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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of)	
)	
Philadelphia Electric Company)	Docket Nos. 50-352
)	50-353
(Limerick Generating Station)	
Units 1 and 2))	

APPLICANT'S SUPPLEMENTAL RESPONSES
TO INFORMATION REQUESTS OF THE
CITY OF PHILADELPHIA TO THE
PHILADELPHIA ELECTRIC COMPANY

DISCOVERY 31
MARCH 21, 1984

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REQUEST NO. 6

For any CRAC runs done for bad weather, please specify a) how these assumptions were different and b) the incremental differential in results.

SUPPLEMENTAL RESPONSE

While no CRAC runs were performed to attempt to explicitly analyze the effects of bad weather, the data base for the Sandia generic model is derived from US evacuation experience. Included are a rain case, a fog case, and a snow case [see Reactor Safety Study (Discovery 26, Item 6a) Table VI J-1]. Hence, bad weather is included in the evacuation model which was applied in SARA.

No specific analysis was performed beyond the use of this model. However, to estimate the effect of explicitly considering bad weather, it could be assumed that 4% of the time (SARA, page 10-11) the evacuation is adversely affected by bad weather to such an extent that the assumptions for evacuation speeds for the seismic evacuation case are appropriate (3 hours delay and 1 mph evacuation speed). In this case, an estimate of the effect of this change may be made by considering the source terms VRH20 and C4~~0~~ and their contribution to the public risk of early fatality. The base case VRH20 contribution to the public risk of early fatality due to internal initiators only is 2.09×10^{-5} per year. This is derived by multiplying the results from the CRAC2 run

(designated Discovery 31, Item 6a) by the point estimate frequency of 1.4×10^{-8} (SARA, Table 12-8). If now, for 4% of the time, weather conditions are so bad that it is necessary to assume the seismic evacuation case, a hand calculation (designated Discovery 31, Item 6b) shows that this quantity increases 4.9%. For C4Y, the corresponding increase is 4.5%, again using a CRAC2 run for C4Y (designated Discovery 31, Item 6c) and the above hand calculation (Discovery 31, Item 6b). These calculations show that the explicit inclusion of slowing of evacuation due to bad weather, in addition to that included in the model data base, would only have a small (less than 5% increase) effect on the results.

PARTICIPANTS IN PREPARATION OF RESPONSE

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REQUEST NO. 7

- a) A description of the different breathing rates, if any, assumed in the analyses.
- b) What the differences were in results as a function of breathing rate assumptions.

SUPPLEMENTAL RESPONSE

The breathing rates assumed in SARA are documented in SARA at 10.1.6.4. The breathing rate given is $2.66 \times 10^{-4} \text{ m}^3 \text{ s}^{-1}$ on page 10-13 and is the same as that which was used in the Reactor Safety Study (Discovery 26, Item 6a) and documented in the PRA Procedures Guide (Discovery 26, Item 7a) at page 9-34.

The precise value or range of values chosen for the breathing rate is a relatively unimportant input to the calculations. Based upon a preliminary scoping execution of CRAC2 for the source term VRH20 (designated Discovery 31, Item 7a) the breathing rate was simply doubled to $5.32 \times 10^{-4} \text{ m}^3 \text{ s}^{-1}$. This assumption is equivalent to assuming that the entire population out to 500 miles was breathing at an average rate indicative of 16 hours of heavy work and 8 hours of resting. By hand calculation (designated Discovery 31, Item 7b) and comparison to the CRAC2 base case run (Discovery 31, Item 6a) the whole-body manrem increased by 18%, latent cancer fatalities increased 57%, and early fatalities increased 45%. These results indicate that even a highly conservative doubling of the breathing rate would not have a large effect on public risk. SARA has indicated that other uncertainties,

such as variations in source terms, are much more significant.

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REQUEST NO. 11

- a) What assumptions were made as to percentage of population that would evacuate within the ten mile EPZ. Provide bases for the assumption.

SUPPLEMENTAL RESPONSE

The percentage of population assumed to evacuate was 100%.

The basis for this assumption is provided in SARA at page 10-10.

A rough estimate can be provided of the likely increase in the public risk of early fatality if it is assumed that a 5% fraction of the population does not evacuate. The basis for 5% as the fraction of nonparticipating people is that, in actual evacuations, Civil Defense Personnel observed this fraction ["A Model of Public Evacuation for Atmospheric Radiological Releases" by D. C. Aldrich et. al., SAND78-0092, (1978) at page 13 (Discovery 26, Item 11a)]. From the CRAC2 runs (Discovery 31, Item 6a and Item 6c) the accident sequences C4Y and VRH20 contribute significantly to the point-estimate public risk of early fatality. (1.8×10^{-4} per year). Two additional CRAC2 runs (designated Discovery 31, Items 11a and 11b respectively), one each for VRH20 and C4Y were performed which assumed a delay time of 24 hours and subsequent evacuation at a high speed (sufficient speed to ensure that the incremental radiation dose accumulated during evacuation is small compared to that accumulated during the delay time). The areas under the conditional CCDFs so

obtained were used in a hand calculation (designated Discovery 31, Item 11c). The increase in public risk is 16%. This scoping calculation shows that including a nonevacuating fraction of the population would not be expected to increase the public risk by a large amount, and that other uncertainties discussed in SARA, such as variations in source term, are much more significant.

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REQUEST NO. 12

It is noted that PECO's SARA analysis assumed normal behavior beyond ten miles for twelve hours then evacuation.

For PECO Only:

- a) What evacuation times were assumed?
- b) If any sensitivity analyses were done with other assumptions, please describe the assumptions and the results.

RESPONSE

- a) The evacuation of the populace beyond 10 miles is "rapid relocation which is discussed in SARA at page 10-11. Rapid Relocation assumes the instantaneous cessation of dose accumulation.
- b) A number of CRAC2 cases were run to specifically evaluate the sensitivity of the results to the assumptions on behavior of the population beyond 10 miles. Except for the cases discussed below no analysis or evaluation of these CRAC2 cases has been made.
 - 1) Results for sheltering in basements for 24 hours followed by Rapid Relocation indicate an 8% decrease in early fatality risk and a 25% decrease in risk of bone marrow dose greater than 200 rems from the base case.
 - 2) CRAC2 cases have been run showing the effect of a 48 hour delay in relocation with "normal activity"

during the 48 hours on the population of the City of Philadelphia. A summary of the results of this is provided in the table on the following page based on point estimate frequencies and considering the actual dose response for early fatalities rather than threshold values as were supplied in Applicant's Responses to Information Requests of the City of Philadelphia to the Philadelphia Electric Company, dated February 16, 1984.

Chance Per Reactor Year That Various Radiological

Effects Will Occur in Philadelphia If No Counter-

measures are Taken for 48 Hours

	<u>Internal</u>	<u>Seismic</u>	<u>Total</u>
Chance that there will be one or more early fatality in the City of Philadelphia	One in 130 billion	One in 4 billion	One in 3 billion
Chance that there will be one or more persons in Philadelphia requiring hospital treatment (bone marrow dose more than 200 rem)	One in 3 billion	One in 1 billion	One in 750 million
Chance that there will be one or more persons in Philadelphia with whole body dose in excess of 25 rem	One in 30 million	One in 40 million	One in 16 million
Chance that there will be one or more persons in Philadelphia with whole body dose in excess of 5 rem	One in 2.5 million	One in 4 million	One in 1.5 million

A number of additional CRAC2 runs were made which included changes in the assumptions on behavior of people beyond 10 miles along with other changes so that the impact of the individual changes cannot be separated. An example of this is the CRAC2 runs, referred to in Response to Request No. 11 above (Discovery 31, Items 11a and 11b), for no evacuation of 5% of the population which also included no relocation (until 24 hours) of the population from 10 to 25 miles.

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COMMONWEALTH OF PENNSYLVANIA

:

ss.

COUNTY OF PHILADELPHIA

:

V. S. Boyer, being first sworn, deposes and states:

That he is Senior Vice President of Philadelphia Electric Company, the Applicant herein; that he has read the foregoing Applicant's Supplemental Responses to Information Requests of the City of Philadelphia to the Philadelphia Electric Company and knows the contents thereof; and that the statements and matters set forth therein are true and correct to the best of his knowledge, information and belief.

V. S. Boyer
Senior Vice President

Subscribed and sworn to
before me this 21st day
of March, 1984.

Patricia D. Scholl
Notary Public

PATRICIA D. SCHOLL
Notary Public, Philadelphia, Philadelphia Co.
My Commission Expires February 10, 1985