

BEFORE THE
PENNSYLVANIA PUBLIC UTILITY COMMISSION

IN RE: APPLICATION OF TRANS-ALLEGHENY	:	
INTERSTATE LINE COMPANY FOR	:	
(I) A CERTIFICATE OF PUBLIC CONVENIENCE	:	
TO OFFER, RENDER, FURNISH AND/OR	:	
SUPPLY TRANSMISSION SERVICE IN THE	:	
COMMONWEALTH OF PENNSYLVANIA;	:	
(II) AUTHORIZATION AND CERTIFICATION	:	
TO LOCATE, CONSTRUCT, OPERATE AND	:	Dockets No. A-110172
MAINTAIN CERTAIN HIGH VOLTAGE ELECTRIC	:	A-110172F0002
TRANSMISSION LINES AND RELATED ELECTRIC	:	A-110172F0003
SUBSTATION FACILITIES; (III) AUTHORITY	:	A-110172F0004
TO EXERCISE THE POWER OF EMINENT	:	G-000721229
DOMAIN FOR THE CONSTRUCTION AND	:	
INSTALLATION OF AERIAL ELECTRIC	:	
TRANSMISSION FACILITIES ALONG THE	:	
PROPOSED TRANSMISSION LINE ROUTES	:	
IN PENNSYLVANIA; (IV) APPROVAL OF AN	:	
EXEMPTION FROM MUNICIPAL ZONING	:	
REGULATION WITH RESPECT TO THE	:	
CONSTRUCTION OF BUILDINGS; AND	:	
(V) APPROVAL OF CERTAIN RELATED	:	
AFFILIATED INTEREST ARRANGEMENTS	:	

REBUTTAL TESTIMONY OF
WILLIAM H. BAILEY, Ph.D.

Re: Electric and Magnetic Fields and Possible Public Health Effects

December 10, 2007

REBUTTAL TESTIMONY OF WILLIAM H. BAILEY, Ph.D.

1 Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

2 A. My name is William H. Bailey. My business address is Exponent, Inc., 420
3 Lexington Avenue, Suite 1740, New York, NY 10170.

4

5 Q. WHAT IS YOUR POSITION AT EXPONENT, INC.?

6 A. I am a Principal Scientist in the Health Sciences practice and Director of
7 Exponent's New York office.

8

9 Q. HAVE YOU PREVIOUSLY SUBMITTED DIRECT TESTIMONY IN THIS
10 PROCEEDING ON BEHALF OF THE TRANS-ALLEGHENY
11 INTERSTATE LINE COMPANY ("TRAILCO")?

12 A. Yes. My direct testimony was previously submitted in this proceeding as
13 TrAILCo Statement No. 8.

14

15 Q. WILL THE USE OF VARIOUS TERMS IN YOUR REBUTTAL
16 TESTIMONY BE CONSISTENT WITH THE DEFINITIONS ASSIGNED TO
17 THOSE TERMS IN THE TABLE OF NOMENCLATURE, ATTACHED TO
18 TRAILCO WITNESS FLITMAN'S DIRECT TESTIMONY AS TRAILCO
19 EXHIBIT DEF-1?

20 A. Yes. In addition, I may define new terms in my rebuttal testimony.

1 Q. PLEASE DESCRIBE THE PURPOSE OF YOUR REBUTTAL
2 TESTIMONY.

3 A. The purpose of my rebuttal testimony is to respond to the direct testimonies of
4 the Office of Trial Staff (“OTS”) witness Gary L. Yocca, the Pennsylvania
5 Office of Consumer Advocate (“OCA”) witness Peter J. Lanzalotta, and the
6 Energy Conservation Council of Pennsylvania (“ECC”) witness Dr. Robert Q.
7 Hanham. My rebuttal testimony will also respond to various concerns raised
8 or allegations made during the public input hearings in Pennsylvania. With
9 regard to the issues raised by the witnesses listed above, my rebuttal testimony
10 will address:

11 1. The “competing reports” that attempt to relate a variety of health-
12 related issues to the electric and magnetic fields (“EMF”) emitted by
13 high-voltage transmission lines and the concerns expressed by persons
14 at the public input hearings regarding the possible adverse health
15 effects of EMF. Several of these reports and concerns were described
16 in the direct testimony of OTS witness Gary L. Yocca to refute the
17 conclusions I reached in my direct testimony. I firmly believe they do
18 not, and in this regard I am supported, *inter alia*, by the assessments of
19 EMF research completed by national and international health agencies
20 that were cited in my testimony. In addition, numerous reviews have
21 been published since the time of my testimony that support my
22 conclusions, most notably a review by the World Health Organization
23 (“WHO”).

1 2. The recommendation of OCA witness Peter J. Lanzalotta that EMF
2 levels be lowered at some locations by eliminating the proposed 500-
3 kV line to Prexy Substation and the Prexy Substation, and by requiring
4 reverse phasing for the 138-kV segments of TrAIL, if material costs
5 would not be significantly increased. For the reasons discussed below,
6 these recommendations to lower magnetic fields at some locations by
7 such means are not consistent with recommendations by scientific
8 organizations on the need or extent of precautionary measures and
9 should, therefore, be rejected.

10 3. The claim that there are “numerous problems” in my direct testimony,
11 as alleged by ECC witness Dr. Robert Q. Hanham. For the reasons
12 described below, the conclusions of my direct testimony reflect an
13 accurate and reasoned application of the assessments provided by
14 national and international health agencies to the question of whether the
15 TrAIL project will present health risks related to EMF.

16

17 Q. FIRST, IS THE EXPERTISE OF WITNESSES YOCCA, HANHAM, AND
18 LANZALOTTA AT ALL RELEVANT AND APPLICABLE TO THE
19 EVALUATION OF EMF FROM THE PERSPECTIVE OF PUBLIC
20 HEALTH?

21 A. No, it is not. Robert Hanham (a geographer), Gary Yocca (a ceramic scientist),
22 and Peter Lanzalotta (an electrical engineer) have no claim to specialized
23 knowledge and training regarding public health and EMF. This is certainly

1 true in connection with OCA witness Lanzalotta's claim that there is a public
2 health "need" to delete the transmission line between 502 Junction and Prexy
3 or to convert the proposed single circuit 138 kV lines to double circuit 138 kV
4 lines solely for the purpose of reverse phasing the circuits.

5
6 REBUTTAL TO OTS WITNESS GARY L. YOCCA

7 Q. IN ADDRESSING EMF, DOES OTS WITNESS GARY L. YOCCA,
8 CONCLUDE IN OTS STATEMENT NO. 1 THAT THE EMF LEVELS
9 ASSOCIATED WITH THE OPERATION OF TRAIL REPRESENT A
10 HEALTH DANGER?

11 A. No, he does not. Mr. Yocca does refer, however, to "many competing reports
12 relating the incidence of certain childhood leukemia's [sic] and other health-
13 related issues to EMF's [sic] such as those emitted by high-voltage lines" (p.
14 27, lines 9-12; p. 49, lines 15-18). He also describes his general review of the
15 public input hearing transcripts as indicating concerns regarding suspected
16 adverse health effects (p. 27, lines 13-15).

17
18 Q. DID THE REVIEWS OF THE RESEARCH THAT YOU SUMMARIZED IN
19 YOUR TESTIMONY ADDRESS THE "COMPETING REPORTS"
20 REFERENCED BY MR. YOCCA?

21 A. Yes. The reviews of the research performed for health agencies (including the
22 International Agency for Research on Cancer ("IARC"), the Health Council of
23 the Netherlands ("HCN"), the International Commission on Non-Ionizing

1 Radiation Protection (“ICNIRP”), the National Radiological Protection Board
2 (“NRPB”) of Great Britain, and the Swedish Radiation Protection Authority
3 (“SSI”) that I cited in my direct testimony, TrAILCo Statement No. 8, at pp.
4 14 (lines 6-23), 16 (lines 4-8), and 19 (lines 12-17), applied appropriate weight
5 of evidence methods, including a comprehensive evaluation of all of the
6 relevant reports in the literature.

7

8 Q. DO THE “COMPETING REPORTS” IN THE SCIENTIFIC LITERATURE
9 MEAN THAT THESE NATIONAL AND INTERNATIONAL HEALTH
10 AGENCIES HAVE NOT ADDRESSED ISSUES RAISED BY SOME
11 STUDIES IN THE LITERATURE OR HAVE BEEN UNABLE TO REACH
12 A CONCLUSION AS TO THE LIKELIHOOD OF ANY PUTATIVE
13 HEALTH HAZARD OF EMFS?

14 A. No. Health agencies have carefully prepared comprehensive reviews of the
15 research, evaluated the studies by their quality and reliability, and drawn
16 conclusions based on the strength and weight of the evidence.

17

18 Q. SO THE ATTENTION THAT OTS WITNESS YOCCA HAS DRAWN TO
19 THESE “COMPETING REPORTS” DOES NOT IMPLY THAT YOUR
20 TESTIMONY IS INCONSISTENT WITH THE CONCLUSIONS OF THE
21 ABOVE CITED HEALTH AGENCIES?

22 A. No, not at all. My testimony summarized the evaluations of the scientific
23 evidence by the health agencies on pages 18-20, and that testimony is clearly

1 consistent with the conclusions reached in these reviews by authoritative health
2 agencies. Moreover, my testimony is consistent with several reports published
3 *after* my testimony was submitted, including the most recent assessment of the
4 scientific evidence published by the WHO in June 2007 (WHO, 2007a, b).

5

6 Q. DO YOU AGREE WITH MR. YOCCA'S CHARACTERIZATIONS OF
7 YOUR TESTIMONY WHICH SUGGESTS THAT YOUR CONCLUSIONS
8 ARE UNSUBSTANTIATED?

9 A. No. All of the statements have a technical basis and are clearly substantiated.
10 If Mr. Yocca had any doubts about the statements he refers to on page 27, lines
11 6-8, he could have easily verified my statements from my responses to various
12 data requests and interrogatories.

13

14 Q. PLEASE COMMENT ON MR. YOCCA'S STATEMENTS THAT A LARGE
15 PERCENTAGE OF PEOPLE ARE DIRECTLY AFFECTED BY THE
16 PROPOSED PROJECT AND HAVE EXPRESSED HEALTH CONCERNS
17 AND FEARS.

18 A. With all due respect to Mr. Yocca, the public expression of concern or fear
19 does not provide evidence or proof as to the accuracy of these concerns.
20 TrAILCo recognizes these concerns, but there is no substitute for accurate and
21 objective information regarding the health research.

1 Q. DO YOU AGREE WITH MR. YOCCA'S CONCLUSION ON PAGE 49 OF
2 OTS STATEMENT NO. 1, AT LEAST FROM AN EMF PERSPECTIVE,
3 THAT TRAIL WOULD CREATE AN UNREASONABLE RISK TO THE
4 HEALTH AND SAFETY OF THE PUBLIC?

5 A. No. His suggestion - not apparently based upon any expert knowledge or
6 reading of the relevant research - is directly contradicted by the conclusions of
7 reviews of the scientific research performed by multidisciplinary groups of
8 scientists convened by national and international health agencies that I
9 referenced in my direct testimony.

10

11 REBUTTAL TO OCA WITNESS PETER J. LANZALOTTA

12 Q. IS OCA WITNESS LANZALOTTA'S RECOMMENDATION, ON PAGE 39
13 OF OCA STATEMENT NO. 1, TO ELIMINATE THE PROPOSED 500-KV
14 LINE FROM 502 JUNCTION TO PREXY SUBSTATION TO DECREASE
15 EMF LEVELS, CONSISTENT WITH THE RECOMMENDATIONS OF
16 THE 1999 REPORT BY THE DIRECTOR OF THE NATIONAL
17 INSTITUTE OF ENVIRONMENTAL HEALTH SCIENCES ("NIEHS") TO
18 CONGRESS OR THOSE OF THE WHO?

19 A. No. The elimination of transmission facilities designed to address a need
20 under consideration by the Commission solely to minimize the EMF associated
21 with the proposed line is not consistent with the recommendations of the
22 NIEHS or the WHO. Following Mr. Lanzalotta's logic would lead to the
23 rejection of the entire project, not just this one proposed segment of the line.

1 The NIEHS and the WHO have recommended only no or low cost activities to
2 minimize levels of EMF where practical; neither organization recommended
3 suspending the construction of electrical facilities as appropriate means of
4 minimizing field levels.

5

6 Q. WHAT JUSTIFICATION DOES MR. LANZALOTTA PROVIDE FOR THIS
7 EXTREME PROPOSAL?

8 A. On page 37 of OCA Statement No. 1, Mr. Lanzalotta cites the “expressed
9 misgivings about the magnetic fields from the proposed lines” by local
10 residents and others at public input hearings as evidence for his proposals. He
11 has not performed or referenced a reasoned risk assessment or public health
12 policy approach, however, which would justify his proposal.

13

14 REBUTTAL TO ECC WITNESS ROBERT Q. HANHAM

15 Q. DO YOU AGREE WITH DR. HANHAM’S CRITICISMS OF YOUR
16 TESTIMONY THAT ARE PREDICATED UPON YOUR EDUCATION,
17 PROFESSIONAL TRAINING, AND WORK EXPERIENCE?

18 Q. No. Dr. Hanham’s three listed claims on pages 8-10 are fallacious. He has
19 mischaracterized my expertise by narrowly limiting it to the area of study in
20 which I was awarded my Ph.D. and has ignored my training in statistical
21 analysis at both the master’s and Ph.D. level. He has also failed to
22 acknowledge my vast expertise in the field of bioelectromagnetics as described
23 by my publications, scientific lectures, teachings, and advisory consultations

1 over the past 25 years, which have largely focused on EMF health issues, and
2 in particular, the interpretation of relevant epidemiology studies.

3

4 Q. DO YOU AGREE WITH ECC WITNESS HANHAM'S CLAIM ON PAGE 9
5 OF ECC STATEMENT NO. 2, THAT YOUR TESTIMONY "INCLUDES
6 MANY UNSUPPORTED ASSERTIONS"?

7 A. No. I will address each of his unsupported allegations in turn.

8 1. The statements from my testimony that Dr. Hanham claims are
9 unsupported, pertain to the implications of the largely rural nature of
10 the proposed TrAIL route to the potential for public exposure to EMF,
11 which is described in the Line Route Evaluation ("LRE") Report
12 sponsored by witness Jack Halpern as TrAILCo Exhibit JH-1. I clearly
13 supported my opinion by referring to the testimony and exhibits of
14 TrAILCo's siting expert in this proceeding.

15 2. Regarding my statement that exposure to the line would be of limited
16 duration and intermittent, it is obvious that persons would have no
17 reason to spend long periods of uninterrupted time on the right-of-way
18 or near the right-of-way because, as shown in the LRE, the proposed
19 route would pass through a sparsely populated area and non-residential
20 exposures to EMF would be of short-duration.

1 Q. DO YOU AGREE WITH DR. HANHAM'S CLAIM ON PAGE 9 OF ECC
2 STATEMENT NO. 2 THAT YOUR STATEMENT THAT PERSONS
3 WOULD BE LARGELY SHIELDED FROM THE ELECTRIC FIELD
4 WHILE IN VEHICLES OR BY INTERVENING TREES, SHRUBBERY,
5 AND BUILDINGS IS UNSUPPORTED?

6 A. No. Any expert in the field of bioelectromagnetics or electrical engineering
7 knows that electric fields are easily shielded or blocked by conductive
8 materials, such as trees, fences, shrubbery, and buildings. This can be readily
9 confirmed by consultation with standard references. An example pertinent to
10 this case is the finding that the electric field from a 500-kV transmission line
11 outside a residence, is attenuated within the residence by about 90% by the
12 building materials (Caola, et al., 1983).

13

14 Q IS YOUR SUMMARY OF THE SCIENTIFIC CONSENSUS AS
15 EXPRESSED IN THE NUMEROUS MULIDISCIPLINARY REVIEWS NOT
16 SUPPORTED BY STATEMENTS IN THESE REVIEWS AS CLAIMED BY
17 ECC WITNESS HANHAM AT PAGES 9-10?

18 A. No, and to support this statement, the conclusions of NIEHS and IARC are
19 provided below.

20 NIEHS:

21

22 The ultimate goal of any risk assessment is to estimate the
23 probability of disease in an exposed population. In general, this
24 involves the combination of three basic pieces of information: the

1 probability that the agent causes the disease, the response as a
2 function of exposure given that the exposure does cause disease
3 and the distribution of exposures in the population being studied.
4 The NIEHS believes that the probability that ELF-EMF exposure
5 is truly a health hazard is currently small. The weak
6 epidemiological associations and lack of any laboratory support for
7 these associations provide only marginal, scientific support that
8 exposure to this agent is causing any degree of harm. The NIEHS
9 concludes that ELF-EMF exposure cannot be recognized as
10 entirely safe because of weak scientific evidence that exposure
11 may pose a leukemia hazard. In our opinion, this finding is
12 insufficient to warrant aggressive regulatory concern.

13 The NIEHS does not believe that other cancers or non-cancer health
14 outcomes provide sufficient evidence of a risk to currently warrant
15 concern. (NIEHS, p. 36, 1999).

16
17 IARC:

18 There is *limited evidence* in humans for the carcinogenicity of
19 extremely low- frequency magnetic fields in relation to childhood
20 leukemia.

21 “There is *inadequate evidence* in humans for the carcinogenicity of
22 extremely low-frequency magnetic fields in relation to all other
23 cancers.”

1 “There is *inadequate evidence* in humans for the
2 carcinogenicity of static electric or magnetic fields and
3 extremely low-frequency electric fields.”

4 “There is *inadequate evidence* in experimental animals for the
5 carcinogenicity of extremely low-frequency magnetic fields.”

6 (IARC, p. 338, 2002).

7
8 Q. DO YOU AGREE WITH DR. HANHAM’S CRITICISM AT PAGES 9-11 OF
9 ECC STATEMENT NO. 2, THAT BASED UPON HIS READING OF THE
10 CALIFORNIA DEPARTMENT OF HEALTH SERVICES (“CDHS”)
11 REVIEW THERE ARE PROBLEMS WITH YOUR CONCLUSIONS
12 BASED UPON THE IARC AND NIEHS REVIEWS?

13 A. No. Dr. Hanham’s knowledge of the review by three scientists at the CDHS
14 appears to be limited to his reading of the Executive Summary of their report.
15 It also appears from his comments that he confuses the presence of a statistical
16 association between magnetic fields and childhood leukemia with proof of a
17 causal relationship. I described this statistical association in my direct
18 testimony at pages 15-16 and page 18, as did each of the reviews I cited. But,
19 unlike Dr. Hanham, both the scientists who prepared these reviews and I have
20 *first-hand knowledge* of the relevant primary epidemiologic and experimental
21 studies that constitute the body of literature for evaluating causation. I will
22 address other examples of Dr. Hanham’s limited knowledge of the issue later
23 in this testimony.

1 Q. ON PAGE 10 OF ECC STATEMENT NO. 2, DR. HANHAM REFERS TO
2 “OTHER INDIVIDUALS, AUTHORITIES, AND AGENCIES, INCLUDING
3 THE CALIFORNIA DEPARTMENT OF HEALTH SERVICES” AS
4 REACHING DIFFERENT CONCLUSIONS FROM THE IARC AND NIEHS
5 “STUDIES” UPON WHICH YOU RELIED. ARE THESE SOURCES
6 IDENTIFIED IN HIS TESTIMONY?

7 A. No. It is unclear who these individuals and agencies are and the “agencies” to
8 which he refers as the support for his claim is a single reference to the review
9 of the research by the CDHS scientists that I discussed on pages 16-17 of my
10 direct testimony, TrAILCo Statement No. 8. He also alludes to individual
11 epidemiology studies (but not to authorities or agencies) discussed at the public
12 input hearings.

13 B.
14 It is important to note here that Dr Hanham appears to mistake my summary of
15 the conclusions expressed by the NIEHS and IARC (and the similar
16 conclusions of agencies that I cited but he did not mention, including the
17 ICNIRP¹, the NRPB², SSI, and the HCN) with his belief that my summary
18 reflects my own personal opinion of individual studies and a pre-conceived
19 position, or at least one tailored to support TrAILCo. The conclusions outlined
20 in my testimony represent a scientific consensus arrived at by independent,
21 multidisciplinary evaluations by qualified scientists.

¹ ICNIRP is an affiliate of the World Health Organization.

² The NRPB is now a part of the Health Protection Agency.

1 Q. IS IT TRUE THAT THE CDHS REVIEW ARRIVED AT MOSTLY
2 DIFFERENT CONCLUSIONS FROM THOSE REACHED BY THE OTHER
3 REVIEWS OF THE RESEARCH YOU CITED?

4 A. Yes. The conclusions of these reviews differ for the reasons I gave in my
5 testimony at pages 16-17 of TrAILCo Statement No. 8.

6

7 Q. HAVE EITHER THE CDHS OR THE PUBLIC UTILITY COMMISSION OF
8 CALIFORNIA CHANGED THEIR POLICIES TOWARD EMF OR
9 CHANGED THEIR RECOMMENDATIONS AS A RESULT OF THE
10 REPORT BY THESE THREE SCIENTISTS EMPLOYED BY CDHS?

11 A. No. The recommendations to the public regarding EMF on the CDHS website
12 today are the same as in 1999 (CDHS, 1999). Furthermore, the California
13 Public Utility Commission, which considered the report by CDHS (2002),
14 expresses the same view of the research as in 1993 – “The Commission is
15 unable to determine whether there is a significant scientifically verifiable
16 relationship between EMF exposure and negative health consequences” – and
17 has reaffirmed the Commission’s 1993 “low-cost/no-cost, policy to mitigate
18 EMF exposure for new utility transmission and substation projects” (CPUC,
19 2007). Thus, it appears that Dr. Hanham is attempting to elevate the status and
20 value of the CDHS report to a level in this proceeding that has not even been
21 recognized in California, where the review was performed and authored.

1 Q. DR. HANHAM OPINES ON PAGE 11 OF ECC STATEMENT NO. 2, THAT
2 YOUR CRITICISM OF THE REVIEW BY THE THREE CDHS
3 SCIENTISTS IS UNPERSUASIVE, NOT BALANCED, AND NOT
4 OBJECTIVE. DO YOU AGREE?

5 A. No. Dr. Hanham mistakes legitimate scientific criticism of the methodology
6 employed by the three scientists as not objective. This scientific criticism has
7 also been expressed by the NRPB (NRPB, 2004), the HCN (HCN, 2004), and
8 the Minnesota Department of Health (MDH, 2002). The MDH expressly
9 stated the following criticisms of the CDHS review and I quote them in their
10 entirety:

11 While some scientists praised the California reviewers for using
12 a novel approach, other researchers raised substantial concerns
13 regarding the report's conclusions, and more fundamentally, the
14 process used to conduct the evaluation (CDHS 2002). Based on
15 these comments and a review of the report, MDH concluded
16 that there is no scientific consensus at this time on the report's
17 conclusions, including the degrees of confidence that the
18 reviewers assigned regarding a causal relationship between
19 EMF and adverse health effects.

20
21 MDH also concluded that there are some significant limitations
22 in California's EMF evaluation. For example, the California
23 reviewers failed to adequately address the lack of supporting

1 data from animal laboratory studies and the lack of a plausible
2 biological mechanism of how EMF may cause harm in their
3 evaluation. Furthermore, they failed to adequately address
4 several well-recognized limitations (e.g., selection bias,
5 confounding, exposure misclassification) in EMF
6 epidemiological research.” (p. 23).

7
8 MDH also has concluded that there are several important
9 distinctions between California’s evaluation process and the
10 processes used by other scientific EMF review panels. The
11 California evaluation was conducted by three reviewers, all
12 from the same agency, and all with primary expertise in
13 epidemiology. Other recent scientific EMF panels (listed
14 above) have taken advantage of a broader review panel selected
15 from leading U.S. and international health agencies and
16 research organizations, representing expertise in a wide variety
17 of disciplines (e.g., epidemiology, cellular biology, physics,
18 statistics). (p. 24).

1 Q. DID YOU ERRONEOUSLY ASSUME THAT “EVIDENCE OF A CAUSAL
2 LINK BETWEEN EMFs AND ADVERSE HEALTH EFFECTS CAN ONLY
3 COME FROM ANIMAL STUDIES, NOT EPIDEMIOLOGICAL ONES” AS
4 CLAIMED BY ECC WITNESS HANHAM ON PAGE 11, LINES 16-18?

5 A. No, I did not. Again, Dr. Hanham has mischaracterized my testimony. I
6 described the methodology used by health and scientific agencies to perform
7 assessments of health risk, including how reviews of the scientific evidence
8 need to consider all of the evidence (Bailey, p. 10, lines 3-5), the importance of
9 both human epidemiology and animal laboratory studies (Bailey, pp. 10-11),
10 and the importance of assessing the quality of individual studies (Bailey, pp.
11 11-12). Dr. Hanham had not addressed the relevance of experimental studies,
12 and so I also pointed out the relevance and use of these studies at page 13.

13

14 Q. IS YOUR COMPARISON OF THE METHODOLOGY AND APPROACH
15 OF EPIDEMIOLOGY AND LABORATORY STUDIES IN YOUR
16 TESTIMONY A “STRATEGY” TO DISCREDIT EPIDEMIOLOGY
17 STUDIES?

18 A. On the contrary, my comparison describes the standard and well-documented
19 approach that the scientific and health agencies I cited understand and applies
20 data obtained by these two approaches.

1 Q. DO HEALTH AND REGULATORY AGENCIES RELY EXCLUSIVELY
2 ON ANIMAL EXPERIMENTS TO ASSESS RISKS TO HUMAN HEALTH?

3 A. No, where epidemiology data are available, they are evaluated and considered
4 alongside the data from experimental studies of animals and humans as I
5 describe on page 11 of my direct testimony. A valid risk assessment is
6 supported by the complementary data from *both* lines of research. In the case
7 of EMF, we are indeed fortunate that a large number of epidemiology studies
8 have been performed, and they have played an important role in the evaluation
9 of questions about potential links between EMF exposures and a wide variety
10 of diseases. Without these epidemiology studies, there would be inadequate
11 data to assess a wide range of potential risks to human health from exposures
12 associated with the electric utility infrastructure and electrical devices. Dr.
13 Hanham's attack on animal experiments is misguided and flawed.

14
15 Q. WHY IS HIS ATTACK ON ANIMAL EXPERIMENTS MISGUIDED?

16 A. It is a 'straw man' argument that he is using to attack the methodology and
17 conclusions of the scientific agencies I have cited. For example, he tries to
18 make it appear that the drug Vioxx, which has been linked to heart attacks and
19 stroke in humans with chronic use, was put on the market (following approval
20 by the Food and Drug Administration) solely on the basis of "animal
21 experiments that did not relate to human conditions." (Hanham, p. 11, lines 25-
22 27). What he fails to point out is that no drug is approved by the FDA solely
23 based upon animal testing and that additional studies that typically involve

1 more than 3,000 human subjects enrolled well-designed clinical trials are
2 required (FDA, 2007). The value of animal studies in human health risk is
3 undisputed; and for a number of chemicals and agents, the evidence of
4 carcinogenicity in experimental animals was established or highly suspected
5 *before* epidemiologic studies supported this conclusion (IARC, 2002).

6
7 It should additionally be noted, that safety trials in human subjects, typically
8 described as randomized clinical trials, differ from simple observational
9 epidemiology studies because they are designed to protect against systematic
10 bias by randomly assigning subjects to treatment or control conditions. So,
11 while there are important differences, of course, between animal and human
12 subjects, this should not overshadow or be confused with the difference
13 between observational epidemiology studies and experimental human clinical
14 trials.

15

16 Q. DR. HANHAM FAVORS THE CDHS REPORT IN HIS TESTIMONY. DID
17 HE CALL THE COMMISSION'S ATTENTION TO THE CONCLUSIONS
18 OF ANY OF THE OTHER REVIEWS YOU DISCUSSED THAT
19 PRESENTED LARGELY DIFFERING CONCLUSIONS?

20 A. No, he did not.

1 Q. AND BY LIMITING HIS RELIANCE ON THIS SOLE REVIEW, DOES HE
2 HIMSELF PRESENT A “SELECTIVE ANALYSIS,” WHICH HE DECRIES
3 ON PAGE 14?

4 A. Yes.

5

6 Q. DR. HANHAM ARGUES, “THE CDHS REPORT CONSIDERED ANIMAL
7 STUDIES IN ITS REVIEW, BUT ON EQUAL TERMS WITH OTHER
8 FORMS OF EVIDENCE, NOT PREFERENTIALLY.” (HANHAM, P. 12,
9 LINES 4-5). DOES IARC WEIGHT THE ANIMAL STUDIES ON EQUAL
10 TERMS WITH HUMAN EPIDEMIOLOGIC STUDIES?

11 A. Yes, neither the process followed by IARC nor by NIEHS gives preferential
12 weighting to animal studies over epidemiologic data as Dr. Hanham’s
13 statement might suggest. The standard risk assessment process is not designed
14 to give either line of evidence preference; rather, each study type has its
15 strengths and weaknesses and it is the combined consideration of both types of
16 research that defines a valid risk assessment.

17

18 Q. At PAGE 12 OF ECC STATEMENT NO. 2, DOES HE SHOW THAT HE
19 HAS MISUNDERSTOOD THE PROCESS FOLLOWED BY THE IARC
20 WORKING GROUP, OF WHICH YOU WERE A MEMBER, IN ITS
21 EVALUATION OF THE POTENTIAL CARCINOGENICITY OF ELF
22 FIELDS?

1 A. Yes. He is in no position to evaluate the respective merits of any of the risk
2 assessments and he has erroneously described the process used by IARC and
3 NIEHS. Contrary to Dr. Hanham's description, the IARC Working Group did
4 not use a "simple binary response (yes or no) in evaluating studies," or simply
5 give "a majority opinion," or draft the entire 395 page report "over five days."

6
7 Both reviews of the research by IARC and NIEHS involved many months of
8 research, review, and evaluation by the participants. In each topic area, the
9 members charged with the evaluation of the relevant studies presented their
10 assessment and conclusions, which were shared with the group before and
11 during the meetings. In the final meetings that took place over seven to eight
12 days, the participants discussed and finalized the text of the review and
13 formulated the evaluations.

14
15 Dr. Hanham also states "the CDHS report incorporated the assessments of all
16 reviewers, positive or negative." (ECC Statement No.2, p. 12, lines 21-22).
17 While CDHS did solicit comments on drafts of their report and published some
18 comments received, there were criticisms even by members of their own hand-
19 picked scientific advisory panel that the authors were not responsive to
20 criticisms and suggestions.

1 Q. DO THE THREE REASONS LISTED BY DR. HANHAM ON PAGE 12 OF
2 HIS ECC REBUTTAL TESTIMONY AS TAKEN FROM THE CDHS
3 REPORT EXPLAIN WHY “ANIMAL EXPERIMENTS OF THE EMF
4 MIXTURE MIGHT MISS THE TRUE EFFECT OF EMFs ON HEALTH,”
5 AND THUS, UNDERMINE THE USE OF SUCH STUDIES?

6 A. No. First, the use of animal data in the evaluation of potential health effects of
7 EMF is not hampered because of a “problem in finding the right animal, one
8 that mimics the human anatomy.” There is no biological basis to assert that
9 animals lack some anatomical feature that we, humans, possess that renders us
10 uniquely susceptible to EMF, nor has this argument been accepted or even
11 asserted in the scientific community. Second, the exposures to EMF in most
12 animal studies replicate the exposures produced by transmission lines, i.e.,
13 fields with a frequency of 60 Hertz without significant mixtures of other
14 harmonic frequencies. Third, the analysis of animal studies does not involve
15 the *a priori* judgment that there is a monotonic relationship between exposure
16 and biological change. In fact, consideration of the shape of the dose-response
17 relationship in animal studies has not been a factor because almost all of the
18 studies report no differences between exposed animals and untreated control
19 animals at any level of magnetic field exposure, including levels up to 50,000
20 times larger than the average level found in residences.

1 Q. DR. HANHAM CLAIMS THAT THE APPROACH USED BY CDHS TO
2 EVALUATE SCIENTIFIC RESEARCH IS MORE RELIABLE THAN THE
3 APPROACH USED BY IARC AND NIEHS. DO YOU AGREE?

4 A. No, I do not. The review method developed and applied by the three scientists
5 at CDHS to evaluate the EMF research had never been tried or tested either by
6 them or any other review group. In contrast, the reliability of the IARC
7 approach has been used in the evaluation of over 900 chemicals, physical
8 agents, and mixtures.

9
10 Q. DR. BAILEY, BASED ON YOUR REVIEW OF DR. HANHAM'S
11 TESTIMONY (AND NEAR IDENTICAL SUBMISSION AT A PUBLIC
12 HEARING), WHAT WEIGHT SHOULD THE COMMISSION ACCORD
13 HIS TESTIMONY?

14 A. None whatsoever. His allegations regarding my testimony are false.
15 Geography, his area of study, is not the same as biomedical research or
16 epidemiology. Dr. Hanham's cursory reading of studies and reviews provides
17 no clarifying insights to the Commission, and his view that "credible, vetted
18 epidemiology evidence" (p. 14, lines 1-2) reaches a conclusion opposite to
19 those of the national and international reviews that I cited and is misguided.
20 Scientific conclusions about causality are not based solely on epidemiologic
21 evidence, and the reviews that considered the cumulative body of evidence
22 (including epidemiology and experimental research) characterized this

1 epidemiologic evidence as “weak”, in supporting their conclusion that the
2 research suggests no adverse health effects.

3

4 Q. WOULD YOU PLEASE BRIEFLY ADDRESS AND RESPOND TO THE
5 FOLLOWING STATEMENTS AND DOCUMENTS ON EMF ISSUES
6 THAT WERE PRESENTED AT THE PUBLIC INPUT HEARINGS: (I) THE
7 "DRAPER STUDY," (II) CITATIONS TO INDIVIDUAL STUDIES BY
8 EDWARD PETSONK, M.D., (III) STUDIES OF THE IMMUNE SYSTEM
9 AND EMF, (IV) STUDIES OF DEPRESSION, (V) A UK CROSS PARTY
10 REPORT, (VI) FARM AND WILDLIFE STUDIES, AND (VII) THE
11 BIOINITIATIVE REPORT?

12 A. Yes.

13 a) Several persons at the public input hearings referred to the study by
14 Draper, et al. (2005) when expressing concern about the proposed transmission
15 line. These investigators reported that the birth addresses of childhood
16 leukemia cases in the United Kingdom were more likely to be within 200
17 meters of a high voltage power line than outside of 600 meters. No
18 measurements or calculations of EMF were provided. The authors commented
19 “There is no accepted biological mechanism to explain the epidemiological
20 results; indeed, the relation may be due to chance or confounding” (p. 1290)
21 and concluded “We have no satisfactory explanation for our results in terms of
22 causation by magnetic fields, and the findings are not supported by convincing
23 laboratory data or any accepted biological mechanism.” (p. 1291). Therefore,

1 while the study by Draper, et al. reported a statistical association between birth
2 address in the vicinity of a power line and childhood leukemia, conclusions
3 about whether magnetic fields cause childhood leukemia are based on the
4 *entire* body of literature, which includes approximately 20 epidemiologic
5 studies, many of which actually measured magnetic field exposure (including
6 large studies in the UK, Canada, and in the US by the National Cancer
7 Institute) that did not report an association between personal magnetic field
8 exposure and childhood leukemia). The WHO review considered the study by
9 Draper, et al. when it concluded that the research does not suggest a cause-and-
10 effect relationship between childhood leukemia and magnetic fields. Thus,
11 when considered alone, the study by Draper, et al. may seem concerning, but
12 (just like any area of study in the field of health) a statistical association
13 reported from one study cannot be used as the basis for conclusions regarding
14 causation, or public policy.

15
16 b) Edward Petsonk, M.D., Michael Faust, M.D., and Ann McCune, M.D.,
17 and other public input hearing witnesses alluded to several individual
18 epidemiology studies of childhood and adult cancer in their statements at the
19 public input hearings. These studies represent just a few of the many
20 epidemiology studies in the literature, and valid assessments about the
21 potential relationship between magnetic fields and cancer cannot be performed
22 by ‘cherry picking’ studies. As I explained above, and in my testimony on
23 page 11, all of the studies, not just selected ones, are considered in a valid

1 epidemiologic assessment. A Task Group of the WHO reviewed the literature
2 earlier this year, and concluded the following:

3 “New human, animal, and in vitro studies published since the
4 2002 IARC Monograph, 2002 [sic] do not change the overall
5 classification of ELF as a possible human carcinogen” (WHO,
6 p. 347, 2007b).

7 “Consistent epidemiological evidence suggests that chronic
8 low-intensity ELF magnetic field exposure is associated with an
9 increased risk of childhood leukaemia. However, the evidence
10 for a causal relationship is limited, therefore exposure limits
11 based upon epidemiological evidence are not recommended, but
12 some precautionary measures are warranted” (WHO, p. 355,
13 2007b).

14 While Dr. Petsonk’s statement that “for the childhood leukemias it’s no
15 longer a hypothesis” (Tr. 838) is open to interpretation as to its
16 meaning, it should be clarified that the only conclusion that scientists
17 on expert panels have reached is that a statistical association has been
18 observed. Explanations for statistical associations include causation,
19 chance, bias, and confounding; scientific panels have not ruled out the
20 latter two explanations, nor has any scientific panel concluded that the
21 hypothesis that magnetic fields cause childhood leukemia has been
22 proven. His assessment of the literature is not shared by scientists who
23 have reviewed the epidemiology and experimental studies of EMF and

1 cancer for IARC, NIEHS, WHO, or the U.S. National Cancer Institute
2 (NCI, 2005).

3
4 c) The basis for concern about adverse effects of EMF on the immune
5 system is also limited. The WHO Task Group concluded “Evidence for the
6 effects of ELF electric or magnetic field on components of the immune system
7 is generally inconsistent ... Overall therefore, the evidence for effects of ELF
8 electric or magnetic fields on the immune and haematological system is
9 considered inadequate.” (WHO, p. 8, 2007b). According to the WHO, the
10 classification “inadequate” is used when the studies cannot be interpreted as
11 showing either the presence or absence of an effect because of major
12 qualitative or quantitative limitations, or when no data are available.

13
14 d) Mr. Levy, at the public input hearings, suggested that his reading of
15 “studies in the psychological and epidemiological literature regarding the
16 repercussions of power line emissions” suggest a link to “safety, health, and
17 mental well-being” but “are neither unequivocal nor conclusive.” (Tr. 2129-
18 2130). He cites two 1997 studies from Finland and Australia. In 2007, the
19 WHO Task Group concluded “There is only inconsistent and inconclusive
20 evidence that exposure to ELF electric and magnetic fields cause depressive
21 symptoms or suicide. Thus, the evidence is considered inadequate.” (p. 161).

1 e) A few other public input hearing witnesses discussed a “Report by a
2 Cross-Party Inquiry into Childhood Leukaemia and Extremely Low Frequency
3 Electric and Magnetic Fields (ELF EMF),” dated July 2007. The report was
4 authored by members of Parliament who heard testimony primarily from those
5 who oppose transmission lines in the UK, and was not a scientific summary of
6 the weight of the evidence. The recommendations of the report appear to be
7 political in nature and are contrary to the advice of the UK’s Health Protection
8 Agency and to the WHO regarding the need for and extent of precautionary
9 measures. No response of the UK government to this report has appeared yet.
10

11 f) A number of general concerns about the effects of EMF on farm
12 animals and wildlife were raised at the public input hearings. Regarding farm
13 animals, a variety of studies have been conducted in which the behavior, health
14 and performance of farm animals (i.e., cows, pigs, and sheep) confined directly
15 under the conductors or in conditions designed to replicate high magnetic and
16 electric field exposure conditions have been reported. Altogether, these studies
17 have not indicated that a transmission line would have adverse effects on the
18 health, behavior or productivity of farm animals. A more specific concern was
19 mentioned about the effect of EMF on honey bees. (Tr. 2014-2015). Studies
20 have reported that when bee hives are placed on the right-of-way of 765 kV
21 transmission lines, the heating of metallic hive components and/or shocks
22 within the hive adversely affects the colony. These effects can be mitigated by
23 placing a grounded screen over the hive to shield the electric field or by

1 moving the hive some distance away from the line. (Bindokas, et al., 2005).

2 No direct effects on the bee's health or productivity have been reported.

3

4 g) There was also mention of the "BioInitiative Report: A Rationale for a
5 Biologically-based Public Exposure Standard for Electromagnetic Fields (ELF
6 and RF)," an unpublished document posed at www.bioinitiative.org. This
7 report has been posted on a website by one of the editors of the report who is
8 not a health scientist. The objective of the report was to "document reasons
9 why the current public exposure standards (i.e., the ICNIRP and ICES
10 guidelines for ELF fields and the ICNIRP guideline for radiofrequency fields)
11 for non-ionizing electromagnetic radiation are no longer good enough to
12 protect public health." (Section 2, p. 1). The scientific methods used in the
13 review are, in a number of important respects, seriously flawed and do not
14 represent a valid weight of evidence review of the literature. Furthermore, the
15 data considered in this report have been assessed by the WHO, which did not
16 recommend any reduction in exposure standards. Unlike the BioInitiative
17 report, the WHO report was the product of a multidisciplinary scientific panel
18 assembled by an established public health agency that followed appropriate
19 scientific methods, including the systematic and critical examination of all the
20 relevant evidence.

1 CONCLUSIONS

2 Q. HAVE THE REBUTTAL WITNESSES YOCCA, LANZALOTTA, AND
3 HANHAM PROVIDED COGENT, SCIENTIFICALLY SUPPORTED
4 ARGUMENTS TO PERSUADE THE COMMISSION THAT THE
5 REVIEWS OF SCIENTIFIC RESEARCH PUBLISHED BY NATIONAL
6 AND INTERNATIONAL HEALTH AGENCIES THAT YOU
7 SUMMARIZED IN YOUR TESTIMONY SHOULD BE DISREGARDED?

8 A. No. The information they have submitted in support of their criticisms is
9 incomplete and does not represent the application of appropriate scientific
10 methods.

11

12 Q. DO ANY OF OCA WITNESS LANZALOTTA'S RECOMMENDATIONS
13 FOR MODIFICATION OF THE TRAIL PROJECT APPEAR TO BE AN
14 APPROPRIATE RESPONSE TO CONCERNS ABOUT EMF?

15 A. No, they would appear to go far beyond policies that have been recommended
16 by the NIEHS and the WHO to address public concern.

17

18 Q. WHAT ABOUT THE COMMENTS AND SUBMISSIONS OF MEMBERS
19 OF THE PUBLIC AT THE PUBLIC INPUT MEETINGS?

20 A. Those who participated in those meetings should be commended for making
21 the effort to become acquainted with EMF, as well as other topics. The
22 problem for them, however, is that the number of studies on this topic is very
23 large and highly technical; therefore, it is difficult for them, regardless of their

1 background and training, to take the individual studies they have read or
2 descriptions of studies on Internet websites and "put them all together." I
3 believe this is the reason that both the public and policy makers should give
4 great weight to the assessments provided by national and international health
5 agencies. Given the degree of public concern about EMF in relation to this
6 project, it is absolutely critical that all parties recognize how important it is for
7 the basis for any decision regarding EMF, whatever the source, be grounded on
8 the highest level of scientific rigor and evidence. Reliance on lesser evidence
9 is unacceptable, where matters of broad public health and welfare are
10 concerned.

11

12 Q. DOES THIS CONCLUDE YOUR REBUTTAL TESTIMONY?

13 A. Yes. However, I reserve the right to file such additional testimony as may be
14 necessary or appropriate.

1 REFERENCES CITED

2 Bindokas VP, Gauger JR, Greenberg B. Exposure scheme separates effects of electric
3 shock and electric field for honey bees, *Apis mellifera L.* Bioelectromagnetics. 9:275-
4 284, 2005.

5
6 BioInitiative Report: A Rationale for a Biologically-based Public Exposure Standard
7 for Electromagnetic Fields (ELF and RF). Accessed at www.bioinitiative.org.

8
9 Caola RJ, Deno DW, Dymek VSW. Measurements of electric and magnetic fields in
10 and around homes near a 500 kV transmission line. IEEE Transactions on Power
11 Apparatus and Systems. PAS-102, 3338-3345, 1983.

12 California Department of Health Services (CDHS). Short Factsheet on EMF, 1999.
13 Accessed at <http://www.dhs.ca.gov/ps/deodc/ehib/emf/shortfactsheet.PDF>.

14 California Department of Health Services (CDHS). Neutra RR, Delpizzo V, Lee GM.
15 An Evaluation Of The Possible Risks From Electric And Magnetic Fields (EMFs)
16 from Power Lines, Internal Wiring, Electrical Occupations And Appliances.
17 California EMF Program, Oakland, California, 2002.

18 California Public Utilities Commission (CPUC). PUC Actions Regarding EMF.
19 November 3, 2007. Accessed at
20 [http://www.cpuc.ca.gov/PUC/energy/electric/Environment/ElectroMagnetic+Fields/ac](http://www.cpuc.ca.gov/PUC/energy/electric/Environment/ElectroMagnetic+Fields/action.htm)
21 tion.htm.

22 Draper G, Vincent T, Kroll ME, Swanson J. Childhood cancer in relation to distance
23 from high voltage power lines in England and Wales: a case-control study. BMJ
24 330:1290-1293, 2005.

25 Health Council of the Netherlands (HCN) Electromagnetic Fields: Annual Update
26 2003. The Hague, Health Council of the Netherlands, 2004. (Publication no.
27 2004/01).

28 Health Council of the Netherlands (HCN). Proposals for Research into Health Effects
29 of Electromagnetic Fields (0 Hz - 300 GHz). The Hague: Health Council of the
30 Netherlands, 2006. (Publication no. 2006/11E.).

31 International Commission on Non-Ionizing Radiation Protection (ICNIRP). Exposure
32 to Static And Low Frequency Electromagnetic Fields, Biological Effects And Health
33 Consequences (0-100 kHz) – Review Of The Scientific Evidence On Dosimetry,
34 Biological Effects, Epidemiological Observations, And Health Consequences
35 Concerning Exposure To Static And Low Frequency Electromagnetic Fields (0-100
36 kHz). Matthes R, McKinlay AF, Bernhardt JH, Vecchia P, Beyret B (eds.).
37 International Commission on Non-Ionizing Radiation Protection, 2003.

- 1 International Agency for Research on Cancer (IARC). IARC Monographs on the
2 Evaluation of Carcinogenic Risks to Humans. Volume 80: Static and extremely low-
3 frequency (ELF) electric and magnetic fields. IARC Press, Lyon, France, 2002.
- 4 Minnesota Department of Health (MDH). EMF White Paper on Electric and Magnetic
5 Field (EMF) Policy and Mitigation Options. 2002.
- 6 National Radiological Protection Board (NRPB). Review of the scientific evidence
7 for limiting exposure to electromagnetic fields (0-300 GHz). National Radiological
8 Protection Board. Volume 15, No. 3, 2004.
- 9 National Institute of Environmental Health Sciences (NIEHS). Assessment of health
10 effects from exposure to power-line frequency electric and magnetic fields: working
11 group report. NIH Publication No. 98-3981. Research Triangle Park, NC: National
12 Institute of Environmental Health Sciences of the U.S. National Institutes of Health,
13 1998.
- 14 National Institute of Environmental Health Sciences (NIEHS). NIEHS REPORT on
15 Health Effects from Exposure to Power-Line Frequency Electric and Magnetic Fields.
16 NIH Publication No. 99-4493 Research Triangle Park, NC: National Institute of
17 Environmental Health Sciences of the U.S. National Institutes of Health, 1999.
- 18 Swedish Radiation Protection Authority (SSI). Fourth annual report from SSI's
19 Independent Expert Group on Electromagnetic Fields, 2006: Recent Research on EMF
20 and Health Risks. SSI Rapport 2007:04.
- 21 U.S. Food and Drug Administration (USFDA). The FDA's Drug Review Process:
22 Ensuring Drugs Are Safe and Effective. FDA Consumer magazine July-August 2002
23 Issue, Pub. No. FDA05-3242, (revised in 2005).
24 http://www.fda.gov/Fdac/features/2002/402_drug.html
25
- 26 U.S. National Institutes of Health, National Cancer Institute (NCI). Factsheet:
27 Magnetic Field Exposure and Cancer: Questions and Answers. April 21, 2005.
28 <http://www.cancer.gov/cancertopics/factsheet/Risk/magnetic-fields>
29
- 30 World Health Organization (WHO). Electromagnetic Fields And Public Health. Fact
31 sheet N°322, June 2007.
32
- 33 World Health Organization (WHO). Extremely Low Frequency Fields.
34 Environmental Health Criteria, Vol. 238, Geneva, WHO, June 2007.