

THE CONNECTICUT SITING COUNCIL
DOCKET NO. 272

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

1 **Q. Dr. Bell, please state your name, position, and business address.**

2
3 A. My name is Leonard Bell. I am a physician, scientist, Adjunct Assistant Professor of
4 Medicine and Pathology at Yale University School of Medicine, and the Chief Executive
5 Officer of Alexion Pharmaceuticals, Inc., 352 Knotter Drive, Cheshire, CT 06410.
6

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

9
10 A. As chief executive officer of a biotechnology company, I have responsibility for
11 understanding and interpreting large and complex sets of data, from thousands of patients,
12 in accordance with federal regulatory guidelines concerned with determination of safety
13 and efficacy. Separately, I have been requested to testify as an expert witness regarding
14 technology and public policy to the U.S. Senate Hearing of the Labor and Human
15 Resources Committee Subcommittee on Public Health and Safety for an Invited
16 Testimony: "Scientific Discoveries in Cloning: Challenges for Public Policy".
17 Additionally, I am currently a Member of the Connecticut Governor's Council on
18 Economic Competitiveness and Technology
19

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

21
22 A. My name is Peter Rabinowitz. I am a physician, scientist, and Assistant Professor of
23 Medicine at Yale University School of Medicine. I am also Director of Clinical Services
24 for the Yale Occupational and Environmental Medicine Program 135 College Street, New
25 Haven CT 06880.
26

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

29
30 A. Yes. I am specialty trained and board certified in occupational and environmental
31 medicine, general preventive medicine, and family medicine. I have a masters degree in
32 Public Health from the Yale University School of Medicine's Department of
33 Epidemiology and Public Health, with a concentration in Chronic Disease Epidemiology.

1 In my clinical and research work, I address the relationship between hazards in the
2 environment and their impact on human health. Clinically, I assess the occupational and
3 environmental exposures of patients to physical, chemical, and biological hazards, and
4 determine whether there appear to be causative relationships between such exposures and
5 the patient's medical conditions. I have served as an expert in numerous legal cases
6 providing an opinion about the relationship between particular exposures and health
7 outcomes. I am currently the Principal Investigator for Federally funded epidemiologic
8 research that examines the interaction of occupational noise and chemical exposures on
9 the auditory system, the nervous system, and other health endpoints. I am also the
10 Principal investigator on a National Library of Medicine grant to assemble and review
11 published animal data regarding human environmental health hazards. I regularly write
12 technical reviews summarizing the latest research on a wide range of environmental
13 health hazards both for this corporation and the International Aluminum Association.
14 Finally, I am a contributor of several chapters to the upcoming second edition of a
15 major textbook in the field: Clinical Occupational and Environmental Medicine
16 (Rosenstock and Cullen, Eds), that will be published by W.B. Saunders later this year,
17 and am knowledgeable about the chapter in this book that provides an up to date review of
18 Electromagnetic Fields and human health.

19
20 **Q. Dr. Baum, please state your name, position, and business address.**

21
22 A. My name is Carl Baum. I am a pediatrician, medical toxicologist, and the Director of the
23 Center for Children's Environmental Toxicology at Yale-New Haven Children's
24 Hospital, 20 York St, New Haven, CT 06504.

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

27
28 A. Yes. I am specialty trained and board-certified in pediatrics, pediatric emergency
29 medicine, and medical toxicology. My primary clinical duties are in the pediatric
30 emergency department at Yale-New Haven Children's Hospital, where I treat thousands

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

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

21
22 A. My name is Alan Gerber. I am a professor and teach statistics and research methods in
23 the Yale University Department of Political Science. My research involves performing

1 and evaluating statistical studies. My office is at 77 Prospect Street, New Haven, CT
2 06520.

3 **Q. Dr. Gerberg, please describe your work performing and evaluating statistical**
4 **studies.**

5
6 A. As a professor, my job involves assessing the quality and interpreting the results of
7 statistical studies. I have performed peer reviews of such studies for leading journals in
8 political science and economics, as well as for organizations including the National Science
9 Foundation. My training includes a Ph.D. in economics from the Massachusetts Institute of
10 Technology. I have published quantitative research in the major peer reviewed journals in my
11 field, including Political Analysis, a journal specializing in technical analysis of research
12 methods. My research focuses on political subjects and typically attempts to discern and
13 accurately measure the causal effect of one variable in complex situations where there are
14 many variables that might contribute to an outcome or behavior. Examples of this research
15 include measurement of the effect of campaign spending on election outcomes, the effect of
16 legislative redistricting on the distribution of state spending, and the effect of voter
17 mobilization efforts on the probability a citizen votes.

18
19 **Q. Dr. Carpenter please state your name, position, and business address.**

20
21 A. My name is David Carpenter. I am currently Professor, Environmental Health &
22 Toxicology, Professor, Biomedical Sciences, and Director, Institute for Health and the
23 Environment, School of Public Health, University at Albany, One University Place,
24 B242, Rensselaer, NY 12144. I am formerly the Dean, School of Public Health,
25 University at Albany.

26
27 **Q. Dr. Carpenter, of what state, national, and international public health, EMF, and**
28 **power line committees or commissions have you been a member?**

29
30 A. With regard specifically to EMF and electric power issues, I have been Executive
31 Secretary, New York State Power Lines Project, Member of the Committee on Electric
32 Energy Systems of the Energy Engineering Board, National Research Council, Member
33 of the Advisory Panel for the Electric Energy System Division, U.S. Department of

1 Energy, Member of Committee #79, National Council on Radiation Protection and
2 Measurements, and Member, Connecticut Academy of Sciences and Engineering
3 Committee on Electromagnetic Field Health Effects. In the more general fields of public
4 and environmental health, I have been Member, Executive Committee of the Association
5 of Schools of Public Health, Member, National Advisory Environmental Health Sciences
6 Council of the National Institutes of Health, United States Co-Chair, Workgroup on
7 Ecosystem Health of the Science Advisory Board of the International Joint Commission,
8 and Member, Board of Directors, Healthy Schools Network, Inc.. Further, I am currently
9 a Member, United States Environmental Protection Agency, Children's Health Protection
10 Advisory Committee.

11
12 Additionally, I was awarded the Homer N. Calver Award from the American Public
13 Health Association for studies in environmental health. I have also published in the field
14 of EMF and public health.

15
16 **Q. Have you previously submitted testimony in this proceeding?**

17
18 A. Yes, Drs. Bell, Rabinowitz, Baum and Gerber submitted testimony on February 9, 2004 at
19 the CSC meeting in Woodbridge, CT.

20
21 **Q. What is the purpose of this supplemental testimony?**

22
23 A. The purpose of this testimony is to update and expand on the testimony submitted on
24 February 9th, 2004 in order to provide the details of the background information on
25 childhood cancers, the nature of EMF, EMF clinical research, EMF epidemiologic meta
26 analyses, EMF laboratory experiments, and the EMF assessment and regulatory
27 recommendations of major scientific panels.

28
29 **Q. Have you revised any of the conclusions in your February 9th, 2004 testimony?**

30
31 A. No.

32
33 **Q. What is your conclusion with respect to the relationship between EMF and**
34 **childhood leukemia?**

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

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

10
11 A. Our conclusion is based on approximately 50 clinical studies and the conclusions reached
12 by independent scientific panels, including panels of the National Research Council, the
13 National Institute for Environmental Health Sciences, the National Radiological
14 Protection Board, the International Agency for Research on Cancer, the International
15 Commission for Non-Ionizing Radiation Protection and the California Health and Human
16 Services Agency.

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

19
20 A. EMF is the term used to describe the electromagnetic fields that can be generated by a
21 number of sources. While the earth's magnetic field is a constant, non-fluctuating DC
22 field, the magnetic fields that result from man-made sources, particularly electric current
23 in power lines and appliances, are dynamic, AC fields. High voltage electric power lines
24 generate significant EMF, and their potential to cause health effects is the subject of this
25 testimony. Clinical studies show that above ground power lines, if adjacent to large
26 concentrations of susceptible human populations, particularly children, would be
27 expected to double the risk of certain deadly childhood cancers.

28

1 **Q. What is the focus of this testimony?**

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

18
19 **Q. What has been the general reaction of the scientific and public health community to**
20 **the many publications showing a strong positive relationship between EMF and**
21 **childhood leukemia?**

22
23 A. The evidence connecting EMF to childhood leukemia has had a major impact on the
24 scientific community and public health community worldwide. It has led the preeminent
25 worldwide council on cancer risks, the International Agency for Research on Cancer
26 (IARC), to officially list EMF as a potential human carcinogen [1]. The NIH National
27 Institutes of Environmental Health Sciences report published in May 1999 [2] concluded
28 that exposure to EMF “cannot be recognized at this time as entirely safe” due to the
29 childhood leukemia risk. The NIEHS Report states that “action is warranted such as a
30 continued emphasis on educating both the public and the regulated community on means
31 aimed at reducing exposures.” Subsequently, the State of California declared that on the
32 basis of all the scientific evidence, EMF was a probable cause of acute childhood

1 leukemia [3]. In January, 2004, the State of Connecticut Department of Public Health
2 Environmental Epidemiology division [4] recommended, "...there is enough uncertainty
3 that some people may want to reduce their exposure to EMF." The Department further
4 concluded that proximity of power lines and exposure to the associated EMF from such
5 power lines is of sufficient potential health concern that residents should consider EMF
6 from high voltage power lines as one of the environmental risks in determining
7 residential location, "Deciding where to live rests upon a number of considerations that
8 varies with each individual. EMF exposure is one of many factors in this decision."
9

10 **Q. What is the background information on childhood leukemia?**

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

24 **Q. What is the nature of EMF?**

25 A. Power lines, electrical wiring, and appliances all produce electric and magnetic fields.
26 Wherever electricity is generated, transmitted, or used, EMF are created, due to the
27 presence and motion of electric charges. Magnetic fields act on other electric charges in
28 motion. Thus, a magnetic field is created by an electric current and can vary in intensity
29 as the current varies. While the magnetic field of the earth is static, the magnetic fields
30 associated with electrical current are usually dynamic. EMF can be thought of as invisible
31

1 lines of force that surround any electrical device and move outward from that electrical
2 current in waves.

3
4 **Q. What is the relationship between EMF and power lines?**

5
6 A. With respect to EMF associated with power lines, the intensity of EMF is proportional to
7 the current carried along the electric line. While EMF is not well insulated by building
8 materials, the strength of the field dissipates with distance so that EMF intensity is
9 inversely proportional to the square of the distance from the power line. Separately, high
10 voltage electric lines emit a nearly continuous glow, or corona, of the electric field
11 breaking down air molecules near the line. This corona may also be a source of
12 downstream adverse health effects.

13
14 **Q. What is the general nature of EMF clinical research?**

15
16 A. Because of the ethical concern of deliberately exposing susceptible individuals to a
17 potential carcinogen, EMF, all clinical studies of EMF have been non-interventional,
18 epidemiologic studies. While common in the study of major public health issues and
19 while also understandable on ethical grounds, the absence of a gold-standard
20 prospectively designed, randomized, placebo-controlled, interventional clinical trial, also
21 weakens the ability to conclusively prove that EMF causes cancer. The use of
22 epidemiologic studies allows for conclusions regarding the certainty of an association
23 between EMF and cancer, as opposed to conclusions regarding whether EMF causes
24 cancer. However, the strength of the certainty of an association, together with the severity
25 of the potential adverse effects of the agent and a consideration of the risk to the
26 susceptible population, does allow for meaningful public health policy designed to
27 prudently protect the public welfare. Indeed, Kriebel and Tickner [7] summed up the
28 precautionary principle, “When there is substantial scientific uncertainty about the risks

1 and benefits of a proposed activity, policy decisions should be made in a way that errs on
2 the side of caution with respect to the environment and the health of the public.”

3
4 **Q. What has been the one particular health concern that has been repeatedly found in**
5 **clinical studies of EMF?**

6
7 A. Childhood leukemia. There have been more than several dozen published clinical studies
8 of EMF and human health. Many different health effects have been measured. In these
9 individual clinical studies, the one health problem that consistently has been found to be
10 associated with EMF exposure is acute childhood leukemia, a rare and potentially fatal
11 disease.

12
13 **Q. What did one of the earliest clinical studies examining the relationship between**
14 **EMF and childhood leukemia, the Wertheimer and Leeper study, show?**

15
16 A. Wertheimer and Leeper [8] initially described in 1979 an increased risk of cancers in
17 subjects less than 19 years of age and living in Denver area homes with elevated wire
18 code configurations as a surrogate measure of EMF. They reported a significantly
19 increased relative risk for childhood leukemia of 3.0 (95% confidence intervals, 1.8-5.0;
20 meaning that there is likely a 3-fold greater risk of childhood leukemia and that the
21 scientists were 95% certain that the increased risk was at least 1.8-fold but could be as
22 high as 5.0-fold greater) and 2.4 for nervous system tumors (95% CI , 1.2-5.0), with a
23 statistical trend for a 2.1 increased relative risk for lymphomas (95% CI, 0.84-5.2). This
24 study was not blinded and thus may have been susceptible to bias. However, the same
25 investigators conducted two additional, smaller blinded studies and showed qualitatively
26 similar results.

27
28 **Q. Are there other studies which show a strong positive relationship between EMF and**
29 **childhood leukemia?**

30
31 A. Yes. Savitz et al. [9] also reported a significant 1.5 increased risk of all cancers in
32 children (95% CI, 1.0-2.3) with elevated wire code configurations in Colorado, a
33 significant dose response for cancer occurrence with increasing wire code configurations,
34 and a relative risk of 1.5 for childhood leukemia (95% CI, 0.9-2.6). Feychting et al. [10]

1 used historically calculated field strengths and identified a significantly increased risk for
2 childhood leukemia of 2.0 (95% CI, 1.0-4.1) for levels greater than or equal to 0.2 uT (in
3 some studies the units “microTesla”, or uT, are used instead of milligauss, or mG; 0.1
4 microTesla = 1 milligauss). Feychting and Ahlbom [11] observed a 2.7 increased risk for
5 childhood leukemia (95% CI, 1.0-6.3; p=0.02) for levels greater than or equal to 0.2 uT,
6 and a 3.8 increased risk for childhood leukemia (95% CI, 1.4-9.3; p=0.005) for levels
7 greater than or equal to 0.3 uT. In this latter study, adjustment for potentially confounding
8 variables did not impact the conclusions.

9
10 **Q. What did the study by Linet et al. [12] show regarding EMF and childhood**
11 **leukemia?**

12
13 A. This study [12] found a positive trend, but not a statistically significant increase in risk
14 for childhood leukemia using a cut-point of 0.2 uT with a 1.53 odds ratio (95% CI, 0.91-
15 2.56; p=0.12 for matched controls). This suggests that there was at least an 88%
16 likelihood that the association between childhood cancer and EMF levels greater than 0.2
17 uT was not due to chance.

18
19 **Q. Did the threshold that Linet et al. [12] selected, ie., 0.2 uT, influence the outcome of**
20 **the study in regard to determining the relationship between EMF and childhood**
21 **leukemia?**

22
23 A. Yes. With a more rigorous threshold for EMF exposure, the same investigators [12]
24 reported a significant increase in childhood leukemia. The same investigators examined
25 the relationship between the incidence of childhood leukemia and EMF with a higher
26 threshold (greater than or equal to 0.3 uT) and observed a statistically significant 1.72 rise
27 in cancer (95% CI, 1.03-2.86).

28
29 **Q. What did the study by Linet et al. [12] teach about epidemiologic studies examining**
30 **the relationship between EMF and childhood leukemia?**

31
32 A. This study suggested that, in part due to the infrequency of childhood leukemia, it would
33 be easier to detect a significant relationship between EMF and childhood leukemia
34 examining somewhat higher “doses” of EMF.

1 **Q. What does the study by Linet et. al [12] teach with respect to any dose-response**
2 **relationship between EMF levels and childhood leukemia?**

3
4 A. That study strongly supports a dose-response relationship between EMF levels and
5 childhood leukemia, further supporting a causal relationship, in children, between EMF
6 and acute lymphocytic leukemia.

7
8 **Q. Did Green et al. [13] observe a positive relationship between EMF and childhood**
9 **leukemia?**

10
11 A. Yes. Green et al. [13] observed that for children younger than 6 years at diagnosis,
12 outside perimeter measurements of the residence greater than or equal to 0.15 uT were
13 associated with a significantly increased leukemia risk (OR = 3.45, 95% CI = 1.14-
14 10.45).

15
16 **Q. Did the Rome study [14] observe a positive relationship between proximity to EMF**
17 **sources and childhood leukemia?**

18
19 A. Yes, the Rome study found that proximity to large EMF sources is associated with a
20 significantly increased risk of childhood leukemia in Rome with an increased risk of 2.2
21 (95%CI, 1.0-4.1) [14].

22
23 **Q. Did scientific studies find a positive relationship between predicted and measured**
24 **magnetic fields and childhood leukemia in Los Angeles?**

25
26 A. Yes, the Los Angeles study found that predicted and measured magnetic fields in Los
27 Angeles were associated with a significant 2.19 (95% CI, 1.12-4.31; p value = 0.007)
28 increased risk of childhood leukemia [15].

29
30 **Q. What did the Los Angeles study [15] conclude was the likelihood that the extremely**
31 **positive relationship between EMF levels and childhood leukemia in Los Angeles**
32 **was not due to chance?**

33
34 A. The Los Angeles study indicated that the likelihood that this association was not due to
35 chance was extremely high, 99.3% [15].

36
37 **Q. Are the epidemiologic results examining the relationship between EMF and**
38 **childhood cancer uniform?**

1
2 A. No. While more than several dozen individual epidemiologic studies have been
3 performed, the results are not uniform. The 1997 National Research Council report
4 summarizes, “Wire codes are associated with an approximate 1.5-fold excess of
5 childhood leukemia, which is statistically significant. Although the literature is not
6 entirely consistent, the combined results from the array of studies that have examined
7 wire codes and related markers of exposure, such as proximity to power lines and
8 calculated magnetic fields from power lines, indicate that an association is present.” [16].

9
10 **Q. What is a meta analysis and why is it used in the study of the relationship between**
11 **EMF and childhood cancer?**

12
13 A. Because of the relative infrequency of childhood leukemia in the general population,
14 individual clinical studies may not be sufficiently large to observe an adverse treatment
15 effect of EMF on the incidence of childhood leukemia. In such situations, clinical
16 scientists frequently use an approved scientific technique where they combine the
17 subjects from many individual trials together into one group. With this combined, single,
18 larger group of subjects, clinical scientists are more likely to be able to accurately identify
19 the presence of rare, or infrequent, events. Further, with these “meta analyses”, clinical
20 scientists can measure whether different interventions increase or decrease the likelihood
21 of rare events, such as childhood leukemia.

22
23 **Q. What do the results of the major meta analyses of the relationship between EMF**
24 **and childhood leukemia teach with respect to the statistical relationship between**
25 **EMF and childhood leukemia?**

26
27 A. At least three major scientific meta-analyses have been performed examining whether
28 EMF is associated with childhood leukemia. Each of these studies has shown similar
29 results: at exposure levels of 2-4 mG (0.2 – 0.4 uT) and above, the risk of childhood
30 leukemia is statistically significantly increased.

31

Study	Studies/# Subjects	Threshold	Increased Risk
Ahlbom et al. [17]	9 studies -13,647	0.4 uT	2.0 (1.27-3.13), P=0.002
Greenland et al. [18]	12 studies	0.3 uT	1.83 (1.34-2.49),
Wartenberg et al. [19]	14 studies – 9,697	0.2 uT	1.34 (1.07-1.67)

1
2 **Q. Did Ahlbom et al. [17] show a significant association between EMF levels and**
3 **childhood leukemia?**

4
5 A. Yes. Ahlbom et al. showed a highly significant association between EMF levels and
6 childhood leukemia.

7
8 **Q. Did Greenland et al. [18] show a significant association between EMF levels and**
9 **childhood leukemia?**

10
11 A. Yes. Greenland et al. showed a highly significant association between EMF levels and
12 childhood leukemia.

13
14 **Q. Did Wartenberg et al. [19] show a significant association between EMF levels and**
15 **childhood leukemia?**

16
17 A. Yes. Wartenberg et al. showed a highly significant association between EMF levels and
18 childhood leukemia.

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

22
23 A. Yes. Together, these studies show an apparent dose-effect of EMF across these 3 meta-
24 analyses, in that the risk of childhood leukemia increases with exposure thresholds
25 increasing from 0.2 to 0.3 to 0.4 uT.

26
27 **Q. What is the scientific importance of a dose-dependent effect in these large clinical**
28 **meta-analyses of the relationship between EMF and childhood leukemia?**

29
30 A. In scientific studies, a dose-dependent effect is important evidence supporting a “cause-
31 and-effect” relationship in the studied species; ie., that EMF causes childhood cancer in
32 the studied human populations.

33
34 **Q. Did Wartenberg [19] state that there is evidence for a linear effect of EMF on**
35 **causing childhood leukemia and that the risk may be increased even for levels less**
36 **than 0.2 uT?**

1 A. Yes. Wartenberg [19] calculated that the risk of childhood leukemia would be increased
2 in a continuous manner, for each 0.1 uT increase in magnetic field strength.

3
4 **Q. Did Wartenberg [19] state that the data is strong and consistent for a positive**
5 **relationship between EMF and childhood leukemia?**

6
7 A. Yes. Wartenberg stated, “many people believe there are no data to support an association
8 between residential magnetic field exposure and childhood leukemia. To the contrary, the
9 data strongly and relatively consistently support such an association...”

10
11 **Q. Is it true that Wartenberg [19] found no statistically consistent results?**

12
13 A. No, it is not true. Wartenberg [19] himself stated, “Overall, I see largely positive results
14 with small to moderate effect sizes...These summaries are unlikely to be changed by
15 additional studies unless those studies are extremely large and produce markedly different
16 results.”

17
18 **Q. Have these meta-analyses of the relationship between EMF and childhood leukemia**
19 **been refuted by subsequent peer-reviewed scientific publications?**

20
21 A. No. Not one of these scientific meta-analyses has been refuted by a peer-reviewed
22 scientific publication. Indeed, these studies have examined an infrequent childhood
23 cancer and identified consistently significant and dose-dependent increases in incidence
24 of this fatal cancer with increasing childhood exposure to EMF. These meta-analyses
25 serve as the most robust identification of the certainty of an association between EMF and
26 childhood leukemia.

27
28 **Q. According to these large meta-analyses of the relationship between EMF and**
29 **childhood cancer, what is the likelihood that EMF is truly associated with childhood**
30 **cancer?**

31
32 A. The likelihood that EMF is truly associated with childhood cancer in humans is extremely
33 high. Ahlbom et al.’s [17] work allows one to conclude that, based on a very large study
34 sample size, there is a 99.8% likelihood that EMF is truly associated with childhood
35 leukemia.

1 **Q. Have preclinical EMF studies shown conclusive results?**

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

17
18 **Q. Have laboratory experiments shown adverse effects of EMF?**

19
20 A. Yes. There are a significant number of diverse experimental laboratory studies
21 demonstrating the direct carcinogenic potential of EMF.

22
23 **Q. With regard to childhood leukemia in humans, what are the laboratory studies that**
24 **would be supportive of a causal role for EMF in childhood leukemia?**

25
26 A. Since leukemia is an abnormality of growth of white blood cells, laboratory experiments
27 showing changes in the immune system, lack of resistance to physiological stresses,
28 mutations in DNA, abnormal proliferation of cells, and potentiation of known
29 carcinogens would be strongly supportive of a causal role for EMF and childhood
30 leukemia.

31
32 **Q. Have there been laboratory studies that support a causal role for EMF in childhood**
33 **leukemia?**

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

19 **Q. Based on laboratory studies, would power lines be expected to cause ozone that is**
20 **toxic and a strong pulmonary irritant?**
21

22 A. Yes. Scientists have demonstrated that experimental animals subjected to the corona
23 associated with electric fields, similar to those demonstrated with high voltage power
24 lines, serve to generate toxic ozone [27].
25

26 **Q. Have experimental studies proposed actual mechanisms by which EMF might cause**
27 **direct injury to children's bone marrow resulting in leukemia?**
28

29 A. Yes. The most important role of experimental studies with regard to determining the
30 potential cancer-causing nature of an environmental hazard is to propose potential
31 mechanisms by which the hazard (EMF) might actually cause the associated cancer. In
32 this regard, scientists believe that recent field studies have suggested a mechanism by
33 which EMF may cause childhood leukemia via the initiation and maintenance of elevated

1 contact currents [28]. Scientists have recently described a highly statistically significant
2 relationship between (i) the voltage between residential water pipes and the earth (called
3 “Vw-e”, or contact current) and (ii) the intensity of the residential magnetic field
4 ($p < 0.001$) [29]. The relationship is considered quite statistically strong since the
5 likelihood of it not being due to chance is greater than 99.9% [29]. Moreover, these
6 scientists demonstrated that “the highest voltages occur[ed] in homes near high voltage
7 transmission lines, most likely due to magnetic induction on the grounding system.” [29]
8 They further demonstrated that the current that would be expected to be generated would
9 be sufficient to bring toxic doses to children’s bone marrow. These scientists concluded,
10 “The results shown suggest that exposure to contact current associated with voltage on
11 residential water pipes could lay at the heart of the association between magnetic fields
12 and childhood leukemia. Our data call into question the possible role of HVTL [high
13 voltage transmission lines] in producing significant levels of Vw-e due to magnetic
14 induction on the grounding system.” [29]

15
16 **Q. Has this “contact-current” mechanism of action for EMF causing childhood cancer**
17 **been refuted in the scientific literature?**

18
19 A. No. The contact-current mechanism for delivery of the carcinogenic action of EMF to
20 children’s bone marrow has not been refuted in any peer-reviewed, published scientific
21 investigation. It remains a viable candidate demonstrating a causal mechanism for EMF
22 and childhood cancer.

23
24 **Q. What was the National Research Council report’s [16] view on the overall clinical**
25 **data examining EMF and childhood cancer?**

26
27 A. In text accompanying a figure showing the odds ratio for 53 individual studies and meta
28 analyses examining the relationship between EMF and childhood cancer, the National
29 Research Council (NRC) [16] report stated, “One striking observation is the
30 preponderance of dots (odds ratios) at or above the null effect line. Only 8 out of 53 odds
31 ratios dots fall below the null effect line...This unweighted vote-counting assessment
32 strongly suggests an association with some feature of the power transmission and
33 distribution system because of a small but consistent positive odds ratio.”

1
2 **Q. Did the NRC report state a conclusion as to whether the link between EMF and**
3 **childhood leukemia was likely caused by chance?**

4
5 A. Yes. The NRC report concluded that the positive association between EMF and
6 childhood leukemia was not caused by chance. The NRC report states: “The purpose of
7 this analysis has been to evaluate the role of random variation in explaining the results
8 observed in the set of epidemiologic studies examining residential magnetic-field
9 exposure and childhood leukemia. When looked at in a variety of analyses, the positive
10 trend in the association cannot be explained statistically on the basis of random
11 fluctuations...”

12
13 **Q. Did the NRC report comment on whether there was substantial consistency of the**
14 **human data showing the relationship between EMF and childhood leukemia?**

15
16 A. Yes. The NRC report notes the consistency of the different studies showing a positive
17 relationship between EMF and childhood leukemia, stating, “...the results of the
18 residential exposure studies to date present a fairly uniform picture supporting an
19 association of childhood leukemia with wire codes, distance from source, and for the
20 three Nordic studies, calculated fields based on historical records of power consumption.”

21
22 **Q. Did the NRC express a belief as to whether subsequent clinical studies were likely to**
23 **overcome the wealth of clinical data demonstrating the positive relationship between**
24 **EMF and childhood leukemia?**

25
26 A. Yes. With regard to the likely impact of even more clinical studies in overturning the
27 already available large reservoir of clinical data showing the positive relationship
28 between EMF and childhood leukemia, the NRC stated, “It would take a relatively large
29 number of studies with largely negative results to balance this effect to null.”

30
31 **Q. Did the NRC report reach a conclusion as to the cancer risk to children placed in**
32 **proximity to power lines?**

33
34 A. Yes. The importance of the proximity of childhood leukemia victims to power lines was
35 recognized. The NRC report stated, “Thus, the finding remains that there are strong and

1 consistent data suggesting a relatively weak increased risk of leukemia for children living
2 in close proximity to power lines.”

3
4 **Q. Did the NRC report discuss whether bias was likely to explain the positive**
5 **association between EMF and childhood leukemia?**

6
7 A. Yes. The NRC noted the potential role of bias, but stated their expert view that bias was
8 unlikely to account for the positive relationship between EMF and childhood leukemia.
9 The NRC report stated, “As with any epidemiologic study, the studies of residential
10 magnetic-field exposure and childhood cancer have many possible sources of bias. Each
11 of these possible errors could influence the size of the reported odds ratios, but none is
12 likely to be present or sufficiently large across all the studies to explain the
13 results...Because the study designs and methods are diverse and because no persuasive
14 flaw is found in all of them, the committee believes that any particular selection bias is
15 unlikely to completely explain the reported associations between exposure to magnetic
16 fields, as reflected by the wire codes, and childhood cancer incidence.”

17
18 **Q. Was the NRC able to conclude, in 1997, that EMF caused childhood cancer?**

19
20 A. No. The NRC was unable to conclude that EMF caused childhood cancer because of the
21 lack of a definitive understanding of the causative mechanism in animal experiments at
22 that time. The NRC report was also completed prior to publication of several meta
23 analyses and experimental data showing the non-thermal, carcinogenic evidence for EMF.

24
25 **Q. Although the NRC was not able to conclude that EMF caused cancer in animal**
26 **experiments, did the NRC report reach a conclusion as to whether EMF and a**
27 **proximity of power lines is positively associated with childhood leukemia?**

28
29 A. Yes. The committee did conclude that further studies would be extremely unlikely to
30 change their expert view concerning the clear association of EMF and childhood
31 leukemia. Such additional studies, they stated, would only confirm the already clear
32 relationship between EMF and childhood leukemia. The NRC report stated, “This pattern
33 of results and the committee’s analysis of these data suggest that an association is likely
34 to be present and if a flawlessly designed and executed study could be conducted it would

1 identify a positive association between indicators of exposure, such as proximity of power
2 lines to residences, and childhood cancer.”

3
4 **Q. Did the National Institutes of Health [2] reach a conclusion as to whether EMF may**
5 **be a human carcinogen?**

6
7 A. Yes. In follow-up to the NRC report, the next US Federal Government report, conducted
8 by the National Institutes for Environmental Health Sciences (NIEHS) of the National
9 Institutes of Health Working Group stated, “The Working Group concluded that ELF
10 EMF are possibly carcinogenic to humans (Group 2B).”

11
12 **Q. Why did the National Institutes of Health Working Group conclude that EMF is a**
13 **possible human cancer-causing agent?**

14
15 A. The National Institutes for Environmental Health Sciences (NIEHS) of the National
16 Institutes of Health Working Group clarified that the positive relationship between EMF
17 and cancer is due largely to the association between EMF and leukemia in children and
18 power line workers, “There is little doubt that the evidence in support of the decision to
19 classify ELF EMF into Group 2B [possible human carcinogen] is driven by the results of
20 studies on childhood leukemia in residential environments and on CLL in adults in
21 occupational settings.”

22
23 **Q. What was the basis of the NIEHS conclusion that EMF is a possible human**
24 **carcinogen?**

25
26 A. The NIEHS Working Group’s conclusion was driven by the positive relationship between
27 EMF and leukemia, particularly childhood leukemia. The NIEHS Working Group
28 overwhelmingly cited the clear positive relationship between EMF and childhood
29 leukemia, stating “The majority (20 out of 26) of the Working Group members who voted
30 concluded there is limited evidence that residential exposure to ELF magnetic fields is
31 carcinogenic to children on the basis of the results of studies of childhood leukemia. . . .
32 Three lines of evidence supported the overall finding: the association between exposure
33 to calculated magnetic fields and risk for childhood leukemia, the association between
34 exposure to measured 24-h magnetic fields and risk for childhood leukemia, and

1 continued concern about the association between wire codes and risk for childhood
2 leukemia.”

3
4 **Q. What does the term “limited evidence” mean?**

5
6 A. While there was a clear association between EMF and childhood leukemia, the qualifying
7 phrase “limited evidence” was employed only because a causal link could not be
8 identified with 100% certainty. The term “limited evidence” does not mean that there is
9 only a small amount of human evidence for cancer-causing activity of EMF. The NIEHS
10 report stated, “This degree of evidence is generally provided by studies for which there is
11 credible evidence of an association and for which a causal linkage cannot be established
12 with a high degree of certainty. This does not mean the effect is weak...”

13
14 **Q. Was the extent of human evidence enough that the NIEHS expressed concern for**
15 **humans?**

16
17 A. Yes. The NIEHS was sufficiently concerned to note, “This level of evidence, while weak,
18 is still sufficient to warrant limited concern.”

19
20 **Q. Did the US Federal Government conclude that EMF is not safe?**

21
22 A. Yes. The US Federal Government’s concern was sufficient to conclude that EMF is not
23 safe, “The NIEHS concludes that ELF-EMF exposure cannot be recognized at this time as
24 entirely safe because of weak scientific evidence that exposure may pose a leukemia
25 hazard.”

26
27 **Q. What was the primary basis of the conclusion that EMF is not safe?**

28
29 A. The NIEHS conclusion that EMF is not safe was largely due to the positive association in
30 clinical studies of EMF and childhood leukemia. The report stated, “The NIEHS
31 concludes that ELF-EMF exposure cannot be recognized at this time as entirely safe
32 because of weak scientific evidence that exposure may pose a leukemia hazard.”

33
34 **Q. Did the NIEHS recommend that exposures of humans to magnetic fields associated**
35 **with power lines be reduced?**

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

6
7 **Q. Is there any evidence that the NIEHS report supports increased exposure of**
8 **children to EMF from power lines?**
9

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

13
14 **Q. What conclusion did the National Radiological Protection Board [30] reach**
15 **concerning the relationship, if any, between EMF and childhood leukemia?**
16

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

22
23 **Q. What did the NRPB conclude as to whether the positive association between EMF**
24 **and childhood leukemia was likely to be due to chance?**
25

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

31
32 **Q. What did the NRPB state were the impacts of any confounding factors on the**
33 **carcinogenic impact of EMF on childhood leukemia?**
34

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

9
10 **Q. What did the International Agency for Research on Cancer (IARC) [1] conclude**
11 **about whether EMF may be carcinogenic to humans?**

12
13 A. The IARC concluded its overall evaluation as follows: “Extremely low-frequency
14 magnetic fields are possibly carcinogenic to humans (Group 2B).”

15
16 **Q. Did the IARC have any particular focus when concluding that EMF may be**
17 **carcinogenic to humans?**

18
19 A. Yes. The IARC particularly focused on the positive relationship between EMF and
20 childhood leukemia. The carcinogenic potential of EMF was believed to be largely due
21 to the effect of EMF to increase childhood leukemia. The IARC stated, “There is limited
22 evidence in humans for the carcinogenicity of extremely low-frequency magnetic fields in
23 relation to childhood leukemia.”

24
25 **Q. Did the IARC conclude that there was consistency in the data between EMF and**
26 **childhood leukemia?**

27
28 A. Yes. The IARC noted the consistency of the clinical relationship between EMF and
29 childhood leukemia stating, “...pooled analyses of data from a number of well-conducted
30 studies show a fairly consistent statistical association between childhood leukaemia and
31 power-frequency residential magnetic field strengths above 0.4 microTesla (4
32 milligauss), with an approximately two-fold increase in risk. This is unlikely to be due to
33 chance, but may be affected by selection bias. Therefore this association between

1 childhood leukemia and high residential magnetic field strengths was judged *limited*
2 *evidence* for excess cancer risk in exposed humans.”

3
4 **Q. Was the IARC’s conclusion that EMF may be cancer-causing in humans specifically**
5 **related to the relationship between magnetic fields and leukemia, particularly with**
6 **childhood leukemia?**

7
8 A. Yes. The effect of EMF to be possibly cancer-causing and strongly associated with
9 childhood leukemia was specific to magnetic fields and childhood leukemia. The IARC
10 stated, “Overall, extremely low frequency magnetic fields were evaluated as *possibly*
11 *carcinogenic to humans (Group 2B)*, based on the statistical association of higher level
12 residential ELF magnetic fields and increased risk for childhood leukaemia. Static
13 magnetic fields and static and extremely low frequency electric fields *could not be*
14 *classified as to carcinogenicity to humans (Group 3)*.”

15
16 **Q. Did the International Commission for Non-Ionizing Radiation Protection [31] reach**
17 **a conclusion as to whether there was a positive relationship between EMF and**
18 **childhood leukemia?**

19
20 A. Yes. The International Commission for Non-Ionizing Radiation Protection (ICNIRP)
21 concluded that there was a positive relationship between EMF and childhood leukemia,
22 based on strong methodology and large study sizes. The ICNIRP, with a focus on the
23 positive relationship between EMF and childhood leukemia, stated, “A large body of
24 high-quality data exists, with measurements of exposure, strong methodology, and large
25 study sizes, for childhood leukemia and brain tumors and for occupational exposure in
26 relation to adult leukemia and brain tumors. Among all the outcomes evaluated in
27 epidemiologic studies of EMF, childhood leukemia in relation to postnatal exposures
28 above 0.4 μT (4 milligauss) is the one for which there is most evidence of an
29 association.”

30
31 **Q. Did the World Health Organization study whether states and countries are**
32 **following the doctrine of “prudent avoidance” with regard to power lines and siting**
33 **away from schools?**
34

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

13
14 **Q. Did the WHO address whether the NIEHS has embraced the doctrine of prudent**
15 **avoidance?**

16
17 A. Yes. The WHO concluded that the NIEHS has at least implicitly recommended the
18 doctrine of prudence avoidance to reduce the exposure of susceptible populations to EMF
19 from power lines. In this Backgrounder [32], the WHO, in describing the National
20 Institutes of Health analysis of EMF with a focus on the reduction of exposure of high
21 levels of EMF in neighborhoods, states, “In the United States, no national body has
22 explicitly recommended a policy of Prudent Avoidance for power line fields. However, in
23 its recent recommendations to the US Congress, the National Institute for Environmental
24 Health Sciences (NIEHS) came close, by suggested that "the power industry continue its
25 practice of siting power lines to reduce exposures and continue to explore ways to reduce
26 the creation of magnetic fields around transmission and distribution lines without creating
27 hazards. We also encourage technologies that lower exposures from neighborhood
28 distribution lines provided that they do not increase other risks, such as those from
29 accidental electrocution and fire".”

30
31 **Q. Does the WHO make an explicit recommendation as to whether power line siting**
32 **decisions should seek to reduce peoples’ exposure to EMF?**
33

1 A. Yes. In its October 2001 Fact Sheet [33], the WHO explicitly states that power line siting
2 decisions should seek to reduce people's exposure to EMF. The WHO restates its
3 prudent avoidance recommendation so as to accomplish reduction of peoples' exposure to
4 EMF associated with high voltage power lines, "Consultation with local authorities,
5 industry and the public when siting new power lines: Obviously power lines must be sited
6 to provide power to consumers. Siting decisions are often required to take into account
7 aesthetics and public sensibilities. However, siting decisions should also consider ways to
8 reduce peoples' exposure."

9
10 **Q. Has the Connecticut Department of Public Health [4] specifically recognized the**
11 **published scientific link between EMF and childhood leukemia?**

12
13 A. Yes. In its January 2004 EMF Fact Sheet, the Connecticut Department of Public Health
14 recognized, "...some studies have shown a weak link between household EMF exposure
15 and a small increased risk of childhood leukemia at average exposures above 3 mG."

16
17 **Q. Has the Connecticut Department of Public Health stated that some people would be**
18 **better off if they had reduced exposure to EMF?**

19
20 A. Yes. The Department of Public Health warned that some individuals should reduce their
21 exposure to EMF, "Although the current scientific evidence provides no definitive
22 answers as to whether EMF exposure can increase health risks, there is enough
23 uncertainty that some people may want to reduce their exposure to EMF." This position is
24 consistent with the WHO position which outlines the policy of prudent avoidance with
25 regard to reducing susceptible peoples' exposure to EMF from high voltage power lines.

26
27 **Q. Has the Connecticut Department of Public Health made recommendations with**
28 **respect to homeowners testing for EMF near their homes?**

29
30 A. Yes. The Connecticut Department of Public Health stated that further away from power
31 lines there is less concern for a health risk, but that closer to power lines it would be
32 prudent to measure to see if the EMF levels are elevated over levels typically found in
33 residences, ie., over 4mG. With further distance from high voltage power lines, the
34 Department of Public Health noted that risk and concern should be decreased, "If the

1 power lines are more than 300 feet away, there should be no cause for concern. At this
2 distance EMF levels from the power lines are no different from typical EMF levels
3 outside or inside the home.” However, within a shorter distance from power lines, the
4 Department of Public Health warned, “If the power lines are less than 300 feet away from
5 the home, you may want to consider obtaining EMF measurements in the yard.”
6

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

10
11 A. Yes. The Department of Public Health addressed the potential environmental risk of EMF
12 associated with high voltage power lines in a section titled “What Should I Do If A Home
13 I Want To Buy Has High Voltage Power Lines Nearby?” In this section, the Department
14 concluded that proximity of power lines and exposure to the associated EMF from such
15 power lines is of sufficient potential health concern that residents should consider EMF
16 from high voltage power lines as one of the environmental risks in determining
17 residential location, “Deciding where to live rests upon a number of considerations that
18 varies with each individual. EMF exposure is one of many factors in this decision.”
19

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

23
24 A. After a lengthy review and analysis by 3 independent scientific experts, the California
25 Health and Human Services Agency presented its conclusions in June 2002. The
26 reviewers evaluated their views with regard to both the IARC guidelines for citing cancer
27 agents as well as a new Department set of criteria. Because these reviewers tended to
28 weight the human clinical cancer data most heavily, they also tended to cite a very strong
29 relationship between EMF and certain diseases, particularly childhood leukemia. Indeed,
30 one of the independent scientific experts, having reviewed all of the available scientific
31 and clinical data, and due to the reviewer’s perception of the clear clinical relationship
32 between EMF and childhood leukemia, concluded that EMF was a definite human
33 carcinogen.

1
2 **Q. What are the 3 levels of human carcinogenicity considered by regulatory agencies?**

3
4 A. Typically, the three levels reflect the relative certainty of the conclusion: the highest level
5 is [definite or certain] human carcinogen, the middle level is probable human carcinogen,
6 and the lowest level of conclusion that a hazard is a human carcinogen is possible human
7 carcinogen. Lower levels of conclusion reflect that a hazard is unknown or unlikely to be
8 a human carcinogen.

9
10 **Q. Did the California Health and Human Services Agency conclude that EMF is a**
11 **probable human carcinogen for childhood leukemia?**

12
13 A. Yes. Focusing specifically on childhood leukemia, the mean determination of the group
14 was that EMF was a probable human carcinogen for childhood leukemia. The reported
15 concluded, “Using the traditional guidelines of the International Agency for Research on
16 Cancer (IARC) for childhood leukemia, their classifications for EMFs ranged from
17 “human carcinogen” to “probable human carcinogen” to “possible human carcinogen”
18 (IARC’s Groups 1, 2A, 2B).”

19
20 **Q. What other conclusions did the California Health and Human Services Agency**
21 **reach concerning EMF and childhood leukemia?**

22
23 A. The California Health and Human Services Agency concluded that they “were prone to
24 believe” that EMF causes some degree of increased risk of childhood leukemia. The
25 report stated, “Using the Guidelines developed especially for the California EMF
26 program, one of the reviewers “strongly believes” that high residential EMFs cause some
27 degree of increased risk of childhood leukemia, another was “prone to believe” that they
28 do, and another was “close to the dividing line between believing or not believing.”

29
30 **Q. Did the California Health and Human Services Agency reach a conclusion as to**
31 **whether EMF is a probable human carcinogen for adult leukemia?**

32
33 A. Yes. The California Health and Human Services Agency concluded that EMF is a
34 probable human carcinogen for adult leukemia. The report concluded, “Using the
35 traditional guidelines of the International Agency for Research on Cancer (IARC) for

1 adult leukemia, their classifications for EMFs ranged from “human carcinogen” to
2 “possible human carcinogen” (IARC’s Group 1 and 2B).”

3
4 **Q. What did the California Health and Human Services Agency base this conclusion**
5 **on?**

6
7 A. The California Health and Human Services Agency concluded that EMF causes human
8 cancer because of strong consistency in the clinical data set that virtually ruled out
9 responsible biases. The consistency amongst all of the clinical scientific studies was an
10 important factor strengthening the view that EMF is a probable carcinogen. The report
11 noted, “*Consistency*: This is the strongest factor arguing for causality. Not one of the
12 studies reviewed is inconsistent with a weak positive association, while many are
13 inconsistent with a null effect. Considering that these studies were conducted over a
14 period of almost a quarter of a century, in different nations in four different continents,
15 using different study designs and analysis methodologies, the possibility that these results
16 are due to a common bias or confounder which has escaped identification, or to a host of
17 diverse biases or confounders which, by chance, almost always biased the risk estimate
18 upward and never downward (which should be equally probable) is virtually ruled out.”

19
20 **Q. Did each of the independent scientific panels, the National Research Council, the**
21 **National Institutes for Environmental Health Sciences, the National Radiological**
22 **Protection Board, the International Agency for Research on Cancer, the**
23 **International Commission for Non-Ionizing Radiation Protection, and the**
24 **California Health and Human Services Agency conclude that there is a statistically**
25 **significant association between EMF levels and childhood leukemia?**

26
27 A. Yes. Each of these independent scientific panels reached the same positive conclusion
28 that there is a statistically significant association between EMF levels and childhood
29 leukemia and that such association is unlikely to be due to chance.

30
31 **Q. What is your conclusion based on the data investigating the relationship between**
32 **EMF and childhood leukemia?**

1 A. Approximately 50 clinical studies have been reviewed and together they demonstrate a
2 strong positive relationship between EMF from power lines and childhood leukemia. The
3 major governmental and scientific authorities have concluded that this significant
4 relationship is not due to chance. On this basis, state and federal and international
5 governmental authorities have recommended that the prudent public health policy is to
6 reduce exposure of people, particularly children, to EMF exposure from high voltage
7 overhead power lines.

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

13
14 A. Yes. In coming to this conclusion, we have focused on the most robust clinical data – the
15 three meta analyses of EMF and childhood leukemia [17-19] that virtually assure a non-
16 random association of elevated EMF with childhood leukemia with a greater than 99%
17 likelihood that the association between EMF and childhood leukemia is not due to
18 chance. We also re-state the consistent conclusions of the significant relationship between
19 EMF and childhood leukemia rendered by each of the National Research Council, the
20 National Institutes for Environmental Health Sciences, the National Radiological
21 Protection Board, the International Agency for Research on Cancer, the International
22 Commission for Non-Ionizing Radiation Protection, and the California Health and
23 Human Services Agency. Further, based on the exhibits provided by the power
24 companies, the operation of these proposed power lines are projected to markedly
25 increase EMF levels in areas specifically in which children congregate for prolonged
26 periods of time. These exposures are projected by the power companies to lead to time-
27 weighted average exposures many fold greater than the levels shown to be associated
28 with a significant likelihood of childhood leukemia. **In sum, based on the specific data**
29 **cited in this testimony, operation of the proposed power lines would be expected to**

1 **significantly increase the likelihood of childhood leukemia in groups of children**
2 **exposed to the elevated EMF associated with these power lines.**

B. References

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