

Docket No. 50-263

FEB 14 1975

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Northern States Power Company  
 ATTN: Mr. L. O. Mayer  
 Director of Nuclear Services  
 414 Nicollet Mall  
 Minneapolis, Minnesota 55401

Gentlemen:

Experiences at various BWR plants with Mark I Containments have shown that damage to the torus structure can occur from two different phenomena associated with relief valve operations. Damage can result from the force exerted on the structure when, on first opening, relief valves discharge air and steam into the torus water. This phenomenon is referred to as steam vent clearing. Damage also can result from torus vibrations which accompany extended relief valve discharge into the torus water or the flow from the drywell during a LOCA if the pool water is at elevated temperatures. This effect is known as the steam quenching vibration phenomenon. These phenomena are discussed below.

Steam Vent Clearing Phenomenon

The Mark I torus structure of some boiling water reactor plants was found to be defective following cycles of steam vent clearing into the torus when primary system relief valves opened. Investigation indicated that some of these plants may not have been designed to withstand this phenomenon throughout the life of the plant when the torus was subjected to a predicted number of relief valve openings.

The Quad Cities Unit 2 and the Browns Ferry Unit 1 torus structures were subjected to tests when defects or excessive noise and vibrations were discovered following the above phenomenon. (1) (2) As a result of these tests, some modifications to the torus structures were made for these facilities and some similar facilities. Because of the apparent progressive nature of the material fatigue type of failure phenomenon, we do not believe that there is any immediate potential hazard; however, we presently do not

(1) NEDO 10859 "Steam Vent Clearing Phenomena and Structural Response of the BWR Torus (Mark I Containment)", General Electric Company.

(2) "1973 Browns Ferry Unit 1 Torus Experience" submitted by the Tennessee Valley Authority to the Office of Regulation, May 7, 1974.

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have the necessary assurance that the torus structures will maintain their integrity throughout the entire life of the facilities. (3)

Steam Quenching Vibration Phenomenon

Elevated torus pool temperatures during extended relief valve operation have become of concern in light of occurrences at two European reactors as reported to us by the General Electric Company. (4)(5) With local torus pool temperatures in excess of about 170F, due to prolonged relief valve operation, it was observed that severe torus structural vibrations occurred with moderate to high relief valve flow rates. GE reported that these vibrations were caused by a steam condensing mode characterized by periodic pulsation of the steam jet at the relief valve discharge point. If allowed to continue, the vibrations could have resulted in structural damage to the torus due to material fatigue.

The probability for this vibration phenomenon from extended relief valve operation is considered to be low in view of operating limits imposed by current technical specifications. The existing technical specifications on torus pool temperatures generally limit normal power operations to 90-95F with a maximum short term limit of 120-130F. However, occasions have arisen when a relief valve remained open for extended periods resulting in elevated pool temperatures and creating the potential for the steam quenching vibration phenomenon.

Requested Action

In view of the foregoing considerations, we request that the following action be initiated.

1. For the Steam Vent Clearing Phenomenon, a program should be developed for our review that is directed toward establishing the continuing integrity of the torus of your plant. You should consider at least the following in developing your program:
  - (a) The need for verification tests.
  - (b) The need for physical modifications to improve capability of the torus structure.

(3) Letter, I. Stuart, GE Company from W. Butler, AEC, dated September 12, 1974.

(4) Letter, E. C. Case, USAEC, from I. F. Stuart, GE Company dated November 7, 1974.

(5) Letter, E. G. Case, USAEC, from I. F. Stuart, GE Company dated December 20, 1974.

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- (c) The torus fatigue characteristics when subjected to forces resulting from opening of relief valves.
  - (d) The predicted maximum number of relief valve openings, singly and collectively, during plant life.
  - (e) Surveillance requirements, including frequency of inspections, for verification of torus structural integrity.
2. For the steam quenching vibration phenomenon, operating procedures should be developed, and changes to the Technical Specifications should be proposed to preclude the development of elevated temperatures of the torus pool water and provide for inspection of the torus as appropriate to identify any damage in the event of an extended relief valve operation. In this effort, consider the results of your review required by Regulatory Operations Bulletin 74-14, "BWR Relief Valve Discharge to Suppression Pool", dated November 11, 1974, and the interim recommendations of the General Electric Company to BWR owners (References 4 and 5).
  3. Submit a description of your program and your proposed changes to the Technical Specifications. A suggested review schedule with major milestones and dates is enclosed for your consideration; if these dates are not satisfactory, adjustments may be possible after discussion with us. If you do not intend to initiate a program for verification of the torus and/or proposed surveillance requirements, we require that you submit appropriate justification.

Your submittals are requested in accordance with the proposed schedule. Three signed and notarized originals and thirty-seven (37) copies of your submittals are needed for our review.

Sincerely,

Original signed by  
Dennis L. Ziemann

Dennis L. Ziemann, Chief  
Operating Reactors Branch #2  
Division of Reactor Licensing

Enclosure:  
Proposed Schedule of  
Major Activities

This request for generic information was approved by GAO under a blanket clearance number B-180225 (R0072); this clearance expires July 31, 1977.

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See next page

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cc w/enclosures:

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ENCLOSURE

SCHEDULE OF MAJOR ACTIVITIES

TORUS STRUCTURE INTEGRITY

<u>Activity</u>	<u>Date</u>
Letter to Licensees	February 15, 1975
Responses of Licensees	
w/Proposed Technical Specifications Revising Temperature Limits	March 31, 1975
w/Proposed Program for Maintaining Integrity of the Torus	May 30, 1975
Review of Responses and Issuance of Technical Specification Changes on Temperature Limits	August 29, 1975
Questions to Licensees Regarding Program for Maintaining Integrity of Torus	September 26, 1975
Licensee's Response with Proposed Technical Specifications on Surveillance Requirements	November 21, 1975
Review of Licensee's Response and Proposed Technical Specifications Surveillance Requirements	January 2, 1976
Technical Specification Change on Surveillance Requirements Issued	February 2, 1976
Expected Completion of Modifications	February 2, 1976