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

Testimony of

Dr. Leonard Bell

Dr. Peter Rabinowitz

Dr. Carl Baum

Dr. Alan Gerber

Dr. David Carpenter

On Behalf of

Ezra Academy, Congregation B’nai Jacob,
The Jewish Community Center of Greater New Haven and
The Jewish Federation of Greater New Haven

March 16, 2004
Q. Dr. Bell, please state your name, position, and business address.

A. My name is Leonard Bell. I am a physician, scientist, Adjunct Assistant Professor of Medicine and Pathology at Yale University School of Medicine, and the Chief Executive Officer of Alexion Pharmaceuticals, Inc., 352 Knotter Drive, Cheshire, CT 06410.

Q. Dr. Bell, what are some of your experiences with regard to interpretation of clinical data, public policy, and technology?

A. As chief executive officer of a biotechnology company, I have responsibility for understanding and interpreting large and complex sets of data, from thousands of patients, in accordance with federal regulatory guidelines concerned with determination of safety and efficacy. Separately, I have been requested to testify as an expert witness regarding technology and public policy to the U.S. Senate Hearing of the Labor and Human Resources Committee Subcommittee on Public Health and Safety for an Invited Testimony: "Scientific Discoveries in Cloning: Challenges for Public Policy". Additionally, I am currently a Member of the Connecticut Governor’s Council on Economic Competitiveness and Technology.

Q. Dr. Rabinowitz, please state your name, position, and business address.

A. My name is Peter Rabinowitz. I am a physician, scientist, and Assistant Professor of Medicine at Yale University School of Medicine. I am also Director of Clinical Services for the Yale Occupational and Environmental Medicine Program 135 College Street, New Haven CT 06880.

Q. Dr. Rabinowitz, do you have any particular training or experience in environmental health?

A. Yes. I am specialty trained and board certified in occupational and environmental medicine, general preventive medicine, and family medicine. I have a masters degree in Public Health from the Yale University School of Medicine's Department of Epidemiology and Public Health, with a concentration in Chronic Disease Epidemiology.
In my clinical and research work, I address the relationship between hazards in the environment and their impact on human health. Clinically, I assess the occupational and environmental exposures of patients to physical, chemical, and biological hazards, and determine whether there appear to be causative relationships between such exposures and the patient's medical conditions. I have served as an expert in numerous legal cases providing an opinion about the relationship between particular exposures and health outcomes. I am currently the Principal Investigator for Federally funded epidemiologic research that examines the interaction of occupational noise and chemical exposures on the auditory system, the nervous system, and other health endpoints. I am also the Principal investigator on a National Library of Medicine grant to assemble and review published animal data regarding human environmental health hazards. I regularly write technical reviews summarizing the latest research on a wide range of environmental health hazards both for this corporation and the International Aluminum Association. Finally, I am a contributor of several chapters to the upcoming second edition of a major textbook in the field: Clinical Occupational and Environmental Medicine (Rosenstock and Cullen, Eds), that will be published by W.B. Saunders later this year, and am knowledgeable about the chapter in this book that provides an up to date review of Electromagnetic Fields and human health.

Q. Dr. Baum, please state your name, position, and business address.

A. My name is Carl Baum. I am a pediatrician, medical toxicologist, and the Director of the Center for Children’s Environmental Toxicology at Yale-New Haven Children’s Hospital, 20 York St, New Haven, CT 06504.

Q. Dr. Baum, do you have any particular training or experience with environmental health?

A. Yes. I am specialty trained and board-certified in pediatrics, pediatric emergency medicine, and medical toxicology. My primary clinical duties are in the pediatric emergency department at Yale-New Haven Children's Hospital, where I treat thousands
of sick and injured children annually. In addition, I have been the Director of Medical Toxicology at Yale-New Haven Hospital since 2000, and last year received a foundation grant to establish a Center for Children’s Environmental Toxicology at Yale-New Haven Children's Hospital. I am also a toxicology consultant to the Connecticut Poison Control Center. In these roles, I receive hundreds of calls annually with questions about environmental hazards to adults and children. I also serve as consultant to the federally funded Yale-New Haven Health System's Office of Emergency Management, charged with the development of terrorism preparedness strategies for all hazards, including chemical, biological, radiation and nuclear threats. I am the Principal Investigator for research on the presence of tobacco-specific carcinogens in the urine of very young children exposed to environmental tobacco smoke. I have gained national recognition in these areas of expertise, and have been named a Fellow of the American Academy of Pediatrics, and a Fellow of the American College of Medical Toxicology. I was recently nominated to serve on the Committee on Injury, Violence and Poison Prevention of the American Academy of Pediatrics. I have contributed numerous original articles to the medical literature, as well as chapters to internationally marketed textbooks of pediatric emergency medicine (environmental emergencies, poisoning) and medical toxicology (mercury). Finally, I have just completed work as an editor of a major new textbook of pediatric toxicology, due out from McGraw-Hill this fall.

Q. Dr. Gerber, please state your name, position, and business address.

A. My name is Alan Gerber. I am a professor and teach statistics and research methods in the Yale University Department of Political Science. My research involves performing
and evaluating statistical studies. My office is at 77 Prospect Street, New Haven, CT 06520.

Q. Dr. Gerber, please describe your work performing and evaluating statistical studies.

A. As a professor, my job involves assessing the quality and interpreting the results of statistical studies. I have performed peer reviews of such studies for leading journals in political science and economics, as well as for organizations including the National Science Foundation. My training includes a Ph.D. in economics from the Massachusetts Institute of Technology. I have published quantitative research in the major peer reviewed journals in my field, including Political Analysis, a journal specializing in technical analysis of research methods. My research focuses on political subjects and typically attempts to discern and accurately measure the causal effect of one variable in complex situations where there are many variables that might contribute to an outcome or behavior. Examples of this research include measurement of the effect of campaign spending on election outcomes, the effect of legislative redistricting on the distribution of state spending, and the effect of voter mobilization efforts on the probability a citizen votes.

Q. Dr. Carpenter please state your name, position, and business address.

A. My name is David Carpenter. I am currently Professor, Environmental Health & Toxicology, Professor, Biomedical Sciences, and Director, Institute for Health and the Environment, School of Public Health, University at Albany, One University Place, B242, Rensselaer, NY 12144. I am formerly the Dean, School of Public Health, University at Albany.

Q. Dr. Carpenter, of what state, national, and international public health, EMF, and power line committees or commissions have you been a member?

A. With regard specifically to EMF and electric power issues, I have been Executive Secretary, New York State Power Lines Project, Member of the Committee on Electric Energy Systems of the Energy Engineering Board, National Research Council, Member of the Advisory Panel for the Electric Energy System Division, U.S. Department of
Energy, Member of Committee #79, National Council on Radiation Protection and Measurements, and Member, Connecticut Academy of Sciences and Engineering Committee on Electromagnetic Field Health Effects. In the more general fields of public and environmental health, I have been Member, Executive Committee of the Association of Schools of Public Health, Member, National Advisory Environmental Health Sciences Council of the National Institutes of Health, United States Co-Chair, Workgroup on Ecosystem Health of the Science Advisory Board of the International Joint Commission, and Member, Board of Directors, Healthy Schools Network, Inc.. Further, I am currently a Member, United States Environmental Protection Agency, Children’s Health Protection Advisory Committee.

Additionally, I was awarded the Homer N. Calver Award from the American Public Health Association for studies in environmental health. I have also published in the field of EMF and public health.

Q. Have you previously submitted testimony in this proceeding?
A. Yes, Drs. Bell, Rabinowitz, Baum and Gerber submitted testimony on February 9, 2004 at the CSC meeting in Woodbridge, CT.

Q. What is the purpose of this supplemental testimony?
A. The purpose of this testimony is to update and expand on the testimony submitted on February 9th, 2004 in order to provide the details of the background information on childhood cancers, the nature of EMF, EMF clinical research, EMF epidemiologic meta analyses, EMF laboratory experiments, and the EMF assessment and regulatory recommendations of major scientific panels.

Q. Have you revised any of the conclusions in your February 9th, 2004 testimony?
A. No.

Q. What is your conclusion with respect to the relationship between EMF and childhood leukemia?
A. Our conclusion is that there is a strong positive relationship between EMF from power
lines and childhood leukemia, this relationship is not due to chance, and that the
operation of the proposed overhead high voltage power lines would be expected to pose a
long-term health hazard particularly to exposed children. As a result, it is prudent public
health policy to reduce exposure of people, particularly children, to EMF exposure from
high voltage power lines.

Q. **On what do you base your conclusion that** there is a strong positive relationship
between EMF from power lines and childhood leukemia and that this relationship is not
due to chance?

A. Our conclusion is based on approximately 50 clinical studies and the conclusions reached
by independent scientific panels, including panels of the National Research Council, the
National Institute for Environmental Health Sciences, the National Radiological
Protection Board, the International Agency for Research on Cancer, the International
Commission for Non-Ionizing Radiation Protection and the California Health and Human
Services Agency.

Q. **What is EMF and generally what is the concern with regard to EMF and childhood
cancer?**

A. EMF is the term used to describe the electromagnetic fields that can be generated by a
number of sources. While the earth’s magnetic field is a constant, non-fluctuating DC
field, the magnetic fields that result from man-made sources, particularly electric current
in power lines and appliances, are dynamic, AC fields. High voltage electric power lines
generate significant EMF, and their potential to cause health effects is the subject of this
testimony. Clinical studies show that above ground power lines, if adjacent to large
concentrations of susceptible human populations, particularly children, would be
expected to double the risk of certain deadly childhood cancers.
Q. What is the focus of this testimony?

A. Over the past 30 years, a large number of studies have examined the relationship between EMF exposures and various health effects. A number of adverse health effects have been found in certain studies, including relationships with certain cancers in adults as well as non-cancer effects including immune dysfunction and reproductive abnormalities. For most conditions, studies have shown conflicting, non-definitive, results. However, one disease has repeatedly shown a clear association with EMF exposure: acute lymphocytic leukemia in children. The correlation is so striking that each of the independent scientific authorities that has been charged with reviewing the available clinical data has concluded that the association of EMF with childhood leukemia is unlikely to be due to chance. Further, pooling all the studies of children together, the correlation between EMF and acute childhood leukemia becomes even more certain. From these studies, it appears that stronger fields (in excess of 2-4 milligauss, where gauss is a measure of EMF field strength) are associated with an approximately 100% increase in the risk compared to background, and this “dose response relationship” adds to the likelihood that EMF is playing a causative role in childhood leukemia.

Q. What has been the general reaction of the scientific and public health community to the many publications showing a strong positive relationship between EMF and childhood leukemia?

A. The evidence connecting EMF to childhood leukemia has had a major impact on the scientific community and public health community worldwide. It has led the preeminent worldwide council on cancer risks, the International Agency for Research on Cancer (IARC), to officially list EMF as a potential human carcinogen [1]. The NIH National Institutes of Environmental Health Sciences report published in May 1999 [2] concluded that exposure to EMF “cannot be recognized at this time as entirely safe” due to the childhood leukemia risk. The NIEHS Report states that “action is warranted such as a continued emphasis on educating both the public and the regulated community on means aimed at reducing exposures.” Subsequently, the State of California declared that on the basis of all the scientific evidence, EMF was a probable cause of acute childhood
leukemia [3]. In January, 2004, the State of Connecticut Department of Public Health Environmental Epidemiology division [4] recommended, “…there is enough uncertainty that some people may want to reduce their exposure to EMF.” The Department further concluded that proximity of power lines and exposure to the associated EMF from such power lines is of sufficient potential health concern that residents should consider EMF from high voltage power lines as one of the environmental risks in determining residential location, “Deciding where to live rests upon a number of considerations that varies with each individual. EMF exposure is one of many factors in this decision.”

Q. What is the background information on childhood leukemia?

A. Cancer in childhood is rare compared to adult cancers, but is still the third leading cause of death in children aged 19 and less [5]. Children, due to the fact that their cells are rapidly dividing, are more susceptible to cancer-causing hazards in the environment. Leukemia was the most common cancer diagnosis for American children between 1973 and 1998, accounting for 20% of childhood cancers [6]. Leukemia is a cancer of the blood system whereby normal infection-fighting white blood cells are transformed into an uncontrollable circulating cancer that, depending on the blood cell type and stage of cancer, can be fatal in over 50% of cases. Acute lymphocytic leukemia, or ALL, accounts for approximately 80% of childhood leukemias, with a rate of approximately 2-4/100,000 per year [6]. Leukemias are generally believed to result from a multi-step initiator/promoter type of process whereby several different stimuli, acting separately, may start and then promote the occurrence of blood cell transformation into a malignant cancer.

Q. What is the nature of EMF?

A. Power lines, electrical wiring, and appliances all produce electric and magnetic fields. Wherever electricity is generated, transmitted, or used, EMF are created, due to the presence and motion of electric charges. Magnetic fields act on other electric charges in motion. Thus, a magnetic field is created by an electric current and can vary in intensity as the current varies. While the magnetic field of the earth is static, the magnetic fields associated with electrical current are usually dynamic. EMF can be thought of as invisible
lines of force that surround any electrical device and move outward from that electrical current in waves.

Q. What is the relationship between EMF and power lines?

A. With respect to EMF associated with power lines, the intensity of EMF is proportional to the current carried along the electric line. While EMF is not well insulated by building materials, the strength of the field dissipates with distance so that EMF intensity is inversely proportional to the square of the distance from the power line. Separately, high voltage electric lines emit a nearly continuous glow, or corona, of the electric field breaking down air molecules near the line. This corona may also be a source of downstream adverse health effects.

Q. What is the general nature of EMF clinical research?

A. Because of the ethical concern of deliberately exposing susceptible individuals to a potential carcinogen, EMF, all clinical studies of EMF have been non-interventional, epidemiologic studies. While common in the study of major public health issues and while also understandable on ethical grounds, the absence of a gold-standard prospectively designed, randomized, placebo-controlled, interventional clinical trial, also weakens the ability to conclusively prove that EMF causes cancer. The use of epidemiologic studies allows for conclusions regarding the certainty of an association between EMF and cancer, as opposed to conclusions regarding whether EMF causes cancer. However, the strength of the certainty of an association, together with the severity of the potential adverse effects of the agent and a consideration of the risk to the susceptible population, does allow for meaningful public health policy designed to prudently protect the public welfare. Indeed, Kriebel and Tickner [7] summed up the precautionary principle, “When there is substantial scientific uncertainty about the risks
and benefits of a proposed activity, policy decisions should be made in a way that errs on
the side of caution with respect to the environment and the health of the public.”

**Q.** What has been the one particular health concern that has been repeatedly found in
clinical studies of EMF?

**A.** Childhood leukemia. There have been more than several dozen published clinical studies
of EMF and human health. Many different health effects have been measured. In these
individual clinical studies, the one health problem that consistently has been found to be
associated with EMF exposure is acute childhood leukemia, a rare and potentially fatal
disease.

**Q.** What did one of the earliest clinical studies examining the relationship between
EMF and childhood leukemia, the Wertheimer and Leeper study, show?

**A.** Wertheimer and Leeper [8] initially described in 1979 an increased risk of cancers in
subjects less than 19 years of age and living in Denver area homes with elevated wire
code configurations as a surrogate measure of EMF. They reported a significantly
increased relative risk for childhood leukemia of 3.0 (95% confidence intervals, 1.8-5.0;
meaning that there is likely a 3-fold greater risk of childhood leukemia and that the
scientists were 95% certain that the increased risk was at least 1.8-fold but could be as
high as 5.0-fold greater) and 2.4 for nervous system tumors (95% CI, 1.2-5.0), with a
statistical trend for a 2.1 increased relative risk for lymphomas (95% CI, 0.84-5.2). This
study was not blinded and thus may have been susceptible to bias. However, the same
investigators conducted two additional, smaller blinded studies and showed qualitatively
similar results.

**Q.** Are there other studies which show a strong positive relationship between EMF and
childhood leukemia?

**A.** Yes. Savitz et al. [9] also reported a significant 1.5 increased risk of all cancers in
children (95% CI, 1.0-2.3) with elevated wire code configurations in Colorado, a
significant dose response for cancer occurrence with increasing wire code configurations,
and a relative risk of 1.5 for childhood leukemia (95% CI, 0.9-2.6). Feychting et al. [10]
used historically calculated field strengths and identified a significantly increased risk for
crildhood leukemia of 2.0 (95% CI, 1.0-4.1) for levels greater than or equal to 0.2 uT (in
some studies the units “microTesla”, or uT, are used instead of milligauss, or mG; 0.1
microTesla = 1 milligauss). Feychting and Ahlbom [11] observed a 2.7 increased risk for
crildhood leukemia (95% CI, 1.0-6.3; p=0.02) for levels greater than or equal to 0.2 uT,
and a 3.8 increased risk for childhood leukemia (95% CI, 1.4-9.3; p=0.005) for levels
greater than or equal to 0.3 uT. In this latter study, adjustment for potentially confounding
variables did not impact the conclusions.

**Q. What did the study by Linet et al. [12] show regarding EMF and childhood
leukemia?**

A. This study [12] found a positive trend, but not a statistically significant increase in risk
for childhood leukemia using a cut-point of 0.2 uT with a 1.53 odds ratio (95% CI, 0.91-
2.56; p=0.12 for matched controls). This suggests that there was at least an 88%
likelihood that the association between childhood cancer and EMF levels greater than 0.2
uT was not due to chance.

**Q. Did the threshold that Linet et al. [12] selected, ie., 0.2 uT, influence the outcome of
the study in regard to determining the relationship between EMF and childhood
leukemia?**

A. Yes. With a more rigorous threshold for EMF exposure, the same investigators [12]
reported a significant increase in childhood leukemia. The same investigators examined
the relationship between the incidence of childhood leukemia and EMF with a higher
threshold (greater than or equal to 0.3 uT) and observed a statistically significant 1.72 rise
in cancer (95% CI, 1.03-2.86).

**Q. What did the study by Linet et al. [12] teach about epidemiologic studies examining
the relationship between EMF and childhood leukemia?**

A. This study suggested that, in part due to the infrequency of childhood leukemia, it would
be easier to detect a significant relationship between EMF and childhood leukemia
examining somewhat higher “doses” of EMF.
Q. What does the study by Linet et. al [12] teach with respect to any dose-response relationship between EMF levels and childhood leukemia?

A. That study strongly supports a dose-response relationship between EMF levels and childhood leukemia, further supporting a causal relationship, in children, between EMF and acute lymphocytic leukemia.

Q. Did Green et al. [13] observe a positive relationship between EMF and childhood leukemia?

A. Yes. Green et al. [13] observed that for children younger than 6 years at diagnosis, outside perimeter measurements of the residence greater than or equal to 0.15 uT were associated with a significantly increased leukemia risk (OR = 3.45, 95% CI = 1.14-10.45).

Q. Did the Rome study [14] observe a positive relationship between proximity to EMF sources and childhood leukemia?

A. Yes, the Rome study found that proximity to large EMF sources is associated with a significantly increased risk of childhood leukemia in Rome with an increased risk of 2.2 (95%CI, 1.0-4.1) [14].

Q. Did scientific studies find a positive relationship between predicted and measured magnetic fields and childhood leukemia in Los Angeles?

A. Yes, the Los Angeles study found that predicted and measured magnetic fields in Los Angeles were associated with a significant 2.19 (95% CI, 1.12-4.31; p value = 0.007) increased risk of childhood leukemia [15].

Q. What did the Los Angeles study [15] conclude was the likelihood that the extremely positive relationship between EMF levels and childhood leukemia in Los Angeles was not due to chance?

A. The Los Angeles study indicated that the likelihood that this association was not due to chance was extremely high, 99.3% [15].

Q. Are the epidemiologic results examining the relationship between EMF and childhood cancer uniform?
A. No. While more than several dozen individual epidemiologic studies have been
performed, the results are not uniform. The 1997 National Research Council report
summarizes, “Wire codes are associated with an approximate 1.5-fold excess of
childhood leukemia, which is statistically significant. Although the literature is not
entirely consistent, the combined results from the array of studies that have examined
wire codes and related markers of exposure, such as proximity to power lines and
calculated magnetic fields from power lines, indicate that an association is present.” [16].

Q. What is a meta analysis and why is it used in the study of the relationship between
EMF and childhood cancer?

A. Because of the relative infrequency of childhood leukemia in the general population,
individual clinical studies may not be sufficiently large to observe an adverse treatment
effect of EMF on the incidence of childhood leukemia. In such situations, clinical
scientists frequently use an approved scientific technique where they combine the
subjects from many individual trials together into one group. With this combined, single,
larger group of subjects, clinical scientists are more likely to be able to accurately identify
the presence of rare, or infrequent, events. Further, with these “meta analyses”, clinical
scientists can measure whether different interventions increase or decrease the likelihood
of rare events, such as childhood leukemia.

Q. What do the results of the major meta analyses of the relationship between EMF
and childhood leukemia teach with respect to the statistical relationship between
EMF and childhood leukemia?

A. At least three major scientific meta-analyses have been performed examining whether
EMF is associated with childhood leukemia. Each of these studies has shown similar
results: at exposure levels of 2-4 mG (0.2 – 0.4 uT) and above, the risk of childhood
leukemia is statistically significantly increased.

<table>
<thead>
<tr>
<th>Study</th>
<th>Studies/# Subjects</th>
<th>Threshold</th>
<th>Increased Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ahlbom et al. [17]</td>
<td>9 studies -13,647</td>
<td>0.4 uT</td>
<td>2.0 (1.27-3.13), P=0.002</td>
</tr>
<tr>
<td>Greenland et al. [18]</td>
<td>12 studies</td>
<td>0.3 uT</td>
<td>1.83 (1.34-2.49),</td>
</tr>
<tr>
<td>Wartenberg et al. [19]</td>
<td>14 studies – 9,697</td>
<td>0.2 uT</td>
<td>1.34 (1.07-1.67)</td>
</tr>
</tbody>
</table>
Q. Did Ahlbom et al. [17] show a significant association between EMF levels and childhood leukemia?

A. Yes. Ahlbom et al. showed a highly significant association between EMF levels and childhood leukemia.

Q. Did Greenland et al. [18] show a significant association between EMF levels and childhood leukemia?

A. Yes. Greenland et al. showed a highly significant association between EMF levels and childhood leukemia.

Q. Did Wartenberg et al. [19] show a significant association between EMF levels and childhood leukemia?

A. Yes. Wartenberg et al. showed a highly significant association between EMF levels and childhood leukemia.

Q. Do these meta-analyses [17-19] show a dose-dependent effect between EMF levels and childhood leukemia?

A. Yes. Together, these studies show an apparent dose-effect of EMF across these 3 meta-analyses, in that the risk of childhood leukemia increases with exposure thresholds increasing from 0.2 to 0.3 to 0.4 uT.

Q. What is the scientific importance of a dose-dependent effect in these large clinical meta-analyses of the relationship between EMF and childhood leukemia?

A. In scientific studies, a dose-dependent effect is important evidence supporting a “cause-and-effect” relationship in the studied species; i.e., that EMF causes childhood cancer in the studied human populations.

Q. Did Wartenberg [19] state that there is evidence for a linear effect of EMF on causing childhood leukemia and that the risk may be increased even for levels less than 0.2 uT?
A. Yes. Wartenberg [19] calculated that the risk of childhood leukemia would be increased in a continuous manner, for each 0.1 uT increase in magnetic field strength.

Q. Did Wartenberg [19] state that the data is strong and consistent for a positive relationship between EMF and childhood leukemia?

A. Yes. Wartenberg stated, “many people believe there are no data to support an association between residential magnetic field exposure and childhood leukemia. To the contrary, the data strongly and relatively consistently support such an association…”

Q. Is it true that Wartenberg [19] found no statistically consistent results?

A. No, it is not true. Wartenberg [19] himself stated, “Overall, I see largely positive results with small to moderate effect sizes…These summaries are unlikely to be changed by additional studies unless those studies are extremely large and produce markedly different results.”

Q. Have these meta-analyses of the relationship between EMF and childhood leukemia been refuted by subsequent peer-reviewed scientific publications?

A. No. Not one of these scientific meta-analyses has been refuted by a peer-reviewed scientific publication. Indeed, these studies have examined an infrequent childhood cancer and identified consistently significant and dose-dependent increases in incidence of this fatal cancer with increasing childhood exposure to EMF. These meta-analyses serve as the most robust identification of the certainty of an association between EMF and childhood leukemia.

Q. According to these large meta-analyses of the relationship between EMF and childhood cancer, what is the likelihood that EMF is truly associated with childhood cancer?

A. The likelihood that EMF is truly associated with childhood cancer in humans is extremely high. Ahlbom et al.’s [17] work allows one to conclude that, based on a very large study sample size, there is a 99.8% likelihood that EMF is truly associated with childhood leukemia.
Q. Have preclinical EMF studies shown conclusive results?

A. No. Preclinical EMF studies have provided varied results. Much of the laboratory experimentation is confounded by observed significant temperature increases associated with laboratory exposure to EMF that would not be expected in whole animal (or human) exposure, and hence has made adverse effects in certain of these laboratory results difficult to interpret. Indeed, many physicists believe, based on their theoretical modeling, that the power associated with extremely low frequency EMF is insufficient to modify chemical bonds in biological tissue. However, as noted by the NIEHS, the lack of definitive experimental proof in laboratory studies may be limited by our own ignorance, “The current biophysical theories for ELF-EMF would suggest little possibility for biological effects below exposures of 100 uT. However, considering the complexity of biological systems and the limitations required by the assumptions to mathematically model these theories, this finding has to be viewed with caution.” [2] Further, this narrow theoretical view has also been disputed by empirical observations in certain laboratory experiments.

Q. Have laboratory experiments shown adverse effects of EMF?

A. Yes. There are a significant number of diverse experimental laboratory studies demonstrating the direct carcinogenic potential of EMF.

Q. With regard to childhood leukemia in humans, what are the laboratory studies that would be supportive of a causal role for EMF in childhood leukemia?

A. Since leukemia is an abnormality of growth of white blood cells, laboratory experiments showing changes in the immune system, lack of resistance to physiological stresses, mutations in DNA, abnormal proliferation of cells, and potentiation of known carcinogens would be strongly supportive of a causal role for EMF and childhood leukemia.

Q. Have there been laboratory studies that support a causal role for EMF in childhood leukemia?
A. Yes. Long-term exposure to EMF significantly alters the immune system and elevates oxidative stress in birds [20]. Additionally, in a system in which temperature was controlled to within 1°C, EMF was associated with a significant decrease in protection from hypoxia and stress in chick embryos [21]. Normal cells may be transformed into cancerous cells by stress responses in the cell and immune system changes can also give rise to blood-borne, and other, cancers. Additionally, in cell culture studies that were maintained within 0.3°C, EMF resulted in breakages, or mutations in cellular DNA, an important pre-requisite for many cancer-causing agents [22]. In an experimental setting where temperature effects were well controlled, EMF by itself caused a significant proliferation, or growth, of brain cells [23]. Moreover, EMF was able to also potentiate the effect of known carcinogens and even further increase the growth of brain cells in these experiments [23], supporting a potential mechanism for EMF causing brain cancer or other cancers. In a new line of research, researchers are exploring non-linear relationships between EMF dose and effect. For example, they have found a striking relationship between EMF exposure and changes in lymphocytes, the immune cells that become cancerous in childhood leukemia, when they modeled exposure in a non-linear fashion [24-26] Such studies emphasize the complexity of understanding the effects of EMF on the cellular level.

Q. Based on laboratory studies, would power lines be expected to cause ozone that is toxic and a strong pulmonary irritant?

A. Yes. Scientists have demonstrated that experimental animals subjected to the corona associated with electric fields, similar to those demonstrated with high voltage power lines, serve to generate toxic ozone [27].

Q. Have experimental studies proposed actual mechanisms by which EMF might cause direct injury to children’s bone marrow resulting in leukemia?

A. Yes. The most important role of experimental studies with regard to determining the potential cancer-causing nature of an environmental hazard is to propose potential mechanisms by which the hazard (EMF) might actually cause the associated cancer. In this regard, scientists believe that recent field studies have suggested a mechanism by which EMF may cause childhood leukemia via the initiation and maintenance of elevated
contact currents [28]. Scientists have recently described a highly statistically significant relationship between (i) the voltage between residential water pipes and the earth (called “Vw-e”, or contact current) and (ii) the intensity of the residential magnetic field (p<0.001) [29]. The relationship is considered quite statistically strong since the likelihood of it not being due to chance is greater than 99.9% [29]. Moreover, these scientists demonstrated that “the highest voltages occur[ed] in homes near high voltage transmission lines, most likely due to magnetic induction on the grounding system.” [29] They further demonstrated that the current that would be expected to be generated would be sufficient to bring toxic doses to children’s bone marrow. These scientists concluded, “The results shown suggest that exposure to contact current associated with voltage on residential water pipes could lay at the heart of the association between magnetic fields and childhood leukemia. Our data call into question the possible role of HVTL [high voltage transmission lines] in producing significant levels of Vw–e due to magnetic induction on the grounding system.” [29]

Q. Has this “contact-current” mechanism of action for EMF causing childhood cancer been refuted in the scientific literature?

A. No. The contact-current mechanism for delivery of the carcinogenic action of EMF to children’s bone marrow has not been refuted in any peer-reviewed, published scientific investigation. It remains a viable candidate demonstrating a causal mechanism for EMF and childhood cancer.

Q. What was the National Research Council report’s [16] view on the overall clinical data examining EMF and childhood cancer?

A. In text accompanying a figure showing the odds ratio for 53 individual studies and meta analyses examining the relationship between EMF and childhood cancer, the National Research Council (NRC) [16] report stated, “One striking observation is the preponderance of dots (odds ratios) at or above the null effect line. Only 8 out of 53 odds ratios dots fall below the null effect line…This unweighted vote-counting assessment strongly suggests an association with some feature of the power transmission and distribution system because of a small but consistent positive odds ratio.”
Q. Did the NRC report state a conclusion as to whether the link between EMF and childhood leukemia was likely caused by chance?

A. Yes. The NRC report concluded that the positive association between EMF and childhood leukemia was not caused by chance. The NRC report states: “The purpose of this analysis has been to evaluate the role of random variation in explaining the results observed in the set of epidemiologic studies examining residential magnetic-field exposure and childhood leukemia. When looked at in a variety of analyses, the positive trend in the association cannot be explained statistically on the basis of random fluctuations…”

Q. Did the NRC report comment on whether there was substantial consistency of the human data showing the relationship between EMF and childhood leukemia?

A. Yes. The NRC report notes the consistency of the different studies showing a positive relationship between EMF and childhood leukemia, stating, “…the results of the residential exposure studies to date present a fairly uniform picture supporting an association of childhood leukemia with wire codes, distance from source, and for the three Nordic studies, calculated fields based on historical records of power consumption.”

Q. Did the NRC express a belief as to whether subsequent clinical studies were likely to overcome the wealth of clinical data demonstrating the positive relationship between EMF and childhood leukemia?

A. Yes. With regard to the likely impact of even more clinical studies in overturning the already available large reservoir of clinical data showing the positive relationship between EMF and childhood leukemia, the NRC stated, “It would take a relatively large number of studies with largely negative results to balance this effect to null.”

Q. Did the NRC report reach a conclusion as to the cancer risk to children placed in proximity to power lines?

A. Yes. The importance of the proximity of childhood leukemia victims to power lines was recognized. The NRC report stated, “Thus, the finding remains that there are strong and
consistent data suggesting a relatively weak increased risk of leukemia for children living in close proximity to power lines.”

Q. Did the NRC report discuss whether bias was likely to explain the positive association between EMF and childhood leukemia?

A. Yes. The NRC noted the potential role of bias, but stated their expert view that bias was unlikely to account for the positive relationship between EMF and childhood leukemia. The NRC report stated, “As with any epidemiologic study, the studies of residential magnetic-field exposure and childhood cancer have many possible sources of bias. Each of these possible errors could influence the size of the reported odds ratios, but none is likely to be present or sufficiently large across all the studies to explain the results…Because the study designs and methods are diverse and because no persuasive flaw is found in all of them, the committee believes that any particular selection bias is unlikely to completely explain the reported associations between exposure to magnetic fields, as reflected by the wire codes, and childhood cancer incidence.”

Q. Was the NRC able to conclude, in 1997, that EMF caused childhood cancer?

A. No. The NRC was unable to conclude that EMF caused childhood cancer because of the lack of a definitive understanding of the causative mechanism in animal experiments at that time. The NRC report was also completed prior to publication of several meta analyses and experimental data showing the non-thermal, carcinogenic evidence for EMF.

Q. Although the NRC was not able to conclude that EMF caused cancer in animal experiments, did the NRC report reach a conclusion as to whether EMF and a proximity of power lines is positively associated with childhood leukemia?

A. Yes. The committee did conclude that further studies would be extremely unlikely to change their expert view concerning the clear association of EMF and childhood leukemia. Such additional studies, they stated, would only confirm the already clear relationship between EMF and childhood leukemia. The NRC report stated, “This pattern of results and the committee’s analysis of these data suggest that an association is likely to be present and if a flawlessly designed and executed study could be conducted it would
identify a positive association between indicators of exposure, such as proximity of power
lines to residences, and childhood cancer.”

Q. Did the National Institutes of Health [2] reach a conclusion as to whether EMF may
be a human carcinogen?

A. Yes. In follow-up to the NRC report, the next US Federal Government report, conducted
by the National Institutes for Environmental Health Sciences (NIEHS) of the National
Institutes of Health Working Group stated, “The Working Group concluded that ELF
EMF are possibly carcinogenic to humans (Group 2B).”

Q. Why did the National Institutes of Health Working Group conclude that EMF is a
possible human cancer-causing agent?

A. The National Institutes for Environmental Health Sciences (NIEHS) of the National
Institutes of Health Working Group clarified that the positive relationship between EMF
and cancer is due largely to the association between EMF and leukemia in children and
power line workers, “There is little doubt that the evidence in support of the decision to
classify ELF EMF into Group 2B [possible human carcinogen] is driven by the results of
studies on childhood leukemia in residential environments and on CLL in adults in
occupational settings.”

Q. What was the basis of the NIEHS conclusion that EMF is a possible human
carcinogen?

A. The NIEHS Working Group’s conclusion was driven by the positive relationship between
EMF and leukemia, particularly childhood leukemia. The NIEHS Working Group
overwhelmingly cited the clear positive relationship between EMF and childhood
leukemia, stating “The majority (20 out of 26) of the Working Group members who voted
concluded there is limited evidence that residential exposure to ELF magnetic fields is
carcinogenic to children on the basis of the results of studies of childhood leukemia. . . .
Three lines of evidence supported the overall finding: the association between exposure
to calculated magnetic fields and risk for childhood leukemia, the association between
exposure to measured 24-h magnetic fields and risk for childhood leukemia, and
continued concern about the association between wire codes and risk for childhood leukemia.”

Q. What does the term “limited evidence” mean?

A. While there was a clear association between EMF and childhood leukemia, the qualifying phrase “limited evidence” was employed only because a causal link could not be identified with 100% certainty. The term “limited evidence” does not mean that there is only a small amount of human evidence for cancer-causing activity of EMF. The NIEHS report stated, “This degree of evidence is generally provided by studies for which there is credible evidence of an association and for which a causal linkage cannot be established with a high degree of certainty. This does not mean the effect is weak…”

Q. Was the extent of human evidence enough that the NIEHS expressed concern for humans?

A. Yes. The NIEHS was sufficiently concerned to note, “This level of evidence, while weak, is still sufficient to warrant limited concern.”

Q. Did the US Federal Government conclude that EMF is not safe?

A. Yes. The US Federal Government’s concern was sufficient to conclude that EMF is not safe, “The NIEHS concludes that ELF-EMF exposure cannot be recognized at this time as entirely safe because of weak scientific evidence that exposure may pose a leukemia hazard.”

Q. What was the primary basis of the conclusion that EMF is not safe?

A. The NIEHS conclusion that EMF is not safe was largely due to the positive association in clinical studies of EMF and childhood leukemia. The report stated, “The NIEHS concludes that ELF-EMF exposure cannot be recognized at this time as entirely safe because of weak scientific evidence that exposure may pose a leukemia hazard.”

Q. Did the NIEHS recommend that exposures of humans to magnetic fields associated with power lines be reduced?
A. Yes. The NIEHS deemed it appropriate to recommend reduced exposure to EMF specifically associated with power lines. The report stated, “NIEHS suggests that the power industry continue its current practice of siting power lines to reduce exposures and continue to explore ways to reduce the creation of magnetic fields around transmission and distribution lines…”

Q. Is there any evidence that the NIEHS report supports increased exposure of children to EMF from power lines?

A. No. The NIEHS report concluded that EMF is not safe for humans, that EMF is a possible carcinogen, that the carcinogenicity is largely due to leukemia in children, and that the exposures of humans to EMF from power lines should be reduced.

Q. What conclusion did the National Radiological Protection Board [30] reach concerning the relationship, if any, between EMF and childhood leukemia?

A. The National Radiological Protection Board (NRPB) concluded that there is consistency in the data showing a positive relationship between EMF and childhood leukemia. It stated, “In most of the individual studies on leukaemia in children, odds ratios or relative risks comparing levels of electromagnetic fields generally more than 0.20 or 0.25 uT with all others or those exposed to low levels have been more than 1.0…”

Q. What did the NRPB conclude as to whether the positive association between EMF and childhood leukemia was likely to be due to chance?

A. The NRPB concluded that the positive relationship between EMF and childhood leukemia was believed unlikely due to chance. Its report stated, “…the recent pooled analysis of Ahlbom et al (2000) of studies with direct or calculated field measurements indicates a relative risk of nearly 2.0 in those exposed to more than 0.4 uT compared to those exposed to less than 0.1 uT. This excess is unlikely to have been due to chance.”

Q. What did the NRPB state were the impacts of any confounding factors on the carcinogenic impact of EMF on childhood leukemia?
A. While the NRPB noted the potential for confounding variables, they stated that any such confounding factors would have been likely to have led to an underestimate of the true impact of EMF on childhood leukemia. The NRPB states, “For both the measured and calculated field studies there is also the possibility that confounding may have contributed. These uncertainties make it difficult to know how much of the observed excess may have been due to a causal effect. As a result of the absence of accurate exposure measurements at the relevant time before diagnosis, any causal component will be underestimated at exposures less than as well as more than 0.4 uT.”

Q. What did the International Agency for Research on Cancer (IARC) [1] conclude about whether EMF may be carcinogenic to humans?

A. The IARC concluded its overall evaluation as follows: “Extremely low-frequency magnetic fields are possibly carcinogenic to humans (Group 2B).”

Q. Did the IARC have any particular focus when concluding that EMF may be carcinogenic to humans?

A. Yes. The IARC particularly focused on the positive relationship between EMF and childhood leukemia. The carcinogenic potential of EMF was believed to be largely due to the effect of EMF to increase childhood leukemia. The IARC stated, “There is limited evidence in humans for the carcinogenicity of extremely low-frequency magnetic fields in relation to childhood leukemia.”

Q. Did the IARC conclude that there was consistency in the data between EMF and childhood leukemia?

A. Yes. The IARC noted the consistency of the clinical relationship between EMF and childhood leukemia stating, “…pooled analyses of data from a number of well-conducted studies show a fairly consistent statistical association between childhood leukaemia and power-frequency residential magnetic field strengths above 0.4 microTesla (4 milligauss), with an approximately two-fold increase in risk. This is unlikely to be due to chance, but may be affected by selection bias. Therefore this association between
childhood leukemia and high residential magnetic field strengths was judged limited evidence for excess cancer risk in exposed humans.”

Q. Was the IARC’s conclusion that EMF may be cancer-causing in humans specifically related to the relationship between magnetic fields and leukemia, particularly with childhood leukemia?

A. Yes. The effect of EMF to be possibly cancer-causing and strongly associated with childhood leukemia was specific to magnetic fields and childhood leukemia. The IARC stated, “Overall, extremely low frequency magnetic fields were evaluated as possibly carcinogenic to humans (Group 2B), based on the statistical association of higher level residential ELF magnetic fields and increased risk for childhood leukaemia. Static magnetic fields and static and extremely low frequency electric fields could not be classified as to carcinogenicity to humans (Group 3).”

Q. Did the International Commission for Non-Ionizing Radiation Protection [31] reach a conclusion as to whether there was a positive relationship between EMF and childhood leukemia?

A. Yes. The International Commission for Non-Ionizing Radiation Protection (ICNIRP) concluded that there was a positive relationship between EMF and childhood leukemia, based on strong methodology and large study sizes. The ICNIRP, with a focus on the positive relationship between EMF and childhood leukemia, stated, “A large body of high-quality data exists, with measurements of exposure, strong methodology, and large study sizes, for childhood leukemia and brain tumors and for occupational exposure in relation to adult leukemia and brain tumors. Among all the outcomes evaluated in epidemiologic studies of EMF, childhood leukemia in relation to postnatal exposures above 0.4 μT (4 milligauss) is the one for which there is most evidence of an association.”

Q. Did the World Health Organization study whether states and countries are following the doctrine of “prudent avoidance” with regard to power lines and siting away from schools?
A. Yes. In its March 2000 Backgrounder [32], the World Health Organization (WHO) recognized that many states and countries have followed the principle of prudent avoidance with regard to exposure of humans to EMF. The WHO stated, "Prudent Avoidance (not necessarily identified as such) has been adopted as policy in parts of the electrical sector in Australia, Sweden and a few US states (California, Colorado, Hawaii, New York, Ohio, Texas, and Wisconsin)." The Backgrounder [32] further focused on the prudent avoidance of health risk to children, "In 1997 Australia adopted a policy of Prudent Avoidance with regard to new transmission lines, with measures described by the government as "general guidance" to be implemented "without undue inconvenience. Measures that can be taken at "modest cost" include routing power lines away from schools, and phasing power line conductors to reduce magnetic fields near their rights of way."

Q. Did the WHO address whether the NIEHS has embraced the doctrine of prudent avoidance?

A. Yes. The WHO concluded that the NIEHS has at least implicitly recommended the doctrine of prudence avoidance to reduce the exposure of susceptible populations to EMF from power lines. In this Backgrounder [32], the WHO, in describing the National Institutes of Health analysis of EMF with a focus on the reduction of exposure of high levels of EMF in neighborhoods, states, "In the United States, no national body has explicitly recommended a policy of Prudent Avoidance for power line fields. However, in its recent recommendations to the US Congress, the National Institute for Environmental Health Sciences (NIEHS) came close, by suggested that "the power industry continue its practice of siting power lines to reduce exposures and continue to explore ways to reduce the creation of magnetic fields around transmission and distribution lines without creating hazards. We also encourage technologies that lower exposures from neighborhood distribution lines provided that they do not increase other risks, such as those from accidental electrocution and fire"."

Q. Does the WHO make an explicit recommendation as to whether power line siting decisions should seek to reduce peoples’ exposure to EMF?
A. Yes. In its October 2001 Fact Sheet [33], the WHO explicitly states that power line siting decisions should seek to reduce people’s exposure to EMF. The WHO restates its prudent avoidance recommendation so as to accomplish reduction of peoples’ exposure to EMF associated with high voltage power lines, “Consultation with local authorities, industry and the public when siting new power lines: Obviously power lines must be sited to provide power to consumers. Siting decisions are often required to take into account aesthetics and public sensibilities. However, siting decisions should also consider ways to reduce peoples’ exposure.”

Q. Has the Connecticut Department of Public Health [4] specifically recognized the published scientific link between EMF and childhood leukemia?

A. Yes. In its January 2004 EMF Fact Sheet, the Connecticut Department of Public Health recognized, “…some studies have shown a weak link between household EMF exposure and a small increased risk of childhood leukemia at average exposures above 3 mG.”

Q. Has the Connecticut Department of Public Health stated that some people would be better off if they had reduced exposure to EMF?

A. Yes. The Department of Public Health warned that some individuals should reduce their exposure to EMF, “Although the current scientific evidence provides no definitive answers as to whether EMF exposure can increase health risks, there is enough uncertainty that some people may want to reduce their exposure to EMF.” This position is consistent with the WHO position which outlines the policy of prudent avoidance with regard to reducing susceptible peoples’ exposure to EMF from high voltage power lines.

Q. Has the Connecticut Department of Public Health made recommendations with respect to homeowners testing for EMF near their homes?

A. Yes. The Connecticut Department of Public Health stated that further away from power lines there is less concern for a health risk, but that closer to power lines it would be prudent to measure to see if the EMF levels are elevated over levels typically found in residences, ie., over 4mG. With further distance from high voltage power lines, the Department of Public Health noted that risk and concern should be decreased, “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.” However, within a shorter distance from power lines, the
Department of Public Health warned, “If the power lines are less than 300 feet away from
the home, you may want to consider obtaining EMF measurements in the yard.”

Q. Did the Connecticut Department of Public Health specifically address location of a
residence near a power line as an environmental hazard within a home that may
affect human health?

A. Yes. The Department of Public Health addressed the potential environmental risk of EMF
associated with high voltage power lines in a section titled “What Should I Do If A Home
I Want To Buy Has High Voltage Power Lines Nearby?” In this section, the Department
concluded that proximity of power lines and exposure to the associated EMF from such
power lines is of sufficient potential health concern that residents should consider EMF
from high voltage power lines as one of the environmental risks in determining
residential location, “Deciding where to live rests upon a number of considerations that
varies with each individual. EMF exposure is one of many factors in this decision.”

Q. What was the process that the California Health and Human Services Agency [3]
employed to generate its report on EMF and human diseases including childhood
leukemia?

A. After a lengthy review and analysis by 3 independent scientific experts, the California
Health and Human Services Agency presented its conclusions in June 2002. The
reviewers evaluated their views with regard to both the IARC guidelines for citing cancer
agents as well as a new Department set of criteria. Because these reviewers tended to
weight the human clinical cancer data most heavily, they also tended to cite a very strong
relationship between EMF and certain diseases, particularly childhood leukemia. Indeed,
one of the independent scientific experts, having reviewed all of the available scientific
and clinical data, and due to the reviewer’s perception of the clear clinical relationship
between EMF and childhood leukemia, concluded that EMF was a definite human
carcinogen.
Q. What are the 3 levels of human carcinogenicity considered by regulatory agencies?

A. Typically, the three levels reflect the relative certainty of the conclusion: the highest level is [definite or certain] human carcinogen, the middle level is probable human carcinogen, and the lowest level of conclusion that a hazard is a human carcinogen is possible human carcinogen. Lower levels of conclusion reflect that a hazard is unknown or unlikely to be a human carcinogen.

Q. Did the California Health and Human Services Agency conclude that EMF is a probable human carcinogen for childhood leukemia?

A. Yes. Focusing specifically on childhood leukemia, the mean determination of the group was that EMF was a probable human carcinogen for childhood leukemia. The report concluded, “Using the traditional guidelines of the International Agency for Research on Cancer (IARC) for childhood leukemia, their classifications for EMFs ranged from “human carcinogen” to “probable human carcinogen” to “possible human carcinogen” (IARC’s Groups 1, 2A, 2B).”

Q. What other conclusions did the California Health and Human Services Agency reach concerning EMF and childhood leukemia?

A. The California Health and Human Services Agency concluded that they “were prone to believe” that EMF causes some degree of increased risk of childhood leukemia. The report stated, “Using the Guidelines developed especially for the California EMF program, one of the reviewers “strongly believes” that high residential EMFs cause some degree of increased risk of childhood leukemia, another was “prone to believe” that they do, and another was “close to the dividing line between believing or not believing.”

Q. Did the California Health and Human Services Agency reach a conclusion as to whether EMF is a probable human carcinogen for adult leukemia?

A. Yes. The California Health and Human Services Agency concluded that EMF is a probable human carcinogen for adult leukemia. The report concluded, “Using the traditional guidelines of the International Agency for Research on Cancer (IARC) for
adult leukemia, their classifications for EMFs ranged from “human carcinogen” to “possible human carcinogen” (IARC’s Group 1 and 2B).

Q. What did the California Health and Human Services Agency base this conclusion on?

A. The California Health and Human Services Agency concluded that EMF causes human cancer because of strong consistency in the clinical data set that virtually ruled out responsible biases. The consistency amongst all of the clinical scientific studies was an important factor strengthening the view that EMF is a probable carcinogen. The report noted, “Consistency: This is the strongest factor arguing for causality. Not one of the studies reviewed is inconsistent with a weak positive association, while many are inconsistent with a null effect. Considering that these studies were conducted over a period of almost a quarter of a century, in different nations in four different continents, using different study designs and analysis methodologies, the possibility that these results are due to a common bias or confounder which has escaped identification, or to a host of diverse biases or confounders which, by chance, almost always biased the risk estimate upward and never downward (which should be equally probable) is virtually ruled out.”

Q. Did each of the independent scientific panels, the National Research Council, the National Institutes for Environmental Health Sciences, the National Radiological Protection Board, the International Agency for Research on Cancer, the International Commission for Non-Ionizing Radiation Protection, and the California Health and Human Services Agency conclude that there is a statistically significant association between EMF levels and childhood leukemia?

A. Yes. Each of these independent scientific panels reached the same positive conclusion that there is a statistically significant association between EMF levels and childhood leukemia and that such association is unlikely to be due to chance.

Q. What is your conclusion based on the data investigating the relationship between EMF and childhood leukemia?
A. Approximately 50 clinical studies have been reviewed and together they demonstrate a strong positive relationship between EMF from power lines and childhood leukemia. The major governmental and scientific authorities have concluded that this significant relationship is not due to chance. On this basis, state and federal and international governmental authorities have recommended that the prudent public health policy is to reduce exposure of people, particularly children, to EMF exposure from high voltage overhead power lines.

Q. Based on the data from published clinical studies specifically described and cited in your testimony, as well as specific conclusions from independent scientific panels cited in your testimony, would the operation of the proposed overhead high voltage power lines be expected to pose a long-term health hazard particularly to exposed children?

A. Yes. In coming to this conclusion, we have focused on the most robust clinical data – the three meta analyses of EMF and childhood leukemia [17-19] that virtually assure a non-random association of elevated EMF with childhood leukemia with a greater than 99% likelihood that the association between EMF and childhood leukemia is not due to chance. We also re-state the consistent conclusions of the significant relationship between EMF and childhood leukemia rendered by each of the National Research Council, the National Institutes for Environmental Health Sciences, the National Radiological Protection Board, the International Agency for Research on Cancer, the International Commission for Non-Ionizing Radiation Protection, and the California Health and Human Services Agency. Further, based on the exhibits provided by the power companies, the operation of these proposed power lines are projected to markedly increase EMF levels in areas specifically in which children congregate for prolonged periods of time. These exposures are projected by the power companies to lead to time-weighted average exposures many fold greater than the levels shown to be associated with a significant likelihood of childhood leukemia. In sum, based on the specific data cited in this testimony, operation of the proposed power lines would be expected to
significantly increase the likelihood of childhood leukemia in groups of children exposed to the elevated EMF associated with these power lines.
B. References