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June 26, 2013

AZ

DOCKET CONTROL

Arizona Corporation Commissioners and staff  
Docket Control  
1200 W. Washington St.  
Phoenix, AZ 85007

2013 JUN 27 PM 4: 21

Re: Dr. David Carpenters' Testimony

The Expert preliminary testimony of Dr. David Carpenter was presented at the Maine Smart Meter Appeal.

Dr. David Carpenter's 29 page Curriculum Vitae can be viewed on line follows the information I have here included, as EXHIBIT A. A Reference List, EXHIBIT B, on Reported Biological Radiation (RFR) at Low-Intensity Exposure Levels (Cell Tower, WI-FI, Wireless Laptop, Wireless Utility Meters 'smart meters'); and a series of informative charts: Reported Biological Effects from Radiofrequency Radiation at Low-Intensity Exposure can also be viewed on line at the following website.

<http://www.mainecoalitionstopsmartmeters.org/wp-content/uploads/2013/01/Exhibit-4-Carpenter-Web.pdf>

A brief description of the "10" Person Complaint" with the Maine Public Utilities Commission [PUC], the 10/31/11, Complainants filed a Notice of Appeal to the Maine Supreme Judicial Court, and subsequent events, can be viewed on the following website:

<http://www.mainecoalitionstopsmartmeters.org/2013/02/introduction-to-our-puc-filings-of-expert-and-lay-witness-testimony/>

**Please Ban Smart Meters Immediately:** before further harm is created by this monstrous technology! It can only get worse!

Respectfully submitted on behalf of a safe, sane and responsibly humane decision by the Arizona Corporation Commissioners.

Patricia Ferre

Arizona Corporation Commission

DOCKETED

JUN 27 2013

DOCKETED BY

**PRE-FILED TESTIMONY  
OF DAVID O. CARPENTER, M.D.  
MPUC Docket No. 2011-00262**

1 **Q. Please state your name and business address.**

2 **A. My name is David O. Carpenter. My business address is:**

3 Institute for Health and the Environment  
4 University at Albany  
5 Five University Place, Room A217  
6 Rensselaer, NY 12144-3456

7 **Q. Briefly state your occupation, educational background and current**  
8 **employment.**

9 **A. I am a public health physician and professor, with a medical degree from Harvard**  
10 **Medical School. I have held various positions in the public health field. My**  
11 **current title is Director of the Institute for Health and the Environment at the**  
12 **University at Albany and Professor of Environmental Health Sciences within the**  
13 **School of Public Health. In addition I am an Honorary Professor, Queensland**  
14 **Children's Medical Research Unit, University of Queensland, Brisbane, Australia.**

15 **Formerly, I was the Director of the Wadsworth Center for Laboratories and**  
16 **Research of the New York State Department of Health and the Dean of the School**  
17 **of Public Health at the University of Albany, while remaining employed by the**  
18 **New York State Department of Health. I assumed my current position in 1998.**

19 **I served as the Executive Secretary to the New York State Powerlines**  
20 **Project in the 1980s, a program of research that showed that children living in**  
21 **homes with elevated magnetic fields coming from powerlines suffered from an**

1 elevated risk of developing leukemia, and that electromagnetic field (EMF)  
2 exposure altered a variety of responses studied in animals and in cellular systems.  
3 After this, I became the spokesperson on EMF issues for New York during the  
4 time of my employment in the Department of Health.

5 Attached as Exhibit A is my *curriculum vitae*.

6 **Q. Are you a member of any professional organizations?**

7 A. I participate in many international, national, state and local organizations and  
8 committees as listed in my *curriculum vitae* along with the Honors, Awards, and  
9 Fellowships I have received.

10 **Q. Have you authored any papers or journal articles?**

11 A. I have authored over 350 major publications in peer-reviewed scientific journals,  
12 have edited five books and have numerous other publications as listed in my  
13 *curriculum vitae*.

14 **Q. Briefly describe your work and experience related to the study of health risks**  
15 **related to electromagnetic fields and radio frequency waves in the 30 MHz to**  
16 **300 GHz range ("RF"). Identify any studies or published writings on the**  
17 **subject.**

18 I have published several reviews and have edited two books on the Biologic  
19 Effects of Electric and Magnetic Fields. I am also a Co-Editor and a Contributing  
20 Author of the *BioInitiative Report: A Rationale for a Biologically-based Public*  
21 *Exposure Standard for Electromagnetic Fields (ELF and RF)*  
22 [www.bioinitiative.org](http://www.bioinitiative.org). This report was first published in 2007, and has just now

1 been updated in 2012. The *BioInitiative Report* documents bioeffects, adverse  
2 health effects and public health conclusions about impacts of electromagnetic  
3 radiation (electromagnetic fields including extremely-low frequency ELF-EMF  
4 and radiofrequency /microwave or RF-EMF fields). I will refer to specific  
5 sections of the report where appropriate but I also reference the entire report as a  
6 comprehensive and up-to-date review of the scientific information on this subject.

7  
8 In 2009, I was invited to present to the President's Cancer Panel on the  
9 subject of power line and radiofrequency fields and cancer, and have also testified  
10 on this issue before the United States House of Representatives.

11 **Q. Are you familiar with peer-reviewed studies addressing the biological effects**  
12 **of exposure to low-level RF, and their potential health effects?**

13 **A.** There are many peer-reviewed studies reporting biological effects and health risks  
14 related to low-level RF exposure. A comprehensive listing of these publications is  
15 found in the *Bioinitiative Report*, which includes both positive and negative  
16 research studies. In this testimony, I will not list peer-reviewed publications dated  
17 prior to 2000 or any covered by publications that are systematic reviews or meta-  
18 analyses reported after that time. I will focus on human studies, and only cover  
19 briefly the huge number of cellular and animal studies. In my judgment the  
20 scientific results of greatest importance, consistency and relevance to human  
21 health are listed first.

1 Q. Is there reliable evidence from epidemiological studies to support the conclusion  
2 that low-level RF (below the level at which thermal effects are confirmed) can  
3 cause adverse health effects?

4 There is consistent evidence for harm from low-level RF radiation in  
5 studies of individuals using cell phones for prolonged periods of time, which gives  
6 a localized exposure to the ipsilateral brain, auditory nerve and parotid gland in the  
7 cheek. There have been seven major publications that are either meta-analyses or  
8 pooled analyses that evaluate all of the earlier literature, and most find statistically  
9 significant relations between elevated exposure to radiofrequency radiation from  
10 cell phones and increased risk of brain cancer. I will also discuss several recent  
11 individual studies on cell phone exposure and some relevant studies on radio  
12 transmission exposure. I will refer frequently to the odds ratio (OR) or risk ratio  
13 (RR). These are statistical analysis terms that are used to determine whether or  
14 not results are statistically significant. The standard use is to give an OR or RR  
15 followed by the 95% confidence interval. Thus, if there is no difference between  
16 the "exposed" and "control" populations, the OR or RR will be 1. If there is an  
17 elevated risk the OR or RR will be greater than 1.0, whereas if the exposure  
18 reduces risk of disease the OR or RR will be less than 1.0. For exposures that  
19 increase risk, results are considered to be statistically significant if the 95% CI has  
20 a lower bound that is greater than 1, which is to say that there is less than a 5%  
21 possibility that the result occurred by chance. The seven major meta-analysis and  
22 pooled analysis publications I mentioned are summarized below:

1  
2 a. Hardell L, Carlberg M, Soderqvist F, Mild KH. 2008. Meta-analysis  
3 of long-term mobile phone use and the association with brain tumours.  
4 *Internat J Oncology* 12: 1097-1103. In ten studies of glioma, cell phone  
5 use for more than ten years gave an OR of 1.2 (95%CI=0.8-1.9) (thus this  
6 result would not be considered to be significant, since the lower bound is  
7 less than 1.0). For ipsilateral cell phone use for more than 10 year the OR =  
8 2.0 (1.2-3.4) (thus this result is statistically significant, since the lower  
9 bound is greater than 1.0). There was also a significant association for  
10 acoustic neuroma and ipsilateral cell phone use for ten years or more, but  
11 no relation for meningioma.

12  
13 b. Kundi M. 2009. The controversy about a possible relationship  
14 between mobile phone use and cancer. *Environ Health Perspect* 117: 316-  
15 324. Reviewed data from 33 epidemiological studies and concludes that  
16 the combined OR = 1.5 (1.2-1.8) for glioma and 1.1 (0.8-1.4) for  
17 meningioma.

18  
19 c. Myung SK, Ju W, McDonnell DD, Lee YJ, Ksazinet G, Cheng CT,  
20 Moskowitz JM. 2009. Mobile phone use and risk of tumors: A meta-  
21 analysis. *J Clin Oncol* 27:5565-5572. Reviewed 465 publications that  
22 reported on 12,344 cases of cancer and 25,572 controls. Risk of developing  
23 brain cancer was OR = 1.8 (1.04-1.34) for more than ten years use.

24  
25 d. Ahlbom A, Feychting M, Green A, Kheifet L, Savitz DA and  
26 Swedlow AJ (ICNIRP Standing Committee on Epidemiology). 2009.  
27 *Epidemiologic evidence on mobile phones and tumor risk: A review.*  
28 *Epidemiology* 20: 639-652. Comment that most studies of glioma show  
29 small increased or decreased risk among users, although a subset of studies  
30 show appreciably elevated risks. They then argue that there are  
31 methodological reasons for these positive studies.

32  
33 e. Khurana VG, Teo C, Kundi M, Hardell L and Carlberg. 2009. Cell  
34 phones and brain tumors: a review including the long-term epidemiological  
35 data. *Surg Neurol* 72: 205-214. Meta-analysis of 11 studies. They  
36 conclude that using a cell phone for more than 10 years approximately  
37 doubles the risk of being diagnosed with a brain tumor (glioma, OR = 1.9,  
38 1.4-2.4, and acoustic neuroma, OR = 1.6, 1.1-2.4) on the ipsilateral side of  
39 the head.

40  
41 f. Repacholi MH, Lerchl A, Roosli M, Sienkiewica Z, Auvinen A, et  
42 al. 2012. Systematic review of wireless phone use and brain cancer and  
43 other head tumors. *Bioelectromagnetics* 33: 187-206. Meta-analysis of

1 studies shows no relationship between brain cancers and ever use of a  
2 mobile phone (for glioma, OR = 1.07, 0.89-1.29, based on eight studies and  
3 use for one to five years), but there is sparse data on long-term use. Meta-  
4 analysis of oncogenicity, tumor promotion and genotoxicity studies also  
5 showed no statistically significant relationship between RF exposure and  
6 genotoxic damage to brain cells.

7  
8 g. Hardell L, Carlberg M, Hansson Mild K: 2012. Use of mobile  
9 phones and cordless phones is associated with increased risk for glioma and  
10 acoustic neuroma. *Pathophysiology* doi:10.1016/j.pathophys.2012.11.001.  
11 In a review of current evidence they report that a meta-analysis for glioma  
12 in the temporal lobe, gave an OR = 1.74 (1.04-2.81). For ipsilateral mobile  
13 phone use for 1640 hours or more gave an OR = 2.29 (1.56-3.37). For  
14 acoustic neuroma, use for more than 10 years gave an OR = 1.81 (0.73-  
15 4.45), and for ipsilateral cumulative use of the same duration the OR = 2.55  
16 (1.50-4.40).

17  
18 A partial list of recent research studies on cell phone exposure (not reviews) are  
19 listed below:

20  
21 a. The INTERPHONE Study Group. 2010. Brain tumour risk in  
22 relation to mobile telephone use: results of the INTERPHONE international  
23 case-control study. *Int J Epidemiol* 39:675-694. While ever vs. never  
24 using a cell phone did not increase risk of brain cancer, there was a  
25 significant OR= 2.18 (1.43-3.31) for use for ten or more years, OR=1.82  
26 (1.15-2.89) for use for 1640 hours or more and OR=1.31 (0.82-2.11) for  
27 more than 270 calls, all for glioma. No significant relations were seen for  
28 meningioma. It should be noted that separate INTERPHONE results have  
29 been published for Sweden (Lonn et al. 2005. *J Epidemiol* 161: 526-636)  
30 and Germany (Schuz et al. 2006. *J Epidemiol* 163: 512-520). The German,  
31 but not the Swedish study, reported elevated rates of glioma with cell phone  
32 use for more than 10 years.

33  
34 b. The INTERPHONE Study Group. 2011. Acoustic neuroma risk in  
35 relation to mobile telephone use: Results of the INTERPHONE  
36 international case-control study. *Cancer Epidemiol* 35: 453-464. Ever  
37 using a cell phone was not associated with elevated risk, nor was use for 10  
38 years or more. For more than 1640 hours of use the OR was 2.79 (1.51-  
39 5.16).

40  
41 c. Larjavaara S, Schütz J, Swerdlow A, Feychting M, Johansen C, et al.  
42 2011. Location of gliomas in relation to mobile telephone use: A case-case  
43 and case-specular analysis. *Am J Epidemiol* 174: 2-11. Investigated 888

1 gliomas from seven European countries (INTERPHONE data) to determine  
2 whether the gliomas were located on the side of the head where the cell  
3 phone was regularly used. They found an elevated, but not significant,  
4 relationship in case-case analysis, but no difference in the case-specular  
5 analysis.

6  
7 d. Levis AG, Minicuci N, Ricci P, Gennaro V, Gabisa S. 2011. Mobile  
8 phones and head tumours. The discrepancies in cause-effect relationships in  
9 the epidemiological studies – how do they arise? *Environ Health* 10:59 doi:  
10 10.1186/1476-069X-10-59. When studies that were blinded, free from  
11 errors and bias were considered, cell phone use for more than ten years  
12 resulted in a near doubling in ipsilateral glioma and acoustic neuroma.

13  
14 e. Aydin D, Feychting M, Schuz J, Tynes T, Andersen TV, et al. 2011.  
15 Mobile phone use and brain tumors in children and adolescents: A  
16 multicenter case-control study. *J Natl Cancer Inst* 103: 1264-1276.  
17 Studied all children between ages 7-19 with a brain tumor in four European  
18 countries. OR for regular mobile phone users was 1.36 (0.92-2.02), and for  
19 those using phones at least five years was 1.26 (0.70-2.28). Thus, rates  
20 were elevated but not statistically significant and there was no evidence of a  
21 dose-response relationship. However, for more than 2.8 years subscription  
22 the OR = 2.15 (1.07-4.29), and almost all ORs were elevated when  
23 comparing users to non-users. There were highly significant ORs with time  
24 since first use, cumulative duration of subscriptions, cumulative duration of  
25 call and cumulative number of calls, and these were found on both ipsi- and  
26 contralateral sides of the head. This is important, since the evidence for  
27 elevated risk only ipsilateral comes from data only on adults, and other  
28 evidence indicates greater penetration into the brain of a child. None-the-  
29 less, the authors conclude that this study provides no support for a  
30 relationship between cell phone use and brain cancer in children and  
31 adolescents because of the failure to find a dose-response relationship. The  
32 conclusions drawn in this study have been questioned by Soderqvist et al.  
33 (*Environ Health* 2011. 10:106) on the basis of the fact that individuals  
34 using cordless phones, which generate comparable RF exposure to that  
35 from cell phones, was included in the “unexposed” category, and that  
36 among the four countries studied ORs for Denmark, Sweden and  
37 Switzerland were 1.73, 1.49 and 1.69, respectively, while that for Norway  
38 was 0.51. They suggest that this may reflect some methodological  
39 difference or bias.

40  
41 f. Cardis E, Armstrong BK, Bowman JD, Giles GG, Hours M, et al.  
42 2011. Risk of brain tumours in relation to estimated RF dose from mobile  
43 phones: results from five Interphone countries. *Occup Environ Med* 68:

1 631-640. ORs for tumours in the most exposed part of the brain in those  
2 with 10+ years of mobile phone use were 2.80 (1.13-6.94), and were  
3 significantly elevated after 7 years of use. The pattern for meningioma was  
4 similar but the ORs were lower.

5  
6 g. Frei P, Poulsen AH, Johansen C, Olsen JH, et al. 2011. Use of  
7 mobile phones and risk of brain tumours: update of Danish cohort study.  
8 BMJ doi: 10.1136/bmj.d6387. Used the Danish cancer registry of 3.8  
9 million persons. There were 10,729 cases of brain cancer between 1990-  
10 2007. No increased risk of brain tumors were found among cell phone  
11 subscribers as compared to non-subscribers. However, cordless phone  
12 subscribers were treated as non-cell phone users in this study.

13  
14 h. Carlberg M, Hardell L. 2012. On the association between glioma,  
15 wireless phones, heredity and ionizing radiation. Pathophysiology 19: 243-  
16 252. Reports on two case-control studies of 1148 glioma cases. They find  
17 an OR = 2.9 (1.8-4.7) for ipsilateral use of mobile phones for more than ten  
18 years. For use of cordless phones they find an OR = 3.8 (1.8-8.1) for  
19 ipsilateral use for more than 10 years. ORs were higher for high grade  
20 gliomas. Risks were highest among those under age 20.

21  
22 There are several reports investigating rates of cancer, particularly leukemia, in  
23 persons living near to AM or FM radio transmission towers or cell towers. While  
24 most of these studies report elevations in rates of cancer, their assessment of  
25 exposure is limited only to residential proximity to the towers, which is not a very  
26 exact monitor. None-the-less, these studies are significant because they directly  
27 monitor rates of human cancer. They also suggest that leukemia is the cancer of  
28 greatest concern when the whole body is exposed to radiofrequency radiation, in  
29 contrast to more localized cancers with localized exposure.

30 a. Michelozzi P, Capon A, Kirchmayer U, Forastiere F, Biggeri A,  
31 Barca A, Perucci CA. 2002. Adult and childhood leukemia near a high-  
32 power radio station in Rome, Italy. Am J Epidemiol 155: 1098-1103. The  
33 authors show that there is a significant elevation of childhood leukemia  
34 among residents living near to Vatican Radio (Standardized mortality ratio

1 = 2.2, 1.0-4.1), and that the risk declines with distance away from the  
2 transmitter ( $p = 0.03$ ).

3  
4 b. Eger H, Hagen KU, Lucas B, Vogel P and Voit H. 2004. Einfluss  
5 der räumlichen Nähe von Mobilfunksendeanlagen auf die Krebsinzidenz.  
6 Umwelt-Medizin-Gesellschaft 17: 326-332. A German government-  
7 supported study of cancer risk in relation to residence close to cell towers  
8 found that rates were significantly higher (OR = 3.38, 95% CI = 1.39-8.25;  
9 99% CI = 1.05-10.91) for persons living within 400 m than among those  
10 living further away from the towers.

11  
12 c. Park SK, Ha M, Im HJ. 2004. Ecological study on residences in the  
13 vicinity of AM radio broadcasting towers and cancer death: preliminary  
14 observations in Korea. *Int Arch Occup Environ Health* 77:387-394. This  
15 study found higher mortality areas for all cancers and leukemia in some age  
16 groups in the area near the AM towers.

17 d. Ha M, Im H, Lee M, Kim HJ, Kim BC, Gimn YM, Paek JK. 2007.  
18 Radiofrequency radiation exposure from AM radio transmitters and  
19 childhood leukemia and brain cancer. *Am J Epidemiol* 166: 270-279.  
20 Leukemia and brain cancer in children in Korea were investigated in  
21 relation to residence within 2 km of AM radio transmitters. There was a  
22 significant elevation in rates of leukemia (OR = 2.15, 1.00-4.67), but not of  
23 brain cancer in relation to peak, but not total radiofrequency exposure for  
24 children living within 2 km as compared to more than 20 km from the  
25 transmitters.

26  
27 e. Merzenich H, Schmiedel S, Barnack S, Bruggemeyer H, Philipp J,  
28 et al. 2008. Childhood leukemia in relation to radio frequency  
29 electromagnetic fields in the vicinity of TV and radio broadcast  
30 transmitters. *Am J Epidemiol* 168: 1169-1178. Studied 1,959 cases of  
31 leukemia and 5,848 controls in Germany. They did not find any significant  
32 relationship between risk of leukemia and living within 2 km of a broadcast  
33 transmitter as compared to those living 10-15 km away.

34  
35 f. Elliott P, Toledano MB, Bennett J, Beale L, Best N, Briggs DF.  
36 2010. Mobile phone base stations and early childhood cancer: case-control  
37 study. *BMJ* 340: c3077 doi:10.1136/bmj/c3077. No association was found  
38 between risk of early childhood cancers and estimates of mother's exposure  
39 to mobile phone base stations during pregnancy.

40  
41 g. Dode AC, Leao M, Tejo FdeAF, Gomes ACR, Dode DC, Dode MC,  
42 Moreira CW, Condessa VA, Albinatti C and Calaffa WT. 2011. Mortality

1 by neoplasia and cellular telephone base stations in the Belo Horizonte  
2 municipality, Minas Gerais State, Brazil. *Sci Total Environ* 409: 3649-  
3 3665. This study shows higher rates of death from cancer among  
4 individuals living close to cell towers than among those living further away.  
5 Rates were highest in residences less than 100 m, falling to near  
6 background a 1,000 m.

7  
8 In summary, the ten major meta-analyses/pooled analyses, the recent cell phone  
9 exposure studies, and the radio transmission exposure studies provide convincing  
10 evidence of adverse health effects in humans associated with low-level RF  
11 exposure. Other relevant evidence of human health effects is discussed in  
12 Sections 11 and 12 of the *Bioinitiative Report 2012*.

13 Q. Is there evidence about the mechanisms by which low-level RF may adversely  
14 affect human physiology?

15 Some, especially those from the physics and engineering community, are skeptical  
16 of the ability of radiofrequency radiation to alter human physiological functions  
17 because of the low energy of the non-ionizing portion of the electromagnetic  
18 spectrum. The studies listed below provide evidence that cell phone use and  
19 applied low-level radiofrequency radiation alter the metabolism of the brain and  
20 various clinical measures in humans. They report a variety of effects on humans  
21 including dose-dependent changes in cortisol and alpha-amylase, increased brain  
22 glucose metabolism, chronic dysregulation of the catecholamine system, and  
23 decreases in ACTH, cortisol, thyroid hormones, and prolactin in young females  
24 and testosterone in males.

25 a. Augner C, Hacker GW, Oberfeld G, Florian M, Hitzl W, Hutter J,  
26 Pauser G. 2010. Effects of exposure to base station signals on salivary

1 cortisol, alpha amylase and immunoglobulin A. *Biomed Environ Sci*  
2 23:199-207. This was a human experimental study with exposure to pulsed  
3 wave microwave radiation wherein immune indicators were monitored after  
4 five 50-minute sessions. The researchers found dose-dependent changes in  
5 cortisol and alpha-amylase.

6  
7 b. Volkow ND, Tomasi D, Wange GJ, Vaska P, Fowler JS, Teland F,  
8 Alexoff D, Logan J, Wong C. 2011. Effects of cell phone radiofrequency  
9 signal exposure on brain glucose metabolism. *JAMA* 305:808-814. In  
10 healthy participants and compared with no exposure, 50-minute cell phone  
11 exposure was associated with increased brain glucose metabolism in the  
12 region closest to the antenna. This shows direct effects of RF radiation on  
13 the brain with cell phone use.

14  
15 c. Buchner K, Eger H. 2011. Changes of clinically important  
16 neurotransmitters under the influence of modulated RF fields – a long-term  
17 study under real-life conditions. *Umwelt-Medizin-Gesellschaft* 24:44-57.  
18 There was clear evidence of health-relevant effects, including an increase in  
19 adrenaline and noradrenaline, and a subsequent decrease in dopamine in  
20 people living near to a new MW-emitting base station. Levels of  
21 phenylethylamine decreased and remained decreased, indicating chronic  
22 dysregulation of the catecholamine system. Clinically documented  
23 increases in sleep problems, headaches, dizziness, concentration problems  
24 and allergies followed the onset of new microwave transmissions.

25  
26 d. Eskander EF, Estefan SF, Abd-Rabou AA. 2011. How does long  
27 term exposure to base stations and mobile phones affect human hormone  
28 profiles? *Clin Biochem* 45:157-161. Measured hormone levels in 82  
29 mobile phone users and 20 controls over a period of 6 years. Report that  
30 there were decreases in ACTH, cortisol, thyroid hormones, and prolactin in  
31 young females and testosterone in males. There was no change in serum  
32 progesterone in females, but in older females prolactin increased with  
33 exposure. Exposure from cell phone base stations was associated with  
34 significant decreases in ACTH and cortisol.

35  
36 The following studies report changes in male fertility and reproductive systems  
37 associated with cell phone and low-level RF exposure.

38  
39 a. Wdowiak A, Wdowiak L, Wiktor H. 2007. Evaluation of the effect  
40 of using mobile phones on male fertility. *Ann Agric Environ Med* 14: 169-  
41 172. Among Polish males with an infertility problem there was “an  
42 increase in the percentage of sperm cells of abnormal morphology  
43 associated with duration of exposure to waves emitted by the GSM phone.

1 It was also confirmed that a decrease in the percentage of sperm cells in  
2 vital progressing motility in the semen is correlated with the frequency of  
3 using mobile phones.”

4  
5 b. Agarwal A, Deepinder F, Sharma RK, Ranga G, Li J. 2008. Effect  
6 of cell phone usage on semen analysis in men attending infertility clinic: an  
7 observational study. *Fert Steril* 89: 124-128.. “Use of cell phones  
8 decreases the semen quality in men by decreasing the sperm count,  
9 motility, viability, and normal morphology. The decrease in sperm  
10 parameters was dependent on the duration of daily exposure to cell phones  
11 and independent of the initial semen quality.”

12  
13 c. Baste V, Riise T, Moen BE. 2008. Radiofrequency electromagnetic  
14 fields: male infertility and sex ratio of offspring. *Int J Epidemiol* 23:369-  
15 377. This is a study of Norwegian Navy personnel chronically exposed to  
16 RF fields on the job. The rates of infertility were related to level of  
17 exposure in a dose-dependent fashion.

18  
19 d. Agarwal A, Desai NR, Makker K, Varghese A, et al. 2009. Effects  
20 of radiofrequency electromagnetic waves (RF-EMW) from cellular phones  
21 on human ejaculated semen: an *in vitro* pilot study. *Fert Stert* 92: 1318-  
22 1325. “Radiofrequency electromagnetic waves emitted from cell phones  
23 may lead to oxidative stress in human semen. We speculate that keeping  
24 the cell phone in a trouser pocket in talk mode may negatively affect  
25 spermatozoa and impair male fertility.

26  
27 e. La Vignera S, Condorelli RA, Vicari E, D’Adata R, Calogero AE.  
28 2012. Effects of the exposure to mobile phones on male reproduction: A  
29 review of the literature. *J Androl* 33: 350-356. Studies in animals and  
30 humans show that “RF-EMR decreases sperm count and motility and  
31 increases oxidative stress....The results showed that human spermatozoa  
32 exposed to RF-EMR have decreased motility, morphometric abnormalities  
33 and increased oxidative stress, whereas men using mobile phones have  
34 decreased sperm concentration, decreased motility (particularly rapid  
35 progressive motility), normal morphology and decreased viability. These  
36 abnormalities seem to be directly related to the duration of the mobile  
37 phone use.”

38  
39 f. Avendaño C, Mata A, Sanchez Sarmiento CA, Doncel GF. 2012.  
40 Use of laptop computers connected to internet through Wi-Fi decreases  
41 human sperm motility and increases sperm DNA fragmentation. *Fert Steril*  
42 97:39-45. In this study human sperm were exposed to Wi-Fi from a laptop,  
43 and were found to show reduced motility after a 4-hour exposure. The

1 results are consistent with other publications (see Agarwal et al., 2008. Fert  
2 Steril 89:124-128) that reported that those who use cell phone regularly  
3 have reduced sperm count.  
4

5 Other evidence of fertility and reproductive effects of low-level RF exposure is  
6 discussed in Section 18 of the *Bioinitiative Report 2012*.

7 Q. Is there evidence that some people may become hyper-sensitive to low-level RF  
8 and experience related adverse health effects?

9 Electrical hypersensitivity (EHS) is a syndrome of relatively non-specific  
10 complaints that are reported to be associated with exposure to electromagnetic  
11 fields. The major symptoms are headache, fatigue, tinnitus, disruption of sleep,  
12 mental dullness and a general feeling of ill health. Whether or not EHS exists has  
13 been widely debated. In spite of widespread reports that up to 10% of the  
14 population may suffer from EHS, most studies in laboratories with blinded  
15 exposures (ie., the subjects do not know whether or not the fields are applied) have  
16 not demonstrated that persons reporting to be electrosensitive can correctly  
17 distinguish when the fields are on. However, there is increasing evidence that  
18 EHS does exist and can be a disabling condition for some particularly sensitive  
19 persons, although evidence to date is certainly incomplete.

20 There has been only one report of a completely blinded study of an  
21 electrosensitive individual that has documented the ability of this individual to  
22 report symptoms (primarily headache) in the presence of an electromagnetic field:

23  
24 a. McCarty DE, Carrubba S, Chesson AL, Frilor C, Gonzalez-Toledo  
25 E, Marino AA. 2011. Electromagnetic hypersensitivity: Evidence for a

1 Bioelectromagnetics 27:142-150. Sleep quality improved and melatonin  
2 excretion increased when the transmitter was shut down.

3  
4 f. Preece AW, Georgious AG, Duunn EJ, Farrow SC. 2007. Health  
5 response of two communities to military antennae in Cyprus. *Occup*  
6 *Environ Med* 64:402-408. Compared to residents of a control village, there  
7 was a highly significant excess in the reporting of migraine, headache and  
8 dizziness in residents living near to military and cell phone antenna  
9 systems.

10  
11 g. Barth A, Winker R, Ponocny-Seliger E, Mayrhofer W, Ponocny I,  
12 Sauter C, Vana N. 2008. A meta-analysis for neurobehavioural effects due  
13 to electromagnetic field exposure emitted by GSM mobile phones. *Occup*  
14 *Environ Med* 65: 342-345. The authors looked at 19 studies of cognitive  
15 function in cell phone users, and found in the meta-analysis that there is  
16 evidence for a decreased reaction time, altered working memory and  
17 increased number of errors in exposed persons.

18  
19 h. Landgrebe M, Frick U, Hauser S, Langguth B, et al. 2008.  
20 Cognitive and neurobiological alterations in electromagnetic hypersensitive  
21 patients: results of a case-control study. *Psychol Med* 38: 1781-1791.  
22 Studies 89 EHS subjects and 107 age and gender matched controls. Found  
23 that discrimination ability was significantly reduced in EHS subjects, while  
24 intra-cortical facilitation was decreased in younger, but increased in older  
25 EHS subjects. They conclude that there are significant cognitive and  
26 neurobiological alterations pointing to a higher genuine individual  
27 vulnerability in EHS subjects.

28  
29 i. Landgrebe M, Frick U, Hauser S, Hajak G, Langguth B. 2009.  
30 Association of tinnitus and electromagnetic hypersensitivity: hints for a  
31 shared pathophysiology? *PLoS One* 4: e5026 doi:  
32 10.1371/journal.pone.0005026. Tinnitus occurrence and severity were  
33 assessed by questionnaire in 89 EHS and 107 control subjects. Tinnitus  
34 was significantly more frequent in the EHS group, but there were no  
35 differences in severity or duration. They conclude that tinnitus is  
36 associated with subjective EHS.

37  
38 j. Furubayashi T, Ushiyama A, Teerao Y, Mizuno Y, et al. 2009.  
39 Effects of short-term W-CDMA mobile phone base station exposure on  
40 women with or without mobile phone related symptoms.  
41 *Bioelectromagnetics* 30: 100-113. In a double-blind, cross over study of 11  
42 subjects with cell phone-related symptoms and 43 controls, subjected to  
43 continuous, intermittent and sham exposure with or without noise, no

1 significant effects were found on any psychological, cognitive or autonomic  
2 response.

3  
4 k. Dahmen N, Ghezel-Ahmadi D, Engel A. 2009. Blood laboratory  
5 findings in patients suffering from self-perceived electromagnetic  
6 hypersensitivity (EHS). *Bioelectromagnetics* 30: 299-306. Monitored  
7 thyroid hormone, liver enzymes, hemoglobin, hematocrit and c-reactive  
8 protein in subjects with and without EHS. "Our results identified  
9 laboratory signs of thyroid dysfunction, liver dysfunction and chronic  
10 inflammatory processes in small, but remarkable fractions of EHS  
11 sufferers."

12  
13 l. Eger H, Jahn M. 2010. [Specific health symptoms and cell phone  
14 radiation in Selbitz (Bavaria, Germany)- Evidence of a dose-response  
15 relationship.] *Umwelt-Medizin-Gesellschaft* 23: 2. Reports on symptoms  
16 of individuals based on residential location and RF measurements of local  
17 cell phone radiation levels. "For symptoms as sleep problems, depressions,  
18 cerebral symptoms, joint problems, infections, skin problems,  
19 cardiovascular problems as well as disorder of the visual and auditory  
20 systems and the gastrointestinal tract, a significant dose-response  
21 relationship was observed in relation to objectively determined exposure  
22 levels".

23  
24 m. Robertson JA, Théberge J, Weller J, Drost DJ, Prato FS, Thomas  
25 AW. 2010. Low-frequency pulsed electromagnetic field exposure can alter  
26 neuro-processing in humans. *JR Soc Interface* 7:467-473. A functional  
27 magnetic resonance imaging study demonstrated how the neuromodulation  
28 effect of extremely low-frequency magnetic fields influences the processing  
29 of acute thermal pain. The study concludes that magnetoreception may be  
30 more common than presently thought. This study was already filed in the  
31 present case as Exhibit C-SE-AQLPA-0043, SE-AQLPA-5, Document 10.

32  
33 n. Heinrich S, Thomas S, Heumann C, von Kries R and Radon K.  
34 2010. Association between exposure to radiofrequency electromagnetic  
35 fields assessed by dosimetry and acute symptoms in children and  
36 adolescents: a population based cross-sectional study. *Environ Health* 9: 75  
37 doi: 10.1186/1476-069X-9-75. The authors studied 1484 children and 1508  
38 adolescents with radiofrequency exposure monitored by a personal  
39 dosimeter. Self-reported statistically significant effects found include  
40 increased headache (OR 1.50, 1.03-2.19), greater irritation in the evening  
41 (OR 1.79, 1.23-2.61) and higher concentrations problems (OR = 1.55, 1.02-  
42 2.33) in individuals with greater exposures. However, many others  
43 measures did not lead to statistically significant associations.

1  
2 o. Mohler E, Frei P, Braun-Fahrlander C, Frohlich J, et al. 2010.  
3 Effects of everyday radiofrequency electromagnetic field exposure on sleep  
4 quality: A cross-sectional study. *Rad Res* 174: 347-356. Studied 1375  
5 inhabitants of Basel with a questionnaire and using a prediction model of  
6 exposure. "Neither mobile phone use nor cordless phone use was  
7 associated with decreased sleep quality."

8  
9 p. Roosli M, Frei P, Mohler E, Hug K. 2010. Systematic review on the  
10 health effects of exposure to radiofrequency electromagnetic fields from  
11 mobile phone base stations. *Bull World Health Organ* 88: 887-896.  
12 Reviewed 17 publications on non-specific symptoms of ill health from RF  
13 exposure from mobile phone base stations, and concluded that "At present  
14 there is insufficient data to draw firm conclusions about health effects from  
15 long-term low-level exposure typically occurring in the everyday  
16 environment."

17  
18 q. Papageorgiou CC, Hountala CD, Maganioti AE, Kyprianou MA,  
19 Rabavilas AD, Papadimitriou GN, Capsalis CN. 2011. Effects of wi-fi  
20 signals on the p300 component of event-related potentials during an  
21 auditory Hayling task. *J Integr Neurosci* 10:189-202. The Hayling  
22 Sentence Completion test was used to evaluate response initiation and  
23 response inhibition. This study concludes that WI-FI exposure may exert  
24 gender-related alterations on neural activity.

25  
26 r. Oshima N, Nishida A, Shimodera S, Tochigi M, et al. 2012. The  
27 suicidal feelings, self-injury, and mobile phone use after lights out in  
28 adolescents. *J Pediat Psychol* 37: 1023-1030. Studied 17,920 adolescents  
29 using a self-report questionnaire. "Logistic regression showed significant  
30 associations of the nocturnal mobile phone use with poor mental health,  
31 suicidal feelings, and self-injury after controlling for sleep length and other  
32 confounders."... "A mechanism of the association might be worsening of  
33 the quality of sleep."

34  
35 In summary, some studies are suggestive of an association, but the reported  
36 evidence falls short of proof. In the context of exposure to RF emissions from  
37 smart meters, there is a substantial body of evidence from the personal accounts of  
38 utility customers who report experiencing EHS symptoms. This evidence should

1 not be disregarded in setting public policy that will determine whether and to what  
2 extent people are exposed to these devices.

3 Further discussion of studies of EHS effects can be found in Sections 6 and  
4 8 of the Bioinitiative Report 2012.

5 Q. Is there evidence that brain cancer rates have increased in recent decades?

6 A. If use of cell phones causes brain cancer, then one might expect that overall rates  
7 of brain cancer would show an increase, since cell phone use has grown  
8 enormously in recent years. However, since use of cell phones is relatively recent  
9 and the latency for development of brain cancer following other environmental  
10 exposures is long (up to 20-30 years), there might not yet be a clear pattern of  
11 increased incidence. The following studies address this issue:

12  
13 a. Central Brain Tumor Registry of the United States (CBTRUS).  
14 Supplemental Report: Primary Brain Tumors in the United States, 2004.  
15 Hinsdale, IL; Central Brain Tumor Registry of the United States 2008.  
16 Age-adjusted CNS tumor incidence was 18.2 cases per 100,000 in 2004,  
17 but 13.4 cases per 100,000 in 1995.

18  
19 b. Lehrer S, Green S, Stock RG. 2010. Association between number of  
20 cell phone contracts and brain tumor incidence in nineteen U.S. states. *J*  
21 *Neuro-Oncol* 101:505-507. "The effect of cell phone subscriptions was  
22 significant ( $P = 0.017$ ), and independent of effect of mean family income ( $P$   
23  $= 0.894$ ), population ( $P = 0.003$ ) and age ( $0.499$ ). The very linear  
24 relationship between cell phone usage and brain tumor incidence is  
25 disturbing and certainly needs further epidemiological evaluation. In the  
26 meantime, it would be prudent to limit exposure to all source of electro-  
27 magnetic radiation."

28  
29 c. De Vocht F, Burstyn I, Cherrie JW. 2011. Time trends (1998-2007)  
30 in brain cancer incidence rates in relation to mobile phone use in England.  
31 *Bioelectromagnetics* 32:334-339. "There were no time trends in overall  
32 incidence of brain cancers for either gender, or any specific age groups.

1 Systematic increases in rates for cancer of the temporal lobe in men... and  
2 women... were observed, along with decreases in the rates of cancer of the  
3 parietal lobe... and cerebellum...”

4  
5 d. Little MP, Curtis RE, Devesa SS, Inskip PD, et al. 2012. Mobile  
6 phone use and glioma risk: comparison of epidemiological study results  
7 with incidence trends in the United States. *BMJ* 344: e1147 doi:  
8 10.1136/bmj.e1147. “Raised risks of glioma with mobile phone use, as  
9 reported by one (Swedish) study forming the basis of the IARC’s re-  
10 evaluation of mobile phone exposure, are not consistent with observed  
11 incidence trends in US population data, although US data could be  
12 consistent with the modest excess risks in the Interphone study.”

13  
14 e. Dobes M, Shadbolt B, Khurana VG, Jain S, et al. 2011. A  
15 multicenter study of primary brain tumor incidence in Australia (2009-  
16 2008). *Neuro-Oncol* 13: 783-790. The authors observed an increased  
17 increase in malignant primary brain tumors over the period 2000-2008, but  
18 cannot determine whether it was due to improved detection, diagnosis or to  
19 a true elevated incidence.

20  
21 f. Deltour I, Auviene A, Feychting M, Johansen C, et al. 2012. Mobile  
22 phone use and incidence of glioma in the Nordic countries 1979-2008.  
23 *Epidemiology* 23:301-307. “No clear trend change in glioma incidence  
24 rates was observed. Several of the risk increases seen in case-control  
25 studies appear to be incompatible with the observed lack of incidence rate  
26 increase in middle-aged men. This suggests longer induction periods than  
27 currently investigated, lower risks than reported from some case-control  
28 studies, or the absence of any association.”

29  
30 g. The Danish Cancer Society recently reported that the number of men  
31 who are diagnosed with the most malignant form of brain cancer  
32 (glioblastoma) has almost doubled over the past ten years.  
33 ([http://www.cancer.dk/Nyheder/nyhedsartikler/2012kv4/Kraftig+stigning+i](http://www.cancer.dk/Nyheder/nyhedsartikler/2012kv4/Kraftig+stigning+i+hjernesvulster.htm)  
34 [+hjernesvulster.htm](http://www.cancer.dk/Nyheder/nyhedsartikler/2012kv4/Kraftig+stigning+i+hjernesvulster.htm))

35  
36 Further discussion of the relevance of brain cancer rates to the debate about the  
37 association between cell phone and RF exposure to cancer is found in Section 11  
38 of the *Bioinitiative Report, 2012*.

1        A.        The standards set by the US Federal Communications Commission (FCC)  
2        and most international government and non-government organizations are based  
3        on the fallacious assumption that there are no adverse human health effects from  
4        radiofrequency radiation that does not cause measureable heating. These  
5        standards provide no protection whatsoever against non-thermal effects of RF.  
6        Some biological effects are known to occur at several hundred thousand times  
7        below the FCC public exposure guidelines and the similar guidelines of Health  
8        Canada's Safety Code no. 6 (of  $6,000,000 \mu\text{W}/\text{m}^2$  or  $600 \mu\text{W}/\text{cm}^2$  for the 902-928  
9        MHz bandwidth), as documented in the 2012 *Biointiative Report*, Section 24. It  
10       is further to be noted that FCC guidelines also apply to 30-minute averaging and  
11       Health Canada's Safety Code no. 6 applies to 6-minute averaging. There is no  
12       evidence that averaging exposures over time is appropriate for assessing maximum  
13       exposure limits to low-level RF.

14       Furthermore, these limits are based on the incorrect biological assumption  
15       that body temperatures must increase at least  $1^\circ\text{C}$  to lead to potential biological  
16       impacts and the impacts of absorbing RF within the band of the electromagnetic  
17       spectrum that smart meters use would only be limited to behavioral disruption.  
18       These limits do not take into account the scientific research that show tissue  
19       heating may result in many adverse health effects other than "behavioral  
20       disruption". These limits also do not take into account the accepted biological fact  
21       that every enzyme system in the body is exquisitely sensitive to temperature and  
22       may increase activity by even a fraction of a degree increase in temperature. What

1 is defined as “non-thermal” effect is therefore partly a function of our ability to  
2 measure the temperature increase. *See Bioinitiative Report, Section 24* for further  
3 discussion.

4 FCC public RF/MW radiation exposure guidelines (and the similar Health  
5 Canada Safety Code no. 6 guidelines) are based on the height, weight and stature  
6 of a 6-foot tall man, not children or adults of smaller stature. The guidelines do not  
7 take into account the unique susceptibility of growing children to RF/MW  
8 radiation exposures. Since children are growing, their rate of cellular activity and  
9 division is more rapid, and they are at a greater risk for DNA damage and  
10 subsequent cancers. Growth and development of the central nervous system is still  
11 occurring well into the teenage years, such that the neurological impairments  
12 predictable by the extant science may have great impact upon development,  
13 cognition, learning, and behavior.

14 **Q. Have you reviewed the joint testimony of William H. Bailey, Ph.D. and Yakov**  
15 **Shkolnikov, Ph.D., dated September 19, 2012?**

16 **A. Yes.**

17 **Q. In their testimony, Dr. Bailey and Dr. Shkolnikov cite a report by the**  
18 **ICNIRP Committee, which concluded that “the trend in the accumulated**  
19 **evidence is increasingly against the hypothesis that mobile phone use causes**  
20 **brain tumors.” Do you agree with that conclusion?**

21 **A. I strongly disagree. The weight of evidence indicates that mobile phone use is**  
22 **associated with elevated risk of brain cancer which becomes apparent after ten or**

1 more years of intensive use and occurs primarily on the side of the head where the  
2 user holds his/her phone the majority of the time. There is emerging evidence that  
3 younger people are at greater risk than older individuals. The great majority of the  
4 meta-analyses that have been published on the subject demonstrate a statistically  
5 significant elevation in rates of brain cancer with long-term cell phone use. This  
6 statement by Bailey and Shkolnikov is simply not true.

7 It is necessary to comment on the ICNIRP report, as well as on the UK  
8 Advisory Group on Non-Ionising Radiation (AGNIR) report, published in April,  
9 2012, which is also cited by Bailey and Shkolnikov. It should be noted that there  
10 is considerable overlap in the membership of these two groups. Both ignore or  
11 attempt to discredit the information presented above. The AGNIR report fails to  
12 even mention the IARC classification of radiofrequency fields as possible human  
13 carcinogens. Neither is a fair and balanced review of the scientific evidence  
14 concerning the human health effects of radiofrequency fields. A much more  
15 convincing review of the evidence is found in the Ramazzini Institute European  
16 Journal of Oncology Library, Volume 5, entitled "Non-thermal effects and  
17 mechanisms of interaction between electromagnetic fields and living matter,"  
18 published in 2010, and in the *Bioinitiative Report, 2012*. The primary reason that I  
19 and the other authors prepared the *Bioinitiative Report* was and is to counter the  
20 prejudicial and false conclusions of these reports, and to do so by presenting a  
21 comprehensive review of scientific evidence.

1 Q. Do you agree with their testimony that the authors of the *Bioinitiative Report*  
2 used flawed methods and failed to follow “the standard, scientific methods for  
3 developing exposure limits.”

4 A. I strongly disagree with this statement. It should be noted that the *Bioinitiative*  
5 *Report* does not recommend exposure limits *per se*, but rather identifies exposures  
6 levels which are associated with biological effects, some of which are adverse  
7 effects on human health. The public health chapter, of which I am a co-author,  
8 identifies a “no observed effect level” (NOEL), based on the scientific evidence  
9 from peer-reviewed scientific studies, then applies safety factors for sensitive  
10 populations (the fetus, children, the aged, etc.) as is standard practice in chemical  
11 risk assessment. This chapter presents clear documentation of why more stringent  
12 limits on exposure are necessary to protect human health.

13 The *BioInitiative Report* is aimed at *restoring* the balance, by providing a  
14 more comprehensive review of the evidence. The *Bioinitiative Report* mentions  
15 many negative reports, discusses the weight of evidence, and looks for  
16 inconsistencies. For example, Prof. Henry Lai of the University of Washington in  
17 the 2012 *Bioinitiative Report* presents summaries of 86 scientific studies on  
18 genotoxic effects of radiofrequency radiation published since 2007, and finds that  
19 63% of these found statistically significant positive effects, while of 155 new  
20 studies on neurological effects, 98 found effects. The *Bioinitiative Report*, unlike  
21 either the ICNIRP or AGNIR reports, reviews of the scientific research available,  
22 both those showing and not showing biological effects and human disease, and

1 draws conclusions based on the weight of the evidence that standard setting  
2 organizations were failing to properly take into account.

3  
4 **Q. Dr. Bailey and Dr. Shkolnikov testified that: "The weight of the evidence does**  
5 **not support the idea that significant biological or adverse health effects can**  
6 **occur" from RF exposure. Do you agree with this conclusion?**

7 **A. This statement is almost incomprehensible given the strength of the evidence**  
8 **demonstrating consistent and serious adverse health effects in both animal and**  
9 **human studies. The studies of greatest importance are those which demonstrated**  
10 **elevations in cancers, especially leukemia and brain cancer, in association with**  
11 **exposure to radiofrequency EMFs. There is evidence that exposure to cell phone**  
12 **frequencies increased uptake of glucose in the brain, which indicates that RF**  
13 **radiation alters fundamental process within the nervous system. The thousands of**  
14 **studies in cellular and animal systems provide additional evidence that**  
15 **radiofrequency fields alter a host of biochemical, physiological and behavioral**  
16 **factors. While certainly not every study reports positive and statistically**  
17 **significant results, the majority do as clearly documented in the 2012 *Biointiative***  
18 **Report. No objective person could possibly make a statement such as this if they**  
19 **are at all familiar with the literature published in high-quality, peer-reviewed**  
20 **scientific journals, and if they are coming to the question with an open mind**  
21 **without a major conflict of interest.**

1           Standards setting organizations aimed at regulating RF exposure have for a  
2 long time been dominated by physicists and engineers, often with close ties with  
3 the industry, with little input from biological and medical science. In spite of  
4 evidence to the contrary, many such people have as a statement of faith that RF  
5 fields that do not cause measureable tissue heating cannot have biologic effects.  
6 This point of view is incompatible with the science. Standards setting  
7 organizations also often explicitly take into account the economic impacts of the  
8 standards when faced with scientific uncertainty. Both because of their training  
9 and because of their ties with the industry, members of most of these organizations  
10 have been reluctant to take the above biological findings into account when  
11 proposing exposure limits.

12           These organizations have generally refused to accept epidemiological and  
13 laboratory research findings linking RF electromagnetic fields exposure with  
14 various non-thermal biological effects, as being inconclusive and requiring further  
15 research. The difficulty stems from the fact that, although links have been  
16 demonstrated repeatedly between RF electromagnetic fields exposure and non-  
17 thermal biological effects in humans, there is a lack of a comprehensive biological  
18 theory explaining why these effects take place, and therefore causality cannot, at  
19 the present time, be demonstrated with certainty. Animals do not always respond  
20 to RF electromagnetic fields as do humans. Also, in some cases, experimental  
21 results in cellular studies have not been replicated in other laboratories; in some  
22 cases attempts to duplicate results showed negative results or variations in the

1 results. These discrepancies are, however, normal in the research process and may  
2 result from slight, but significant differences in procedures; they indicate that  
3 biological systems are complex and that different variables need to be isolated in  
4 order to fully understand these systems. Research is still needed in order to  
5 determine to what extent non-thermal biological effects may vary with frequency,  
6 with modulation and depend on the pulsed (instead of continuous) character of RF  
7 emissions. There may also be variance between the levels of reaction of different  
8 subjects for reasons that still remain to be explained. This is what the research  
9 process is about. In biology and medicine there is nothing that is 100% proven:  
10 our understanding of various illnesses, cancer and Alzheimer's, for example, is  
11 still largely incomplete. We rely on statistical significance and weight of evidence  
12 and, therefore, on judgment, when drawing conclusions about health effects.

13 **Q. In your opinion, could a careful scientist familiar with the body of knowledge**  
14 **on the subject reliably conclude that there are no risks of adverse health**  
15 **effects from the exposure to RF in the 2.4 GHz range?**

16 **A. On the basis of the vast body of scientific literature, many public health experts,**  
17 **myself included, are of the opinion that exposure to RF/MW radiation and EMFs,**  
18 **including in the range of 2.4GHz, poses a potential of serious threat to public**  
19 **health. The degree of risk will vary with both the intensity and duration of**  
20 **exposure. It is likely society will face markedly increased incidence of neurotoxic**  
21 **effects, neurodegenerative diseases, cancers and genotoxicity in the future,**

1 resulting from the extreme and mostly involuntary exposure to RF/MW radiation  
2 and EMFs.

3 **Q. Are you familiar with smart meter technology?**

4 **A. I am familiar with smart meter technology.**

5 **Q. In your opinion, could a careful scientist familiar with the body of knowledge**

6 **on the subject reliably conclude that there are no risks of adverse health**

7 **effects from exposure to RF from smart meters emitting RF radiation in the**

8 **2.4 GHz range with peak power densities of approximately 0.44 mW/cm<sup>2</sup>?**

9 **A. There are two types of smart meter technology. Wired smart meters pose no risk**

10 **of exposure to RF radiation. Wireless smart meters, on the other hand, pose a**

11 **substantial risk of RF exposure which is dependent on the frequency of pulsed RF,**

12 **the intensity of the pulsed RF and the individual's distance from the meter. While**

13 **there have not been human health studies done to date of the effects of exposure to**

14 **smart meter RF, because the technology is too new and the latency for adverse**

15 **effects for diseases such as cancer is long, the evidence from the cell phone studies**

16 **demonstrates convincingly that wireless smart meters pose a risk to human health.**

17 **Smart meters send pulsed RF radiation at intermittent periods of time.**

18 **While the frequency of these pulses may vary with different smart meters, some**

19 **have been reported to send pulses over 30 times a minute at peak power density**

20 **reading of over 67mW/m<sup>2</sup> (0.0067mW/cm<sup>2</sup>) (Maisch, 2012. Smart meter health**

21 **concerns: Just a placebo effect or an emerging public health nightmare? ACNEM**

22 **Journal 31: 15-19), and this exposure has been associated with self-reported**

1 experimental studies that provide some of the evidence of low intensity exposure  
2 effects from radiofrequency radiation at low-intensity exposures. Because the  
3 meters operate intermittently 24/7, an individual in the vicinity of the meter will be  
4 continuously exposed to RF.

5 It is correct that the CMP smart meters comply with the FCC standard of 1  
6 mW/cm<sup>2</sup>. The problem is that the FCC standard is based on the assumption that  
7 there are no effects of RF radiation other than tissue heating, which is simply not  
8 the case.

9 For most smart meter use, the cumulative average RF exposure is not great,  
10 but the reported health effects are large. This raises the important question as to  
11 whether the exposure of greatest concern is the cumulative average, or rather the  
12 peak power levels in the pulses. This issue is discussed in Chapter 24 of the 2012  
13 *Biointiative Report*, which presents some evidence that it is the peak power that is  
14 important. However, the total exposure will only increase in the future as RF  
15 devices are being placed in every appliance in the home, and will use RF to  
16 communicate to the smart meter which will communicate with the utility. This  
17 will make the home, especially the kitchen, a source of highly elevated RF  
18 exposure whenever an appliance is used.

19 Further investigation of the human health effects of smart meter exposures  
20 is essential. In the meantime it is extremely unwise to implement the smart grid  
21 with wireless smart meters until we understand fully the potential for harm to  
22 human health.

Dated this 18th day of January, 2013.

David O. Carpenter  
David O. Carpenter, M.D.

STATE OF NEW YORK  
RENSSELAER, ss:

January 22, 2013

Personally appeared the above-named David O. Carpenter, M.D., and stated under oath that the foregoing Affidavit made by him is true and based upon his own personal knowledge, information or belief, and so far as upon information and belief, he believes the information to be true. Before me,

Doreen A. Van Vorst  
Notary Public/Attorney-at-Law  
Doreen A. Van Vorst  
Name Typed or Printed  
My Commission Expires: \_\_\_\_\_

DOREEN A. VANVORST  
Notary Public, State of New York  
Qualified in Rensselaer County  
Reg. No. 01VA5063834  
My Commission Expires Aug. 25, 2013