8/25/83

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
PHILADELPHIA ELECTRIC COMPANY	)	Docket Nos. 50-352
	)	50-353
(Limerick Generating Station, Units 1 and 2)	)	

NRC STAFF RESPONSE TO INTERVENOR LEWIS'S "THIRD AND FINAL SET OF INTERROGATORIES TO THE NRC STAFF AND LICENSEE"

I. INTRODUCTION

Pursuant to the Licensing Board's Special Prehearing Conference Order of June 1, 1982 and Memorandum and Order Confirming Schedules Established During Prehearing Conference of May 16, 1983, Intervenor Marvin Lewis Propounded his "Third and Final Set of Interrogatories to the NRC Staff and Licensee" on August 1, 1983.

The NRC Staff's responses to Mr. Lewis' Interrogatories are set forth below.

II. RESPONSES TO INTERROGATORIES[1/]

Interrogatory 1[A]

1. In the "NRC Response to the first set of interrogatories on contention I-62", the staff states, "the basic conditions under which BWRs operate make it much less likely for BWRs than for PWRs that the simultaneous rapid cooling and high pressure necessary to create a PTS will occur."

1/ Interrogatories 2 and 6 are directed to the Applicant and are, therefore, not addressed in these responses.

The response leaves open the question, "Are there any set of conditions wherein a BWR can experience the simultaneous rapid cooling and high pressure necessary to create a significant PTS?"

Further, can a BWR experience a cooling (rapid or not) which will produce significance stresses at temperatures close to rtndt in any temperature - pressure boundary?

Please answer above two questions regarding any set of conditions that can produce a PTS in a BWR.

NRC Staff Response

A BWR operates with the primary system "saturated". That is, the steam-water coolant mixture inside the pressure vessel is at the pressure determined by boiling and steam formation in the core region where the nuclear fuel is providing a heat source. Any cold water introduction into such a system will reduce the steam formation or result in steam condensation, which will lower the pressure. Thus, it is not possible to postulate conditions for such a system that will result in simultaneous cooling and pressurization.

The above applies to cooling - rapid or otherwise.

The effect is most pronounced for rapid cooling events, for which significant thermal stress (a necessary ingredient for the PTS concern) could be developed in the pressure vessel. But the effect discussed above prevents occurrence of high pressure for such rapid cooling events, and high pressure is another necessary ingredient for a significant PTS concern (i.e. one must have both rapid cooling resulting in thermal stress and high pressure). For "not rapid" cooling events there is no significant thermal stress, therefore no significant PTS concern.

Interrogatory 1[B]

Also refer to NRC Memorandum UNANALYZED REACTOR VESSEL THERMAL STRESS DURING COOLDOWN from Eisenhut for Commissioners dated April 12, 1983. Discuss whether this type of stratification could occur in a PWR and its effect upon thermal stresses. Include in your discussion any staff concerns on the operability of safety relief valves which could complicate the thermal picture. Also discuss how natural circulation can fail or be reduced.

Document request related to above interrogatory. Please provide GE NEE 24988 P, "Analysis of Generic BWR Safety Relief Valve Operability Test Results." I do not know the date nor availability as I have only read a short synopsis.

NRC Staff Response

Pursuant to an agreement reached in a telephone conversation between Intervenor Lewis and Staff Counsel, this question is addressed in the letter from Staff Counsel which covers these responses.

Interrogatory 3

Recently the NRC released an order concerning the ongoing IGSCC in BWRs. I have attempted to get further information on this without success. Therefore, I am submitting the following interrogatory on the relationship of IGSCC to PTS in BWRs.

Are any structures which receive neutron irradiation subject to IGSCC? Discuss the feedwater nozzle and piping as mentioned on page 5.3-7 of the LGS FSAR, Para. 5.3.1.5.3.

a. Has all "new" information on unresolved safety issues been factored into the PTS problem as the information has become available?

b. Have all synergistic or cumulative effects from other USI been factored into the PTS problem and its consideration by the Licensee and NRC staff? Give specific examples. Discuss USI of "cold overpressurization" in your answer.

c. Are there any other concerns not covered in the USI which can or do have an effect on the consideration of PTS been considered adequately at LGS? Discuss measurement of neutron flux (PECo Boyer to Eisenhut, April 15, 1983, Page 4, last paragraph) and difficulties of ultrasonic testing (NRC Schwencer to PECo Bauer, June 3, 1983, MEB enclosure Page 250-8 Paragraph 250.4 and 250.3.A.)

NRC Staff Response

Some structures which receive neutron irradiation are subject to IGSCC (intergranular stress corrosion cracking). Recent NRC releases concerning IGSCC in BWRs were for BWR recirculation piping which was fabricated from austenitic grade 304 stainless steel. This material was sensitized during welding and became susceptible to IGSCC. The internal core support structures inside the Limerick reactor vessels are constructed of austenitic grade 304 stainless steel and receive considerable neutron irradiation. Inservice examination of BWR internal core support structures at other facilities, which is performed in accordance with Table IWB-2500 of Section XI, ASME Code, indicates IGSCC is not a problem for such structures. The BWR recirculation piping outside the vessel receives insignificant neutron irradiation.

Feedwater nozzle and piping do not contain sensitized austenitic grade 304 stainless steel and are not located in the reactor vessel beltline. Hence, feedwater nozzle and piping are not susceptible to either IGSCC or significant neutron irradiation.

a. New information is being and will continue to be factored into resolving USI A-49.

b. The Staff is exploring in USI A-49 all such effects associated with PTS. Pressurized Thermal Shock (PTS) is the name given to certain accident conditions which result in high thermal and pressure stresses. "Cold overpressurization" is an event which occurs at low temperatures, has high pressure stresses and no thermal stresses. As a result, a PTS event would be more limiting for reactor vessel integrity than a "cold overpressurization" event.

c. The Staff believes that all concerns regarding PTS have been adequately considered for Limerick. The amount of neutron flux affects the amount of embrittlement. This is discussed in Commission Report SECY 82-465, "Pressurized Thermal Shock," which has previously been provided to you. Ultrasonic inspection is a method used to determine whether cracks exist in a vessel. The minimum size of defect that can be detected depends on the ultrasonic inspection method. Since the minimum size of detectable crack varies with inspection method, all size cracks are considered in USI A-49.

Interrogatory 4

4. In the NRC Staff Response to Intervenor Lewis's First Set of Interrogatories in PTS Contention (I-62), the staff states, "For BWRs plants including Limerick, the location of fluid systems injection does not result in direct impingement on the vessel wall." Page 3.

What does fluid system impinge directly upon? Are any of these structures able to fail in a PTS situation or during a transient? Are any of these structures made of a material which will change RTndt with neutron flux?

Also provide a drawing of a jet pump and a description of its function and material of construction.

NRC Staff Response

The "fluid systems" (high pressure emergency cooling system) inject directly into the core region inside the core shroud and through the feedwater sparger radially inward away from the vessel wall. The stainless steel and fuel cladding materials in that region are designed to withstand the resulting thermal shock. PTS involves failure of the vessel due to combined thermal and pressure induced stresses. Thermal shock of the core is not related to PTS.

The injection location for the "fluid systems" through the feedwater spargers, which are located above the downcomer outside the core shroud, allows considerable mixing of the cold water with the warmer water outside the core shroud before the mixture contacts the pressure vessel wall, thus precluding a significant PTS concern.

Drawings of the jet pumps and descriptions of the material used in the reactor cooling system may be found in the FSAR.

Interrogatory 5

To the staff : Document request: Please provide GE NEDO 10029, "An Analytical Study of Drittle Fracture of GE BWR Vessels Subject to a Design Basis Accident."

NRC Staff Response

See Response to Interrogatory 1[B].

Interrogatory 7

In my Interrogatory 6 of my first set of Interrogatories I was looking for a yes or no answer. Please provide a yes or no answer to the following repeat interrogatory.

Have any "test coupons" of affected materials been irradiated and tested from BWRs of design similar to Limerick?

a. Reference E-7 has not yet been published. I therefore cannot make a document request. Hopefully you can provide some information nonetheless. Please provide the number of Charpy test which were used to determine the Guthrie trend curve, standard deviation, and 2 sigma upper bound.

If possible, provide the statistical value of "confidence" for the above data. Provide the reference from which the statistical values were developed.

NRC Staff Response

Irradiated test coupons have been tested from BWRs of design similar to Limerick.

a. The Guthrie trend curve was developed from 136 data points. There were approximately 15 Charpy V-Notch tests per data point. The Guthrie trend curve has a standard deviation of ± 24.3°F and a 2 sigma of ± 48.6F. The Guthrie data were published in NUREG-CR 2805 Vol. I, HEDL-TME 82-18, Quarterly Progress Report Jan.-March 1982. This publication does not identify the "confidence" for the above data.

Respectfully submitted,

Ann P. Hodgdon

Ann P. Hodgdon
Counsel for NRC Staff

Dated at Bethesda, Maryland
this 25th day of August 1983