

**BEFORE THE  
NEW JERSEY BOARD OF PUBLIC  
UTILITIES**

**IN THE MATTER OF THE PETITION OF  
JERSEY CENTRAL POWER & LIGHT COMPANY PURSUANT TO  
N.J.S.A. 40:55D-19 FOR A DETERMINATION THAT THE  
OCEANVIEW 230 KV TRANSMISSION PROJECT IS  
REASONABLY NECESSARY FOR THE SERVICE, CONVENIENCE  
OR WELFARE OF THE PUBLIC**

**Direct Testimony**

**of**

**William H. Bailey, Ph.D.**

**Re: Status of Research on EMF and Health**

1 **I. INTRODUCTION AND BACKGROUND**

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

3 A. My name is William H. Bailey, Ph.D. My business address is Exponent, Inc.  
4 (“Exponent”), 17000 Science Drive, Suite 200, Bowie, Maryland 20715.

5 **Q. By whom are you employed and in what capacity?**

6 A. I am a Principal Scientist in the Center for Exposure Assessment and Dose  
7 Reconstruction in the Health Sciences practice of Exponent, an international  
8 scientific and engineering firm providing services in over 90 scientific and  
9 engineering disciplines with a staff of approximately 900 located in 20 offices  
10 throughout the nation and 5 international locations.

11 **Q. Please describe your professional experience and educational background.**

12 A. I specialize in applying state-of-the-art assessment methods to environmental and  
13 occupational health issues. My training and experience include 30 years of  
14 laboratory and epidemiologic research, health risk assessment, and comprehensive  
15 exposure analysis. Of particular significance here, I have investigated exposures  
16 to alternating-current (“AC”) electric and magnetic fields (“EMF”), conducted  
17 research on potential health effects of EMF, and served as an advisor to numerous  
18 state, federal, and international agencies on this topic.

19 Currently, I am involved in research on EMF exposure guidelines,  
20 respiratory exposures to ultrafine and nanoparticles, and detection of magnetic  
21 fields by marine organisms. Since 1986, I have been a visiting scientist at the  
22 Weill-Cornell University Medical College. During my career, I have lectured at  
23 Rutgers University, the City University of New York (Queens College), the

1 University of Texas (San Antonio), and the Harvard School of Public Health.  
2 Formerly, I was the Head of the Laboratory of Neuropharmacology and  
3 Environmental Toxicology at the New York State Institute for Basic Research in  
4 Staten Island, New York, and an Assistant Professor and National Institutes of  
5 Health postdoctoral fellow in Neurochemistry at The Rockefeller University in  
6 New York City.

7 I hold the following degrees: Ph.D., Neuropsychology, City University of  
8 New York, 1975; M.B.A., University of Chicago, 1969; and B.A., Dartmouth  
9 College, 1966. In addition, I completed a two year post-doctoral fellowship in  
10 neurochemistry at The Rockefeller University under a grant from the National  
11 Institutes of Health.

12 **Q. Have you served as a reviewer and scientific advisor on health-related issues**  
13 **for state and federal agencies or scientific organizations?**

14 A. Yes. I have reviewed research for the National Institutes of Health, the National  
15 Science Foundation, and other government agencies. Specifically regarding  
16 transmission lines, I served on a Scientific Advisory Panel convened by the  
17 Minnesota Environmental Quality Board to review the health and safety aspects  
18 of a high-voltage transmission line. In addition, I served as a consultant on  
19 transmission line health and safety issues to the Vermont Department of Public  
20 Service, the New York State Department of Environmental Conservation, and the  
21 staffs of the Maryland Public Service Commission and the Maryland Department  
22 of Natural Resources.

1 I have worked with the National Institute of Occupational Safety and  
2 Health, the Oak Ridge National Laboratories, the U.S. Department of Energy, and  
3 the Federal Railroad Administration to review and evaluate health issues related  
4 to EMF from other sources. I also assisted the U.S. EMF Research and Policy  
5 Information Dissemination Program to evaluate biological and exposure research  
6 as part of its overall risk assessment process.

7 I worked with scientists from 10 countries to evaluate possible hazards  
8 from exposures to static and extremely low frequency (“ELF”) EMF for the  
9 International Agency for Research in Cancer (“IARC”), a division of the World  
10 Health Organization (“WHO”) located in Lyon, France. I also was an invited  
11 participant in the workshop convened by the International Committee on Non-  
12 Ionizing Radiation Protection (“ICNIRP”) to update guidelines for human  
13 exposures to AC EMF. I have reviewed ICNIRP’s draft guidelines for direct  
14 current (“DC”) and AC magnetic fields for the International Committee on  
15 Electromagnetic Safety (“ICES”) as well. Most recently, I have served as an  
16 advisor to several government agencies in Canada and the Netherlands on topics  
17 relating to scientific research on EMF health and safety.

18 I have published or presented more than 50 scientific papers on this and  
19 related subjects.

20 My education, experience, and qualifications are fully-set forth in my  
21 curriculum vitae, Exhibit WHB-1 attached to my testimony.

22 **Q. Have you previously testified in Board of Public Utilities (“BPU”)**  
23 **proceedings?**

1 A. Yes, I have testified in several BPU proceedings, most recently at the request of  
2 Public Service Electric and Gas in connection with its application for the Garden  
3 State Reliability Project.

4 **Q. Have you testified in proceedings before other utility regulatory**  
5 **commissions?**

6 A. I have testified in regulatory proceedings on behalf of state public utility  
7 commissions as well as project applicants in various states.

8 **Q. Would you describe the purpose of your testimony?**

9 A. Jersey Central Power & Light Company (“JCP&L”) requested that Exponent  
10 evaluate the Oceanview 230 kilovolt (“kV”) transmission line project (“Project”)  
11 with respect to the expected levels of EMF associated with the operation of the  
12 existing and proposed transmission line and provide information about the current  
13 status of health-related research on EMF. These topics are addressed in my  
14 testimony below.

15 **II. PROJECT EVALUATION**

16 **Q. Are you familiar with the rebuilt and new transmission lines proposed as**  
17 **part of the Project that is the subject of these proceedings?**

18 A. Yes, I am.

19 **Q. What sources of information did you consult to become familiar with the**  
20 **Project?**

21 A. I reviewed the Petition to the BPU, the testimony and Exhibit KGK-2 prepared by  
22 Kyle G. King (EMF and Field Effects), and the testimony of other witnesses  
23 including John T. Toth (Overview of Project and Filing), Jeffrey A. Goldberg

1 (Electrical Need), Timothy B. Gaul (Transmission Project Study & Route  
2 Selection), and Kristy M. Cronin (Environmental Impact & Permitting).

3 **Q. Is the operation of the new and re-built 230 kV transmission lines that are**  
4 **part of this Project likely to markedly increase the exposure of persons to 60-**  
5 **Hertz (“Hz”) electric fields?**

6 A. No, as described in Exhibit KGK-2, the peak electric fields from existing and  
7 proposed lines will occur on the right-of-way. In two of the three sections of the  
8 route (Larrabee to Herbertsville Road and Herbertsville Road to Atlantic), the  
9 peak electric field on the right-of-way after the Project is in operation will be  
10 lower than under existing conditions. In the third section (Atlantic to  
11 Oceanview), the peak electric field will be slightly higher than produced by the  
12 existing lines but will be similar to existing peak electric field levels on the other  
13 two route sections.

14 At the edges of the right-of-way, the electric field from the Project will be  
15 similar to or slightly increased above that from existing lines. Outside the right-  
16 of-way, where persons are more likely to spend time in buildings and other  
17 facilities for longer periods, the electric field levels will be roughly 10 times lower  
18 than peak levels. In addition, shrubbery, fences, trees, and buildings between  
19 persons and the transmission line that partially or largely reduce the electric field  
20 level from the existing line will also partially or largely reduce the electric field  
21 level from the proposed lines.

1 **Q. What about the 60-Hz magnetic field from the Project lines? Will the**  
2 **exposure of persons to 60-Hz magnetic fields be markedly higher because of**  
3 **the Project?**

4 A. Again, the answer is no. The peak magnetic field on the right-of-way in the  
5 Larrabee to Herbertsville Road and Herbertsville Road to Atlantic sections after  
6 the Project is constructed will be about 100 milligauss (“mG”) lower than the  
7 peak magnetic field associated with the operation of the existing lines. The peak  
8 magnetic fields from the existing and proposed lines are far lower on the Atlantic  
9 to Oceanview section of right-of-way than the two other sections but the peak  
10 magnetic field due to the new line design will be somewhat higher than from the  
11 existing lines in this section.

12 Like the electric field, the magnetic field diminishes quickly with distance  
13 from the lines. The calculated magnetic field levels at the edges of the Larrabee  
14 to Herbertsville Road and Herbertsville Road to Atlantic sections will be reduced  
15 below those associated with the existing lines. The magnetic field will decrease  
16 on one side of the Atlantic to Oceanview section and increase to a similar extent  
17 on the other side. Outside the right-of-way the magnetic fields on all three  
18 sections are far below peak levels and the field from the existing and proposed  
19 lines becomes more similar as distance increases from the right-of-way.

20 **Q. Mr. King has testified that the proposed line meets the State of New Jersey**  
21 **guideline for electric fields at the edge of the right-of-way and the State of**  
22 **New Jersey has no guidelines for magnetic fields. Was the guideline for the**

1           **electric field at the edge of the right-of-way recommended based upon a**  
2           **formal health risk assessment?**

3    A.    No.

4    **Q.    Have other organizations reviewed the research on EMF, performed health**  
5           **risk assessments, and recommended health-based exposure guidelines?**

6    A.    Yes. Guidelines for exposure of the public and workers to EMF have been  
7           recommended by ICNIRP and other agencies. ICNIRP is a body of independent  
8           scientific experts consisting of: a main Commission of 14 members; Scientific  
9           Standing Committees covering Epidemiology, Biology, Dosimetry, and Optical  
10          Radiation; and a number of consulting experts. ICNIRP's exposure guidelines  
11          and its statements on particular topics of interest are published in *Health Physics*,  
12          the Journal of the Health Physics Society of which I am an Editor.

13                 Another organization, ICES, has also recommended standards for the safe  
14                 use of electromagnetic energy in the range of 0 Hz to 300 Gigahertz, which  
15                 includes power frequency 60 Hz fields. ICES is sponsored by the Institute of  
16                 Electrical and Electronics Engineers and operates under its rules and oversight.  
17                 ICES follows an open consensus process, with a balanced representation from the  
18                 medical, scientific, engineering, industrial, government, and military  
19                 communities. ICES has approximately 119 members, including 43 members from  
20                 outside the United States representing 23 different countries.

21    **Q.    What are the recommendations of these organizations for exposures of the**  
22           **general public to EMF?**



1 A. ICNIRP and ICES have reviewed research on electric and magnetic fields and  
2 have recommended “basic restrictions” or limits on exposure to protect against  
3 acute established effects (i.e., the stimulation of nerves and muscles) that occur at  
4 very high EMF levels. These limits on internal electric fields are difficult to  
5 measure directly so these organizations have identified screening levels that are 2-  
6 3 times below exposures meeting basic restrictions to ensure that limits on  
7 internal electric fields are not exceeded. The ICNIRP recommends screening  
8 values of 4.2 kV/m at 60 Hz to evaluate exposures to the general public (ICNIRP,  
9 1998). In the latest guidelines published in December 2010, ICNIRP increased  
10 the screening value for magnetic fields from 833 mG at 60 Hz to 2,000 mG  
11 (ICNIRP, 2010). No change was recommended to the electric field screening  
12 value in the latest guidelines. The member countries of the European Union apply  
13 the ICNIRP recommendations to areas where the general public spend significant  
14 time (CEU, 1999). The ICES has recommended screening values for magnetic  
15 field exposure at 9,040 mG and at 5 kV/m for electric field exposure (ICES,  
16 2002), higher than ICNIRP’s guidelines at 60 Hz.

17 Both guidelines incorporate large safety factors (i.e., decreases in the  
18 recommended exposure levels below the lowest threshold for potentially adverse  
19 effects) to account for uncertainty and variation in exposure conditions.  
20 Exposures above the ICNIRP and ICES screening guidelines are permitted if it  
21 can be shown that their basic restrictions on internal electric fields and current  
22 densities are not exceeded.

1 **Q. Will the levels of EMF associated with the operation of the rebuilt and new**  
2 **transmission lines be below the ICNIRP and ICES guidelines?**

3 A. Yes, the calculated electric field even directly under the conductors will be at or  
4 below the lowest guideline limit and the calculated magnetic field will be far, far  
5 below the lowest guideline limit.

6 **III. ASSESSMENTS OF EMF RESEARCH BY MULTIDISCIPLINARY**  
7 **SCIENTIFIC REVIEW PANELS**

8 **Q. In addition to the EMF exposures guideline just described has research on**  
9 **EMF and health been reviewed by national and international agencies?**

10 A. Yes. Numerous agencies with responsibility for public health have performed  
11 weight-of-evidence reviews of EMF research, including the National Institutes of  
12 Environmental Health Sciences (1998, 1999), The Health Council for the  
13 Netherlands (2000, 2001, 2004, 2009), UK National Radiological Protection  
14 Board (2001, 2004), IARC (2002), and WHO (2007a).

15 **Q. What was the scientific consensus reached by these reviews?**

16 A. The scientific consensus is that the evidence is insufficient to conclude that EMF  
17 is a cause of any long-term health effect.

18 **Q. Did these reviews consider both epidemiology and experimental studies?**

19 A. Yes. They noted that, as a group, epidemiology studies have reported statistical  
20 associations between higher, average exposure levels to magnetic fields (greater  
21 than 3-4 mG) and childhood leukemia, although potential biases and other factors  
22 cannot be ruled out as the explanation. Other epidemiology studies do not  
23 provide strong evidence suggesting that EMF is the cause of cancer or other long-

1 term adverse health effects. The agencies also evaluated experimental laboratory  
2 studies, but did not find that they support a causal link between EMF and any  
3 adverse health effect because no consistent increase in cancer, including  
4 leukemia, or indicator of toxicity was consistently found in a dose-response  
5 pattern in laboratory animals exposed to EMF, including those exposed over their  
6 entire lifespan. These reviews did not find that research confirmed any  
7 mechanism to explain how magnetic fields could cause cancer or any other  
8 adverse effect.

9 **Q. The most recent review listed above was sponsored by the WHO. What was**  
10 **its overall conclusion?**

11 A. This most recent, as well as the most comprehensive review, was performed by 21  
12 members of a WHO Task Group. They concluded:

13 Acute biological effects [i.e., short-term, transient health effects  
14 such as a small shock] have been established for exposure to ELF  
15 electric and magnetic fields in the frequency range up to 100 kHz  
16 that may have adverse consequences on health. Therefore,  
17 exposure limits are needed. International guidelines exist that have  
18 addressed this issue. Compliance with these guidelines provides  
19 adequate protection. Consistent epidemiological evidence suggests  
20 that chronic low-intensity ELF magnetic field exposure is  
21 associated with an increased risk of childhood leukemia.  
22 However, the evidence for a causal relationship is limited,  
23 therefore exposure limits based upon epidemiological evidence are

1 not recommended, but some precautionary measures are warranted  
2 (WHO, 2007a, pp. 355-356).

3 The WHO further concluded “that there are no substantive health issues  
4 related to ELF electric fields at levels generally encountered by members of the  
5 public” (WHO, 2007b). Subsequent to its most comprehensive in-depth review of  
6 the scientific literature on potential health effects related to EMF, the WHO stated  
7 “Based on a recent in-depth review of the scientific literature, [we conclude] that  
8 current evidence does not confirm the existence of any health consequences from  
9 exposure to low level electromagnetic fields” (WHO, 2014).

10 **Q. Have other more current reports by health agencies confirmed this**  
11 **assessment of the scientific research?**

12 **A.** Yes. Very similar conclusions have been reached in reports by the Scientific  
13 Committee on Emerging and Newly Identified Health Risks in the European  
14 Union (SCENIHR, 2009; SCENIHR, 2013); the European Health Risk  
15 Assessment Network on Electromagnetic Fields (EFHRAN, 2010); ICNIRP  
16 (2010); and the Swedish Radiation Safety Authority (SSM, 2010; SSM, 2013).  
17 These recent weight-of evidence reviews do not support a causal link between  
18 EMF and any adverse health effects.

19 **IV. CONCLUSION**

20 **Q. Does the application by JCP&L to the BPU meet the New Jersey interim**  
21 **guidelines for managing electric fields associated with the proposed**  
22 **transmission line?**

23 **A.** Yes.

1 **Q. Are the calculated levels of EMF below international health-based exposure**  
2 **limits?**

3 A. Yes.

4 **Q. Does scientific research show that electric fields or magnetic fields are**  
5 **harmful to human health?**

6 A. The weight of the scientific evidence from research studies does not support the  
7 conclusion that electric fields or magnetic fields are harmful at the levels to which  
8 people are exposed under transmission lines, in homes, or near machines and  
9 electrical appliances. EMF can cause transient effects at extremely high levels,  
10 but not at the levels found under transmission lines of this voltage or even near  
11 home appliances.

12 **Q. Does this conclude your direct testimony?**

13 A. Yes.

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# **Exhibit WHB-1**



**William H. Bailey, Ph.D.**  
**Principal Scientist**

**Professional Profile**

Dr. William H. Bailey is a Principal Scientist in Exponent's Health Sciences practice. Dr. Bailey specializes in applying state-of-the-art assessment methods to environmental and occupational health issues. His 30 years of training and experience include laboratory and epidemiologic research, health risk assessment, and comprehensive exposure analysis. Dr. Bailey has investigated exposures to alternating current, direct current, and radiofrequency electromagnetic fields, 'stray voltage', and electrical shock, as well as to a variety of chemical agents and air pollutants. He is particularly well known for his research on potential health effects of electromagnetic fields and has served as an advisor to numerous state, federal, and international agencies. Currently, he is involved in research on exposures to marine life from submarine cables and respiratory exposures to ultrafine- and nanoparticles. Dr. Bailey is a visiting scientist at the Cornell University Medical College and has lectured at Rutgers University, the University of Texas (San Antonio), and the Harvard School of Public Health. He was formerly Head of the Laboratory of Neuropharmacology and Environmental Toxicology at the New York State Institute for Basic Research, Staten Island, New York, and an Assistant Professor and NIH postdoctoral fellow in Neurochemistry at The Rockefeller University in New York.

**Academic Credentials and Professional Honors**

Ph.D., Neuropsychology, City University of New York, 1975

M.B.A., University of Chicago, 1969

B.A., Dartmouth College, 1966

Sigma Xi; The Institute of Electrical and Electronics Engineers/International Committee on Electromagnetic Safety (Subcommittee 3, Safety Levels with Respect to Human Exposure to Fields (0 to -3 kHz) and Subcommittee 4, Safety Levels with Respect to Human Exposure to Radiofrequency Fields (3 kHz to 3 GHz); Elected member of the Committee on Man and Radiation (COMAR) of the IEEE Engineering in Medicine and Biology Society, 1998-2001

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Bailey WH, Weiss JM. Effect of ACTH 4-10 on passive avoidance of rats lacking vasopressin (Brattleboro strain). *Hormones and Behavior* 1978; 10:22–29.

Pohorecky LA, Newman B, Sun J, Bailey WH. Acute and chronic ethanol injection and serotonin metabolism in rat brain. *Journal of Pharmacology and Experimental Therapeutics* 1978; 204:424–432.

Koh SD, Vernon M, Bailey WH. Free-recall learning of word lists by prelingual deaf subjects. *Journal of Verbal Learning and Verbal Behavior* 1971; 10:542–574.

### **Book Chapters**

Bailey WH. Principles of risk assessment and their limitations. In: *Risk Perception, Risk Communication and its Application to EMF Exposure*. Matthes R, Bernhardt JH, Repacholi MH (eds), International Commission on Non-Ionizing Radiation Protection, Oberschleißheim, Germany, 1998.

Bailey WH. Biological responses to air ions: Is there a role for serotonin? pp. 151–160. In: *Air Ions: Physical and Biological Aspects*. Charry JM and Kavet R (eds), CRC Press, Boca Raton, FL, 1987.

Weiss JM, Bailey WH, Goodman PA, Hoffman LJ, Ambrose MJ, Salman S, Charry JM. A model for neurochemical study of depression. pp. 195–223. In: *Behavioral Models and the Analysis of Drug Action*. Spiegelstein MY, Levy A (eds), Elsevier Scientific, Amsterdam, 1982.

Bailey WH. Mnemonic significance of neurohypophyseal peptides. pp. 787–804. In: *Changing Concepts of the Nervous System*. Morrison AR, Strick PL (eds), Academic Press, New York, NY, 1981.

Bailey WH, Weiss, JM. Avoidance conditioning and endocrine function in Brattleboro rats. Pp 371–395. In: *Endogenous Peptides and Learning and Memory Process*. Martinez JL, Jensen RA, Messing RB, Rigter H, McGaugh JL (eds), Academic Press, New York, NY, 1981.

Weiss JM, Glazer H, Pohorecky LA, Bailey WH, Schneider L. Coping behavior and stress-induced behavioral depression: Studies of the role of brain catecholamines. pp. 125–160. In: *The Psychobiology of the Depressive Disorders: Implications for the Effects of Stress*. Depue R (ed), Academic Press, New York, NY, 1979.

### **Technical Reports**

Normandeau, Exponent, Tricas T, Gill A. Effects of EMFs from undersea power cables on elasmobranchs and other marine species. U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Regulation, and Enforcement, Pacific OCS Region, Camarillo, CA. OCS Study BOEMRE 2011-09, May 2011.

Jardini JA, et al. Electric field and ion current environment of HVDC overhead transmission lines. Report of Joint Working Group B4/C3/B2.50, CIGRÉ, August 2011.

Johnson GB, Bracken TD, Bailey WH. Charging and transport of aerosols near AC transmission lines: A literature review. EPRI, Palo Alto, CA, 2003.

Bailey WH. Probabilistic approach to ranking sources of uncertainty in ELF magnetic-field exposure limits. In: Evaluation of Occupational Magnetic Exposure Guidelines, Interim Report, EPRI Report TR-111501, 1998.

Bracken TD, Bailey WH, Su SH, Senior RS, Rankin RF. Evaluation of occupational magnetic-field exposure guidelines; Interim Report. EPRI Report TR-108113, 1997.

Bailey WH, Weil DE, Stewart JR. HVDC Power Transmission Environmental Issues Review. Oak Ridge National Laboratory, Oak Ridge, TN, 1996.

Bailey WH. Melatonin responses to EMF. Proceedings, Health Implications of EMF Neural Effects Workshop, Report TR-104327s, EPRI, 1994.

Bailey WH. Recent neurobiological and behavioral research: Overview of the New York State powerlines project. In: Power-Frequency Electric and Magnetic Field Research, EPRI, 1989.

Bailey WH, Bissell M, Dorn CR, Hoppel WA, Sheppard AR, Stebbings, JH. Comments of the MEQB Science Advisors on Electrical Environment Outside the Right of Way of CU-TR-1, Report 5. Science Advisor Reports to the Minnesota Environmental Quality Board, 1986.

Bailey WH, Bissell M, Brambl RM, Dorn CR, Hoppel WA, Sheppard AR, Stebbings JH. A health and safety evaluation of the +/- 400 KV powerline. Science Advisor's Report to the Minnesota Environmental Quality Board, 1982.

Charry JM, Bailey WH, Weiss JM. Critical annotated bibliographical review of air ion effects on biology and behavior. Rockefeller University, New York, NY, 1982.

Bailey WH. Avoidance behavior in rats with hereditary hypothalamic diabetes insipidus. Dissertation, City University of New York, 1975.

### **Selected Invited Presentations**

Bailey WH. Measurements of charged aerosols around DC transmission lines and other locations. International Committee on Electromagnetic Safety TC95/ Subcommittee 3: Safety Levels with Respect to Human Exposure to Electromagnetic Fields, 0 – 3 kHz, December 2011.

Bailey WH, Erdreich LS. Human sensitivity and variability in response to electromagnetic fields: Implications for standard setting. International Workshop on EMF Dosimetry and Biophysical Aspects Relevant to Setting Exposure Guidelines. International Commission on Non-Ionizing Radiation Protection, Berlin, March 2006.

Bailey WH. Research-based approach to setting electric and magnetic field exposure guidelines (0-3000 Hz). IEEE Committee on Electromagnetic Safety, December 2005.

Bailey WH. Conference Keynote Presentation. Research supporting 50/60 Hz electric and magnetic field exposure guidelines. Canadian Radiation Protection Association, Annual Conference, Winnipeg, June 2005.

Bailey WH. Scientific methodology for assessing public health issues: A case study of EMF. Canadian Radiation Protection Association, Annual Conference, Public Information for Teachers, Winnipeg, June 2005.

Bailey WH. Assessment of potential environmental effects of electromagnetic fields from submarine cables. Connecticut Academy of Science and Engineering, Long Island Sound Bottomlands Symposium: Study of Benthic Habitats, July 2004.

De Santo RS, Coe M, Bailey WH. Environmental justice assessment and the use of GIS tools and methods. National Association of Environmental Professionals, 27<sup>th</sup> Annual Conference, Dearborn, MI, June 2002.

Bailey WH. Applications to enhance safety: Research to understand and control potential risks. Human Factors and Safety Research, Volpe National Transportation Systems Center/Dutch Ministry of Transport, Cambridge, MA, November 2000.

Bailey WH. EMF health effects review. EMF Exposure Guideline Workshop, Brussels Belgium, June 2000.

Bailey WH. Dealing with uncertainty when formulating guidelines. EMF Exposure Guideline Workshop, Brussels Belgium, June 2000.

Bailey WH. Field parameters: Policy implications. EMF Engineering Review Symposium, Status and Summary of EMF Engineering Research, Charleston, SC, April 1998.

Bailey WH. Principles of risk assessment: Application to current issues. Symposium on EMF Risk Perception and Communication, World Health Organization, Ottawa, Canada, August 1998.

Bailey WH. Current guidelines for occupational exposure to power frequency magnetic fields. EPRI EMF Seminar, New Research Horizons, March 1997.

Bailey WH. Methods to assess potential health risks of cell telephone electromagnetic fields. IBC Conference—Cell Telephones: Is there a Health Risk? Washington, DC, June 1997.

Bailey WH. Principles of risk assessment and their limitations. Symposium on Risk Perception, Risk Communication and its Application to EMF Exposure, International Commission on Non-Ionizing Radiation Protection, Vienna, Austria, October 1997.

Bailey WH. Probabilistic approach for setting guidelines to limit induction effects. IEEE Standards Coordinating Committee 28: Non-Ionizing Radiation, Subcommittee 3 (0–3 kHz), June 1997.

Bailey WH. Power frequency field exposure guidelines. IEEE Standards Coordinating Committee 28: Non-Ionizing Radiation, Subcommittee 3 (0–3 kHz), June 1996.

Bailey WH. Epidemiology and experimental studies. American Industrial Hygiene Conference, Washington, DC, May 1996.

Bailey WH. Review of 60 Hz epidemiology studies. EMF Workshop, Canadian Radiation Protection Association, Ontario, Canada, June 1993.

Bailey WH. Biological and health research on electric and magnetic fields. American Industrial Hygiene Association, Fredrickton, New Brunswick, Canada, October 1992.

Bailey WH. Electromagnetic fields and health. Institute of Electrical and Electronics Engineers, Bethlehem, PA, January 1992.

Bailey WH, Weiss JM. Psychological factors in experimental heart pathology. Visiting Scholar Presentation, National Heart Lung and Blood Institute, March 1977.

### **Presentations**

Perez V, Alexander DD, Bailey WH. Air ions and mood outcomes: A review and meta-analysis. Poster presentation at the American College of Epidemiology, Chicago, IL, September 8–11, 2012.

Shkolnikov Y, Bailey WH. Electromagnetic interference and exposure from household wireless networks. Product Safety Engineering Society Meeting, San Diego, CA October 2011.

Nestler E, Trichas T, Pembroke A, Bailey W. Will undersea power cables from offshore wind projects affect sharks? North American Offshore Wind Conference & Exhibition, Atlantic City, NJ, October 2010.

Nestler E, Pembroke A, Bailey W. Effects of EMFs from undersea power lines on marine species. Energy Ocean International, Ft. Lauderdale, FL, June 2010.

Pembroke A, Bailey W. Effects of EMFs from undersea power cables on elasmobranchs and other marine species. Windpower 2010 Conference and Exhibition, Dallas, TX, 2010.

Bailey WH. Clarifying the neurological basis for ELF guidelines. Workshop on Practical Implementation of ELF and RF Guidelines. The Bioelectromagnetics Society 29<sup>th</sup> Annual Meeting, Kanazawa, Japan, June 2007.

Sun B, Urban B, Bailey W. AERMOD simulation of near-field dispersion of natural gas plume from accidental pipeline rupture. Air and Waste Management Association: Health Environments: Rebirth and Renewal, New Orleans, LA, June 2006.



Bailey WH, Johnson G, Bracken TD. Method for measuring charge on aerosol particles near AC transmission lines. Joint Meeting of The Bioelectromagnetics Society and The European BioElectromagnetics Association, Dublin Ireland, June 2005.

Bailey WH, Bracken TD, Senior RS. Long-term monitoring of static electric field and space charge near AC transmission Lines. The Bioelectromagnetics Society, 26<sup>th</sup> Annual Meeting, Washington, DC, June 2004.

Bailey WH, Erdreich L, Waller L, Mariano K. Childhood leukemia in relation to 25-Hz and 60-Hz magnetic fields along the Washington DC—Boston rail line. Society for Epidemiologic Research, 35<sup>th</sup> Annual Meeting, Palm Desert CA, June 2002. American Journal of Epidemiology 2002; 155:S38.

Erdreich L, Klauenberg BJ, Bailey WH, Murphy MR. Comparing radiofrequency standards around the world. Health Physics Society 43rd Annual Meeting, Minneapolis, MN, July 1998.

Bracken TD, Senior RS, Rankin RF, Bailey WH, Kavet R. Relevance of occupational guidelines to utility worker magnetic-field exposures. Second World Congress for Electricity and Magnetism in Biology and Medicine, Bologna, Italy, June 1997.

Weil DE, Erdreich LS, Bailey WH. Are 60-Hz magnetic fields cancer causing agents? Mechanisms and Prevention of Environmentally Caused Cancers, The Lovelace Institutes 1995 Annual Symposium, La Fonda, Santa Fe, NM, October 1995.

Bailey WH. Neurobiological research on extremely-low-frequency electric and magnetic fields: A review to guide future research. Sixteenth Annual Meeting of the Bioelectromagnetics Society, Copenhagen, Denmark, June 1994.

Blondin J-P, Nguyen D-H, Sbeghen J, Maruvada PS, Plante M, Bailey WH, Goulet D. The perception of DC electric fields and ion currents in human observers. Annual Meeting of the Canadian Psychological Association, Penticton, British Columbia, Canada, June 1994.

Erdreich LS, Bailey WH, Weil DE. Science, standards and public policy challenges for ELF fields. American Public Health Association 122nd Annual Meeting, Washington, DC, October 1994.

Bailey WH, Charry JM. Particle deposition on simulated VDT operators: Influence of DC electric fields. 10<sup>th</sup> Annual Meeting of the Bioelectromagnetics Society, June 1988.

Charry JM, Bailey WH. Contribution of charge on VDTs and simulated VDT operators to DC electric fields at facial surfaces. 10<sup>th</sup> Annual Meeting of the Bioelectromagnetics Society, June 1988.

Bailey WH, Charry, JM. Dosimetric response of rats to small air ions: Importance of relative humidity. EPRI/DOE Contractors Review, November 1986. Charry JM, Bailey WH, Bracken TD (eds). DC electric fields, air ions and respirable particulate levels in proximity to VDTs. International Conference on VDTs and Health, Stockholm, Sweden, June 12–15 1986.

Charry JM, Bailey WH. Air ion and DC field strengths at  $10^4$  ions/cm<sup>3</sup> in the Rockefeller University Small Animal Exposure Chambers. EPRI/DOE Contractors Review, November 1985.

Charry JM, Bailey WH. DC Electrical environment in proximity to VDTs. 7th Annual Meeting of the Bioelectromagnetics Society, June 1985.

Bailey WH, Collins RL, Lahita RG. Cerebral lateralization: Association with serum antibodies to DNA in selected bred mouse lines. Society for Neuroscience, 1985.

Kavet R, Bailey WH, Charry JM. Respiratory neuroendocrine cells: A plausible site for air ion effects. Seventh Annual Meeting of The Bioelectromagnetics Society, June 1985.

Bailey WH, Charry JM. Measurement of neurotransmitter release and utilization in selected brain regions of rats exposed to DC electric fields and atmospheric space charge. 23rd Hanford Life Sciences Symposium, Richland, WA, October 1984.

Bailey WH, Charry JM, Weiss JM, Cardle K, Shapiro M. Regional analysis of biogenic amine turnover in rat brain after exposure to electrically charged air molecules (air ions). Society for Neuroscience, 1983.

Bailey WH. Biological effects of air ions: Fact and fancy. American Institute of Medical Climatology Conference on Environmental Ions and Related Biological Effects, October 1982.

Goodman PA, Weiss JM, Hoffman LJ, Ambrose MJ, Bailey WH, Charry, JM. Reversal of behavioral depression by infusion of an A2 adrenergic agonist into the locus coeruleus. Society for Neuroscience, November 1982.

Charry JM, Bailey WH. Biochemical and behavioral effects of small air ions. Electric Power Research Institute Workshop, April 1981.

Bailey WH, Alonson DR, Weiss JM, Chin S. Predictability: A psychologic/ behavioral variable affecting stress-induced myocardial pathology in the rat. Society for Neuroscience, November 1980.

Salman SL, Weiss JM, Bailey WH, Joh TH. Relationship between endogenous brain tyrosine hydroxylase and social behavior of rats. Society of Neuroscience, November 1980.

Bailey WH, Maclusky S. Appearance of creatine kinase isoenzymes in rat plasma following myocardial injury produced by isoproterenol. Fed Assoc Soc Exp Biol, April 1978.

Bailey WH, Maclusky S. Appearance of creatine kinase isoenzymes in rat plasma following myocardial injury by isoproterenol. Fed Proc 1978; 37:889.

Bailey WH, Weiss JM. Effect of ACTH 4-10 on passive avoidance of rats lacking vasopressin (Brattleboro strain). Eastern Psychological Association, April 1976.

### **Prior Experience**

President, Bailey Research Associates, Inc., 1991–2000

Vice President, Environmental Research Information, Inc., 1987–1990

Head of Laboratory of Environmental Toxicology and Neuropharmacology, New York State Institute for Basic Research, 1983–1987

Assistant Professor, The Rockefeller University, 1976–1983

### **Academic Appointment**

- Visiting Fellow, Department of Pharmacology, Cornell University Medical College, New York, NY, 1986–present

### **Prior Academic Appointments**

- Visiting Scientist, The Jackson Laboratory, Bar Harbor, ME, 1984–1985
- Head, Laboratory of Neuropharmacology and Environmental Toxicology, NYS Institute for Basic Research in Developmental Disabilities, Staten Island, NY, 1983–1987
- Assistant Professor, The Rockefeller University, New York, NY, 1976–1983
- Postdoctoral Fellow, Neurochemistry, The Rockefeller University, New York, NY, 1974–1976
- Dissertation Research, The Rockefeller University, New York, NY, 1972–1974
- CUNY Research Fellow, Dept. of Psychology, Queens College, City University of New York, Flushing, NY, 1969–1971
- Clinical Research Assistant, Department of Psychiatry, University of Chicago; Psychiatric Psychosomatic Inst., Michael Reese Hospital, and Illinois State Psychiatric Inst, Chicago, IL, 1968–1969

### **Teaching Appointments**

- Lecturer, University of Texas Health Science Center, Center for Environmental Radiation Toxicology, San Antonio, TX, 1998
- Lecturer, Harvard School of Public Health, Office of Continuing Education, Boston, MA, 1995, 1997
- Lecturer, Rutgers University, Office of Continuing Education, New Brunswick, NJ, 1991–1995
- Adjunct Assistant Professor, Queens College, CUNY, Flushing, NY, 1978
- Lecturer, Queens College, CUNY, Flushing, NY, 1969–1974

## Editorship

- Associate Editor, Non-Ionizing Radiation, *Health Physics*, 1996–present

## Advisory Positions

- ZonMw – Netherlands Organization for Health Research and Development, 2012; 2007-2008, reviewer for National Programme on EMF and Health
- US Bureau of Ocean Energy Management, Regulation and Enforcement, 2009–2010
- Canadian National Collaborating Centre for Environmental Health, reviewer of Centre reports, 2008
- Island Regulatory and Appeals Commission, province of Prince Edward Island, Canada, 2008
- National Institute of Environmental Health Sciences/ National Institutes of Health, Review Committee, Neurotoxicology, Superfund Hazardous Substances Basic Research and Training Program, 2004
- National Institute of Environmental Health Sciences, Review Committee Role of Air Pollutants in Cardiovascular Disease, 2004
- Working Group on Non-Ionizing Radiation, Static and Extremely Low-Frequency Electromagnetic Fields, International Agency for Research on Cancer, 2000–2002
- Working Group, EMF Risk Perception and Communication, World Health Organization, 1998–2005
- Member, International Committee on Electromagnetic Safety, Subcommittee 3 - Safety Levels with Respect to Human Exposure to Fields (0 to 3 kHz) and Subcommittee 4 - Safety Levels with Respect to Human Exposure (3kHz to 3GHz) Institute of Electrical and Electronics Engineers (IEEE), 1996–present
- Invited participant, National Institute of Environmental Health Sciences EMF Science Review Symposium: Clinical and In Vivo Laboratory Findings, 1998
- Working Group, EMF Risk Perception and Communication, International Commission on Non-Ionizing Radiation Protection, 1997
- U.S. Department of Energy, RAPID EMF Engineering Review, 1997
- Oak Ridge National Laboratory, 1996
- American Arbitration Association International Center for Dispute Resolution, 1995–1996
- U.S. Department of Energy, 1995
- National Institute for Occupational Safety and Health, 1994–1995
- Federal Rail Administration, 1993–1996
- U.S. Forest Service, 1993
- New York State Department of Environmental Conservation, 1993
- National Science Foundation
- National Institutes of Health, Special Study Section—Electromagnetics, 1991–1993

- Maryland Public Service Commission and Maryland Department of Natural Resources, Scientific Advisor on health issues pertaining to HVAC Transmission Lines, 1988–1989
- Scientific advisor on biological aspects of electromagnetic fields, Electric Power Research Institute, Palo Alto, CA, 1985–1989
- U.S. Public Health Service, NIMH: Psychopharmacology and Neuropsychology Review Committee, 1984
- Consultant on biochemical analysis, Colgan Institute of Nutritional Science, Carlsbad, CA, 1982–1983
- Behavioral Medicine Abstracts, Editor, animal behavior and physiology, 1981–1983
- Consultant on biological and behavioral effects of high-voltage DC transmission lines, Vermont Department of Public Service, Montpelier, VT, 1981–1982
- Scientific advisory committee on health and safety effects of a high-voltage DC transmission line, Minnesota Environmental Quality Board, St. Paul, MN, 1981–1982
- Consultant on biochemical diagnostics, Biokinetix Corp., Stamford, CT, 1978–1980

### **Professional Affiliations**

- The Health Physics Society (Affiliate of the International Radiation Protection Society)
- Society for Risk Analysis
- International Society of Exposure Analysis
- New York Academy of Sciences
- American Association for the Advancement of Science
- Air and Waste Management Association
- Society for Neuroscience/International Brain Research Organization
- Bioelectromagnetics Society
- The Institute of Electrical and Electronics Engineers/Engineering in Medicine and Biology Society
- Conseil International des Grands Réseaux Électriques