

UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION

BEFORE THE COMMISSION

In the Matter of

PHILADELPHIA ELECTRIC COMPANY

(Limerick Generating Station  
Units 1 and 2)

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)  
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Docket Nos. 50-352-OL-2  
50-353-OL-2

(Severe Accident Mitigation  
Design Alternatives)

JOINT AFFIDAVIT OF GENE Y. SUH AND CHARLES S. HINSON

Gene Y. Suh and Charles S. Hinson do depose and say:

1. I, Gene Y. Suh, am a Project Manager, Project Directorate I-2, Division of Reactor Projects I/II, Office of Nuclear Reactor Regulation at the United States Nuclear Regulatory Commission. I am assigned to coordinate and manage the staff review of the consideration of severe accident mitigation design alternatives for the Limerick Generating Station.
2. I, Charles S. Hinson, am a Health Physicist, Radiation Protection Branch, Division of Radiation Protection and Emergency Preparedness, Office of Nuclear Reactor Regulation at the United States Nuclear Regulatory Commission. I am assigned to review the radiation protection aspects of the severe accident mitigation design alternatives for the Limerick Generating Station.
3. The NRC staff considered whether fuel loading, low power testing, and full power operation would preclude the implementation of the severe accident mitigation design alternatives being considered for Limerick, Unit 2 as a result of a February 28, 1989, Court of Appeals

decision. Low power testing would result in moderate irradiation of the core and contamination of the remainder of the primary coolant system, with no significant impact on the surrounding environment by releases of effluents during normal operation. As a first approximation, we referred to the cost estimates for the severe accident mitigation design alternatives discussed in NUREG/CR-4025, titled "Design and Feasibility of Accident Mitigation Systems for Light Water Reactors," dated August 1985. These cost estimates are subject to further review. The design alternatives considered in the Staff's review included those for containment heat removal, drywell sprays, core retention devices, containment venting, and vacuum breakers, for which NUREG/CR-4025 provided cost estimates. In its May 5, 1989 Order, the Commission directed that on remand, litigation on the contention of severe accident mitigation design alternatives should be limited to those mitigation alternatives identified by the Appeal Board in ALAB-819, 22 NRC 681, as being supported with the required basis and specificity. The severe accident mitigation design alternatives which are discussed and for which cost estimates are provided in NUREG/CR-4025 appear to be those identified in ALAB-819 as having the required basis and specificity.

4. Comparison of cost estimates for implementing design alternatives for an operating plant versus a plant about halfway through its construction showed an increase in cost for the operating plant by about five to 25 percent for most alternatives and up to about 70 percent for core retention devices. The cost increase for an operating plant was attributed to various factors, including more

involved design and engineering work, increased installation costs, costs associated with system draining and refilling, and provisions for occupational radiation exposure reduction, when required. The actual differences for Limerick Generating Station, Unit 2 would be expected to be less given that Unit 2 is essentially 100 percent constructed, rather than 50 percent constructed. These cost differences compare to uncertainties of two orders of magnitude or more for risk estimates from severe accidents.

5. In the Staff's review, it appeared that a core retention device would be the most severe design alternative as described in NUREG/CR-4025 with respect to the occupational exposure incurred during installation. A scoping calculation was performed based on installation time estimates given in NUREG/CR-4025 for the direct water-cooled rubble bed core retention device and on applicable containment radiation dose data taken at Limerick Generating Station Unit 1 during the second refueling outage. The results indicated that the factor of occupational exposure incurred during design alternative installation could affect the costs of proceeding with the alternative by about 40 percent, assuming a numerical value of \$1000 per person-rem of occupational exposure per NUREG/CR-3568, titled "A Handbook for Value-Impact Assessment," dated December 1983. This compares to the uncertainty in risk which ranges over two orders of magnitude. The Staff also noted that NUREG/CR-3568 states that in many cases the effect on occupational exposure due to a proposed action will be small compared to the effect on public risk.

6. Surveys performed about one week after reactor shutdown for the second refueling outage at Limerick Unit 1 showed general area radiation dose rates of less than 100 millirem per hour in the area immediately below the reactor pressure vessel in the drywell and generally lower dose rates in other parts of the drywell and the rest of containment. General area radiation dose rate on the drywell diaphragm floor immediately below the reactor pressure vessel were about 10 millirem per hour. The Staff understands that dose rates on the drywell diaphragm floor immediately below the reactor pressure vessel of an operating plant (Susquehanna) similar in design to Limerick ranged from 30 to 40 millirem per hour during shutdown conditions. The dose rate used in our scoping analysis (40 millirem per hour) appears to be consistent with typical dose rates for this part of the plant. Radiation dose rates would be expected to be lower after low power testing only, compared to the refueling outage survey data.
7. Based upon ongoing discussion among the parties to this remand proceeding, severe accident mitigation design alternatives other than those discussed and for which cost estimates are provided in NUREG/CR-4025 are being considered by one or more of the parties for litigation on this contention. Based on a review of the lists of possible mitigation design alternatives presented at the ASLB prehearing conference held on June 6, 1989, the Staff concludes that operation of Limerick Unit 2 would not make physically impossible the implementation of the mitigation design alternatives identified in the lists. Although scoping analyses on design alternatives beyond

those discussed and for which cost estimates are provided in NUREG/CR-4025 were not performed, the Staff notes that the utility's June 5, 1989 motion had attached an affidavit of Corbin A. McNeill, Jr., Executive Vice President-Nuclear of Philadelphia Electric Company, which stated:

"PECO would agree that, for purposes of evaluation of SAMDA's, the cost/benefit analysis of alternatives for Unit 2 could be viewed as of the time of initial licensing. Hence, the evaluation would not be skewed by any incremental costs associated with adding a design alternative after operation has commenced. Based upon this evaluation, the fact that Unit 2 would be operated during the pendency of a hearing would not prejudice the addition of design alternatives."

8. The Staff concludes that any additional costs of implementation for an operating plant, as compared to a virtually 100 percent constructed plant, do not appear to be a significant factor in regulatory decisions dealing with the severe accident mitigation design alternatives under consideration.
9. It should be noted that plant downtime and startup delay costs were not taken into account in our review. The Staff understands that Limerick Unit 2 will be ready for fuel loading in June of 1989 with subsequent low power testing. A delay in the issuance of a license authorizing fuel loading and low power testing would result in a startup delay and would also delay the early discovery and correction of unforeseen but possible problems which may prevent or delay full-power operation. Similarly, the implementation of a mitigation design alternative, if warranted, for an operating plant during a

refueling or maintenance outage could result in plant downtime costs if the design alternative could not be fully installed, tested, and declared operational within the scheduled outage time frame. The authors of NUREG/CR-4025 noted that the applicable design alternatives described in the report could be implemented during a scheduled refueling outage, and thus not result in additional plant downtime costs, with the exception of the direct water-cooled rubble bed core retention design alternative.

The foregoing is true and accurate to the best of our knowledge and belief.

Gene Y. Syn  
Gene Y. Syn

Charles S. Hinson  
Charles S. Hinson

Subscribed and sworn to before  
me this 10th of June, 1989.

Elva P. Burden Notary Public

My commission expires: My Commission Expires July 1, 1990

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UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION  
BEFORE THE COMMISSION

OFFICE OF THE CLERK  
DOCKETING BRANCH

In the Matter of	)	
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PHILADELPHIA ELECTRIC COMPANY	)	Docket Nos. 50-352-OL-2
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(Limerick Generating Station, Units 1 and 2)	)	(Severe Accident Mitigation Design Alternatives)

CERTIFICATE OF SERVICE

I hereby certify that copies of "RESPONSE OF NRC STAFF TO PECO MOTION FOR CLARIFICATION OF EFFECT OF REMAND ON ISSUANCE OF OPERATING LICENSE FOR UNIT 2" in the above-captioned proceeding have been served on the following by deposit in the United States mail, first class, or as indicated by an asterisk through deposit in the Nuclear Regulatory Commission's internal mail system, or as indicated by a double asterisk by use of express mail service, or as indicated by a triple asterisk by hand-delivery, this 20th day of June, 1989:

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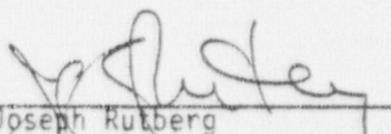
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