THE CONNECTICUT SITING COUNCIL
DOCKET NO. 272

Application of Northeast Utilities Service Company
for a Certificate of Environmental Compatibility
and Public Need for a new 345-kV Electric Transmission Line Facility
between Scovill Rock Switching Station in Middletown
and Norwalk Substation in Norwalk

Supplemental Testimony Concerning Background Levels and Statutorily Required Buffer Zones of

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Q. What is the purpose of this testimony?

A. The purpose of this testimony is to provide the Siting Council with reliable information regarding the appropriate targets for the establishment of safety buffer zones around overhead power lines in the State of Connecticut.

Q. From a health perspective, what is the purpose of safety buffer zones around power lines?

A. The purpose of safety buffer zones is to protect susceptible individuals from the harmful effects of EMF. Particularly susceptible individuals include children less than 19 years of age with whom EMF exposure is associated with a statistically significant increase in the risk of leukemia. By excluding the presence of such individuals from such safety buffer zones, the exposure of the susceptible population to the harmful effects of EMF will be lessened and the public health of the State will be better served.

Q. What is the appropriate target for the establishment of safety buffers?

A. The appropriate target for EMF levels at the boundaries of safety buffers is to have EMF levels that are no greater than background, or ambient, levels.

Q. Why is "background" EMF level a suitable EMF target level for the exposure of the susceptible population, children?

A. The view that the EMF target level should be undetectable EMF levels is supported by empirical observations provided by Wartenberg [1]. As we reviewed in our initial Testimony filed March 16, 2004, Wartenberg [1] has demonstrated that there is a continuous and linear relationship, as opposed to a threshold relationship, between EMF levels and the risk of childhood leukemia. However, in an industrialized society it is probably not reasonable to seek levels of EMF equivalent to "no risk"; ie., undetectable or zero levels of EMF. In a medically imprudent approach, one could select a "known increased risk" level of EMF, for example where the risk of childhood leukemia is known to be statistically significantly increased by 34% - 100% or more [1-3]. However, this medically imprudent approach would translate into a health policy which condones, and potentially encourages, an increased risk of childhood leukemia in Connecticut children. In contrast to the probably overly conservative "no risk" level and the clearly medically imprudent "known increased risk" level, a more common and suitable target level is to obtain "background" levels. By definition, it is technologically feasible to obtain background levels since EMF at these levels or at lower levels exist in 50% of the population. Background levels, as determined by a median or geometric mean of a large unbiased survey, help define the "normal" levels commonly found in a population whereby there would not be expected to be a "detectable" increase in the risk of childhood leukemia. Other values for EMF associated with power lines, above background levels but below known risk levels, are rejected as suitable target levels. These EMF levels above background are rejected as power line buffer zone boundary EMF levels since such power line EMF levels would be expected to be associated with a

detectable childhood leukemia risk should one enroll a sufficiently large number of subjects in an EMF/leukemia epidemiologic study.

Q. Have "background" levels of 60 Hz EMF been determined?

A. Yes. Comprehensive measurements of EMF levels in various situations are recorded in Chapter 2 of the National Institute of Environmental Health EMFRapid Working Group Assessment of Health Effects from Exposure to Power-Line Frequency Electric and Magnetic Fields Working Group Report [4].

Q. What is the Electric Power Institute (EPRI) "1000 homes study" determination of median residential 60 Hz EMF levels?

A. As presented in the Working Group Report [4], the EPRI 1000 homes study found that the median spot 60 Hz magnetic field reading in all rooms in the homes was 0.6 mG. The 24-hour combined field from power-line and ground system median measurement in this same study was 0.5 mG.

Q. What is the geometric mean 60 Hz EMF exposure for a population of children?

A. As determined from a 1000 person survey by Zaffanella and colleagues in 1998 and recorded in the Working Group Report [4], the geometric mean 60 Hz EMF exposure for school age children was 0.8 mG and the geometric mean 60 Hz EMF exposure for pre-school children was 0.6 mG.

Q. What is the geometric mean 60 Hz EMF exposure in schools?

A. As determined from a survey of 79 Canadian schools by Sun and colleagues in 1995 and recorded in the Working Group Report [4], the geometric mean 60Hz EMF level was 0.66 mG. Separately, a survey of 89 schools by the California EMF Program in 1996-1999 [5], showed that the median 60 Hz EMF level was approximately 0.4 mG.

Q. What is the consensus "background" level of 60Hz EMF in the non-occupational setting?

A. In schools and residences and in the target child population, the acceptable background level of EMF in an industrialized society is 0.6 mG.

Q. What should be the 60 Hz EMF level at the boundary of the safety buffer so as to protect children from the adverse health effects of EMF?

A. In order to protect children from the adverse health effects of EMF, the 60 Hz EMF level at the boundary of the safety buffer zone should be at background levels wherein "background" level herein is defined as 0.6 mG or lower at peak load levels. In this way, modified or new overhead power lines will not reasonably be expected to increase the incidence of childhood leukemia in children resident outside of the safety buffer zones.

Since load levels are expected to increase over time, and because substantial exposure time is obtained at load levels considerably greater than average load conditions, such background level of 0.6 mG or lower should be provided at the boundary of the safety buffer zone at maximum capacity load levels.

Q. Is there a very reliable method to provide for background levels of EMF on the boundaries of a safety buffer?

A. Yes. The most reliable method to obtain background levels of EMF, as defined herein, is to allow the decay of the electromagnetic field to occur as distance increases from the source of the electromagnetic field. From a policy point of view, this may most efficiently be obtained by mandating a linear distance from any power line to the edge of the safety buffer. Therefore, establishing a safety buffer zone through the provision of a minimal linear distance from overhead power lines to locations of children is the preferred method for establishing safety buffer zones for overhead power lines in order to provide background levels of EMF, as defined herein.

Q. What is the minimum distance generally believed to provide sufficient distance for a safety buffer zone?

A. A variety of calculations have been made supporting a range of minimum distances required to achieve background levels of EMF from overhead power lines.

The State of New Jersey [6] states, "For any transmission line in the State of New Jersey, at a perpendicular distance of 400 feet from the center of the line configuration, the magnetic field level on the ground from the line will be approximately 1 milligauss or less."

The Tennessee Valley Authority (TVA) has provided residential and school setbacks from transmission lines. In a 2003 transmission line siting fact sheet [7], the TVA stated, "Q. What are the building setback guidelines that TVA has to abide by?" The TVA provides the following generalized response, "A. When routing transmission lines, TVA attempts to maintain a buffer around certain structures and the line itself. A 300-foot buffer for homes and a 1,200-foot buffer for schools is desirable."

The Connecticut Department of Public Health [8] has provided suggested residential setbacks from overhead power lines. In its 2004 EMF Fact Sheet, the Department stated, "If the power lines are more than 300 feet away, there should be no cause for concern. At this distance EMF levels from the power lines are no different from typical EMF levels outside or inside the home."

Therefore, the minimum distance to generally and reliably obtain a sufficient safety buffer zone to allow decay of EMF to background, or ambient, levels and to thus mitigate the risk of adverse effects of EMF including childhood leukemia to an acceptable level is 300 feet. In

this way, modified or new overhead power lines will not reasonably be expected to increase the incidence of childhood leukemia in children outside of the safety buffer zones.

The minimum distance requirement, when employed in addition to the 0.6mG or lower background level, provides at least four further advantages not obtained by the 60 Hz EMF measurement alone: (i) an easily verifiable standard in each community without need of third party experts; (ii) an easily marked line on the ground that can serve to notice children and adults of the boundaries of the safety buffer zone; (iii) a reduction in EMF at the boundaries generated by harmonics from the power line that would not be measured at 60 Hz; and (iv) reduced exposure of children to additional power line health hazards including the electric-field generated corona and audible noise.

Q. Given these scientific determinations and the obligations and responsibilities set forth in Public Act 04-146, can you suggest an algorithm for assisting in the determination of individual siting decisions?

A. Yes. Pursuant to implementation of the obligations and responsibilities obtained with newly enacted P.A. 04-246, we would suggest that for each structure or group of structures in the path of a proposed new or modified transmission facility, the algorithm to arrive at a solution should comprise an ordered three step process as follows:

First Step Solution: Power lines should be undergrounded and should expose children to no more than background levels of EMF, as defined herein, unless such undergrounding is definitively determined to not be technically feasible by a disinterested party; if not solved, then

Second Step Solution: Enforcement of an absolute minimum of a 300 linear foot safety buffer zone from any overhead power line to any residence, school, licensed child day care facility, licensed youth camp or public playground so as to expose children to no more than background levels of EMF, as defined herein; if not solved, then

Third Step Solution: Enforcement of a safety buffer zone extending from the power line to the residence, school, licensed child day care facility, licensed youth camp or public playground such that the boundary of the safety buffer zone provides a 95% confidence or greater of a 60 Hz EMF level of 0.6 mG or lower at maximum capacity load levels ("background" level as defined herein").
If the siting is not solved, in order, by one of these 3 Steps, then the siting should not be permitted as provided in P.A. 04-246.

Using this approach, the parties should seek to determine the path and features of a new or modified transmission facility based upon a rank-ordered analysis of topographic, geologic, and technical factors all of which are required by P.A. 04-246 to be subordinated to the

obligation of the State to reduce EMF levels from new or modified overhead power lines to background levels which do not increase the risk of leukemia in the children in Connecticut.

References

1. Wartenberg D et al. Bioelectromagnetics. 2001;Supplement 5:S86-S104 (found at Tab (#19 in Appendix No. 1 to the Testimony of Dr. Bell et al dated March 16, 2004 (the "March Testimony Appendix")).
2. Ahlbom A et al. British Journal of Cancer. 2000;83:692-698 (found at Tab #17 in the March Testimony Appendix).
3. Greenland S et al. Epidemiology. 2000;11:624-634 (found at Tab #18 in the March Testimony Appendix).
4. National Institute of Environmental Health EMFRapid Working Group. Assessment of Health Effects from Exposure to Power-Line Frequency Electric and Magnetic Fields Working Group Report: Chapter 2 In vitro and mechanistic studies. NIH Publication No. 98-3981, 1998 (found at Tab #4 in the Appendix attached hereto).
5. Electric and Magnetic Field Exposure Assessment of Powerline and Non-powerline Sources for Calfiornia Public School (found at Tab #5 in the Appendix attached hereto). Environments.http://www.dhs.ca.gov/ehib/emf/school_exp_ass_exec.pdf
6. New Jersey Department of Environmental Protection Radiation Protection Programs. http://www.nj.gov/dep/rpp/nrs/powlines.htm (found at Tab #7 to the Appendix to the Supplemental Testimony Concerning Buffer Zones of Dr. Bell et al dated May 11, 2004 (the "May Testimony Appendix")).
7. Tennessee Valley Authority. Proposed Middle Tennessee 500-kV Transmission Line Project Fact sheet: Questions and Answers (found at Tab #8 in the May Testimony Appendix). http://www.tva.com/power/projects/500kv_line/facts_qa.htm#bury
8. Connecticut Department of Public Health. Division of Environmental Epidemiology & Occupational Health. Electromagnetic Fields (EMF): Health Concerns. Fact Sheet. January 2004 (found at Tab #4 in the March Testimony Appendix).