June 25, 1981

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
PENNSYLVANIA POWER & LIGHT COMPANY	)	
	)	
and	)	Docket Nos. 50-387
	)	50-388
ALLEGHENY ELECTRIC COOPERATIVE, INC.	)	
	)	
(Susquehanna Steam Electric Station, Units 1 and 2)	)	

APPLICANTS' STATEMENT OF MATERIAL FACTS AS TO WHICH THERE IS NO GENUINE ISSUE TO BE HEARD (CONTENTION 5)

Pursuant to 10 C.F.R. § 2.749(a) Applicants state, in support of their Motion for Summary Disposition of Contention 5 in this proceeding, that there in no genuine issue to be heard with respect to the following material facts:

A. Contention 5(a)

1. The levels or radioactivity in the environment resulting from routine releases from a nuclear power plant and the radioactive doses imparted upon members of the public as a result of those releases are estimated at the plant's preoperational stage by means of mathematical models. Two types of models are utilized for that purpose: models for the transport of radionuclides from the release point at a plant to the body of man ("pathway models"), and models for the dose received by the individual once radionuclides reach his body through the various pathways ("internal dosimetry models"). Affidavit of Frazier L. Bronson in Support of Summary Disposition of Contention 5(a) ("Bronson 5(a) Aff.") at para. 3.

2. A set of pathway and internal dosimetry models for exposures due to gaseous releases from a nuclear power plant was developed for the NRC Staff ("Staff") by Battelle Pacific Northwest Laboratories in the mid 1970's. Those models are described in Regulatory Guide 1.109 and have been put in the form of a computer code named "GASPAR" which is widely used by the nuclear industry. The models include suggested parameters to be used in the absence of specific data. The Staff regards these models as acceptable for calculating the radiological impact of the plant operation on individuals and populations and determining compliance with Appendix I to 10 C.F.R. Part 50, and recommends their use by license applicants. Bronson 5(a) Aff., para. 4.

3. The radioactive gaseous effluents from the Susquehanna facility, as reported in the Operating License Stage Environmental Report ("ER") and the Final Safety Analysis Report ("FSAR") for the facility, were computed utilizing the GASPAR computer code and using most of the general parameters cited in Regulatory Guide 1.109. Id., para. 5.

4. One of the exposure pathways to man included in the Staff's models is the ingestion of milk containing radioactive iodine isotopes. As with other operating nuclear power plants, minute amounts of radioiodines may be released by the Susquehanna units into the atmosphere. A fraction of the radioiodines released may eventually be deposited onto plant foliage or may be taken up by the plant's root system from activity initially deposited on the ground. In turn, some of the radioiodines thus deposited on pasture grass may be consumed by dairy cows as fresh forage. Finally, a

fraction of the radioiodines ingested by the cow may find their way into the animal's milk and will be available for ingestion by humans consuming that milk. Id., para. 6.

5. The most critical individuals for estimating the effects of radioiodines in milk are the infants (age 1 or less). The basic formula relating the dose received by an infant ingesting milk and the amount of radioiodines released from a nuclear power plant can be expressed as the product of nine parameters. Id., para. 7.

6. Of the nine parameters in the formula, the one at issue in Contention 5(a) is F_m, the transfer coefficient to milk, which is the fraction of the radioiodine ingested daily by a cow that is secreted in one liter of milk during equilibrium conditions. Id. The value of F_m utilized in the radioiodine in milk dose calculations for the Susquehanna plant was 0.006 days/liter. This is the general value suggested by the Staff in Appendix E to Regulatory Guide 1.109. Id., para. 8.

7. Recent surveys of the technical literature indicate that a range of values of F_m have been obtained by experimentation and environmental monitoring. According to the surveys, the value utilized by the Staff, .006 days/liter, is within the range of reported values. Id., para. 9.

8. The existence of such a range of values is not unusual and does not imply that the value chosen by the Staff for F_m is erroneous. Most measurements of the parameter have been conducted over only short time periods, whereas the model parameters are assumed to be averaged over the length of the grazing season.

In the absence of measurements extending over long periods of time, there is no reason to believe that the Staff's value is less accurate than others in the range. Id., para. 10.

9. Each of the nine parameters in the dose equation is obtained through a combination of discrete measurements and estimation, and therefore the value assigned to each parameter lies within a band of error that can be reduced, but not eliminated totally. To compensate for the uncertainty in the estimates, the Staff has chosen in many cases the upper end of the range. Id., para. 11.

10. The Staff recommends, and Applicants used in calculating the radioiodine doses attributable to the Susquehanna plant, values of 1.0 for F_s (the fraction of the total dry matter intake of a cow composed of fresh forage) and for F_p (the fraction of the year in which a cow receives fresh forage). However, a survey of the dairy farms in the vicinity of the Susquehanna site revealed that the applicable values for those parameters at Susquehanna are 0.42 and 0.5, respectively. Thus, the potential dose underestimation that could result from using too low a value for F_m would be more than compensated by the overestimation built into the model by using 1.0 for F_s and F_p. Id.

11. Another conservative assumption is associated with "D", the thyroid dose conversion factor for infants. According to a statistical analysis of the various parameters in the formula, the value of this parameter suggested by the Staff and used for the Susquehanna dose computations is about 100% larger than the most probable value of the parameter. Therefore, another overestimation factor of two is built into the iodine health effect estimates

obtained using the Staff's model. Id., para. 12.

12. There are other conservative assumptions built into the Staff model that make it likely that the doses computed by means of the model will overestimate those that would be received by members of the public, even if a parameter such as F_m is underestimated. The model assumes maximum consumption of milk containing radioiodines for the most sensitive age group members, and assumes that all milk comes from cows constantly located at the pasture nearest to the plant. Id., para. 13.

13. If the estimate for any of the parameters in the dose computation were to be grossly in error, field measurements of radioactive iodine in milk in the vicinity of nuclear power plants would be higher than the concentrations estimated using the model. Measurements of radioiodine concentration in milk from dairy farms located near operating power reactors, however, show that the concentration of radioiodine in milk attributable to routine plant operations is at or below the minimum detection levels. Those measurements are two orders of magnitude lower than the maximum estimated radioiodine concentration in milk for Susquehanna using the Staff model. Id., para. 14.

14. The measured concentrations of radioiodines demonstrate that the Staff model, taken as a whole, gives conservatively high radioiodine concentration estimates and hence conservatively high dose estimates, and that no gross underestimation of any of the parameters exists. Id., para. 15.

15. A determination that the F_m parameter had been underestimated by a ratio of .01/.006 (67%), would not require

altering the radioiodine dose calculated in the Susquehanna ER and FSAR, for it would be more than offset by overestimation of other parameters. Id., paras. 11, 15.

B. Contention 5(b)

16. The release and dose analyses to show Susquehanna's compliance with 10 C.F.R. Part 20 and Appendix I to 10 C.F.R. Part 50 were based in part on estimated amounts of the various radionuclides in the reactor primary water. Of those radionuclides, curium-242 and certain plutonium isotopes (plutonium-238, plutonium-239, plutonium-240 and plutonium-242) decay by alpha particle emission. The concentration of curium-242 in reactor primary water is on the order of 10^{-12} Ci/ml, which is about 20 times lower than the permissible concentration of that radionuclide for unrestricted release in water under 10 C.F.R. Part 20. The concentration of the plutonium isotopes is even lower than that of curium-242, being on the order of 10^{-13} Ci/ml. Affidavit of John C. Dodds in Support of Summary Disposition of Contention 5(b) ("Dodds Aff."), para. 3.

17. Because the amounts of alpha emitting isotopes in reactor primary water are so minute, the release and dose analyses for Susquehanna did not include any alpha emitters since their contribution to the total dose to the public outside the plant would be insignificant compared to that from other particulate releases. Thus, no dose conversion factor for alpha emitters was utilized in the analysis. Dodds Aff., para. 4.

18. The Susquehanna releases of isotopes in particulate form are expected to be equivalent to those which have been measured at similar operating plants, after adjusting for

plant-specific parameters such as filtration systems. The release data for those operating plants are given in NUREG-0016, Rev. 1 (1979). These data show no measured alpha-emitting isotopes in operating plant releases, confirming that any alpha emitters released from plants such as Susquehanna are present, if at all, in amounts too small to be detected. Id., para. 5.

19. A calculation of hypothetical doses due to alpha-particle emitter releases from Susquehanna was made utilizing the extremely conservative (on the high side) assumption that alpha emitters such as curium-242 are released from Susquehanna at the lowest detectable particulate levels reported in NUREG-0016. The calculation utilized a dose conversion factor of 20 for alpha particles, which is the most recent value recommended by the International Commission on Radiation Protection and is also the dose conversion factor specified by the NRC for alpha particles. The calculation showed a dose due to releases of an alpha-particle emitter (such as curium-242 or plutonium) of approximately 8×10^{-4} mrem/year to the lung of a person at the point in the Susquehanna site boundary closest to the plant. Id., para. 6. A similar calculation of the maximum dose due to ingestion of curium-242 or plutonium in drinking water at the Danville location would give a dose of 9×10^{-7} mrem/year to the critical organ (bone) of a person consuming two liters of untreated water a day. Id., footnote 3.

20. The calculated maximum dose for hypothetical particulate releases of alpha-emitting particles would be about four orders of magnitude smaller than the already very small dose due to

other particulate releases from Susquehanna, and therefore negligible. Id., para. 6. The calculated maximum dose from hypothetical liquid releases of alpha-emitting particles would be almost three orders of magnitude smaller than the already very small dose due to other liquid releases from Susquehanna, and therefore also negligible. Id., footnote 3.

C. Contention 5(c)

21. Two radioactive particles depositing the same amount of energy per unit mass of irradiated tissue (that is to say, imparting the same "dose" in rads) may produce significantly different degrees of biological effect on the affected tissue. Since, in radiation protection work, it is desirable to express on a common scale for all types of radiation the exposure received by an individual, a "quality factor" ("Q") has been defined. Q is a modifying factor which weights the absorbed dose of radiation by the biological effectiveness of the charged particles producing the dose. As a result of the use of Q, doses of different biological effectiveness can be added and measured relative to the effects of a reference radiation (the biological effect of one roentgen of X-rays, known as the "rem"). Affidavit of Frazier L. Bronson in Support of Summary Disposition of Contention 5(c) ("Bronson 5(c) Aff."), para. 3.

22. Low energy beta and gamma radiation, that is, beta and gamma radiation having a linear energy transfer ("LET") between 0.2 and 3.5 kiloelectronvolts (keV) per micrometer (μm), has traditionally been assigned a Q of 1. Bronson 5(c) Aff., para. 4.

23. While low-LET beta and gamma radiation has traditionally been assigned a Q of 1, there was a brief period when the International Commission on Radiation Protection ("ICRP") recommended that the Q for beta and gamma radiation with energies below 30 KeV be raised to 1.7 to account for some biological research which had indicated that the Q for such radiation might lie between 1 and 2. In 1969, however, the ICRP published a new report indicating that further research and study showed that a Q value of 1 was the best estimate for low-LET beta and gamma emitters. Since that time, all major national and international advisory and regulatory groups have used a Q of 1 for low-LET beta and gamma radiation. The most recent ICRP standard, contained in ICRP Publication 30, retains a Q of 1 as the recommended value for low-LET beta and gamma radiation. Id., paras. 5, 6.

24. The NRC has also established by regulation, in 10 C.F.R. § 20.4(c)(2), a Q of 1 for low-LET beta and gamma radiation. Id., para. 6.

25. A Health Physics article referenced in Contention 5(c) asserts that different kinds of radiation in the "low-LET" range may have biological effectiveness varying by as much as a factor of 4, yet all have been assigned the same Q of 1. As a proposed solution to this perceived ambiguity, the authors of the article propose that a reference radiation be chosen in the midpoint of the 0.2 - 3.5 keV/μm range. If this were done, some kinds of low-LET radiation would have their Q go up or down by a factor of approximately 2. Id., para. 4.

26. The Susquehanna dose estimates for low-LET beta and gamma emitters were performed in accordance with the equations for calculating internal dose commitments developed for the NRC by Battelle Pacific Northwest Laboratories. In the Battelle study, the earlier recommendations of ICRP with respect to using a Q of 1.7 for low-LET beta and gamma radiation were followed. Thus, the Susquehanna dose computations for low-LET beta and gamma radiation utilize essentially the same Q proposed by the authors of the article cited in the contention. Id., para. 7. Therefore, even if the redefinition of Q proposed in the article cited in the contention were accepted and applied to low-LET beta and gamma emitters, this would not require a change in the dose estimates for low-LET beta and gamma emitters released from Susquehanna. Id.

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Respectfully submitted,

SHAW, PITTMAN, POTTS & TROWBRIDGE

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