STATE OF CONNECTICUT
SITING COUNCIL

THE CONNECTICUT LIGHT AND POWER COMPANY APPLICATION FOR A CERTIFICATE OF ENVIRONMENTAL COMPATIBILITY AND PUBLIC NEED FOR THE CONSTRUCTION, MAINTENANCE, AND OPERATION OF A PROPOSED SUBSTATION LOCATED NORTH OF STEPSTONE HILL ROAD AND EAST OF ROUTE 77, GUILFORD, CONNECTICUT.	:	DOCKET NO. 326
	:	April 13, 2007

DIRECT TESTIMONY OF KENNETH BOWES REGARDING PLANNING MATTERS CONCERNING THE PROPOSED STEPSTONE SUBSTATION

INTRODUCTION

Q. Please identify yourself and the other members of the panel who will respond to cross examination concerning the proposed Stepstone Substation and related facilities (the "Project" or "Proposed Substation").

A. I am Kenneth Bowes, Director, Transmission Projects employed by Northeast Utilities Service Company ("NUSCO"), agent for The Connecticut Light and Power Company (the "Company"). With me on this panel is Michael Libertine Director, Environmental Services, Vanasse, Hangen, Brustlin, Inc. The resumes of these panel members are attached.

Q. Does the Company expect to call on any other personnel to respond to planning or environmental issues?

A. NUSCO employees, including Robert E. Carberry, Manager of Transmission Siting, and Permitting, Helen Wong, Project Manager, Robert Charpentier, Project, Engineer Manager, and Michael Carlson, Principal Engineer, may be called upon to respond to questions relating to specific siting, engineering design or government and community relations topics. In addition, the Company may call on Dr. William H. Bailey, Ph.D., Principal Scientist and Director, New York Office , from Exponent®. The resumes of the NUSCO employees and Dr. Bailey are also attached.

Q. What responsibility have you had in connection with the Application to the Siting Council?

A. With Mr. Carberry, I have supervised the preparation and submission of the Application and interrogatory responses. The Application was compiled under our supervision by NUSCO staff, including Ms. Wong, environmental consultants and others.

Q. What is the purpose of your testimony?

A. The purpose of my testimony is to provide an overview of the proposed Stepstone Substation Project ("Project" or "Substation"). I will cover eight primary topics pertaining to planning matters:

1. Overview and general location of the Project;
2. Review of siting criteria;
3. Need;
4. Line Connections;
5. Safety and reliability of Substation Operation;
6. Electric and Magnetic Fields;
7. Municipal Consultations; and
8. Notices to Nearby Property Owners.

Further direct testimony on environmental matters concerning the Project will be provided by Michael Libertine of Vanasse Hangen Brustlin, Inc.

1. OVERVIEW AND GENERAL LOCATION OF THE PROJECT

Q. Please describe the Project.

A. The Company is proposing a Project to build a new substation, to be known as the Stepstone Substation in Guilford, Connecticut. The Proposed Substation will improve the capacity and reliability of the electric power distribution system which serves the Town of Guilford and adjacent towns, and will add distribution capacity by connecting a new 47-

Megavolt-Ampere ("MVA") bulk power transformer to an existing 115-kilovolt ("kV") transmission line and to the local 23- kV and 13.8-kV distribution line system.

Q. Please describe generally the location of the Proposed Substation.

A. The Proposed Substation will be strategically placed within the south-central portion of a secluded, 38-acre parcel owned by CL&P, located north of Stepstone Hill Road and east of Route 77 (the "Property"). The Property is undeveloped and forested and is bisected by an existing 115-kV transmission line, along the southern portion of the Property. An associated unpaved access route extends northward from Stepstone Hill Road to the transmission line corridor.

Q. How does the Company intend to access the Proposed Substation?

A. The Substation would be accessed from Stepstone Hill Road where the existing unpaved access route begins.

Q. Approximately how many vehicle trips to the site would occur per month?

A. Normally two to four.

Q. What will be the dimensions of the Proposed Substation within the fence line?

A. The Substation would occupy an area of 240 feet by 270 feet and be covered with a trap rock surface and secured by a seven-foot high chain link fence with an additional foot of

barbed wire. A gravel driveway will be established generally along the route of the existing dirt access.

Q. Will CL&P need to acquire any additional land for the Project?

A. No. The Property will accommodate the construction and operation of the Proposed Substation without the need to purchase any additional real estate.

Q. What equipment will be located within the Proposed Substation area?

A. The Substation would consist of the following equipment:

- One 47-MVA, 115- to 23-kV power transformer
- Two transformer disconnect switches and two circuit switchers.
    - One disconnect switch and one circuit switcher will be in the supply path to the 47-MVA power transformer
    - A second disconnect switch and circuit switcher would initially be used to temporarily connect a mobile transformer, when one is necessary for maintenance or to replace a failed piece of equipment.
- A metal-clad switchgear enclosure, approximately 24-feet long, 14-feet wide and 14-feet high to provide the switching equipment for three underground distribution feeders. Two of the three feeders will extend from the switchgear enclosure to 23- to 13.8-kV, 20.8-MVA autotransformers located within the Substation.
- Two 23- to 13.8-kV, 20.8-MVA autotransformers to supply two 13.8-kV distribution feeder circuits (one from each autotransformer) which can take over portions of circuits from Guilford Substation. Cables for these two circuits and for one 23-kV feeder circuit (three phases each) will exit the Substation underground in conduits southward to Stepstone Hill Road, following the general route of the new access drive.

- A 48-foot by 14-foot by 14-foot high protective relay and control equipment enclosure (the "control enclosure") that will house protective relaying and control equipment.

- A 24-foot by 14-foot by 14-foot high battery enclosure at the east end of the Substation. The battery enclosure houses a substation battery and a battery charger used to operate the transmission equipment within the Substation.

Q. How will the distribution feeder lines leave the Proposed Substation?

A. The two initial 13.8-kV feeder cables will rise up poles and connect to the existing 13.8-kV overhead circuit conductors on the road-side pole line along Stepstone Hill Road, one at a pole to the east of the entrance of the access way and one at a pole to the west.

The 23-kV distribution feeder cable will also rise on a pole of this same 13.8-kV overhead line on Stepstone Hill Road and connect to a new aerial cable west of the entrance of the driveway. The aerial cable would be supported on the poles below the level of the 13.8-kV circuit conductors. From there it will proceed as aerial cable out to Route 77 and then south.

Q. Will it be possible to increase the distribution capacity at this site?

A. Yes. CL&P could some day use the mobile transformer connection equipment to accommodate a second 47-MVA transformer, if needed, and there is room for additional metal-clad switchgear.

Q. What is the estimated cost of the Project?

A. Approximately $8,466,000.

Q. How much of that cost will be allocated to transmission?

A. Approximately $4,466,000.

Q. What is the service life of the equipment?

A. Approximately 40 years.

Q. How long do you anticipate the construction phase of the Project to take?

A. Approximately 12 to 18 months.

Q. What is the tentative in-service date?

A. June of 2009.

Q. What will be the general operation of the Proposed Substation?

A. The Proposed Substation will operate on a 24-hour per day basis.

Q. Will staff be on site?

A. No, not normally. The equipment will be designed so it can be monitored remotely, and personnel will be dispatched for unusual or emergency situations and for routine/scheduled maintenance.

2. REVIEW OF SITING CRITERIA

Q. Please review the siting criteria that were used to identify the Proposed Substation site.

A. The major criteria used to evaluate site alternatives and to select the best location for the Proposed Substation were:

- sufficient developable space for needed facilities;
- proximity to an existing 115-kV transmission line;
- central location with respect to a local distribution (customer) load area

Other important site-evaluation considerations include:

- proximity to neighbors and other surrounding features;
- natural resource and cultural resource constraints;
- zoning and present land use;
- access from a public road;
- earthwork requirements based on existing topography, and
- real estate considerations such as whether the land is owned by CL&P or would have to be acquired.

Q. In addition to the proposed site, what other locations were considered?

A. In addition to the proposed site off of Stepstone Hill Road in Guilford, three (3) other locations were considered:

- Farm property east of Little Meadow Road in Guilford. This property contains inland wetlands and significant historical resources, and a substation siting on the property to avoid wetlands impacts would result in extensive grading and the removal of mature trees, increasing the visibility of the Proposed Substation.

- CL&P property west of Warpas Road in Madison. This property is not near the Guilford load center, requires extensive cutting of mature trees and substantial cut and fill activity to prepare the site, and an access road would be through a residential neighborhood over a 15% grade. These are drawbacks that are not found at the preferred site.

- Orchard property north of New England Road in Guilford. The downsides to this property are potential elevated levels of pesticides, moderate earth work, requirements, lack of sufficient vegetative screening, and CL&P does not own this land.

Q. Why was the Stepstone Hill Road location selected?

A. This location was selected because it meets the major siting criteria very well and rates favorably under CL&P's other important site evaluation considerations, as discussed previously, and effectively balances the Project goals while minimizing adverse environmental effects. It is central to a growing load area, requires the least environmental disturbance of the

four sites reviewed, CL&P owns the land and it will be the most screened from neighbors or travelers on passing roads.

Q. Did you review the Connecticut Energy Advisory Board's ("CEAB") Preferential Criteria?

A. Yes.

Q. Is the Project consistent with the CEAB's Preferential Criteria?

A. Yes, the Project:

- Enhances distribution system reliability;
- Protects energy resources from physical risk through the Company's substation security designs and practices;
- Provides long-term system benefit (the Project will be designed to last for more than 40 years) and avoids stop-gap measures (long distribution lines from substations in other towns will largely be eliminated);
- Capitalizes on existing infrastructure by locating immediately adjacent to an existing transmission line with adequate capacity (no transmission line extension or new right-of-way is needed);
- Meets an identified energy need and is consistent with forecasted resource needs as identified by the Regional System Operator (ISO-NE) and the Council;
- Provides local tax revenues; and
- Supports environmental protection.

Q. What is the status of the CEAB's review of this Project?

A. The CEAB issued a Request for Proposals ("RFP") for alternatives to CL&P's Stepstone Substation on December 29, 2006 which were due February 27, 2007. No one responded to the CEAB's RFP. On April 13, 2007, the CEAB approved La Capra's report noting no alternative proposals had been submitted and the substations were necessary and needed.

3. NEED

Q. What is the purpose of the Proposed Substation?

A. The purpose of the Proposed Substation is to address the need for additional distribution-system capacity and reliability in Guilford by establishing a new bulk substation in the Town. The service area that would be supplied by the Stepstone Substation has experienced significant growth in recent years and is projected to continue to do so for the foreseeable future. A central portion of Guilford is also vulnerable to long outages should a severe storm damage 23-kV distribution feeder lines that stretch east and west along the coast of Long Island Sound bringing power from bulk substations in Madison and Branford to a small distribution substation in Guilford. The addition of a new inland bulk power substation in Guilford, centrally located

between the two existing bulk sources and with a 115-kV looped transmission supply, will increase capacity and create a stronger and more reliable distribution system.

Q What is the present situation in Guilford?

A. Guilford and its four surrounding towns (Branford, Madison, Clinton, and Killingworth) have experienced significant growth over the past two decades. The migration of residents who commute to this area of Connecticut has accelerated as those communities along I-95 have become increasingly developed. This has meant a change in the demographics of the communities surrounding Guilford. Not only are more people moving to the area, they are building larger homes that require more electricity. The kilowatt-hour use in these five towns has increased by more than 67% from 1981 to 2004.

Q. How does this affect demand?

A. The peak power demand on the Branford and Green Hill bulk power substations, and also smaller downstream distribution substations, serving these towns has increased significantly with this increased energy usage. Peak demand is expected to grow further at an annual compound rate of between 2% and 3%. Commercial development in Guilford and surrounding towns is experiencing resurgence. This is at least partly attributable to the fact that retail stores and medical services currently operating in New Haven are becoming more difficult to access as a result of the rebuilding of the Quinnipiac Bridge, which is expected to impact the

I-95 corridor until at least 2014. With the Stepstone Substation, CL&P achieves an improved distribution system with more opportunities to enhance reliability and more capacity expansion opportunities in the future.

Q. What is the present substation capacity situation in Guilford?

A. Today the Guilford load is served from the Branford and Green Hill (located in eastern Madison) Substations. Two 23-kV feeders from the Branford Substation and one 23-kV feeder from the Green Hill Substation supply power to a downstream distribution substation, the Guilford Substation, where voltage is reduced to 13.8 kV by two 12.5-MVA power transformers, and from where four 13.8-kV feeders emanate and serve the town center and portions of town east and west of Route 77 as far north as Route 80. The Guilford Substation is projected to exceed its load ratings as early as 2008. The Green Hill Substation benefited from the recent addition of a third 115- to 23-kV, 47-MVA power transformer; however, that additional capacity will be required to meet the growing needs in Madison and Clinton.

Q. What does this mean for the Guilford's present distribution system?

A. Currently, the small Guilford Substation serves the town center and portions of town east and west of Route 77 as far north as Route 80 with 13.8-kV service. A portion of the 23-kV supply line to Guilford Substation from Green Hill Substation follows a "swamp" route

through tidal-flow marsh land areas bordering Long Island Sound. This lengthy and older supply line, initially built in the 1930s, is susceptible to interruption from significant storm events and could be severely damaged by a strong hurricane. Severe damage to portions of the line occurred during hurricane Gloria in 1985. Similarly, the 23-kV supply feeders from Branford Substation to the Guilford Substation extend in the opposite direction along the coast, and share common structures. If these lines experience another catastrophic incident similar to hurricane Gloria, a large area of Guilford supplied by the Guilford Substation could be without power for an extended period of time.

Because direct circuit routes from Green Hill Substation to Guilford are all but exhausted, installing an inland bulk substation in north-central Guilford where load is growing, and which can provide a 23-kV feeder supply to the Guilford Substation, will provide not only much needed capacity and a means to reduce the loading on both the Branford Substation and the small Guilford Substation, but also increased reliability. Establishing a new bulk substation source north of the existing Guilford Substation will increase reliability by providing an additional, shorter 23-kV feeder supply line for the Guilford Substation that is away from the coastline and less susceptible to major storm events. Additionally, new 13.8-kV circuits from this new bulk substation can be used to take over some load east and west of Route 77 that is now served from the Guilford Substation so that the Guilford Substation will not be overloaded.

Q. How else will the new substation improve reliability?

A. CL&P is committed to the Connecticut Department of Public Utility Control's goal of a more reliable distribution system. By adding a new bulk power-supply substation source to the area, CL&P can improve reliability by the deployment of more recloser-loop schemes on the distribution feeders. Recloser-loop schemes minimize the number of customers that lose power during an outage when power is available from more than one direction or source. CL&P currently utilizes recloser-loop schemes, where possible, to minimize outages mostly associated with longer repair time events. Currently, the potential for utilizing these schemes is very limited in the Guilford area. The addition of a new bulk power substation in Guilford will bring not only needed capacity but additional feeders, allowing for the creation of more recloser-loop schemes between feeders, and thus enabling enhanced customer reliability. Also, planning for the needed substation capacity in this case presents an opportunity to prepare for when the coastline of Connecticut experiences another hurricane by improving the 23-kV sources to the Guilford Substation.

Q. Was this substation identified in the Council's "Review of The Ten Year Forecast of Connecticut Loads and Resources 2006-2015?"

A. Yes. References to the Stepstone Substation are found on page 22 and on a back-cover fold-out map of Connecticut that depicts the location of Proposed Substations and

switchyards planned for the state. The Council's similar reports in the three previous years of 2003, 2004 and 2005 also identified Stepstone Substation as a needed facility addition.

Q. Did CL&P examine system alternatives?

A. CL&P has considered an alternative system redesign option to meet the challenges in Guilford for the past several years. This alternative included adding a third large power transformer to each of the existing Branford and Green Hill Substations, each with associated distribution feeder circuit additions and changes. However, Green Hill Substation experienced a 20% peak-load growth from 2004 to 2006 and exceeded its capacity rating sooner than anticipated, requiring the prompt installation of a third 47-MVA transformer at this Substation in 2006-2007. [The Council approved this capacity modification to Green Hill Substation on August 24, 2005 under Petition No. 729.] The additional capacity at Green Hill Substation is needed primarily to meet the load growth in Madison, Killingworth and Clinton. Installing a third large power transformer in Branford Substation now is not a favored solution to adding a new bulk power substation in Guilford. This action would also require constructing additional 23-kV feeders from Branford to reach into northern and central Guilford (distances exceeding five miles from the power source) and would produce a Guilford distribution system that is not as reliable and flexible as the system which will result from the Project. Shorter feeder lengths, a significant back-up source for Guilford Substation's 13.8-kV load, and the

potential for utilizing more recloser-loop schemes within the area's distribution system are significant reliability benefits offered by the Project in comparison with the Branford Substation transformer alternative.

Q. Did CL&P explore distributed generation and demand response solutions?

A. Yes. CL&P considered that the addition of properly sized, properly located, available, and dispatchable distributed generation (interconnected to distribution feeders or customer-side), and/or demand response could mitigate the growing pressure on local electric distribution system capacity. Generally speaking, distributed generation ("DG") or demand response might assist in reducing some load on the feeders presently serving Guilford, however the reasonable-cost benefits and the added capacity of the Project will likely far exceed the opportunities for these alternatives.

DG proposals would need to address the following:

- A large number of small generators would be needed to match the capacity offered by the Project, quite likely more than the existing local distribution system could reliably interconnect with.
- The generators would need to be installed on customer premises or be interconnected to the CL&P distribution system rather than to the transmission system.
- The design of the local distribution system would need to be carefully reviewed to ensure multiple power-supply sources are appropriately integrated with the distribution system.

- The locations of protective devices on distributed generators and on CL&P's distribution feeders and operating practices would need to be reviewed: to protect customers, utility workers, and the distribution system from over-voltages, potential damage during line switching, and unexpected energizing of downed lines; and to protect the generators from automatic switching and reclosing on the distribution system.

Q. What success has CL&P had in promoting development of DG or similar solutions in Guilford?

A. CL&P has contacted a number of customers in the area to determine if they will consider installing DG or combined heat power ("CHP") projects. To date two parties are considering emergency diesel generators rated 170 kW and 1,350 kW respectively. These generators will not operate in parallel with the CL&P system. No other customers have expressed interest in installing DG or CHP in Guilford.

Q. What success has CL&P had in promoting development of Demand Side Management in the Guilford area?

A. CL&P's longstanding Conservation and Load Management ("CL&M") programs have only slightly reduced the rate of growth for summer peak demands in Guilford, and CL&P forecasts that any significant future reductions, on the scale of the proposed 47-MVA Project, would not be cost effective. Since 2005, CL&P's efforts in this area of Connecticut have achieved peak demand savings of approximately 3.3 MW and will save approximately

111,202,820 kWh of energy over the life of the installed measures for the customers in the towns of Guilford, Branford, Madison, Clinton and Killingworth..

Q. Did the CEAB solicit DG and Demand Side Management proposals as potential alternatives to the Stepstone Substation?

A. Yes. On December 29, 2006, the CEAB issued a request for proposals seeking alternatives to CL&P's proposed Stepstone Substation in Guilford. The CEAB received no responses to this request.

Q. How do these results from CL&P's experience with DG and Demand Side Management in this area reflect on the need for the Proposed Substation?

A. While there may be opportunities for small-scale distributed generation and demand response to contribute to the overall solution, but it is likely they will be quite limited in comparison to the Project. The size of the near-term load requirement and reliability issues are far greater than these alternative approaches could alleviate. The Project is the best way to address the growing load and reliability needs in Guilford.

4. LINE CONNECTIONS

Q. Where will the Proposed Substation interconnect with the transmission system?

A. The Substation would connect into the existing 115-kV overhead transmission line (1508 circuit) that interconnects the Branford Substation on Route 1 in Branford with the Green Hill Substation in Madison.

Q. Could you briefly describe how the Substation will be connected with the 115-kV line?

A. The transmission line would be "looped through" the Proposed Substation, and a new 115-kV circuit breaker will be installed in the 115-kV Substation bus to separate the existing transmission circuit #1508 into two circuits. The connections between the Substation and the 115-kV transmission line would be made by installing new spans of conductors from two new 85-foot-tall steel poles in the line to two line-terminal structures within the Substation, where each structure would support a line-disconnect switch and conductor drops to a 115-kV substation bus. Existing wood-pole line structures #5901 and #5902 would be removed and replaced by these two single-circuit steel poles on concrete foundations. The existing line conductors from the east and the west would be dead-ended on the line side of the new poles and would be connected at the pole to a new span of 1590-kcmil ACSR conductors which will bring the east and west line sections into the Substation. The new #5902 steel pole would be

located approximately 150 feet west of the existing #5902 wood structure and new steel pole #4988 (to replace #5901) would be located approximately 40 feet east of existing wood structure #5901.

Q. What does a "loop-through" design provide for the Substation?

A. When a line is looped through a substation, it creates two (2) independent portions of a line, or two (2) circuits. If one of the transmission circuits experiences a fault, only that circuit is interrupted, thereby allowing the other circuit to remain connected to the transmission grid and to supply the Substation and its load. When both circuits are in-service, power can flow to the substation over either line, and a path also exists for through-power flows from one circuit on to the other.

Q. Have you received approval from ISO-New England to interconnect this proposed new substation?

A. Yes, CL&P was notified on November 8, 2005, of ISO-New England's approval of the Project. See Appendix H of the Application, Volume 2 of 2.

5. SAFETY AND RELIABILITY OF SUBSTATION OPERATION

Q. How would reliability be maintained?

A. Continued reliability would be maintained by transformer protection devices and redundant automatic protective relaying equipment. Protective relaying equipment would provide automatic detection of abnormal conditions. When an abnormal condition occurs, a protective trip signal would be sent to the respective circuit breaker(s), for example, to isolate faulted equipment. The Company plans to install redundant protective relaying schemes to continue monitoring and provide protection should one system fail. Protective relaying equipment along with a Supervisory Control and Data Acquisition (SCADA) system that allows for monitoring and remote control of the equipment by the Connecticut Valley Electric Exchange would also be maintained by CL&P.

Q. Please discuss why CL&P believes there should be no public safety concerns.

A. The Proposed Substation would not pose a safety concern or create any undue hazard to the general public. The Proposed Substation would be designed and constructed in accordance with all applicable national, electric utility industry, state and, to the extent practical, local codes. The perimeter of the Proposed Substation would be surrounded by a seven-foot high chain-link fence with an additional foot of barbed wire on top. Gates in the fence would be

locked. A locked gate would also be installed across the driveway entrance. Visitors would be accompanied by Company employees, and they are required to adhere to prescribed safety standards including such procedures as the wearing of protective clothing and safety glasses.

Q. Will fire protection systems be maintained for the Proposed Substation?

A. CL&P complies with pertinent standards of the Institute of Electrical and Electronic Engineers, the American National Standards Institute and the National Fire Protection Association for fire protection in its substations. At the Proposed Substation, the relay and control enclosure would have fire extinguishers installed along with smoke and heat detectors. Other equipment monitoring devices would be monitored from a remote location including the SCADA system. Fire and smoke detection would activate an alarm at Connecticut Valley Electric Exchange, and the system operators would take appropriate action. Moreover the Substation will have protective relaying to quickly interrupt fault currents and minimize equipment damage, sumps to contain spilled transformer oil to quench any fire, and use of steel structures and enclosures as well as reasonable equipment separations.

In addition, CL&P trains its employees and local fire departments on safe methods to deal with a substation fire. The Guilford Fire Marshall has previous experience working with CL&P and is comfortable with CL&P's fire protection measures.

Q. Could you describe worker protection at the Proposed Substation?

A. In addition to the careful design and construction of the Substation in accordance with all applicable national, electric utility industry, state and, to the extent practical, local codes, strict procedures and training for worker safety will be maintained when employees and contractors are on the site. No employees will be permanently located at the Proposed Substation.

Q. Will the environment be protected from the insulating oil used in the transformers?

A. Yes. The transformers will contain non-polychlorinated biphenyl mineral oil insulating oil, and below-grade sumps will be designed to contain 110% of the volume of the transformer oil should there be any inadvertent release of oil.

Q. Does CL&P have any substations located in areas with residences?

A. CL&P has 234 substations, including approximately 100 substations with 69-, 115- and/or 345-kV facilities, and over half of CL&P's substations are in areas with adjacent residential development.

Q. What have you observed about the impact of CL&P's substations on residential development near CL&P's substation facilities?

A. From CL&P's experience, reasonably screened substations are acceptable to neighbors when you consider that residential development continues to move closer to many of CL&P's substations. CL&P attached aerial photographs taken in 2004 with its answer to Question 9 of the Council's first set of Interrogatories that provided views of the extent of residential development near several of CL&P's substations. As these photographs show, many homes are located approximately 200 feet from these substations and in some cases even closer.

6. ELECTRIC AND MAGNETIC FIELDS

Q. What are Electric and Magnetic Fields?

A. Electric fields ("EF") are produced when a voltage is applied to a conductor. The level of an electric field at a given location depends on the magnitude of the voltage applied, the spacing between conductors and the distance between them.

Magnetic Fields ("MF") are produced when electric current flows on a conductor. The level of a magnetic field at a given location depends on the magnitude of the current, the spacing of the conductors, and the distance from them. Levels of each field fall off quickly as the

distance from the conductor source is increased. Objects such as trees or building walls easily block electric fields, but magnetic fields penetrate most materials.

EF and MF are collectively referred to as "EMF".

Q. Did the Company perform an analysis of the existing EMF and potential EMF if the Proposed Substation was in operation, and if so, what was the outcome?

A. Yes. The highest levels of electric and magnetic fields that are found around the perimeter fence of a substation come from the transmission and distribution lines which enter and leave the substation. The level of fields produced by the substation equipment that is inside the fence will decrease very rapidly with distance, reaching very low levels at short distances beyond substation fences. Typical background magnetic field levels in residences range up to 4 milligauss ("mG"), and the magnetic fields off the property of a substation due to currents in the substation equipment will commonly be in this same range.

Q. What effect will the Proposed Substation equipment within the fenced area have at CL&P's property line?

A. Since the fence of the Proposed Substation is more than 200 feet from all points along CL&P's property line, the substation equipment within the fenced area will not cause any measurable change in electric or magnetic fields along the property line.

Q. Do magnetic fields ("MF") currently exist at the property lines of the Proposed Substation?

A. Yes. A 115-kV transmission line (circuit #1508) now crosses over the property, and the east and west property lines and is a source of MF at the property line in its near vicinity. Also, 13.8-kV distribution lines along Route 77/Durham Road and Stepstone Hill Road border the property line and are sources of MF.

Q. What changes in EMF will be expected if the Proposed Substation is constructed?

A. The Substation equipment will not produce measurable increases in EMF at the property lines, but its operation will lead to a general increase in currents on the 115-kV line segment crossing over the westerly property line and a small decrease in currents on the 115-kV line segment crossing over the easterly property line.

Because new poles will be constructed to loop the existing 1508 transmission circuit in and out of the Proposed Substation, the configuration and spacing of the 115-kV line conductors where these cross over the easterly and westerly property lines will be altered. This will cause small changes in the electric and magnetic fields along the easterly and westerly property lines for a short distance on either side of the transmission line. Changes in magnetic field levels at these locations will also be caused by the aforementioned changes in currents on the transmission line conductors.

Q. How have you estimated the post-project electric and magnetic fields?

A. Yes. Calculations were made of post-project electric and magnetic fields produced by the transmission circuit along the westerly property line with Route 77/Durham Road and along the section of the easterly property line which crosses beneath the transmission circuit, using the expected conductor configurations and heights over their property line crossings. Projected peak line currents in the year 2013, determined by system power-flow model simulations, were used for these calculations. Assumptions used in the system power-flow model were ISO-NE's forecast system summer peak load in 2013, no transmission circuit outages, Stepstone Substation installed as proposed and with projected load transfers from Branford and Green Hill Substations, a realistic generation dispatch and Connecticut power import expectation for the peak-load day, and a generation and transmission system which reflects all Council-approved additions and changes which are expected to be completed by 2013. The system model projections of peak currents over this specific transmission line in future years through to 2013 are below 400 amperes.

In the application both electric and magnetic field calculations are shown for peak-day average load conditions and for peak-load conditions. The results depicted in Figures M2 and M3 demonstrate that MF levels beneath and close to the 115-kV line along the westerly property line will increase under both of the load conditions, and MF levels beneath and close to the

115-kV line along the easterly property line depicted in Figures M4 and M5, will decrease under both of the load conditions.

The MF levels continue to drop off rapidly with distance from the transmission line source, so the levels of MF at all points along a property boundary to the north and south of the transmission circuit will be much lower than the levels found beneath the circuit. Beyond distances of not more than 200 feet from the center of the circuit, MF levels will remain at very low background or negligible levels.

Q. Would there be any EMF changes at the property line from sources other than the 115-kV line after the Proposed Substation is built?

A. Yes. Underground 13.8-kV and 23-kV distribution getaway cables are planned to exit the Proposed Substation under the Proposed Substation access drive to the south towards Stepstone Hill Road. Current flows over these distribution cables will produce magnetic fields along the property line where they cross or parallel it, with measurable field levels possibly extending to a distance of 50 feet to either side. And the existing overhead distribution lines along the property line with Stepstone Hill Road will produce different levels of magnetic fields because of changes in the currents these lines will carry. As a rule, the highest electric and magnetic field levels in the vicinity of these distribution lines will be lower than those associated with the 115-kV line.

Q. Has the Company considered the Council's EMF Best Management Practices?

A. Yes. Consistent with the Connecticut Siting Council's Electric and Magnetic Field Best Management Practices, February 11, 1993 and its Draft of September 28, 2006, version Electric and Magnetic Field Best Management Practices for the Construction of Electric Transmission Facilities in Connecticut, the design of the Substation will incorporate field management practices as follows:

- the Substation equipment has been located at a sufficient distance from property lines so that this equipment makes no noticeable contribution to EMF levels along these property lines
- the Substation has been located very close to an existing transmission line so that the length of Substation entry spans is very short
- vegetation will effectively screen electric fields
- new 13.8-kV distribution lines and a new 23-kV distribution line will exit the Substation underground to Stepstone Hill Road with close circuit spacings and conductor-phase spacings

Q. Has the Company complied with State and Federal EMF standards?

A. There are no State or Federal limits to electric or magnetic field levels at the property line of a substation; however, the Institute of Electrical and Electronic Engineers and the International Commission on Non-Ionizing Radiation Protection have issued guideline limits for long-term public exposure to magnetic fields. These guideline limits are 9,040 mG for the Institute of Electrical and Electronic Engineers and 833 mG for the International Commission on

Non-Ionizing Radiation Protection.

Q. How will the MF from the Proposed Substation compare with those guidelines?

A. The existing and proposed levels of magnetic fields at and beyond the property lines of the substation are well below these limits and typical for all similar substations. Based on these aforementioned guidelines and science peer group reviews of epidemiological and laboratory studies, these magnetic field exposure levels will not pose an undue safety or health hazard to persons or property at or adjacent to the substation property.

7. MUNICIPAL CONSULTATIONS

Q. Did you consult with officials of the Town of Guilford? If so, please provide details of those consultations.

A. Yes. Prior to the required municipal consultation process, CL&P representatives and Town officials held discussions about the need for a new substation to better serve the residents of Guilford and surrounding communities as well as to provide capacity for load growth within the Town.

CL&P also consulted with the Guilford Inland Wetlands Commission ("IWC") as to the location of the Substation and filed a permit application on July 6, 2006. The IWC approved the

location for the Substation at its site walk meeting in August, 2006 as noted in its letter to CL&P dated September 6, 2006.

In addition, the P&Z unanimously approved the location of the Substation subject to certain conditions in a letter dated September 29, 2006. CL&P subsequently discussed with the P&Z some issues CL&P had with a few of the conditions included with the approval. On October 18, 2006, CL&P's and the Town's concerns were resolved resulting in the P&Z modifying its conditions, as documented in its letter filed with the Council dated October 26, 2006.

As mentioned earlier, CL&P has discussed this Project with the Guilford Fire Marshall. Subsequent to these meetings, CL&P filed its Municipal Consultation Filing ("MCF") with the Town of Guilford CEO on October 5, 2006. In response to the MCF, First Selectman for the Town of Guilford, Carl A. Balestracci, Jr., sent a letter of support for the Project to CL&P on October 27, 2006,

8. NOTICES TO NEARBY PROPERTY OWNERS

Q. What measures were undertaken to inform the public and the property owners in the vicinity of the Project?

A. As more fully described in Section Q of the Application, Volume I of II, the legal notice for the Project was published on several occasions in the New Haven Register. In addition, notices were sent by certified mail to all abutters and nearby owners. See Exhibit 1 of the Application in Volume 1 of 2.

Q. What was the outcome of the certified mailing to all abutters and nearby owners?

A. Four letters were returned as unclaimed by the property owner. Certified mail receipts were received from the remaining abutters and nearby owners listed in Exhibit 1. Notices to addresses of the unclaimed letters were subsequently mailed by first class mail.

Q. Does this conclude your testimony?

A. Yes.

List of Exhibits

A. Witness Resumes

Robert E. Carberry
Manager, Transmission Siting and Permitting
Northeast Utilities Service Company
Hartford, Connecticut

Robert E. Carberry
Manager – Transmission Siting and Permitting
Northeast Utilities Service Company
Hartford, Connecticut

April, 2007

Education:

Bachelor of Science in Electric Power Engineering, June, 1972, Rensselaer Polytechnic Institute, Troy, NY

Master of Engineering in Electric Power Engineering, June 1973, Rensselaer Polytechnic Institute, NY

Management Development Program, Hartford Graduate Center, 1989

Experience:

June 1973 to March 1974 - Bechtel Associates Professional Corp., electrical design of Midland nuclear plant including load flow and voltage studies.

March 1974 to March 1975 - NUSCO, Protection Engineering Section. Performed relay settings and assisted Transmission Line Engineering.

March 1975 to March 1984 - NUSCO, Transmission Line Engineering. Standards, investigations and studies for permanent and temporary grounding, radio and audible noise, electrical/biological effects of AC fields, special insulation, thermal rating studies and research projects, high phase order, HVDC, compact line design, insulated shield wires, and lightning performance.

March 1984 to April 1985 - NUSCO, Substation Project Engineering. Project conceptual development and management plus associated studies and standards activities.

April 1985 to March 1988 - NUSCO, Substation Project Engineering Manager.

March 1988 to November 1992 - NUSCO, Manager of Substation Engineering and Design.

December 1992 to June 1997 - NUSCO, Manager of Transmission Line and Civil Engineering.

June 1997 to October 2000 - NUSCO, Manager of T&D Asset Strategy.

October 2000 to September 2001 - NUSCo, Manager of Transmission Engineering.

September 2001 to March 2003 - NUSCO, Project Manager – Bethel to Norwalk Transmission Project.

March 2003 to October 2004 - NUSCO, Project Director – Bethel to Norwalk Transmission Project.

October 2004 to Present – NUSCO, Manager – Transmission Siting and Permitting.

NU's EMF expert 1975- present and leader of the NU EMF Task Force established in 1990.

Other Experiences:

Adjunct Faculty Member, University of Hartford, College of Engineering, January to May, 1987. Conducted portions of course in Power Systems Analysis.

T&D Emergency plan assignment as First Deputy to the Director, Electric, a liaison position with the CT Office of Emergency Management, 1985 to 2002.

Member of Advisory Committee serving the Connecticut Interagency EMF Task Force, 1991 to present.

Professional Engineering Registration: Connecticut and Massachusetts

Industry and Professional Society Activities/Senior Member, IEEE (1983)

IEEE Power Engineering Society, Transmission and Distribution Committee memberships.

1) Corona and Field Effects (C&FE) Subcommittee, Member 1976 to present, Vice Chairman 1983 to 1985.

2) C&FE Working Groups on AC Fields and Audible Noise, 1976 to present.

3) Chairman of C&FE Working Group on Design and Environmental Considerations, 1977 to 1985.

4) Secretary and Vice Chairman of Administrative Subcommittee's Coordinating Group on Environment, Safety and Public Affairs, 1981 to 1984.

IEEE Power Engineering Society, Substations Committee memberships

1) Substations Committee, member 1987 to 1995

2) Environmental Subcommittee and Associated Working Groups, member 1985 to 1995.

3) Various Working Groups of the Distribution Substations Subcommittee and the Gas Insulated Substations Subcommittee, member 1985 to 1995.

Edison Electric Institute - Chairman of the Electric Light and Power group delegation to the American National Standards Committee C63 on Electromagnetic Compatibility, 1980 to 1985.

Electric Power Research Institute - Industry advisor on project RP1591, Assessment of AC Transmission Line Field Effects, 1982 to 1984. NU representative on Transmission Line Business Unit Council, October, 1995 to December, 1996, and on EMF/RF Area Council, 2005-present.

International Electrotechnical Commission, CISPR C - Member of an advisory group assisting the Technical Advisor to the U.S. National Committee of the IEC on matters pertaining to interferences from overhead power lines, 1980 to 1988.

Edison Electric Institute - EMF Task Force, 1990 to present: EMF Steering Committee 1995 to 2003.

Professional Recognitions:

IEEE PES Working Group Recognition and/or Prize Paper Awards

- AC Fields Working Group (1992)
- Working Group on Design and Location of Substations for Community Acceptance (1992)
- Substation Security Working Group
- "A Survey of Methods for Calculating Transmission Line Conductor Surface Voltage Gradients," 1980
- "Corona and Field Effects of AC Overhead Transmission Lines: Information for Decision Makers," 1986

Kenneth B. Bowes
Director, Transmission Projects
Northeast Utilities Service Company
Berlin, Connecticut

Kenneth B. Bowes
Director, Transmission Projects
Northeast Utilities Service Company
Berlin, Connecticut

RESUME

Director, Transmission Projects, 2004 - Present

- Responsible for the project management of transmission projects in the three-state service area for Northeast Utilities. Development of the scope definition, budget and schedule for >$100 million in annual project spending. Responsible for the administration of Transmission contracts and project cost & scheduling departments.

Director, Transmission Construction, Test & Maintenance, 2002 - 2004

- Responsible for the field construction, test and maintenance of the transmission system for Northeast Utilities. Development and staffing of the new 150 employee organization to assume transmission O&M functions including safety and environmental programs and compliance for the Transmission Business.

Director, Transmission & Distribution Maintenance, 1999 - 2002

- Responsible for the operation and maintenance of the transmission system, substation facilities, and the underground network system for CL&P. Process Owner of Maintenance for Northeast Utilities System. Direct management of 375 employees including: union line workers, electricians, general utility workers, underground cable splicers, test personnel, central maintenance workforce, and the Technical Services department. Provide expert testimony in lawsuits and regulatory proceedings.

Manager, Technical Services, 1997 - 1999

- For the Retail Business Group, manage a technical support department with staff of 55 employees and annual budget of $4 million. Responsible for: environmental operations, telecommunication network systems, process computers, mobile radio, paging, radio control, SCADA, telemetry systems, distribution automation, chemistry laboratory, corrosion control, and support services for the Northeast Utilities System.

Team Leader, Market Management Industrial Accounts, 1995 - 1997

- For the Retail Marketing Group, establish the strategic direction of the Industrial Market Segment, including the preparation of marketing plans, development of value-added services, strategic partnerships, sales and marketing materials, and direct sales support.

Senior Engineer and Section Lead - Laboratory Services, 1993 - 1995

- For the Technical Services Department, establish and define the section workload, assign, schedule and track activities and expenditures. Represent the electric utility industry on national technical committees and panels. Perform complex power engineering assignments requiring a high standard of professional technical competence including: new energy conservation technologies, power conditional equipment, electric vehicles, railway electrification, and transmission and distribution grounding studies.

Engineer - Laboratory Test, Standards Laboratory, 1984 - 1985, 1986 - 1992

- For the System Test Department, primarily responsible for power quality investigations to determine the causes of power system disturbances and their cost effective mitigation. Other duties include the metrology of the electrical standards used for the corporation. Inter-laboratory comparisons with the National Institute of Science and Technology, manufacturers, and other utilities.

Assistant Engineer - Area Operations, 1985-1986

- Performed engineering assignments in the support of the design, analysis, construction, operation, and maintenance of the electric distribution system. Customer relations skills were developed through the coordination and scheduling of customers, contractors, and other utilities for the installation and maintenance of electric service.

EDUCATION

M.S.E.E. 1990, Concentration in Telecommunications and Information Processing

- Rensselaer Polytechnic Institute, Hartford, Connecticut

B.S.E.E. 1984, Electronic Systems Option

- University of New Hampshire, Durham, New Hampshire
  Grant State Honor Scholarship

PUBLICATIONS

- IEEE Working Group on Nonsinusoidal Situations, "Practical Definitions for Powers in Systems with Nonsinusoidal Waveforms and Unbalanced Loads: A Discussion", 95 WM 040-6 PWRD, 1995
- IEEE Working Group on Nonsinusoidal Situations, "A Survey of North American Electric Utility Concerns Regarding Nonsinusoidal Waveforms", 95 WM 036-4 PWRD, 1995
- Bowes, K. B., "The Effects of Temporary Overvoltage (TOV) on Consumer Products", POWER QUALITY '91 USA, Official Proceedings of the Third International Power Quality Conference, Universal City, CA, September 22-27, 1991
- Bowes, K. B., Lorusso, A., "Harmonic and Power Characteristics of Electronic Ballasts for Fluorescent Lighting Applications", POWER QUALITY '90 USA, Official Proceedings of the Second International Power Quality ASD Conference, Philadelphia, PA, October 21, 29, 1990
- Anderson, L.M., Bowes, K.B., "The Effects of Power-line Disturbances on Consumer Electronic Equipment", IEEE Transactions on Power Delivery, Volume 5, Number 2, pp. 1062-65, April 1990
- Bowes, K. B., "The Effects of Power-line Disturbances on Electronic Products", POWER QUALITY '89 USA, Official Proceedings of the First International Power Quality Conference, Long Beach, CA, October 15-20-1989 (Also edited and reprinted in Power Quality Magazine - Premier V Issue)

PROFESSIONAL AFFILIATIONS

- Edison Electric Institute, Transmission Committee – 1st Vice Chairman, 2006
- IEEE Working Group on Nonsinusoidal Situations, 1993 - 1998 (Winner of 1998 IEEE Working Group Award)
- National Fire Protection Association (NFPA), National Electrical Code, Subcommittee on Nonlinear Loads, 1993

HELEN H. WONG
Transmission Project Manager
Northeast Utilities System

RESUMEŚ

HELEN H. WONG
Transmission Project Manager
Northeast Utilities System

107 Selden Street
Berlin, CT 06037
WongHH@NU.com

EXPERIENCE

Northeast Utilities

- Project Manager in the Transmission Group at Northeast Utilities. In addition to being the Project Manager for the proposed Stepstone Substation, Ms. Wong is responsible for Plumtree-Triangle 115 kV Transmission Line Upgrade project between the Plumtree substation in Bethel and the Triangle substation in Danbury, and was the Project Manager for the Long Island Replacement Project, as well as various, substation modification projects. Duties include project costs, engineering, siting, environmental impacts, regulatory applications, transmission system impacts, and construction.

- Ms. Wong Joined Northeast Utilities in 1976 as a Nuclear Engineer at the Connecticut Yankee Nuclear Power Plant. She has also held positions in Project Management, Outage Planning, Cost and Schedule Control, Rates, Conservation and Load Management, Environmental Services, and Principal at Charter Oak Energy. She was involved in the project management during construction and Operations of Millstone Unit 3 nuclear power plant in Waterford, CT.
Wong was a Project Director for developing power plants in China and Mexico. She holds the distinction of being the first woman in the United States to have obtained a Senior Nuclear Reactor Operator license in her first attempt. She is a past recipient of the Connecticut Women in Leadership Award for contributions to her profession and the community.

CREDENTIALS

Bachelor of Science degree in Chemistry from National Taiwan University.
Master of Science degree in Chemistry from Fisk University.
Master's degree in Business Administration from the University of New Haven.
Master's Certificate in Project Management from the George Washington University.
Project Management Professional Certificate from the Project Management Institute.
Graduate study in Civil/Environmental Engineering at the University of Cincinnati.

Robert J. Charpentier
Project Engineering Manager
Northeast Utilities

RESUMEŚ

Robert J. Charpentier
Project Engineering Manager
Northeast Utilities

Years of Experience: 24

SUMMARY OF WORK EXPERIENCE

Twenty-four years experience in the Substation Engineering Dept. at Northeast Utilities; an investor-owned utility. The first two years were in the Protection Engineering Section. The last twenty-two years have been in the Substation Project Engineering Section where I've served as both Project Engineer for Substation Projects and Power Transformer Specialist for all of NU, including Generating Stations. Additionally, during 2002-2004 I served as the transmission cable specialist with team lead responsibility for another engineer in addition to Power Transformer Specialist and Project Engineer duties. For the past three years I've worked as a Project Engineering Manager in Distribution Substation Engineering with specialist responsibilities for metalclad switchgear.

EDUCATION

Worcester Polytechnic Institute - BSEE in Electrical Engineering (Power Option) 1983

University of New Haven - I took a number of courses towards an MBA

LICENCES

Registered Professional Engineer in the State of Connecticut (Lic. # PEN. 19683)

EMPLOYMENT HISTORY

Northeast Utilities, Berlin CT
Project Engineering Manager 5/04 to Present

Moved to Distribution Substation Engineering and took on Project Manager/Project Engineer responsibilities along with specialist responsibility for metalclad switchgear. Major projects assigned to me this past year include rebuild of West Springfield 13.8-kV open bus (multi-year, $8 million dollar project) and rebuild of Doreen open bus along with purchase of a number of metalclad switchgear lineups.

Northeast Utilities, Berlin CT
Principal Engineer 3/02 to 5/04

In addition to substation engineering duties described below, took on responsibility as transmission cable specialist for NU. Projects worked on in the past two years include the Long Island replacement cable project, Bethel-Norwalk project, Middletown-Norwalk project and most recently the Glenbrook-Norwalk cable project. Along with specialist responsibility, took team leader responsibility for another cable engineer. Also involved in specifying the first shunt reactors for the NU system along with the first applications of transmission single phase autotransformers. Also assigned as project engineer for a large substation rebuild project at Haddam S/S.

Northeast Utilities, Berlin CT
Senior Engineer 3/90 to 3/02

Responsible for a number of substation projects including coordinating with cogenerators connecting to the NU system and leading a significant installation at a municipal utility (Bozrah Light & Power). Also responsible for specifying, evaluating bids, reviewing drawings and witnessing testing of all power transformers for NU. During this time frame also took delivery of four mobile transformers/substations, which are complicated pieces of equipment requiring significant oversight. In early 1992 took responsibility for arrester applications. In 1994 took responsibility for engineering liaison work associated with insulator coatings (RTV) used to combat insulator contamination. Have taken on Protection/Controls responsibility on a number of projects in addition to Project Engineering duties in order to meet project schedules. Provided preliminary scoping input on major projects such as summer capacity projects (1996-1997), and Compo S/S rebuild. Wrote packaged substation specification for Compo (1996). Have PE responsibility for rebuild of Town of Wallingford's Wallingford 13M substation along with Protection/Controls responsibility. (1998-2001). PE for South Agawam S/S and Berkshire Power interconnection which required numerous regulatory approvals including testifying before the Massachusetts Dept. of Telecommunications and Energy. (1998-present)

Northeast Utilities, Berlin CT
Engineer 5/87 to 3/90

Responsibility for a number of substation projects including 115 kV capacitor installations at six substations. Also responsible for specifying, evaluating bids, reviewing drawings and witnessing testing of all power transformers for NU.

Northeast Utilities, Berlin CT
Associate Engineer 6/85 to 5/87

Responsibility for a number of substation projects. Took initiative to lead study for first installation of capacitors at 115 kV. Assisted switchgear specialist. Took over partial responsibility for EMF bioeffects issues. Also began in 11/86 as Power Transformer Specialist for NU. Responsibilities included specifying, evaluating bids, reviewing drawings and witnessing testing of all power transformers for NU.

Northeast Utilities, Berlin CT
Assistant Engineer 2/85 to 6/85

Responsibility as Project Engineer for a few minor projects. Performed ferroresonance study.

Northeast Utilities, Berlin CT
Assistant Engineer 2/83 to 2/85

Worked in Protection Engineering. Performed a number of studies including coordination studies in a generating plant, practical uses for programmable controllers and evaluated new distance relay technologies. Performed settings of line step distance relays, line directional comparison blocking schemes, line permissive overreaching schemes, transformer differential relays and overcurrent coordination.

SPECIAL AWARDS

Received the 1990 Chairman's Excel Award for cost savings associated with the installation of capacitors at 115 kV.

Received the 2000 President's Award as part of a team that developed new methods for rating substations.

AFFILIATIONS

Member IEEE

Michael D. Carlson
Principal Engineer
Northeast Utilities service Company

Michael D. Carlson

18 Lancaster Road
Cromwell. CT 06416
(860) 665-6766 (W) (860) 635-0077 (H)

Summary of qualifications

Northeast Utilities Service Company
Berlin, CT

2003-Present Principal Engineer
1985-2003 Senior Engineer
1975-1985 Engineer
1973-1975 Associate Engineer
1971-1973 Assistant Engineer

All positions were within the Transmission Line & Civil Engineering Section.

Position Summary:

To supervise and train direct reports in the design and construction of new or modifications to transmission line facilities for the NU system.

To act as project leader\manager in support of the design and construction of new or modifications to transmission line facilities for the NU system.

Primary Duty:

1. Engineer\design, schedule, material acquisition, obtain\review permits required from regulatory agencies and assist construction to completion of new\modifications to NU transmission system.
2. Assist in Storm Restoration of T&D facilities.

Sole Department Duties:

1. Responsible for material standards for the NU transmission system which includes reviewing and qualifying prospective vendors.
2. Responsible for conceptual designing and providing material and construction cost estimates, for decision making purposes, for future system proposals sand alternatives.
3. Transmission Line Section interface with Connecticut Department of Transportation and Massachusetts Department of Public Works for highway projects which may affect the NU transmission system.

The Hartford Electric Light Company
Cumberland Avenue
Wethersfield, CT

Summer 1970 Construction Representative

Worked for the Construction Department following ongoing projects.

Education

1967 - 1971

University of Connecticut; Hartford and Storrs, CT

Received Bachelor of Science Degree in Civil Engineering

Professional experience

Major Projects Completed:

1. Independent Power Plants

   Project Engineer responsible for the interconnection of several independent power plants in Connecticut and Massachusetts to the NU transmission system

2. Summer 1997 Capacity Projects:

   Project Engineer for the Agawam - Chicopee 115-kV Reconductor project. Also ordered and follow purchase orders on companion project Agawam - North Bloomfield 115-kV Reconductor project. These projects required an all out effort as the lead time was less than half of what normally would be scheduled.

2. Millstone - Manchester 345-kV Line:

   Engineered and field monitored the construction of 47 miles of transmission line in support of Millstone Unit #3

3. Chestnut Junction - Black Pond Junction 115/345- kV Lines:

   Engineered and field monitored the construction of a new 345-kV line, relocation of an adjacent 115-kV line and reconstruction of junction points to accommodate new construction.

Awards

Received two SPOT Recognition Awards:

1. For innovative design at Stony Hill Substation to modify transmission supply (1996).
2. For letter of commendation from the Commissioner of the Connecticut Department of Transportation on highway relocation project in Stamford (1996).

Professional Licenses

Professional Engineer Licenses in Connecticut and Massachusetts

Seminars \ Training

Have attended the following seminars:

1. Engineering and Construction Law Seminar
2. ECNE Annual Transmission and Distribution Seminar (1994)
3. Transmission Underground Seminars sponsored by the University of Connecticut.
4. Northeast Transmission Line Group Meeting
5. Hubble Power Systems Seminar
6. PDC Underground Cable Systems: Principles and Practices

William H. Bailey, Ph.D.
Exponent®
Principal Scientist and Director, New York Office

RESUMEŚ

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William H. Bailey, Ph.D.
Principal Scientist and Director, New York Office

Professional Profile

Dr. William H. Bailey is a Principal Scientist in Exponent's Health Sciences practice and Director of the New York office. Before joining Exponent, Dr. Bailey was President of Bailey Research Associates, Inc., the oldest research and consulting firm with specialized expertise in electromagnetic fields and health. 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. Dr. Bailey was one of the scientists invited from the U.S. and 9 other countries to evaluate possible health hazards of exposures to static and extremely low frequency (ELF) electric and magnetic fields for the International Agency for Research in Cancer in 2002. Most recently, he has been invited to participate in the International Workshop on EMF dosimetry and biophysical aspects relevant for setting exposure guidelines, organized by the International Commission on Non-ionizing Radiation Protection (ICNIRP). He also participated in a working group that advises a committee of the World Health Organization on risk assessment, perception, and communication. Currently, he is involved in research on 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.

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 (Subcommitee 3, Safety Levels with Respect to Human Exposure to Fields (0 to –3 kHz) and Subcommitte 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);

Invited Speaker, First Institute of Neurological Sciences Symposium in Neurobiology, University of Pennsylvania (1980); Invited Speaker, National Heart and Lung Institute (1977).

Prior Experience

Bailey Research Associates, Inc., President, 1991-2000
Environmental Research Information, Inc., Vice President, 1987-1990
New York State Institute for Basic Research, Head of Laboratory of Environmental Toxicology and Neuropharmacology, 1983-1987
The Rockefeller University, Assistant Professor, 1976-1983

Publications

Bailey, WH, Erdreich, L. Accounting for human variability and sensitivity in setting standards for electromagnetic fields. Health Phys 2006 (in press).

Bailey, WH, Nyenhuis, JA. Thresholds for 60-Hz magnetic field stimulation of peripheral nerves in human subjects. Bioelectromagnetics 2005; 26:462–468.

Bracken TD, Senior RS, Bailey WH. DC electric fields from corona-generated space charge near AC transmission lines. IEEE Transactions on Power Delivery 2005; 20:1692-1702.

Bailey WH. Dealing with uncertainty in formulating occupational and public exposure limits. Health Phys 2002; 83: 402–408.

Bailey WH. Health effects relevant to the setting of EMF exposure limits. Health Phys 2002; 83:376–386.

Kavet R, Stuchly MA, Bailey WH, Bracken TD. Evaluation of biological effects, dosimetric models, and exposure assessment related to ELF electric- and magnetic-field guidelines. Applied Occupational and Environmental Hygiene 2001; 16:1118–1138.

Bailey WH. ICNIRP recommendation for limiting public exposure to 4 Hz–1 kHz electric and magnetic fields. Health Phys 1999; 77:97–98.

Bailey WH. Principles of risk assessment with application to current EMF risk communication issues. In: EMF Risk Perception and Communication, Repacholi MH, Muc, AM (eds.), World Health Organization, Geneva, 1999.

De Santo RS, Bailey, WH. Environmental justice tools and assessment practices. Proceedings, 1999 American Public Transit Association, 1999.

Bailey WH, Su SH, Bracken TD. Probabilistic approach to ranking sources of uncertainty in ELF magnetic field exposure limits. Health Phys 1999; 77:282–290.

Bailey WH. Field parameters. Proc. EMF Engineering Review Symposium, Status and Summary of EMF Engineering Research, Bracken TD, Montgomery JH (eds.), Oak Ridge National Laboratory, Oak Ridge, TN, April 28–29, 1998.

Bailey WH. Policy implications. Proceedings, EMF Engineering Review Symposium, Status and Summary of EMF Engineering Research, Bracken TD, Montgomery JH (eds.), Oak Ridge National Laboratory, Oak Ridge, TN, April 28–29, 1998.

Bailey WH. Probabilistic approaches to deriving risk-based exposure guidelines: application to extremely low frequency magnetic fields. In: Non-Ionising Radiation, Dennis JA and Stather JW (eds.), Special Issue of Radiation Protection Dosimetry 1997; 72:327–336.

Bailey WH, Su SH, Bracken TD, Kavet R. Summary and evaluation of guidelines for occupational exposure to power frequency electric and magnetic fields. Health Phys 1997; 73:433–453.

Bracken TD, Senior RS, Rankin RF, Bailey WH, Kavet R. Magnetic field exposures in the electric utility industry relevant to occupational guideline levels. Appl Occupat Environ Hyg 1997; 12:756–768.

Blondin J-P, Nguyen D-H, Sbeghen J, Goulet D, Cardinal C, Maruvada P-S, Plante M, and Bailey WH. Human perception of electric fields and ion currents associated with high voltage DC transmission lines. Bioelectromagnetics 1996; 17:230–241.

Bailey WH, Charry JM. Acute exposure of rats to air ions: effects on the regional concentration and utilization of serotonin in brain. Bioelectromagnetics 1987; 8:173–181.

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. Proceedings, Twenty-Third Hanford Life Sciences Symposium, Interaction of Biological Systems with Static and ELF Electric and Magnetic Fields, 1987.

Pavildes C, Aoki C, Chen J-S, Bailey WH, Winson J. Differential glucose utilization in the parafascicular region during slow-wave sleep, the still-alert state and locomotion. Brain Res 1987; 423:399–402.

Bailey WH, Charry JM. Behavioral monitoring of rats during exposure to air ions and DC electric fields. Bioelectromagnetics 1986; 7:329–339.

Charry JM, Shapiro MH, Bailey WH, Weiss JM. Ion-exposure chambers for small animals. Bioelectromagnetics 1986; 7:1–11.

Charry JM, Bailey WH. Regional turnover of norepinephrine and dopamine in rat brain following acute exposure to air ions. Bioelectromagnetics 1985; 6:415–425.

Bracken TD, Bailey WH, Charry JM. Evaluation of the DC electrical environment in proximity to VDTs. J Environ Sci Health Part A 1985; 20:745–780.

Gross SS, Levi R, Bailey WH, Chenouda AA. Histamine modulation of cardiac sympathetic responses: a physiological role. Fed Proc 1984; 43:458.

Gross SS, Guo ZG, Levi R, Bailey WH, Chenouda AA. 1984. Release of histamine by sympathetic nerve stimulation in the guinea pig heart and modulation of adrenergic responses. Circulation Res 1984; 54:516–526.

Dahl D, Bailey WH, Winson J. Effect of norepinephrine depletion of hippocampus on neuronal transmission from perforant pathway through dentate gyrus. J Neurophysiol 1983; 49:123–135.

Guo ZG, Gross SS, Levi R, Bailey WH. Histamine: modulation of norepinephrine release from sympathetic nerves in guinea pig heart. Fed Proc 1983; 42:907.

Bailey WH. Biological effects of air ions on serotonin metabolism: Fact and fancy. In: Conference on Environmental Ions and Related Biological Effects, pp. 90–120, Charry JM (ed.), American Institute of Medical Climatology, Philadelphia, PA, 1982.

Weiss JM, Goodman PA, Losito BG, Corrigan S, Charry JM, Bailey WH. Behavioral depression produced by an uncontrollable stressor: Relationship to norepinephrine, dopamine, and serotonin levels in various regions of rat brain. Brain Res Rev 1981; 3:167–205.

Bailey WH. Ion-exchange chromatography of creatine kinase isoenzymes: A method with improved specificity and sensitivity. Biochem Med 1980; 24:300–313.

Bailey WH, Weiss JM. Evaluation of a 'memory deficit' in vasopressin-deficient rats. Brain Res 1979; 162:174–178.

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

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Presentations

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

Bailey, WH, Bracken, TD, Senior, RS. Long-term monitoring of static electric field and space charge near AC transmission Lines. The Bioelectromagnetics Society, 26th 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, 35th Annual Meeting, Palm Desert CA, June 2002. American Journal of Epidemiology. 155:S38, 2002.

De Santo, RS, Coe, M, Bailey, WH. Environmental justice assessment and the use of GIS tools and methods. National Association of Environmental Professionals, 27th 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.

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

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

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. 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, Charry JM. Particle deposition on simulated VDT operators: influence of DC electric fields. Tenth 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. Tenth 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. 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^3 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. Seventh 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.

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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. Twenty-third 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, Alsonso 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.

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

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

Academic and Research Appointments

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

Advisory Positions

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

- Member, International Committee on Electromagnetic Safety, Subcommittee 3 - Safety Levels with Respect to Human Exposure to Fields (0 to 3 kHz) and Subcommitee 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
- 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