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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

DOCKETED
USNRC

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

Lawrence Brenner, Chairman
Dr. Richard F. Cole, Member
Dr. Peter A. Morris, Member

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OFFICE OF SECRETARY
DOCKETING & SERVICE
BRANCH

IN THE MATTER OF: :

Philadelphia Electric Company: DOCKET NOS. 50-352-02
50-353-02

(Limerick Generating Station,:
Units 1 and 2)

DOCKET NUMBER
PROD. & UTIL FAC. 50-352 OL
50-353 OL

CITY OF PHILADELPHIA'S TRANSMITTAL OF PROPOSED
PARTIAL INITIAL DECISION ON THE CITY
OF PHILADELPHIA'S NATIONAL
ENVIRONMENTAL POLICY ACT
SEVERE ACCIDENT CONCERNS

In accordance with the Atomic Safety and Licensing Board's ("Board") June 22, 1984 "Order Correcting Schedule for Proposed Findings on NEPA Severe Accident Contentions," transmitted herein is the City of Philadelphia's Proposed Partial Initial Decision, which includes proposed findings and conclusions of law related to National Environmental Policy Act issues of concern, raised by the City, as admitted by the Board.

Respectfully submitted,

Martha W. Bush

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FOR THE CITY OF PHILADELPHIA

Dated: July 26,1984

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

Lawrence Brenner, Chairman
Dr. Richard F. Cole
Dr. Peter A. Morris

In the Matter of:	:	
PHILADELPHIA ELECTRIC COMPANY	:	DOCKET NOS. 50-352-OL 50-353-OL
(Limerick Generating Station, Units 1 & 2)	:	

CERTIFICATE OF SERVICE

I hereby certify that a true and correct copy of the City of Philadelphia's Proposed Partial Initial Decision On City of Philadelphia's National Environmental Policy Act Severe Accident Concerns in the above-captioned proceeding have been served on the following persons named on the attached service list by Federal Express Mail, or by causing the same to be deposited in envelopes addressed to said persons, first class, postage prepaid, and deposited with the United States Postal Service at Philadelphia, Pennsylvania 19107.

Respectfully submitted,

Martha W. Bush

MARTHA W. BUSH,
Deputy City Solicitor

Dated: July 26, 1984

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CITY OF PHILADELPHIA'S PROPOSED INITIAL PARTIAL DECISION ON CITY OF PHILADELPHIA'S NATIONAL ENVIRONMENTAL POLICY ACT SEVERE ACCIDENT CONCERNS

I. SUMMARY

1. The Limerick Generating Station ("Limerick") consists of two (2) units and their associated common facilities. The design capacity of each unit is 1055 MWs. The Limerick site is located on the Schuylkill River, 21 miles northwesterly from the boundary of the City of Philadelphia, in Montgomery County. SER, 2-1. The wind direction from Limerick is toward Philadelphia 27% of the time. FES, 5-79. The population of the City of Philadelphia, the area with closest population of the highest density, is approximately 1.7 million. The population within the fifty miles radius from the plant is approximately 8 million. Tr. 11, 283.

2. In this particular aspect of the proceeding, we are considering the environmental impacts that can result from a "severe" accident at Limerick. Severe accidents are those residual accident possibilities that cannot be prevented through design or operational safety measures. "Severe" or core melt accidents have only recently begun to receive close scrutiny. See, Environmental Protection Regulations, 49 Fed.Reg. 9352, March 12, 1984 ("EP Regulations"). In fact, this is the first operating licensing proceeding in which a National Environmental Policy Act ("NEPA"), Pub.L. 91-190, §2, Jan. 1, 1970, 83 Stat. 852, 42 U.S.C. §4321, analysis has been done for a severe accident. This is in large part due to the new perspective gained from TMI, see EP Regulations at 9356, combined with the density of the population near the Limerick site.

3. The total probability of a severe core melt at Limerick is slightly under 1/10,000 per reactor year. Tr. 11, 290. The value is derived by adding all of the accident probability values listed on Table 5.11(d), FES. 5-77. Each calculated accident consequence has a projected associated probability. There are wide variations in both consequences and probabilities. The accidents with the severest calculated consequences are projected to have the lowest probability of occurrence. The entire aim of regulation has been to reduce the chances of the worst types of accidents and to minimize environmental impacts resulting therefrom. To obtain the total site, lifetime core melt accident probability, one multiplies the core melt probability times the number of reactors and their expected life. Tr. 11,193-95; 11,487. The thus derived value is 1/166 (30 year life) to 1/250 (40 year life, Tr. 11,279). This calculated value assumes a 105% capacity factor, at 30 years of continual operation, Tr. 11,299-300, but a witnesses' recollection was that the expected capacity factor might be 80%. Tr. 11,300. Human errors of commission and sabotage are not included in these estimates. Tr. 11,192.

4. The two modes of contamination are airborne and the water pathway. As for airborne contamination, for Philadelphia the greatest potential source of fatalities are latent cancer fatalities (not immediate fatalities). "[T]he bulk of those [latent fatality] cancers come from distances beyond ten miles ... perhaps tens of miles down-wind with large populations where individuals will receive more small doses...." Tr. 11,627; 11,677. Latent fatalities begin to appear in the population, on average, ten years after exposure and continue to appear over the lives of those individuals who were exposed. Another large effect in terms of numbers is genetic defects. Tr.11,212. Water contamination

has been estimated to be a small fraction of the air contamination on a point estimate basis. However, contamination levels above EPA standards could continue for a long period--up to 53 years in the most extreme case measured -- as a result of long term term run-off of contamination from the soil into the watersheds. We do not know the levels of contamination in the first month after an accident. Tr. 12,171.

5. The City of Philadelphia participated in this aspect of the proceeding. The City's litigation effort was directed toward trying to have available study results so that (a) the City officials, and the NRC could assess the potential risk to the City, with its relatively high population density and moderately proximate location, and, (b) the City and the NRC could assess and factor into their decisionmaking, a full and reasonable range, of potential contamination and the associated probabilities for all accident sequences, weather conditions, and possible exposure levels (evacuation scenarios) and dose conversion levels. In light of the record here so developed, the requirements of NEPA, and the on-going state investigation into any potential benefits that might be associated with Unit No. 2's operation, the Commission will stay any licensing of Unit No. 2 pursuant to NEPA, until the Commission has available for further NEPA review the results of the Pennsylvania Public Utility Commission's investigation, see paragraph 8 below.

II. APPROPRIATE ANALYTIC FRAMEWORK FOR EVALUATION OF RISK IN THE NEPA CONTEXT: BENEFITS VERSUS ENVIRONMENTAL COSTS

6. "[R]isk acceptability is related to the benefit to the population incurring the risk." Tr. 11,475. This is not only analytically the appropriate framework, but is also the requirement of NEPA. Calvert Cliffs' Coordinating

Committee, Inc. v. AEC, 449 F.2d 1109, 1113-4 (D.C.Cir. 1971). The Court there held that NEPA requires a "balancing act." Any consideration of environmental impacts, or costs, must be weighed, or evaluated, in the context of any benefits that would accrue from the federal action. One specific section of NEPA requires the responsible federal official to include a "detailed statement" on "the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity ...." 42 U.S.C. §4332(2)(c). Here we must examine the efficacy of the proposed short-term uses of the environmenta, that is, Unit No. 2's operation, to determine whether the proposed action does provide a benefit that might offset the potential severe environmental impacts.

7. The Staff did present an updated calculation of the economic benefits associated with the operation of both units. FES, 6-1 et seq. The Staff stated that this was not a "[n]eed for power issue." FES, 1-5. Rather, the Staff indicated this was an "economic" analysis. Ibid. The analyses were extremely abbreviated and should be greatly expanded as to Unit No. 2, albeit not by the Staff here, until the issue has been fully examined by the Pennsylvania Public Utility Commission. See paragraph 26, infra. However, this issue was correctly raised again at this stage by the Staff. The Commision by its rules did not intend to bar the NRC Staff's initiative (or its own) as to need for power or economic consideration at this stage of the licensing process. See Need for Power and Alternative Energy Issues, Final Rule, Response to Comment No. 4, 47 Fed.Reg. 12940,41 (March 26, 1982). Such is properly the posture of the Staff as it is the Commission that is charged with assuring that NEPA's mandate is fulfilled. Re-examination is justified here, in part, because

of the vastly changed circumstances in the energy environment since 1974 when the question was last determined by the NRC. As to Unit No. 2, which is not even currently planned for operation until 1990, Philadelphia Electric Company, Annual Report, 1983, p. 33, these conclusions fail to provide a basis for a full and adequate NEPA analysis. Even the abbreviated recent analysis in the 1983 DES and the FES, must be greatly expanded and subjected to full consideration. Conservation, load management, co-generation, uprating of existing plants, solar, and other alternative energy sources have not been considered. These options are not only considered viable today, whereas in 1973 the experience was more limited, but they are an integral part of the Nation's energy policy. See National Energy Act of 1978.

8. As importantly, the Pennsylvania Public Utility Commission, the state regulatory body that examines issues of need and economics, has recently initiated an investigation into any potential benefits that operation of the second unit may offer the public. See attached Motion Re: Order To Show Cause Why The Construction Of Limerick Unit II Is In The Public Interest, July 6, 1984 (slip op.), signed by a majority of the Commissioners. That motion indicates that this body will examine whether the plant is needed for reliability purposes and whether there are less costly alternatives to Unit No. 2. These results are precisely of the nature that need to be weighed in the balance with the environmental impacts measured here. For this reason we will stay any decision concerning licensing of Unit No. 2 until that investigation is complete.

III. DESCRIPTION OF THE COMPLEX AND UNCERTAIN RISK ASSESSMENT METHODOLOGY AND PROCESS

A. History of Risk Assessment

9. Risk assessment is a complex undertaking. The last generic study commissioned by the AEC was issued in 1975 (WASH-1400). That study, the result

of the efforts of sixty specialists, consisted of eighteen volumes. In 1979, the then NRC Commission accepted the criticisms and appreciation of the Reactor Safety Study as proferred by a review group in the "Risk Assessment Review Group Report." EP Regulations at 9356. The analysis that was done here relied in large part on the basic WASH-1400 study, with site specific and other revisions.

B. Risk Assessment Methodology

10. In very general terms, "risk" can be broken down into two components: the probabilities of accidents and the associated consequences. The basic areas of input that make up risk assessment are:

a) the probabilities of accidents;

b) the degree and nature of release into the atmosphere;

c) the probabilities of relevant weather conditions;

d) the level, location and activity of population;

e) the conversion of dose to health consequence.

11. More specifically, the NRC Staff has calculated the probabilities of various types of severe accidents. These probabilities are a function of the causes of severe accidents, e.g., system failures, earthquakes, etc. The Staff also attempted to determine, once a failure occurred, what would be released into the atmosphere. This result is a function of various factors such as the amount of plating out of radionuclides in the plant, the level of degradation of core, the status of the containment structure, etc. These are called "source

terms." Included in the measurement process are the probabilities of various weather conditions, i.e., wind direction, atmospheric dispersion, cloud depletion, precipitation, and ground contamination (FES, 5-78). Also input are assumptions as to level of exposure of the population, given any one option in the three above-described categories of variables. The level of population exposure is a function of the exposure period, the population density level and the type and proportions of human activity during the exposure period, i.e., indoors/outdours, types of buildings with their associated sheilding values, situation of density of population in relation to cloud location, and evacuation scenario. Finally, once it is assumed there is a certain level and time period of contamination to a defined number of people, the consideration then is what level of health consequences will result from a given dose of radiation. This factor is called dose conversion factor.

12. For each of the 15-20 "release categories" or accident types analyzed by the NRC, hundreds of computer runs are done for 91 different "start times" for weather conditions and, in turn, assuming three different exposure levels/evacuation times. Given the number of release categories analyzed under many varying weather conditions, there are thousands of resulting values. As stated above, these results change as a function of the assumption as to evacuation time/exposure level. In summary, one will have a range of possible consequences which range is a function of release category, weather, population and, ultimately, dose conversion factors. Each of these results has an associated probability of the type (release category) of accident occurring and the probability of the weather conditions (wind direction, atmospheric dispersion, precipitation in relation to population density). Tr. 11,629. These results

range from the most extreme within each release category (worst weather, high density population and highest exposure/slowest evacuation time, most sensitive conversion factors) to the most moderate.

C. Uncertainties

13. The record in this proceeding has shown that the process of assessing the probabilities and consequences of severe accidents contains many uncertainties, is based on limited data and contains many judgments. Tr. 11,181; 11,286. The codes have been validated through theory, not actual experience. Tr. 11,171. Different codes have been compared to one another. Tr. 11,171. The only experimental date used in the models is the atmospheric dispersion model, Tr. 11,175, and there still are uncertainties associated with that mode. FES, 5-112. A reasoned evaluation of environmental impacts here is with an awareness of these limitations. Quantitative computerized results can easily take on a level of validity that we would not so readily attach to the judgments, estimates and equations that form the basis of the computer models.

14. The uncertainties in this analysis, according to the Staff, are primarily created by how little is known about how to quantify the human error element, the limited data base on failure rates of individual plant components, the limited data base on external causes of accidents, and the lack of knowledge as to the accident scenarios at the plant (quantity and chemical form of radioactivity released). FES, 5-108 through 5-110 and Tr. 11,332-33; 35. There are also uncertainties, according to the Staff, due to modeling errors and uncertainties in the modeling of atmospheric dispersion, including the transport of radioactivity. To a lessor, but still substantial extent, there are uncertainties, according to the Staff, associated with duration and energy of

release; meteorological sampling, emergency response effectiveness and other that will not be repeated here. FES, 5-112 through 5-115.

15. This range of uncertainties is estimated to result in "risk" values that may be too low by a factor of 40 and too high by a factor of 400. TR.11,176. There remains a 5% chance that the values could lie outside the uncertainty range. Tr. 11,315. (The results, per se, are discussed in Section IV below.) The Staff witness testified that the uncertainty figure applies to the "overall assessment of risk from all accidents." Tr. 11,183. The witness further stated: "It does not apply when we use a specific sequence. It applies to overall risk estimates not to individual probability or consequence." Tr. 11,183. Staff witness Acharya stated that "you canot apply a risk uncertainty estimate to consequences only. It is to the product of the two and we have no estimate of the uncertainty of either, just their product." Tr. 11,861.

16. However, the Staff has quantitively broken down the areas of uncertainty to (1) probability quantification, (2) source term uncertainty and (3) consequence value uncertainty. Tr. 11,178. Initially, the Staff witnesses were unwilling to specify any weight to each of these three areas. Tr. 11,180. Subsequently, the three separate areas of uncertainty were valued quantitatively, as follows: a) the projected probability value could be in a range of a factor 30, either higher or lower. Tr. 11,286-87, b) the fractions of the radionuclides that are associated with the release categories could be higher by a factor of 3 or lower by a factor of 30, Tr. 11,287, and c) the conditional estimates of the consequences could be higher or lower by a factor of ten, Tr. 11,288.

IV. QUANTITATIVE CONSEQUENCE AND PROBABILITY RESULTS

A. Staff Calculated Consequences For Airborne Pathway

17. The analysis done by the Staff calculated the conditional mean individual dose level at 20 miles, to be 13 rem. At 25 miles it is projected to be 8 rem and at 30 miles, to be 5 rem. Figure L. 15, FES. The total probability value is discussed in paragraph 3 above. These consequences are termed conditional mean values because they are conditional upon an accident occurring. Many accident probabilities are derived and each of those probabilities, which have a wide range all smaller than the one in ten thousand, are totalled to get the one in ten thousand estimate. While the total accident probability is one in about ten thousand reactor years, the conditional mean consequence value is not associated with any one accident. These are simply the average consequence values derived if all accident sequence consequences values (themselves an average of results associated with a difference weather scenario) are summed and that total is divided by the number of accident consequences examined. To get person rem and then latent fatality values for the City, these values can be derived in rough terms by multiplying the mid-point value of 8 rem times the City of Philadelphia's population of 1.7 million. Tr. 11,689. The resulting person rem exposures is 13,600,000 person rem. Computerized results would be somewhat different depending on where individuals are located in relation to the contamnation. This result would not give Philadelphia's tail end values. Tr. 11,689. From the record here, one "could not derive the range of consequences and probabilities to citizens of Philadelphia in terms of health effects." Tr. 11,848.

18. Utilizing 400 cancer deaths per 1 million person rem, the upper

end of the dose conversion range, Daebeler et al. at 48, the conditional mean latent fatalities are 5,440. If an assumption of 140 is used, the result is 1,904 latent fatalities. If it is thought appropriate to reduce the health effects because the exposure levels are below 30 rem, these calculated results would be divided by 5, for 1080 and 388, respectively. The dose distance curves do not reveal peak values. For these results to occur the wind would have to be blowing in the direction of Philadelphia. The wind direction from the plant is toward Philadelphia 27% of the time.

19. PECO presented average calculated individual doses, conditional upon the occurrence of an accident. (2.4 x 10-5). Daebeler, et al., Figure 2. At 21 miles, the projected life time site probability is 1/62,000 at 30 rem and 1/32,500 at 5 rem. Daebeler et al. at Table 9. These results assume normal activity for 24 hours.

20. The Staff, in testimony, examined one of the most severe accidents with the lower projected probability value. That case was II-T/WW with a probability of 1/500,000. Adding the two probabilities (for the accident and wind toward the E and ESE sectors) associated with this accident sequence, results in a 5 x 10(-7) projected probability value. Hulman et al., May 16, 1984 at 24. This projected value, adjusted for the site (2 units, 40 years), is 1/25,000. The mean or average projected conditional consequence value for the entire population associated with this sequence is 18 million (SE sector) and 13 million (ESE Sector) person-rem. The Staff calculated the expected health consequences to be 1,100 and 800 latent cancer fatalities, respectively. Latent fatalities occur over the lives of the individuals exposed. This reflects the base value of 60 cancer per million person rem. Tr. 11,865. A value of 400 is toward the

upper of the range of uncertainty on this relationship. Daebeler, et al., at 48. In calculating health effects, the Staff also reduced the expected health consequence by 80% as a result of their optimistic view of the health effects of low level radiation. Tr. 11,863.

21. As shown in City Exhibit No. 2, the calculated potential exposure from this accident sequence at 22.5 miles (interval 19) ranges from a high peak value of 100 rem (with a .22% chance) to a low of 1 rem (97.8% chance). Thus peak values can be substantially higher than mean values.

Table 1, infra, portrays the NRC's study results in terms of a range of projected mean latent fatalities within 50 miles and the associated probabilities. These figures are derived from the FES, Figure L.6, and are described below. Column (1). The consequence values are based on dose conversion values of 60-140 latent cancer fatalities per million person rem, Tr. 11,862-68, plus a further reduction by a factor of 5 (80%) for exposures that are below 30 rem. Tr. 11,863 According to the NRC a range of 10 to 500 cancer fatalities per million person rem is shown in the literature. FES 5-67. Comparative consequence codes have resulted in differences that range by a factor of 10. Tr. 11,474-75. Column (5). The consequence values are adjusted for the Staff's uncertainty factor of 10. This uncertainty range includes the possible higher latent cancers per million person rem conversion factor plus other unspecified causes of uncertainty. Column (2). This shows the average probabilities associated with each average consequence value, stated in terms of one reactor for one year, i.e, "per reactor year." These are mean consequence and probability values in that health consequences associated with all weather scenario results are averaged. Thus these results do not state the full range of consequences.

TABLE 1

NRC's Calculated Latent Fatalities Within a Fifty Mile Radius, Using 30-140 Cancers Per Million Person Rems and as Adjusted for Uncertainty Factors

Latent Cancer Excluding Thyroid Within 50 Miles, Using NRC Values (1)	Base Case Probability Per Reactor Year (2)	Adjusted for 2 Units, 30 Years of Operation (3)	Probability Adjusted for Uncertainty Factor of 30 (4)	Consequence Value, Adjusted for Uncertainty (5)
10	1/14,285	1/238	1/8	100
100	1/25,000	1/416	1/14	1,000
1,000	1/100,000	1/1,666	1/56	10,000
10,000	1/10,000,000	1/166,666	1/5,555	100,000
15,000	1/100,000,000	1/1,666,666	1/55,555	150,000
20,000	1/555,000,000	1/9,250,000	1/308,333	200,000

Single peak values could be many multiples of the mean values. See City Exh. No. 2. Column (3). This adjusts the probabilities to reflect the total probabilities associated with the site (2 units) during an expected 30 year lifetime. Column (4). Multiplication of the probability value by the Staff's estimated uncertainty factor gives a bounding range of the highest possible level of probability. Tr. 12,075. (There is still a 5% chance the probability could be outside of this bounding range.)

B. Calculated Water Contamination

22. The Staff assumed that about 50% of the City is supplied from each river and that about six days' supply was available in the existing system. This was based on an assumption that conservation measures could be enforced and on the availability of 1.121 billion gallons of filtered water storage and 503 million gallons of untreated and in process water (86.2 mg. at Belmont, 177 mg. at Queen Lane and 176 mg. at Baxter). The Staff assumed that 7% of the City's consumption level, in the Belmont and Roxborough high service districts, could not immediately be met by the Delaware, but that with storage capacity and other alternatives, individuals residing in those areas would never consume Schuylkill water if that watershed were ever contaminated. It was assumed that strontium-90 and cesium-137 contribute to 90% of the dose and all other radionuclides the remaining 10%. Lehr at 6. It was also assumed that the greatest long term concern was strontium-90.

23. There have been a wide range of experimental study results in terms of percentage removal of strontium-90 from water. Lehr at 7 et seq. Removal levels appear to be a function of treatment process and contamination. Results range from 0% to 75% for alum ferrous sulfate plus lime treatment. In

order to maximize contamination removal, any such treatment facilities would have to be modified so that the water can be treated with lime-soda softening twice. This would reduce the treatment system's through-put in half.

24. Reduction of contamination in the Schuylkill River to EPA levels of 8 picocuries/liters for almost all of the cases analyzed would not be possible at all in the first year. Thus the asssumption that the Delaware can supply all of the City for at least a year and in some cases 20-50 years is crucial. Similarly, the immediacy of providing service to high service territory is a large factor in determining the dose levels to that population. It was assumed here that the high service territory would not consume contaminated Schuylkill water, but would be served by alternative means.

25. The Staff approached the water contamination issue by making an analysis of one relatively lower probability and relatively higher consequence accident scenario. This particular accident sequence's proability of occurrence is 1/500,000 for one unit for one reactor year. Acharya at 13. The site and lifetime adjusted probability is 1/8333, with no adjustment for uncertainty.

26. According to the Staff, under the assumption that this accident scenario has occurred, "the Schuylkill River is likely to be highly contaminated and there is a 50% probability that the concentrations in the Delaware River following the accident would be less than 15 picocuries per liter (15 p Ci/l)." Wescott at 11. It is highly probable that contamination of the Schuylkill will exceed 8 picocuries, for strontium, given this type of accident. Tr. 12,173. If there is a deposition on the Delaware, there will"always" be a deposition in the Schuylkill. Tr. 12,154.

27. The Staff calculated a 60% chance that both watersheds would be

contaminated. Wescott at 6. If the highest expected depositions were to occur in one watershed, wind conditions would generally (probability unknown) preclude similarly high depostions on the other watershed. Acharya at 7. The Staff was not able to calculate in detail the interrelationship between both rivers for contamination levels and probabilities. Tr. 12,168.

28. It could take 53 years for Schulykill River contamination levels to reach 100 p Ci/l. Wescott at 16. There is a less than a 50% chance that after 30 years the levels of contamination will be at 100 p Ci/l. Achyara at 8. However, there is a 13% chance that levels will be 100 p Ci/l after the immediate initial washoff period. Westcot at 11.

29. For the Delaware River, the probability of virtually no contamination, assuming this accident scenario has occurred and given the NRC weather model, is 38%. There is a 50% chance that 15 p Ci/l will not be exceeded and a 85% chance that 100 p Ci/l will not be exceeded. Acharya at 10. We have no figures on contamination levels in the first few months because of data availability limitations. Batram at 15-16.

30. PECO reviewed all accident probabilities and the associated mean consequences values together in their analysis in contrast to the Staff results that examined one accident sequence and looked at the chance of various doses, assuming the accident occurs.

31. PECO examined probabilities associated with an average annual concentration of 96 p Ci/l. The predicted per reactor year values for the Schuylkill and Delaware were 1/300,000 and 1 in 7 million, respectively. Batram at 17. The adjusted 2 unit lifetime predicted values are 1/5,000 and 1/283,000. The adjusted probabilities calculated to be associated with concentrations

reaching 8 pCi/l are 1/1,000 and 1/6,000 respectively. Batram at Figure 4(a) and Figure 5(a). The calculated probability of exceeding 8 p Ci/l in the two watersheds on a one month average basis (immediately subsequent to a sever accident), adjusted for two units, during their lifetime, were estimated to be 1/1,111 and 1/2,380, respectively. Ibid.

32. NEPA requires worst case analysis, especially if there are uncertainties in the analysis. Sierra Club v. Sigler, 695 F.2d 957 (5th Cir. 1983).

33. The FES conclusory results here were presented, discussed and compared to other adverse environmental impacts in terms of predicted "risk" values. FES, 5-98 et seq. A "risk" number in contrast to probability and consequence values are without any understandable meaning to decisionmakers. The conclusions of the NEPA should be in a form easily understood by public officials. 40 C.F.R. §1502.8. Risk values also do not portray the relationship between probabilities and consequences. Tr. 11,631. The CCDF curves, which do portray probabilities and consequences separately, contain mean or average consequences values for all accident sequences examined and all weather conditions (average of consequence results associated with 91 weather condition start times). Thus, they do not show peak values. (Nor do they show uncertainty bounds, see paragraph 34 below.) Table K.1 in the FES shows projected average consequence values for each release category listed on Table 5.11(d) separately, in contrast to CCDF curves. Tr. 11,285. However, each of these are averaged values derived from results associated with each of the 91 weather sequence start times. Tr. 11,285. Dose distance curves, as also presented in the FES, do not show peak values; they are graphs of mean individual exposures. Tr. 11,834.

34. The Staff witness, Acharya, stated that CCDF curves normally "reflect the uncertainty of the estimates upon which the CCDF was constructed, by showing an upper bound and a lower bound." Tr. 11,216. A single CCDF curve does not display the range of uncertainty. Tr. 11,315. These uncertainty bounds were not portrayed as integral to the CCDF curves presented in the FES

35. The Staff "did not examine the individual frequencies with the high or low probability that would result in high doses beyond the ten mile EPZ." Tr. 11,692. Nor did the Staff's analysis measure "the range of the probability of events which would result in high doses substantially beyond ten miles." Tr. 11,693.

36. Table L.4 shows a jump in risk at distances that are covered by Philadelphia. Tr. 11,675.

37. To the extent the CRAC's random methodology fortuitously captured a bad weather scenario, see paragraph 38 below, those consequence results are obscured by the averaging process that forms the basis of Table K.1.

38. The 1976 data base that was used in the CRAC analysis might not contain the worst meterological sequence. Tr. 11,766. It is more likely that CRAC (random sampling) compared to CRAC 2 (binning) would miss very bad weather conditions, although both could miss it. Tr. 11,673. There is no assurance that rain beyond ten miles is picked up by CRAC. Tr. 11,685.

39. The Staff attempted to approximate bad weather by use of 91 weather samples, Tr. 11,745, and by considering an emergency response mode that is slower than the base case. Tr. 11,744. Weather sampling has been discussed above. The Staff has also indicated bad weather would affect the tail end

values. Tr. 11,745. That is, peak values would be higher. Finally, the Staff witness testified that, at any rate, the 40 uncertainty variable bounds bad weather effects. Tr. 11,746.

40. The problem remains of bounding the effects of slowed evacuation due to possible back-ups as evacuees might approach the City area. The Board can envision a situation wherein evacuees move toward Philadelphia in order to escape the plume and the direction of the plume changes. There is no credible evidence on this record of the ability to overcome the difficulties associated with knowing the precise direction of the wind and the location of the plume at these distances from the plant at all times, or being able to notify all evacuees of such, given the myriad road network, large members of evacuees and limited monitoring device. We are not convinced that modeling more people, evacuating at the same rate, as did the Staff at pp. 15-17 of Hulman et al., May 16, 1984, fully reflects the difficulties here. At any rate, however, the uncertainty range covers this effect and we consider heavily this uncertainty range in our conclusions.

41. The analysis done by the Company showed a doubling of "risk" associated with slowed evacuation time. Tr. 11,631. This result does not indicate the level of increase in consequences and the associated expected probability value. Tr. 11,632.

V. CONCLUSIONS OF LAW

Based on the foregoing Findings of Fact, which are supported by reliable, probative and substantial evidence as required by the Administrative Procedure Act and the Commission's Rules of Practice, and upon consideration of the entire evidentiary record in this proceeding, the Board reaches the following conclusions pursuant to 10 C.F.R. § 2.760a:

1. The National Environmental Policy Act of 1970 ("NEPA") directed federal officials "to use all practicable means, consistent with other essential considerations of national policy," to protect the environment. 42 U.S.C.A. §4331. Consistent with that mandate, the Nuclear Regulatory Commission, prior to issuance of an operating licensing for both Limerick units, must fully disclose the environmental impacts of the units' operation and must factor into its licensing decision consideration of NEPA's mandate.

2. The informative uses of the environmental impact study are to provide information to the general public and public officials at all levels of government, 40 C.F.R. §1500.1(b), and to provide the basis for an informed decision on the part of the NRC. Sierra Club v. Froehike, 345 F.Supp. 440, 444 (W.D. Wis. 1972), aff'd 486 F.2d 946 (7th Cir. 1973). On this count the study must be reasonably thorough and must take a "hard look" at the environmental consequences. Kleppe v. Sierra Club, 427 U.S. 390, 410, n.21 (1976).

3. NEPA does not mandate informational requirements only, however. NEPA injects environmental considerations into the decision making process itself. Weinberger v. Catholic Action of Hawaii, 454 U.S. 139, 143 (1981). An essential element of decision making is whether alternatives should be considered in light of any benefits of the action in relation to the measured environmental impacts of the action. 42 U.S.C.A. §4332(2)(c)(iii).

4. In keeping with the National Environmental Policy Act, 40 CFR 1502.22(b) and the Commission's Environmental Protection Regulations, 49 Fed. Reg. 9352, 9347 (March 12, 1984), the Board has considered a full range of both the probabilities of various accident scenarios and their associated consequen-

ces. Given the developmental status of these types of analyses and their high degree of uncertainty, a reasoned approach is to review and consider this range, including the calculated uncertainty range. We have considered on this record a reasonable range of dose conversion factors, exposure levels (protective action effectiveness), bad weather, and the probability calculation uncertainty range. Although upper bound results were not portrayed here in every instance, we have compensated for that lacking by giving greater weight to the uncertainty range, especially the upper bounds.

5. Based on our consideration of this record in the above described framework and what has been thereby disclosed in terms of the environmental impacts of potential severe accidents and the uncertainty in measuring both the probabilities and consequences associated therewith, we conclude that further NEPA assessment in terms of weighing environmental costs versus benefits of the project is warranted for Unit No. 2. A stay by our Commission of any determination of licensing of Unit No. 2, in terms of the acceptability of environmental impacts, is appropriate for the following additional reasons:

(a) The pending availability, for NRC review, of the Pennsylvania Public utility Commission's investigation results will precisely focus on and develop the economic issues associated with Unit No. 2's potential operation.

(b) Unit No. 2 is only partially completed, with in-service not scheduled until the 1990s. A stay of licensing now will not have the construction scheduling impact associated with such a stay for a nearly completed plant.

(c) There have been vastly changed circumstances since 1973, when this issue was last examined by the Commission in an adjudicatory context. These changes will affect the economics of the plant's operation. Also the partial nature of construction completion will affect the economic analysis when comparing Unit No. 2 to alternatives, in contrast to comparing the economics of a completed plant to the economics of alternatives.

(d) The lack of previous consideration at the construction stage of conservation, cogeneration, etc., as alternatives also compels reconsideration. Conservation, good management, cogeneration, and rate structures to promote efficient use of production are now an essential component of the Nation's energy policy. National Energy Act of 1978. They are no longer viewed as "remote and speculative" possibilities.

In conclusion, before doubling the potential for the public's exposure to these environmental impacts in such a high density population area, NEPA requires us, as federal officials charged with the protecting environment, to stay a decision on Unit No. 2 until the Pennsylvania Pennsylvania Public Utility has completed its investigation.

ORDER

WHEREFORE IT IS ORDERED, that this Partial Initial Decision shall become effective immediately and shall constitute with respect to the matters decided herein the final action of the Commission forty-five (45) days after the date of issuance hereof, subject to any review pursuant to the Commission's Rules of Practice.

A notice of appeal may be filed any party within ten (10) days after service of this Partial Initial Decision. Within thirty (30) days after service of a notice of appeal (forty (40) days in the case of the Staff), any party filing a notice of appeal shall file a brief in support thereof. Within thirty (30) days of service of the brief of the appellant (forty (40) days in the case of the Staff), any other party may file a brief in support of, or in opposition to, the appeal.

IT IS SO ORDERED.

THE ATOMIC SAFETY AND LICENSING BOARD

Judge Lawrence J. Brenner, Chairman

Judge Peter A. Morris, Member

Judge Richard F. Cole, Member

Public Meeting July 6, 1984

MOTION

RE: ORDER TO SHOW CAUSE WHY THE CONSTRUCTION O[illegible] LIMERICK UNIT II IS IN THE PUBLIC INTEREST

On October 10, 1980, this Commission entered an Order at docket number I-80100341 initiating an Investigation into the need for, and economy of, the Limerick Nuclear Generating Station of Philadelphia Electric Company (PECO). At the end of the Investigation, the Commission concluded that the simultaneous construction of Limerick Units I and II would not be in the public interest because of PECO's precarious financial condition and the effect that the continued construction of both units would have upon PECO's ability to provide safe and reliable service. PECO was given the option of either cancelling Unit II, or suspending Unit II until Unit I was completed; however, if PECO refused to suspend or cancel Unit II, the Commission would not approve any future securities issuances to raise capital for construction of Unit II. The Commission's Order was reversed by the Commonwealth Court but was upheld by the Supreme Court of Pennsylvania. Pennsylvania Public Utility Commission v. Philadelphia Electric Co., 501 Pa. 153, 460 A.2d 734 (1983). After the Supreme Court decision, PECO indicated that it intended to suspend Unit II until Unit I was completed, and then resume construction.

Recent developments have raised anew grave concerns regarding PECO's ability to provide adequate service at reasonable rates. PECO filed for a general rate increase on April 27, 1984, and has already announced its intention to file for another increase after Unit I comes on line in 1985. The amount of human suffering that these increases could cause is deplorable. The spectre of these rate increases also threatens to further undermine the economic climate in Southeastern Pennsylvania. Indeed, recent attempts by the Scott Paper Co. to generate its own power and sell the excess to PECO, and by Luken's Steel Co. to obtain power from Pennsylvania Power & Light Co, are both attributable in part to the high level of PECO's current rates. Future rate increases can only accelerate the efforts of industrial customers to either seek alternative sources of power or to move out of PECO's service territory.

Unit I is scheduled to be completed in April 1985. At that time, PECO could resume construction of Unit II. In light of recent developments, however, we are concerned that the impending construction of Unit II might not be in the best interest of PECO's ratepayers.1/ Therefore, we should order PECO to show cause why the construction of Unit II is in the public interest. Specifically, this proceeding should address the following issues:

1. Is construction of Unit II necessary for PECO to maintain adequate reserve margins?

2. Are there less costly alternatives - such as cogeneration, additional conservation measures, or purchasing power from neighboring utilities or the P.J.M. interchange - for PECO to obtain power or decrease consumption?

3. How will the large capital requirements necessary to complete Unit II affect PECO's financial health and its ability to provide adequate service?

1/ We are also concerned whether PECO's current bond rating of BAA3, which means that PECO's bonds have speculative characteristics, might drop further if PECO resumes construction of Unit II when Unit I is completed.

4. Should the Commission reject any securities filings, or impose any other appropriate remedy, to guarantee the cancellation of Unit II?

5. If Unit II is cancelled, what, if any, percentage of the sunk costs should PECO be permitted to recover from its ratepayers?

6. If construction of Unit II is found to be in the public interest, should the Commission adopt an "Incentive/Penalty Plan" as an inducement to cost efficient and timely construction?

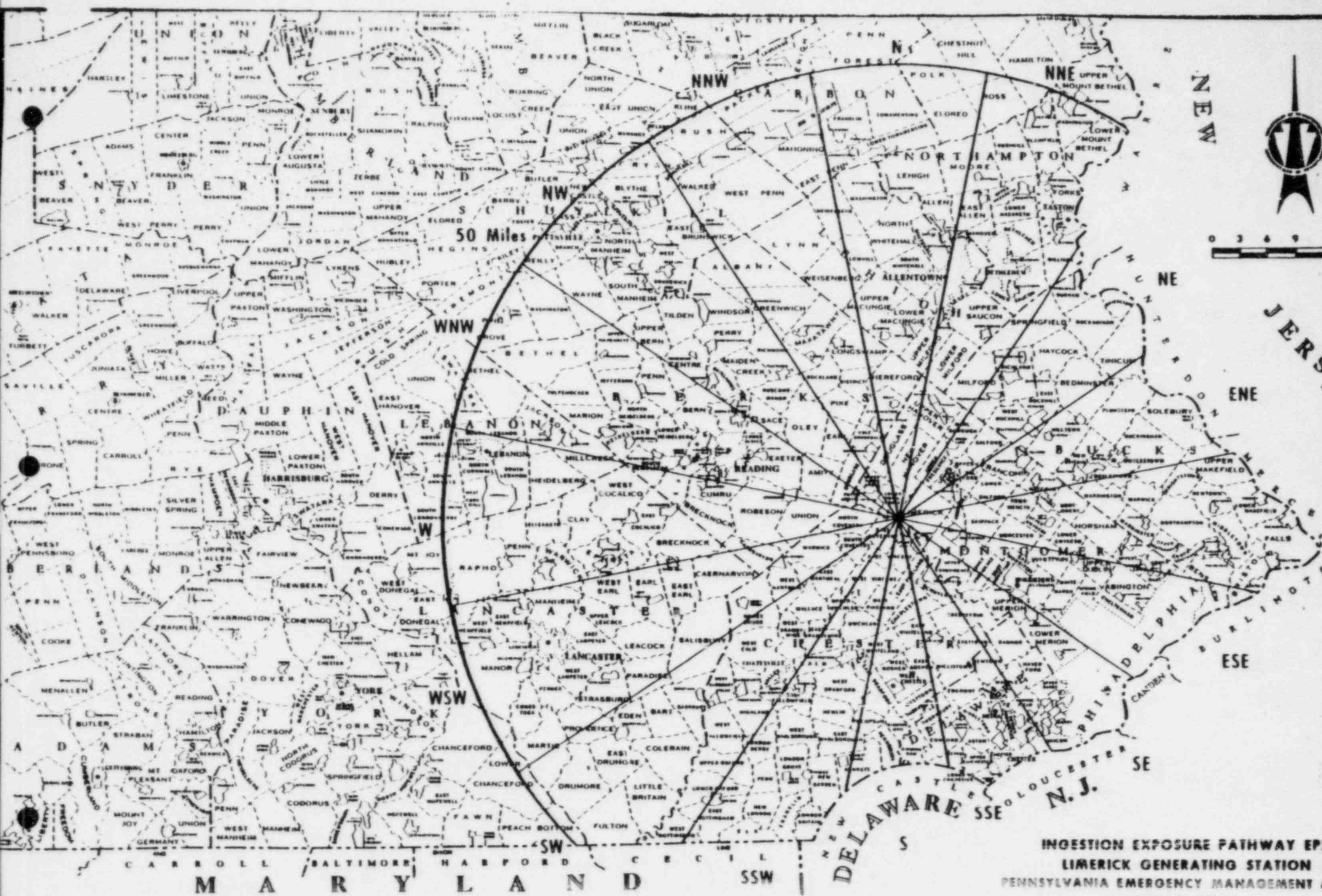
We believe that our duty to guarantee just and reasonable rates and to maintain adequate service require that the above issues be addressed by all affected parties and resolved by the Commission prior to April 1985, the date upon which construction of Unit II could resume; THEREFORE,

WE MOVE:

1. That the Philadelphia Electric Company be ordered to show cause why the completion of Limerick Nuclear Generating Station, Unit II, would be in the public interest.

2. That the Law Bureau prepare the necessary Order to Show Cause.

Bill Shane	6/28/84 DATE
Frank Fischl	6/28/84 DATE
Michael Johnson	6/28/84 DATE
	DATE
	DATE



INGESTION EXPOSURE PATHWAY EPZ
LIMERICK GENERATING STATION
PENNSYLVANIA EMERGENCY MANAGEMENT A
AUGUST 1983