a third transmission frequency of 850 MHz (http://sagereports.com/smart-meter-rt/?oage_id=210). They receive and retransmit the signals from Smart Meters to assure that those signals reach the antennas of the electric power company. It is not clear to me at this time whether Collector Smart Meters are employed in all installations of Smart Meters.

¹² The most likely transmitter/receiver in the Smart Appliances is the so-called ZigBee device. ZigBee devices operate at 865 MHz (in Europe) and 915 MHz (in the USA and Australia) as well as 2.4 GHz (worldwide) (<https://en.wikipedia.org/wiki/ZigBee>). But the Smart Meters first observed in installations in Maryland seem to require that the ZigBee devices operate at 2.4 GHz.

¹³ BioInitiative 2012 Report cited in footnote 2 on page 1, cover page of the full report, as a single PDF file.

¹⁴ BioInitiative 2012 Report cited in footnote 2 on page 1, Section i, Preface 2012, page 2.

The Scope of the BioInitiative 2012 Report

The 1479-page BioInitiative 2012 Report considers the “content and implications of about 1800 new studies” since the last BioInitiative Report was published in 2007.¹⁵ The 2012 Report contains 16 chapters that address key categories of biological effects. The 2012 Report also contains several chapters that address key public policy issues, such as the nature and shortcomings of the current exposure standards, and the bases for sufficient argument for changing those standards. Emphasized is the importance of weighing the magnitude of potential harm against the evidence of potential harm, to determine when protective action should be triggered.¹⁶ Since Smart Meters are being mandated for entire populations in the United States, the magnitude of potential harm is considerable, so prudence dictates serious consideration of the increasing evidence of harm.

The Data Source for the Biological Effects Chart

The data for the appended Biological Effects Chart were drawn from the so-called RF Color Charts in the BioInitiative 2012 Report.¹⁷ The RF Color Charts contain two charts:

The first chart describes 67 studies of the biological effects of radiofrequency (RF) radiation.¹⁸ Each study represents one or more biological effects found at a one value of the RF power density (RF power per unit area) or within a range of such values. These data are especially useful when considering whole-body exposure, which is the type of exposure that human beings receive from Smart Meters at a distance of 1 meter or more.¹⁹ These data form the basis for the appended Biological Effects Chart.

The second chart describes 68 studies of the biological effects of radiofrequency (RF) radiation.²⁰ In this chart, each study represents one or more biological effects found at one Specific Absorption Rate, or SAR value, or within a range of such values. A SAR value is the RF power absorbed per unit mass of the biological entity being irradiated. These data are especially useful when less than the entire body is irradiated, and at very close distances, such as when a cell phone irradiates the head.

¹⁵ BioInitiative 2012 Report cited in footnote 2 on page 1, Section 1, Summary for the Public and Conclusions, 2012 Supplement: Summary for the Public – Ms. Sage, page 3.

¹⁶ BioInitiative 2012 Report, cited in footnote 2 on page 1, Table 1-1, Section 23: The Precautionary Principle, 2012 Supplement: The Precautionary Principle – Mr. Gee, page 2.

¹⁷ BioInitiative 2012 Report, cited in footnote 2 on page 1, Section 1, Summary for the Public and Conclusions, Table 1-2 Reported Biological Effects from Radiofrequency Radiation at Low-Intensity Exposure 2012, no page numbers.

¹⁸ Each study in the first chart derives from one publication. But three publications contributed two studies, and one publication contributed three studies. As a result, the 67 studies derive from 62 publications. So the terms *studies* and *publications* have slightly different meanings as used here.

¹⁹ More specifically, the power density values used in the first table are valid in the “far field” (also called the “radiative field”) of the Smart Meter. For the type of antenna in a Smart Meter or a Collector Smart Meter, the far field should begin about two wavelengths from the meter (http://en.wikipedia.org/wiki/Far_field). A Collector Smart Meter transmits on three frequencies (850, 900, and 2400 MHz). The longest wavelength transmitted by a Collector Smart Meter is determined by the lowest frequency which it transmits, which is 850 MHz. That wavelength is 0.35 meters (about 1 foot). A Smart Meter transmits on two frequencies (900 MHz and 2400 MHz), so the lowest frequency transmitted by a Smart Meter is 900 MHz, and the longest wavelength it transmits is 0.33 meters (again about 1 foot). Smart Appliances are expected to transmit at 2400 GHz, with has a wavelength of 0.13 meters (about 5 inches). So for all three devices, the far field begins about 0.7 meters (about 2 feet), or less, from them. This document addresses distances from 1 meter (about 3 feet) up, so all such distances are in the far field for all three devices.

²⁰ Each study in the second chart derives from one publication. But two publications contributed two studies each. As a result the 68 studies derive from 66 publications. So the terms *studies* and *publications* have slightly different meanings as used here.

This is not the usual case for RF exposure from Smart Meters, so these data were not used for the appended Biological Effects Chart.

Criteria for Selection of the Studies in the RF Color Charts

The criteria used in the BioInitiative 2012 Report to select the studies for the RF Color Charts, and thus for the appended Biological Effects Chart, were the following:²¹

- (1) A selection of good examples only. Not intended to be comprehensive.
- (2) Peer-reviewed and published studies only.
- (3) Good exposure data (numeric).
- (4) Author(s) have clear methods and conclusions.
- (5) Cover wide range of topics, such as genotoxicity, neurological, immune, cancers, behavior, attention, memory, sleep, etc.
- (6) Cover wide range of exposure levels, with an emphasis on the lowest levels and the more recent studies.

Every study in the first chart of the RF Color Charts, and thus every study in the appended Biological Effects Chart based on that first chart, except one (Dumansky, 1974), was published after 1986. 1986 is the year of publication of the document on which the current FCC Maximum Permitted Exposure (MPE) limits are principally based.²² That was 27 years ago, which is one factor in explaining why the current FCC MPE limits are out of date. The references for the studies in the RF Color Charts, and thus for the biological effects data in the appended Biological Effects Chart, are included in the reference list that immediately follows the RF Color Charts in the PDF file of the full BioInitiative 2012 Report.²³

Explanation of the Appended Biological Effects Chart

The Horizontal Axis of the Biological Effects Chart

The studies are presented in order of increasing RF power density along the horizontal axis of the Biological Effects Chart. That order facilitates comparing effects observed at similar RF power densities. Each position along the horizontal axis of the Biological Effects Chart represents one study whose principal author and date of publication are written under that axis. The studies could just as well have been ordered alphabetically by the authors' last names, or numerically by the publication dates.

The Vertical Axis of the Biological Effects Chart

The vertical axis represents the RF power densities at which each study was conducted. These power densities cover a wide range of values, so a logarithmic vertical axis was employed. This approach permitted displaying 11 orders of magnitude on the Biological Effects Chart.²⁴ The units of measure

²¹ The criteria were provided by Cindy Sage, co-editor of BioInitiative 2012, in a private communication, April 23, 2013.

²² The current FCC exposure limits are based principally on a 1986 publication of the National Council on Radiation Protection and Measurements (NCRP). That publication is "Report No. 086 - Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields". The NCRP was chartered by the U.S. Congress in 1964, but is not a Government agency and is not subject to oversight by the Congress.

²³ BioInitiative 2012 Report cited in footnote 2 on page 1, Reported Biological Effects from Radiofrequency Radiation (RFR) at Low-Intensity Exposure Levels, sequential pages 112-121 in the 1479-page PDF version of the full Report.

²⁴ Each order of magnitude is a factor of 10.

selected for the vertical axis are milliwatts per square meter (mW/m^2).²⁵ These units work well for the wide range of power densities required for the vertical axis, making the length of the smallest number, 0.000001, not too much longer than the length of the largest number, 10000.

The selected units for the vertical axis also work well for relating the RF power density shown to the total RF power that an adult human would receive. The surface area of an adult human is about 2 square meters (m^2).²⁶ So the surface area that an adult human presents to an RF wave arriving from the front, or from the back, is about 1 square meter (m^2). So when an adult human faces an oncoming wave of radiation with a power density of, say, 10 milliwatts per square meter (mW/m^2), that human will receive a total of 10 milliwatts (mW) of radiation over the entire body. That is, the number describing the power density will be the same as the number describing the total power received, even though the units of measure are different in the two cases. So, when examining the vertical axis of the attached Biological Effects Chart, each number on that axis may be taken to mean *both* the power density (in mW/m^2) of the oncoming wave of RF radiation *and* the total RF power (in mW) received by an adult human when standing with the front, or the back, facing the direction from which the radiation is coming.

The Round Red Dots on the Biological Effects Chart

Each round red dot on the attached Biological Effects Chart indicates the RF power density at which the study named on the horizontal axis, directly below the dot, was conducted. Some studies were conducted over a range of power densities. In such cases, the average value of the high and low ends of the range determines the location of the dot on the vertical axis. The range of power densities applicable is shown as a black vertical line through the dot. The top of the vertical line marks the high end of the range, and the bottom of the vertical line marks the low end of the range. On those vertical lines, the dots appear higher than the middle. That effect results from the logarithmic vertical axis, even though the dots are located at the true average value of the high and low ends of the range.

The Alphabetic Codes above the Dots on the Biological Effects Chart

A one- or two-letter code appears just above each of the dots on the Biological Effects Chart. Each code, such as "CB", identifies the category into which the biological effects found by a given study fall. Those one- and two-letter codes are translated in the table on the Biological Effects Chart, first into the one or two words represented by the letters of the codes, and then into a fuller description of the category, as reported in the RF Color Charts of the BioInitiative 2012 Report. For example, the code "CB" stands for the words "Cancer, Brain" and represents a category that contains "Brain tumors and blood-brain barrier".²⁷ Similarly, the code "CO" stands for the words "Cancer, Other" and represents a category that contains "Cancer (other than brain), cell proliferation".

The Thick Horizontal Blue Line at the Top of the Biological Effects Chart

The thick horizontal blue line, which appears at the top of the Biological Effects Chart, represents the Maximum Permitted Exposure (MPE) limits of the Federal Communications Commission (FCC). These are the limits applicable to the general population for uncontrolled exposure for the frequencies that Smart

²⁵ 1 milliwatt (mW) is one-thousandth of a watt (W).

²⁶ The surface area of a man is about 1.9 square meters (m^2); and the surface area of a woman is about 1.6 square meters (m^2), both according to Wikipedia (http://en.wikipedia.org/wiki/Body_surface_area).

²⁷ The reference to blood-brain barrier refers to the weakening of the barrier that the body erects between the blood and the brain to prevent harmful entities circulating in the blood from entering the brain.

Meters, Collector Smart Meters, and Smart Appliances use: 2400 MHz, 900 MHz, and 850 MHz. The top edge of the blue line is the limit applicable to 2400 MHz. The bottom edge of the blue line is the limit applicable to 850 MHz. The limit applicable to 900 MHz falls in between.

Frequency (MHz)	FCC Maximum Permitted Exposure (MPE) Limits ²⁸ (mW/m ²)	
2400	10,000	(Smart Meters, Collector Smart Meters, and Smart Appliances)
900	6000	(Smart Meters and Collector Smart Meters)
850	5700	(Collector Smart Meters)

However, those FCC limits apply to the time-average RF power density over a period of 30 minutes. So, pulsed signals, like those issued by Smart Meters and Smart Appliances, are permitted to assume even higher peak values, as long as the time-average over a period of 30 minutes is below the FCC limits shown.

The Thick Horizontal Yellow Line on the Biological Effects Chart

The thick horizontal yellow line, which appears about one-third from the bottom of the Biological Effects Chart, shows the new RF exposure limits proposed in the BioInitiative 2012 Report for chronic exposure to pulsed radiation. Pulsed radiation is the type of radiation that Smart Meters and Smart Appliances emit. The top of this line is located at 0.006 milliwatts per square meter (mW/m²). The bottom of this line is located at 0.003 milliwatts per square meter (mW/m²).²⁹

New Biologically Based RF Exposure Limits Proposed in the BioInitiative 2012 Report³⁰ (as expressed, equivalently, in various units of measure)

0.3 to 0.6	nanowatts per square centimeter (nW/cm ²)	(units used in BioInitiative 2012)
0.003 to 0.006	milliwatts per square meter (mW/m ²)	(units used in appended Chart)
3 to 6	microwatts per square meter (μW/m ²)	

The data from the 67 studies in the Biological Effects Chart indicate why this level might have been judged appropriate by the authors of the BioInitiative 2012 Report: This level would protect against the biological effects found by all but five of the 67 studies. The BioInitiative 2012 Report indicates that these proposed new limits “may need to change in the future, as new and better studies are completed.”³¹ Note that this level, which can also be expressed as 3 to 6 microwatts per square meter (μW/m²), is in agreement with the level of 5 microwatts per square meter (μW/m²) proposed by Dietrich Klinghardt, M.D., Ph.D., in his detailed video treatment of the health hazards of Smart Meters.³²

²⁸ Questions and Answers about Biological Effects and Potential Hazards of Radiofrequency Electromagnetic Fields, OET (Office of Engineering and Technology) Bulletin 56, Fourth Edition, Federal Communications Commission, August 1999. See Table 1(B), Limits for General Population/Uncontrolled Exposure, page 15.

(http://www.fcc.gov/Bureaus/Engineering_Technology/Documents/bulletins/oet56/oet56e4.pdf)

²⁹ BioInitiative 2012 Report cited in footnote 2 on page 1, Section 1, Summary for the Public and Conclusions, 2012 Supplement: Summary for the Public – Ms. Sage, pages 25-26.

³⁰ 1 milliwatt (mW) is one thousandth of a watt (W). 1 microwatt (μW) is one millionth of a watt (W). 1 nanowatt (nW) is one billionth of a watt (W). 1 centimeter (cm) is one hundredth of a meter (m). So, 1 square centimeter (cm²) is one ten thousandth of 1 square meter (m²).

³¹ See footnote 29 above.

³² Dr. Klinghardt’s video, and further information about him, can be found on the following web sites:

(<http://marylandsmartmeterawareness.org/smart-meter-news/dr-dietrich-klinghardt-smart-meters-emr-the-health-crisis-of-our-time>) and (<http://www.klinghardtacademy.com/BioData/Dr-Dietrich-Klinghardt.html>).

The Thin Horizontal Green Lines on the Biological Effects Chart

The four thin horizontal green lines show the power density of the RF radiation emitted by a Smart Meter at four different distances. To determine these levels, I assumed that the Smart Meter is the type being installed in Maryland, as described in footnote 11 on page 3:

$$P = \text{RF power output} = 1 \text{ watt}$$
$$g = \text{antenna gain} = 4 \text{ dBi} = 2.5 \text{ (a pure number, a ratio)}^{33}$$

This Smart Meter has an RF power output, P , of approximately 1 watt. The antenna used in the Smart Meter is a variation of a vertical dipole antenna which provides a gain, g , of 4 dBi, or 2.5, in the horizontal direction. I have not accounted for absorption by obstructions, such as walls and other objects, which can lower RF power density levels. Nor have I accounted for reflections from walls or other objects, which can raise or lower RF power density levels. So the actual power densities would likely fall somewhere between the two extremes that could apply if these other factors had been considered. The RF power density, P_D , in watts per square meter (W/m^2) can be calculated from this equation:

$$P_D = g \left[\frac{P}{4\pi r^2} \right]$$

In the above equation, r is the distance, in meters, from the Smart Meter, in the horizontal direction. This equation can be understood this way: The radiation from the Smart Meter travels outward from the meter and is initially regarded as spreading uniformly over the surface of a sphere (centered on the Smart Meter) which has a radius, r , and thus a surface area of $4\pi r^2$. So the part of the equation in square brackets [] indicates the power density that would be produced, at a distance, r , if the radiation from the Smart Meter spread uniformly over the surface of that sphere. The antenna used in the Smart Meter increases the power density in the horizontal direction, at the expense of a decrease in the power density in the vertical direction, because all receivers of interest are in the horizontal direction. Those receivers include the antennas of the electric power company and the antennas of other Smart Meters in the area with which a given Smart Meter communicates. The antenna gain, g , accounts for this characteristic of the antenna and causes P_D to represent the power density in the horizontal direction.

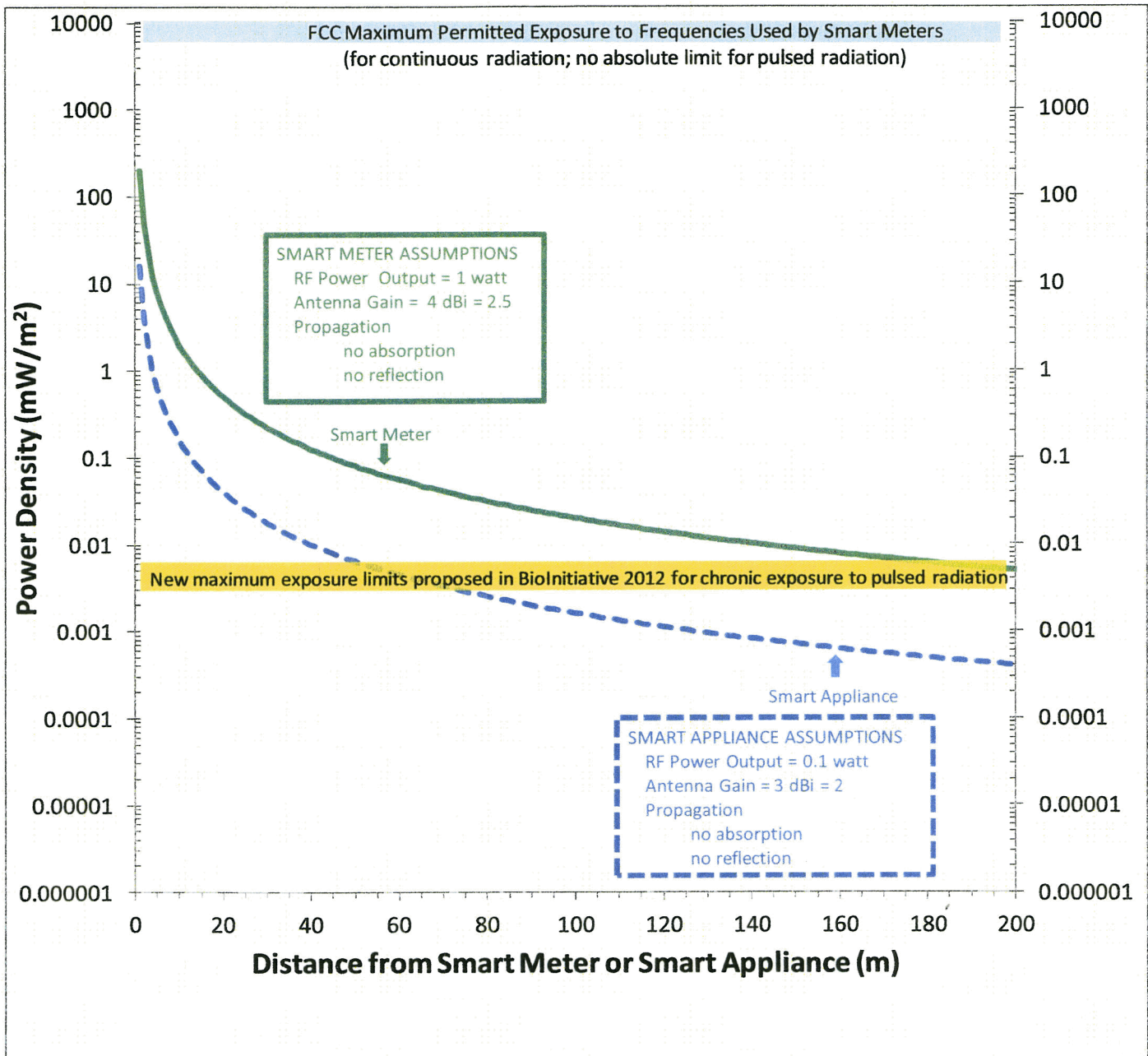
The RF power density, P_D , computed from the above equation is plotted in Figure 1 on page 9 as a function of the distance from the Smart Meter. The power density is expressed in units of milliwatts per square meter (mW/m^2) to match the units in the Biological Effects Chart under discussion. A logarithmic vertical axis is used for the power density, again to match the logarithmic vertical axis of the Biological Effects Chart. The vertical axis appears on both sides of Figure 1 to facilitate easier reading.

The power density is strongest near the Smart Meter and falls off quickly with increasing distance, but persists at lower levels to great distances. The power density of the Smart Meter drops to the maximum

³³ The antenna gain, g , is usually specified in dBi, which means the gain, in decibels, relative to an ideal isotropic antenna, which is an idealized antenna that radiates equally in all directions. The gain of the antenna in a Smart Meter (with FCC ID OWS-NIC514) is 4 dBi and translates to a factor of 2.5. That is, the power density in the horizontal direction is 2.5 times greater than it would be if the antenna radiated equally in all directions. In the case of Smart Meters, the power density in the vertical direction is reduced in favor of increased power density in the horizontal direction where all intended receivers are located. To access the reference, start at (<http://transition.fcc.gov/oet/ea/fccid>). In the box Grantee Code, enter OWS. In the box Product Code, enter -NIC514 (including the hyphen), press Search, click on the first entry Detail, and click on Test Report. This should take you to this location (<https://apps.fcc.gov/eas/GetApplicationAttachment.html?id=1174749>) which you cannot address directly. Then see page 3 of 66 of the document found.

exposure level proposed in the BioInitiative 2012 Report at a distance of about 180 meters. On the appended Biological Effects Chart, the four thin horizontal green lines show the power densities, taken from Figure 1, for distances of 1 meter (3 feet), 5 meters (16 feet), 20 meters (66 feet), and 100 meters (328 feet).

Figure 1: Smart Meter and Smart Appliance RF Power Densities versus Distance



The Thin Dashed Horizontal Blue Lines on the Biological Effects Chart

Smart Meters are designed to communicate wirelessly with new Smart Appliances that are now becoming available. The Smart Appliances contain RF transmitters and receivers of their own. Through the Smart Meters, the Smart Appliances can report, to the electric power company, data sufficient to identify the specific appliances and to indicate when they were installed or removed, and how much power they are

consuming throughout the day and the night, every day of the year. Less certain is whether the electric power company will be able to turn off the Smart Appliances by sending a wireless signal to them through the Smart Meter. (For example, the electric power company might want to turn off appliances that draw a lot of electricity at certain times of day, and in certain seasons, when the load on the electric power system is high. An example would be turning off the air-conditioner at midday in midsummer.)

Such Smart Appliances will increase the RF radiation inside each home. Verifiable data on the actual RF power output of the transmitters that will be used in the Smart Appliances is hard to find at present; but a likely value is 0.1 watt, since that is a common value used for other short-range wireless devices.³⁴ The antenna gain is assumed to be 3 dBi or 2.³⁵ The frequency of operation is assumed to be 2.4 GHz to communicate with the Smart Meters.³⁶

The RF power density for Smart Appliances is calculated with the same equation used for Smart Meters above but with the different values for P and g just cited:

$$P = \text{RF power output} = 0.1 \text{ watt}$$
$$g = \text{antenna gain} = 3 \text{ dBi} = 2 \text{ (a pure number, a ratio)}$$

The result for a single Smart Appliance is shown by the dashed blue line in Figure 1 on page 9. Once again, I have not accounted for absorption and reflection during propagation. Absorption can lower the power density. Reflection can lower or raise the power density. So the power densities shown in Figure 1 would likely fall somewhere between the two extremes that could apply if these other factors had been considered. The patterns of absorption and reflection inside homes vary greatly, so many different situations are possible.

The power density from a single Smart Appliance does not fall to the new maximum exposure level proposed in the BioInitiative 2012 Report until a distance of 50 meters (164 feet) from the Smart Appliance has been reached. So there will be no location within the typical home that will be that far from a Smart Appliance. Of course, over time, many such Smart Appliances may be purchased for a home, multiplying the total exposure produced.

In the appended Biological Effects Chart, the thin dashed blue lines show the RF power density, taken from Figure 1, for a single Smart Appliance at three distances: 1 meter (3 feet), 3 meters (10 feet), and 10 meters (33 feet) from the Smart Appliance. 10 meters is about as far from a Smart Appliance as a person can get inside the typical home with a single centrally located Smart Appliance.

³⁴ The most likely transmitter/receiver in the Smart Appliances is the so-called ZigBee device. These devices have RF outputs ranging from 0.001 watt to 0.1 watt, which is equivalent to a range of 1 milliwatt (mW) to 100 milliwatts (mW).

(<https://en.wikipedia.org/wiki/ZigBee>)

³⁵ The assumed gain, g , in this case, is 3 dBi, which is based on the performance of an ordinary vertical dipole antenna. That is, the power density in the horizontal direction is 2 times greater than it would be if the antenna radiated equally in all directions.

³⁶ ZigBee devices operate at 865 (in Europe) and 915 MHz (in the USA and Australia), as well as 2.4 GHz (worldwide); but the design of the Smart Meters installed in Maryland seems to require that the ZigBee devices operate at 2.4 GHz.

(<https://en.wikipedia.org/wiki/ZigBee>)

Conclusions and Observations

Current FCC Maximum Permitted Exposure (MPE) Limits Are Too High to Protect the Public

Because the FCC Maximum Permitted Exposure (MPE) limits are at power densities higher than the power densities addressed in all of the 67 studies, those limits provide no protection against the biological effects found in any of the 67 studies, no matter what the source of the RF radiation.

Further, the FCC Maximum Permitted Exposure limits apply to each source of radiation, individually, not to the combined exposure from all sources. But a person will generally be exposed to radiation from a combination of sources. So the FCC Maximum Permitted Exposure limits not only are too high to protect a person from a single source of radiation, but also do not consider the actual exposure received by a person from multiple sources of radiation.

New Biologically Based RF Exposure Limits, Proposed in the BioInitiative 2012 Report, are 1 Million Times Lower than the FCC Limits, to Protect the Public

The new RF exposure limits proposed in the BioInitiative 2012 Report are about 1 million times lower (stricter) than the current FCC Maximum Permitted Exposure Limits in the frequency ranges at which Smart Meters, Collector Smart Meters, and Smart Appliances operate.

Comparison of RF Exposure Limits

Biointiative 2012 Report (RF)	FCC MPE (850 to 2400 MHz)	Ratio (FCC/BioInitiative 2012)
.003 to .006 mW/m ²	5700 to 10,000 mW/m ²	950,000 to 3,000,000

As shown in the appended Biological Effects Chart, the new RF exposure limits in the BioInitiative 2012 Report are low enough to protect against the biological effects found in nearly all of the 67 studies covered by that Chart.

A Single Smart Meter Can Produce RF Power Density Levels Shown to Cause Biological Effects

The Biological Effects Chart enables a comparison between the RF power densities produced by a Smart Meter, at various distances from that Smart Meter, and the RF power densities that triggered biological effects in the 67 studies.

The power density at 1 meter (3 feet) from a Smart Meter is higher than the power density that triggered biological effects in 50 of the 67 studies.

The power density at 5 meters (16 feet) from a Smart Meter is higher than the power density that triggered biological effects in 26 of the 67 studies.

The power density at 20 meters (66 feet) from a Smart Meter is higher than the power density that triggered biological effects in 14 of the 67 studies.

This distance of 20 meters is likely as far from a Smart Meter as a person can get and still be inside the typical home. So living and sleeping on the side of a home that is farthest from the Smart Meter is helpful but still may not reduce the received power densities to biological insignificance. Further, one or more of the neighbors' Smart Meters may be closer and may thus be the stronger source.

The power density at 100 meters (328 feet) from a Smart Meter is higher than the power density that triggered biological effects in 6 of the 67 studies.

So, even at the distance of a football field from the Smart Meter, the power density received may still be biologically significant.

As shown in Figure 1, the RF power density from a Smart Meter does not drop down to the level of the proposed new RF exposure limits until distances of 180 to 200 meters from the Smart Meter are reached. In most residential communities, whether composed of single-family homes, townhomes, or apartments, it will not be possible to get sufficiently far away from *all* of the Smart Meters present in that community.

A Single Smart Appliance inside a Home Can Produce RF Power Density Levels Shown to Cause Biological Effects

Unfortunately, the problem of excess exposure to RF radiation will get worse as Smart Appliances are adopted. They contain their own internal RF transmitters and receivers. Those Smart Appliances are designed to communicate with Smart Meters and to report through the Smart Meters to the electric power company. The data the Smart Appliances report will be sufficient for the electric power company to identify which appliances you own, when you use them, and how much power they consume, throughout the day and the night. The electric power company may even be able to turn the Smart Appliances off by sending a wireless signal to the Smart Meter that is then transferred to the Smart Appliances, but that is less certain at this time.

When these Smart Appliances are installed in a home, they will significantly increase the radiation levels in that home for several reasons:

They will begin transmitting, and from distances very close to the residents.

The number of Smart Appliances in the home may increase with time as the residents gradually replace their old appliances with new Smart Appliances, increasing the total radiation level.

The Smart Meters will transmit more frequently, in order to communicate with the Smart Appliances.

Even a single Smart Appliance can produce RF power densities of concern. An inspection of the appended Biological Effects Chart indicates the following:

The power density at 1 meter (3 feet) from a Smart Appliance is higher than the power density that triggered biological effects in 32 of the 67 studies.

The power density at 3 meters (10 feet) from a Smart Appliance is higher than the power density

that triggered biological effects in 21 of the 67 studies.

The power density at 10 meters (33 feet) from a Smart Appliance is higher than the power density that triggered biological effects in 10 of the 67 studies.

These observations do not bode well for having 5, 10, or 15 Smart Appliances in a home. The RF radiation from even a few Smart Appliances, because they will be so close to the residents, may rival that of a home's more distant Smart Meter. And the RF radiation from a large number of Smart Appliances may exceed that of a home's Smart Meter.

A Single Smart Meter on a Neighbor's Home Can Produce RF Power Density Levels Shown to Cause Biological Effects

For some locations in a given home, the distance to a neighbor's Smart Meter may be less than the distance to the resident's own Smart Meter. Thus, a neighbor's Smart Meter may be the principal source of radiation for some locations in the given home. The Biological Effects Chart shows that a single Smart Meter can produce RF power densities found to cause biological effects even at distances greater than 20 meters, and certainly up to 100 meters. And the number of neighbors within that range can be large. A given single-family home in a residential community may have one to eight nearest neighbors, and even more next nearest neighbors, all within 100 meters (328 feet) of a given home, and each with a Smart Meter.

The problem of exposure from the neighbors' Smart Meters becomes more serious as the distances between adjacent homes, and thus the distances between adjacent Smart Meters, get smaller. So, generally speaking, residents of townhouses will receive more radiation from their neighbors' Smart Meters than residents of single-family homes. And residents of apartments will receive even more radiation from their neighbors' Smart Meters, depending on the location of the Smart Meters in the apartment buildings.

So Smart Meters are a community concern, not just an individual concern. To resolve the problems of RF exposure for a given home, it will be necessary to address all of the Smart Meters near that home. Smart Appliances, too, contribute to this concern. While, individually, they have a lower RF power output than a Smart Meter, the Smart Appliances of neighbors can also increase the RF exposure in the given home.

Fortunately, some states have offered an individual OPT OUT from the installation of a Smart Meter.³⁷ While such an OPT OUT is very helpful, and is definitely the *vital first step*, the data on biological effects discussed here suggest the limitations of such an OPT OUT in resolving the problem of excess radiation from Smart Meters. There is no substitute for a roll back of all Smart Meters at the community level, or higher.

Most Biological Effects of RF Radiation Cannot be Sensed by Human Beings

Most biological effects of RF radiation cannot be sensed by human beings. This fact is evident from an inspection of the categories of biological effects from the RF Color Charts in the BioInitiative 2012 Report, as shown below. For example, humans cannot sense the onset of cancer, DNA damage, or fertility effects.

³⁷ Maryland, through the Maryland Public Service Commission, currently offers a temporary OPT OUT, with the future of that OPT OUT yet to be decided. And the Maryland House of Delegates is currently considering legislation (HB1038) that would make the OPT OUT permanent and would provide other protections for Maryland homeowners.

Categories of Biological Effects in the RF Color Charts of the BioInitiative 2012 Report

Code	Code Translation	Biological Effects Category
CB	Cancer, Brain	Brain tumors and blood-brain barrier
CO	Cancer, Other	Cancer (other than brain), cell proliferation
H	Heart	Cardiac, heart muscle, blood-pressure, vascular effects
MC	Metabolism, Calcium	Disrupted calcium metabolism
OD	Oxidation, DNA	Oxidative damage/ROS/DNA damage/DNA repair failure
R	Reproduction	Reproduction/fertility effects
S	Sleep	Sleep, neuron firing rate, EEG, memory, learning, behavior
SI	Stress, Immune	Stress proteins, HSP, ³⁸ disrupted immune function

The principal category of biological effects that humans *can* often sense is the S (or Sleep) category. This category includes neurological effects on sleep, memory, learning, and behavior, among others. Unfortunately, not sensing these particular effects does not guarantee that other biological effects are not occurring.

RF Radiation May Affect Unborn and Very Young Children More Severely than Adults

The BioInitiative 2012 Report presents evidence that unborn and very young children may be more greatly affected by RF radiation than adults because unborn and very young children are in “critical phases of growth and development”.³⁹

Concern for unborn and very young children is shared by the American Academy of Pediatrics (AAP) which wrote to the U.S. Congress in support of a bill before the U.S. House of Representatives (H.R. 6358).⁴⁰ This bill would fund development of better founded RF exposure limits to protect against cell phones and other wireless sources of RF radiation. The AAP made the following statement:

*The AAP strongly supports H.R. 6358’s emphasis on examining the effects of radiofrequency (RF) energy on vulnerable populations, including children and pregnant women. In addition, we are pleased that the bill would require the consideration of those effects when developing maximum exposure standards. Children are disproportionately affected by environmental exposures, including cell phone radiation. The differences in bone density and the amount of fluid in a child’s brain compared to an adult’s brain could allow children to absorb greater quantities of RF energy deeper into their brains than adults. It is essential that any new standards for cell phones or other wireless devices be based on protecting the youngest and most vulnerable populations to ensure they are safeguarded through their lifetimes.*⁴¹

³⁸ HSP stands for Heat Shock Proteins. BioInitiative 2012 Report, cited in footnote 2 on page 1, Section 1, Summary for the Public and Conclusions, Table 1-2 Reported Biological Effects from Radiofrequency Radiation at Low-Intensity Exposure 2012, no page numbers.

³⁹ BioInitiative 2012 Report cited in footnote 2 on page 1, Section 1: Summary for the Public and Conclusions, 2012 Supplement: Summary for the Public – Ms. Sage, pages 8-10.

⁴⁰ Summary of H.R. 6358 can be found here:

(<http://marylandsmartmeterawareness.org/smart-meter-news/ask-your-congressional-rep-to-co-sponsor-h-r-6358>). Full copy of H.R. 6358 can be found here: (http://thomas.loc.gov/home/gpoxmlc112/h6358_ih.xml).

⁴¹ (http://ehtrust.org/wp-content/uploads/2012/12/aap_support_letter_cell_phone_right_to_know_act.pdf)

Smart Meters and Smart Appliances operate in the same frequency ranges as cell phones. Further, Smart Meters have twice the RF power output of the typical cell phone, as shown in the table below, and will be transmitting day and night. Emerging Smart Appliances will likely have about one-fifth the RF power output of the typical cell phone. But a given home may have several Smart Appliances; and they, too, will be transmitting day and night.

Device	RF Power Output				
Smart Meter ⁴²	1.115	watts	which is	1115	milliwatts
Typical leakage from a microwave oven ⁴³	1	watt	which is	1000	milliwatts
Typical cell phone ⁴³	0.5	watt	which is	500	milliwatts
Wireless LAN (802.11a) ⁴³	0.251	watt	which is	251	milliwatts
Wireless LAN (802.11n) ⁴³	0.250	watt	which is	250	milliwatts
Cordless phone ⁴⁴	0.230	watt	which is	230	milliwatts
Smart Appliance ⁴⁵	0.100	watt	which is	100	milliwatts
Wireless LAN (802.11 b, g) ⁴³	0.100	watt	which is	100	milliwatts
Typical laptop wireless LAN (Wi-Fi) ⁴³	0.032	watt	which is	32	milliwatts

A Final Note

The Smart Meter is the first source of RF exposure that is mandated for installation in every home in an entire region without the informed consent, or any consent, of the residents, and that is not under the control of the residents.

For other sources of RF exposure in the home, the residents have a choice to use them, or not to use them, and how often, and how long. Some of those other sources are included in the table above.

The Smart Appliances, while not mandated, will be the second source of RF exposure in a home that is not under the control of the residents -- if manufacturers of the Smart Appliances provide no way of turning off the RF transmitters in those appliances.

The only solution for the individual homeowner, at present, is the removal of the Smart Meter and the avoidance of the Smart Appliances. This is a vital first step; but it is only a partial solution for a given home, because the radiation from the neighbors' Smart Meters and Smart Appliances will cross property boundaries. Collaboration with the neighbors on reducing exposure levels is needed; and a solution at the community level, or higher, will be even more effective.

⁴² The Landis+Gyr FOCUS AXR-SD and the General Electric I-210+c, being installed in Maryland, have FCC-ID OWS-NIC514 which indicates that they send and receive information in two microwave frequency ranges: (1) 902.3 to 926.9 MHz, and (2) 2405.8 to 2480.9 MHz. The RF power output in the first frequency range is 0.968 watts. The RF power output in the second frequency range is 0.147 watt. These values sum to the 1.115 watts shown here, to provide an indication of the total RF power output capability of a Smart Meter. I have used an approximate value of 1 watt for the RF power output of a Smart Meter throughout this document (<http://stopsmartmeters.org/wp-content/uploads/2012/01/OWS-NIC514-FCC-specifications.pdf>).

⁴³ The RF power output levels come from this web site: (<http://en.wikipedia.org/wiki/DBm>). 1 watt equals 1000 milliwatts.

⁴⁴ Panasonic specifies the power output of its DECT 6.0 cordless telephone Model KXTG1061 as 115 milliwatts for the handset and another 115 milliwatts for the base station, for a total capability of 230 milliwatts.

⁴⁵ For a reference, see footnote 34 on page 10.

BIOINITIATIVE 2012

A Rationale for Biologically-based Exposure Standards for Low-Intensity Electromagnetic Radiation¹

Conclusions

- **BIOEFFECTS ARE CLEARLY ESTABLISHED**
- **BIOEFFECTS WITH CHRONIC EXPOSURES CAN REASONABLY BE PRESUMED TO RESULT IN ADVERSE HEALTH EFFECTS**
- **EVIDENCE FOR FERTILITY AND REPRODUCTION EFFECTS: HUMAN SPERM AND THEIR DNA ARE DAMAGED**
- **EVIDENCE THAT CHILDREN ARE MORE VULNERABLE**
- **FETAL AND NEONATAL EFFECTS OF EMF**
- **EMF/RFR AS A PLAUSIBLE BIOLOGICAL MECHANISM FOR AUTISM (ASD)**
- **THE BLOOD-BRAIN BARRIER IS AT RISK**
- **EPIDEMIOLOGICAL STUDIES CONSISTENTLY SHOW ELEVATIONS IN RISK OF BRAIN CANCERS**
- **EVIDENCE FOR GENETIC EFFECTS**
- **EVIDENCE FOR NEUROLOGICAL EFFECTS**
- **EVIDENCE FOR CHILDHOOD CANCERS (LEUKEMIA)**
- **MELATONIN, BREAST CANCER AND ALZHEIMER'S DISEASE**
- **MELATONIN AND BREAST CANCER**
- **ALZHEIMER'S DISEASE**
- **STRESS PROTEINS AND DNA AS A FRACTAL ANTENNA FOR RFR**

¹ <http://www.bioinitiative.org/conclusions/>

- 1 • **EVIDENCE FOR DISRUPTION OF THE MODULATING**
- 2 **SIGNALHUMAN STEM CELL DNA DOES NOT ADAPT OR**
- 3 **REPAIR**
- 4 • **N. EFFECTS OF WEAK-FIELD INTERACTIONS ON NON-LINEAR**
- 5 **BIOLOGICAL OSCILLATORS AND SYNCHRONIZED NEURAL**
- 6 **ACTIVITY**
- 7 • **EMF AND RFR MAKE CHEMICAL TOXINS MORE HARMFUL**
- 8 • **EMF IS SUCCESSFULLY USED IN HEALING AND DISEASE**
- 9 **TREATMENTS**
- 10 • **ELF-EMF AND RFR ARE CLASSIFIED AS POSSIBLE CANCER-**
- 11 **CAUSING AGENTS –WHY ARE GOVERNMENTS NOT ACTING?**
- 12 • **NEW SAFETY LIMITS MUST BE ESTABLISHED – HEALTH**
- 13 **AGENCIES SHOULD ACT NOW**
- 14 • **SCIENTIFIC BENCHMARKS FOR HARM PLUS SAFETY MARGIN**
- 15 **= NEW SAFETY LIMITS THAT ARE VALID**
- 16 • **SENSITIVE POPULATIONS MUST BE PROTECTED**
- 17 • **PROTECTING NEW LIFE – INFANTS AND CHILDREN**
- 18 • **STANDARD OF EVIDENCE FOR JUDGING THE SCIENCE**
- 19 • **WIRELESS WARNINGS FOR ALL**
- 20 • **EMF AND RFR ARE PREVENTABLE TOXIC EXPOSURES**
- 21 • **DEFINING A NEW ‘EFFECT LEVEL’ FOR RFR**

22

23 On a precautionary public health basis, a reduction from the

24 BioInitiative 2007 recommendation of 0.1 uW/cm² (or one-

25 tenth of a microwatt per square centimeter) for cumulative

26 outdoor RFR down to something three orders of magnitude

27 lower (in the low nanowatt per square centimeter range) is

justified.

28 A scientific benchmark of 0.003 uW/cm² or three nanowatts

1 per centimeter squared for 'lowest observed effect level' for
2 RFR is based on mobile phone base station-level studies.
3 Applying a ten-fold reduction to compensate for the lack of
4 long-term exposure (to provide a safety buffer for chronic
5 exposure, if needed) or for children as a sensitive
6 subpopulation yields a 300 to 600 picowatts per square
7 centimeter precautionary action level. This equates to a 0.3
8 nanowatts to 0.6 nanowatts per square centimeter as a
9 reasonable, precautionary action level for chronic exposure to
10 pulsed RFR. These levels may need to change in the future, as
11 new and better studies are completed. We leave room for
12 future studies that may lower or raise today's observed 'effects
13 levels' and should be prepared to accept new information as a
14 guide for new precautionary actions.

Why We Care?

The stakes are very high.

<http://www.bioinitiative.org/participants/why-we-care/>

Do We Know Enough to Take Action?

There is more evidence than we need.

<http://www.bioinitiative.org/participants/do-we-know-enough-to-take-action/>

Reported Biological Effects from Radiofrequency Radiation at Low-Intensity Exposure (Cell Tower, Wi-Fi, Wireless Laptop and 'Smart' Meter RF Intensities)

<http://www.bioinitiative.org/report/wp-content/uploads/pdfs/BioInitiativeReport-RF-Color-Charts.pdf>

List of BioInitiative Participants

http://www.bioinitiative.org/report/wp-content/uploads/pdfs/sec25_participants.pdf

1
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5
6

7 **"I am a retired U.S. Government scientist (Ph.D., Applied**
8 **Physics, Harvard University, 1975).**
9

10 **During my Government career, I worked for the Executive**
11 **Office of the President, the National Science Foundation,**
12 **and the National Institute of Standards and Technology.**
13 **For those organizations, respectively, I addressed Federal**
14 **research and development program evaluation, energy**
15 **policy research, and measurement development in support**
16 **of the electronics and electrical-equipment industries and**
17 **the biomedical research community. I currently interact**
18 **with other scientists and with physicians around the world**
19 **on the impact of the environment – including the**
20 **radiofrequency/microwave environment – on human**
21 **health."**
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