

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of
PENNSYLVANIA POWER & LIGHT COMPANY
and
ALLEGHENY ELECTRIC COOPERATIVE, INC.
(Susquehanna Steam Electric Station,
Units 1 and 2)

Docket Nos. 50-387
50-388

APPLICANTS' STATEMENT OF MATERIAL FACTS
AS TO WHICH THERE IS NO GENUINE ISSUE
TO BE HEARD (CONTENTION 17)

Pursuant to 10 C.F.R. § 2.749(a) Applicants state, in support of their renewed motion for summary disposition of Contention 17 in this proceeding, that there is no genuine issue to be heard with respect to the following material facts:

1. There will be a maximum electric field gradient of 11 kV/m (kilovolts per meter) at ground level at the point of minimum clearance on the right-of-way, and 2.28 kV/m at the edge of the right-of-way, of the 500 kV lines to be utilized for transmitting the electric power produced by the Susquehanna Steam Electric Station ("the Susquehanna lines"). Licensing Board's Order of May 20, 1981, slip cp. at p.10.



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2. Living organisms respond to many stimuli as part of the process of living; such responses are examples of biological "effects." Since biological organisms have considerable tolerance to change, these "effects" may be well within the capability of the organism to maintain a normal equilibrium. If, on the other hand, an effect is of such a nature and/or duration that it impairs the organism's ability to function properly or overcomes the recovery capability of the organism, then the "effect" is regarded as "hazard." Affidavit of Solomon M. Michaelson in Support of Summary Disposition of Contention 17 ("Michaelson Aff."), para. 4.

3. Some biological "effects" on animals and humans have been observed as a result of exposure to the electric fields of similar magnitude to those produced by the Susquehanna lines. For instance, certain animal species are able to detect very small electric fields. Other species are reported to perceive fields in the range of 30 to 100 kV/m. A person standing in the 10 kV/m electric field set up by a high voltage transmission line may experience slight movement in the hair of an upwards-extended hand. However, an effect such as detection of the field does not necessarily make the field hazardous. In fact, no substantiated effects of exposure to high voltage electric fields have been found which can be considered hazardous. Michaelson Aff., para. 5 and n.l.

4. Scientific knowledge of the biological effects of electric fields from transmission lines comes from theoretical, epidemiological, and experimental evidence. Id., para. 6.

5. The theoretical evidence indicates that the electric fields produced by the Susquehanna lines will induce an extremely small electric field in the body of a person in the vicinity of the line, about 100,000 times smaller than the external field. The induced field will cause internal body currents to flow. Such currents are also very small, on the order of 0.1 to 1 milliamperes ("mA") per square meter, depending on the field strength. Such small currents are well below the perception level and consequently are imperceptible. Id., para. 10.

6. In order for an induced electric field or the internal current it induces to produce recognizable effects on tissue, the external field strength would have to be one hundred times larger than the field strength at which air breaks down as an insulator and sparking occurs. This is a very large field, thousands of times larger than the maximum field in the vicinity of the Susquehanna lines. Therefore, it is practically impossible to induce dangerous currents in people by mere exposure to the electric fields produced by transmission lines such as the Susquehanna lines. Id., para. 11.

7. While the theoretical evidence predicts no recognizable biological effects from exposure to high voltage electric fields, some writers have postulated that behavioral and central nervous system modifications result from such exposure. These effects, however, are not amenable to explanation using traditional theoretical analysis, and if indeed existing, are

caused by some yet unknown biophysical mechanism which is not explained by those postulating the effects. The majority of the scientists working in this field believe such unexplained effects to be highly improbable. Id., paras. 5, 12.

8. Epidemiological evidence is derived from analysis of health records of members of the population who are exposed to a substance or agent and comparison of those people with appropriate control groups. Id., para. 8.

9. The most comprehensive epidemiological studies on electrical workers were performed by scientists at Johns Hopkins University who conducted medical surveillance of eleven linemen over a period of 42 months during the time they were performing live-line maintenance work on a 345 kV transmission system. Those workers doing bare hand work were exposed to fields ranging from 20 kV/m to 470 kV/m. After nine years of observation, none of the workers showed any change in his physical, mental, or emotional characteristics, and their health was not changed in any way by their exposure to high voltage lines. Id., para. 14.

10. Another epidemiological investigation of medical visits and druggist bills in a population living and working close to high-voltage power lines, compared with a similar, but unexposed population, did not disclose any significant differences between the health data for exposed and unexposed persons. Id., para. 15.

11. In another study, there was an evaluation of 56 individuals working in 735 kV switchyards for more than two

years. No adverse health symptoms were observed, and no clinical pathological changes in general somatic health, neuropsychiatric symptomatology, ECG, X-ray of the lungs, audiometry or visual acuity were found. Id., para. 16.

12. In another epidemiologic study, 110 high voltage workers who worked bare-handed on 110-380 kV lines were compared with electrical maintenance men who were exposed to similar physiological stresses but at field strengths less than 5 kV/m. Based on extensive clinical and psychological examinations, no difference in state of health was seen between the exposed and the control group. Id., para. 17.

13. Soviet studies have reported measurable biological changes among electrical workers exposed to intense electric fields in electric switchyards. Evaluation of these studies, however, is difficult due to the incomplete nature of the material presented, the variable quality of the reported data, methodological deficiencies, and the absence of controls. Id., paras. 18, 19. Moreover, the Soviet studies deal with exposure to high electric fields in a complex environment (electric switchyard), which is not directly translatable to transmission line conditions. Id., para. 20.

14. By 1975 the Soviets had already 150,000 kilometer-years of 500 kV transmission line operation, producing fields in the order of 12-15 kV/m near ground level, without having identified any biological effects from the lines' electric fields. The Soviets have instituted standards

for the protection of substation workers, but do not apply them to infrequent exposure by the local population or by workers in transmission line rights-of-way. The Susquehanna lines would meet the Soviet standards, as well as the more rigorous standards generally utilized by the electric power industry in the United States. Id., para. 21.

15. The Soviet results on the effects of electric fields on switchyard workers are contradicted by an official Swedish investigation of the effects of electric fields on personnel in Swedish 400 kV substations. In this study, 53 workers with long-term (more than five years) exposure to the electric fields of 400 kV substations were examined and compared with a matched control group of 53 non-exposed workers from the same power companies. The investigation, which included the nervous system, cardiovascular system, and the blood indicated no differences between the exposed and control groups that could be attributed to long-term exposure to the electric fields. Id., para. 22.

16. In summary, epidemiological studies of workers exposed to electric fields set up by high voltage transmission lines have produced no credible evidence of organic injury to man caused by such exposure. This applies both to acute and chronic exposure. Comprehensive biochemical examinations have not indicated any evidence of a "stress" response. No occupational disease or deviation of general morbidity patterns has been reliably reported among high voltage transmission line workers. Id., para. 23.

17. Experimental evidence results from direct exposure of animals or humans to electric fields under controlled conditions and observation of any biological effects. Id., para. 9. Experiments with human subjects (male and female volunteers) have examined reaction time, blood pressure, pulse, ECG, EEG, peripheral blood counts, coagulation time and sedimentation rate in the presence for up to 2 hours of strong electric fields, under test conditions equivalent to those under high voltage transmission lines up to a ground field strength of 12 kV/m. Deviations observed in both control and exposed subjects did not exceed normal physiological limits. These experiments led to the conclusion that there are no detrimental biological effects resulting from exposures to fields of these magnitudes. Id., para. 24.

18. In another human experiment, two test groups, each consisting of 10 males and 10 females, were exposed to an electric field between 90 kV/m and 110 kV/m for 75 minutes and were subjected to a series of psychological tests which measured reaction time, attention, memory and motor preparedness. No statistically significant effect on the performance of the two groups could be observed. Id., para. 25.

19. Still another experimental study on humans, on serum triglyceride levels, found no differences in triglyceride values 24 hours after subjects had been exposed for 3 hours to a 50 Hz, 20 kV/m electric field. Id., para. 26.

20. A number of animal experiments have been, and continue to be conducted on the biologic effects and potential

azards of exposure to electric fields of high voltage transmission lines. For instance, extensive research programs are being sponsored by the Department of Energy ("DOE") and by the Electric Power Research Institute ("EPRI"). Id., para. 32.

21. While the DOE-sponsored research programs have not reached completion, there have been no reported significant effects in most organisms and areas studied, with the exception of some "subtle and small" effects reported by one researcher on the nervous systems of rats and mice exposed for long periods of time to 60-Hz electric fields up to 130 kV/m. The results of the ongoing research projects have been consistent with previous studies in finding no significant effects which would adversely influence the health of animals exposed to low-frequency fields up to 100 kV/m. Id., para. 33.

22. The most numerous animal experiments have involved mice and rats. For example, in a study male mice were exposed to a 60 Hz field of 160 kV/m for 1500 hours during the course of approximately 10-1/2 months. No effects were observed on the general health, behavior or reproductive ability of these animals, and necropsies performed after exposure failed to show any pathologic effects. Id., para. 34. Another series of studies on chicks, voles and mice showed no adverse effect when the animals were exposed to high voltage electric fields of 50 to 80 kV/m. Id., para. 41, n.8.

23. While a study by Marino has reported weight loss and increase mortality among mice subjected to 15 kV/m vertical

electric fields, the results observed were most likely produced by "microshocks" which the exposed animals received when eating and drinking due to the experimental set-up utilized. Id., para. 35.

24. Another experiment on mice by Noval et al., which also showed weight loss by mice exposed to electric fields, was criticized by a committee of the National Academy of Sciences that reviewed the experiment; the committee concluded that no reliable data could emanate from a study conducted under the poor conditions in which that study was performed. Id., para. 36.

25. Phillips et al., using rats in the same type of experiment but at field strengths six times higher than Marino, reported no effect. Mathewson et al., using rats, performed an experiment similar to Noval's and reported no effect. Knickerbocker et al. used mice at a field strength 16 times greater than Marino, and concluded from the study of mice exposed for approximately 1500 hours over a period of 10 to 12 months to a field of 160 kV/m that there was no signs of a detrimental effect of this field on the animals. Id., para. 37.

26. Another group of animal experiments have involved monkeys. Several studies have been performed on monkeys exposed to 10, 45 and 75 Hz electric fields of different intensities (up to 7.4 kV/m) for various periods of time up to 42 days. Multiple psychological and behavioral studies did

not show any differences between exposed and control monkeys. Id., para. 38. In another study, thirty experimental rhesus monkeys were matched with thirty controls and exposed for 3 years to a 20 V/m electric field and 2 Gauss magnetic field. During this period all animals were subjected to comprehensive clinical-pathological and behavioral examinations. There was no evidence of any detrimental affect of the exposure. Id., para. 40.

27. An ongoing research project sponsored by EPRI is being conducted by Battelle Pacific Northwest Laboratories ("PNL"). PNL has constructed a specially designed barn in which three generations of female miniature swine have been subjected continuously to an electric field of 30 kV/m, with a matching control group of swine in a similar barn without the field. The results obtained in the experiment indicate no differences among the exposed and control groups in growth rate, hematology, serum chemistry, immunology, cytogenics, or in neurophysiological tests. The experiment found, however, more instances of malformed fetuses among exposed sows than for those on the control group; more prenatal deaths among the control group; and resistance to mating among sows born and raised in the exposed barn. These differences between the exposure and control groups are not necessarily attributable to the electric field exposure because a serious outbreak of dysentery took place during the course of the experiment, so that the fetal malformations and mating problems (all of which

occurred thereafter) may have been the result of the disease and/or its treatment. Also, mating of exposed sows took place in a special pen outside the electric field, thus the resistance to mating may have been due to the change in the sows' environment. Id., paras. 41, 42.

28. Most of the animal studies to date have failed to identify any biological effects that could be attributed to low frequency high voltage electric fields. Therefore, the indication from this, as well as other sources of evidence, is that no significant effects exist. Id., para. 43.

29. The animal experiments also demonstrate that there will be no adverse impact on animals that may graze on or otherwise occupy the right of way of a high voltage transmission line such as the Susquehanna lines. Confirmation of the lack of adverse effects from exposure to high voltage transmission lines is given by surveys of animal grazing in transmission line rights-of-way, which show that livestock graze under 500 and 765 kV lines normally, and exhibit no reduction in growth or milk production or other detrimental effects. Id., para. 44.

30. The induced electric field inside the body of a person standing under a transmission line is very much smaller than the external electric field. There is such a tremendous reduction in terms of the field inside the body that it does not seem reasonable to expect electric field effects. Using a biophysical approach combining physical laws with known

biological properties, the conclusion is that there is no scientific basis for expecting that there will be significant effects induced by the transmission line's electric fields.

Id., para. 45.

31. Epidemiological studies and experimental studies on humans and animals indicate that there are no demonstrable biological effects which may be hazardous to health or safety or to the general biological environment as a result of exposure to electric fields from high voltage transmission lines. Id., para. 47.

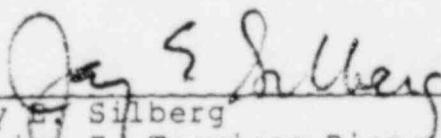
32. In North America, there are currently more than 200,000 circuit miles of overhead transmission lines rated 138 kV or higher, of which 14,000 miles constitute 500 kV and several thousands of miles of 765 kV lines have been operating since 1969. There is no evidence of harm to humans or animals from exposure to the electric fields set up by those high voltage transmission lines. Id., paras. 48-50.

33. Based on all the theoretical, epidemiological and experimental evidence, the electric fields from the Susquehanna transmission lines will result in no detrimental effects to humans or animals. Id., para. 50.

Dated: August 18, 1981.

Respectfully submitted,

SHAW, PITTMAN, POTTS & TROWBRIDGE


Jay E. Silberg
Matias F. Travieso-Diaz

Counsel for Applicants

1800 M Street, N. W.
Washington, D. C. 20036
(202) 822-1000

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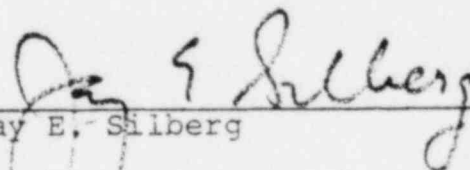


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CERTIFICATE OF SERVICE

This is to certify that copies of the foregoing "Applicants' Renewed Motion for Partial Summary Disposition of Contention 17", "Applicants' Statement of Material Facts As To Which There Is No Genuine Issue To Be Heard (Contention 17)", "Memorandum in Support of Applicants' Renewed Motion for Summary Disposition of Contention 17" and "Affidavit of Solomon M. Michaelson in Support of Summary Disposition of Contention 17", were served by deposit in the U. S. Mail First Class, postage prepaid, this 18th day of August, 1981 to all those on the attached Service List.


Jay E. Silberg

Dated: August 18, 1981.

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SERVICE LIST

Secretary of the Commission U. S. Nuclear Regulatory Commission Washington, D. C. 20555	Dr. Judith H. Johnsrud Co-Director Environmental Coalition on Nuclear Power 433 Orlando Avenue State College, Pennsylvania 16801
Administrative Judge James P. Gleason 513 Gilmore Drive Silver Spring, Maryland 20901	Susquehanna Environmental Advocates c/o Gerald Schultz, Esquire Post Office Box 1560 Wilkes-Barre, Pennsylvania 18703
Mr. Glenn O. Bright Atomic Safety and Licensing Board Panel U. S. Nuclear Regulatory Commission Washington, D. C. 20555	Mr. Thomas J. Halligan, Correspondent The Citizens Against Nuclear Dangers Post Office Box 5 Scranton, Pennsylvania 18501
Dr. Paul W. Purdom 245 Gulph Hills Road Kadnor, Pennsylvania 19087	Ms. Colleen Marsh Box 558 A, R. D. #4 Mt. Top, Pennsylvania 18707
Atomic Safety and Licensing Board Panel U. S. Nuclear Regulatory Commission Washington, D. C. 20555	Jessica H. Laverty, Esquire Office of the Executive Legal Director U. S. Nuclear Regulatory Commission Washington, D. C. 20555
Docketing and Service Section Office of the Secretary U. S. Nuclear Regulatory Commission Washington, D. C. 20555	

Robert W. Adler, Esquire
Department of Environmental Resources
Commonwealth of Pennsylvania
505 Executive House
Post Office Box 2357
Harrisburg, Pennsylvania 17120

James M. Cutchin, IV, Esquire
Office of the Executive Legal
Director
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

DeWitt C. Smith
Director
Pennsylvania Emergency Management Agency
Transportation and Safety Building
Harrisburg, Pennsylvania 17120

Mr. Thomas M. Gerusky, Director
Bureau of Radiation Protection
Department of Environmental
Resources
Commonwealth of Pennsylvania
Post Office Box 2063
Harrisburg, Pennsylvania 17120

Atomic Safety and Licensing Appeal
Board Panel
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555