2/15/77

MEMORANDUM FOR: Karl R. Goller, Assistant Director for Operating Reactors, NRR

FROM: John Guibert, Project Manager, ORB #3, DOR

SUBJECT: TURBINE BUILDING FLOODING

50-269

As requested by your memorandum of January 17, 1977 on this subject, ORPMs have conducted an investigation into the potential for turbine building flooding incidents at operating facilities similar to that which occurred at Oconee Nuclear Station on October 10, 1976. Enclosure 1 is a summary of the results of this investigation.

The potential for an "Oconee-like" flooding incident could exist at a particular facility if (1) the circulating water system piping is located at an elevation lower than that of the source of circulating water, and (2) the circulating water system piping is susceptible to a postulated unisolable leak (i.e. the piping is non-seismic category I).

Based on the results of this investigation and in consideration of the above-mentioned criteria, the potential for this type of flooding incident exists at ten operating facilities: Palisades, Trojan, Zion Units Nos. 1 & 2, D.C. Cook Unit No. 1, Monticello, Pilgrim Unit No. 1, Nine Mile Point Unit No. 1, Humboldt Bay, and Rancho Seco. However, in each of these cases, facility design features and protection systems mitigate the impact of turbine building flooding due to a postulated circulating water system break such that the operability of safety-related equipment required to safely shut down the reactor would be assured. The applicable design features of each of these ten facilities are described below:

1. PALISADES - Safety-related equipment is located at an elevation higher than that of the postulated flooding level. Syphon breakers are installed in the circulating water system line to minimize water discharged through a postulated break.

2. TROJAN - The turbine building was constructed with twenty-two 2-foot high slots in the West side which will pass 500,000 gpm to the yard should flooding occur.

3. ZION UNITS NOS. 1&2 - No safety-related equipment is located in the turbine building. The auxiliary building is separated from the turbine building by barriers.

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4. D.C. COOK UNIT NO. 1 - Safety-related equipment is located at an elevation higher than that of the postulated flooding level.

5. MONTICELLO - At least one train of the redundant safety related equipment is located at an elevation higher than that of the postulated flooding level.

6. PILGRIM UNIT NO. 1 - Safety-related equipment is located at an elevation higher than the postulated flooding level.

7. NINE MILE POINT UNIT NO. 1 - Safety-related equipment is located at an elevation higher than the postulated flooding level.

8. HUMBOLDT BAY - Analysis demonstrates that the facility can withstand the consequences of a 20-foot tsunami. Such an event bounds other postulated flooding incidents.

9. RANCHO SECO - The turbine and condenser are located outdoors. The condenser pit is vented to the yard and the grade slopes away from safety-related equipment.

In addition to the operating facilities mentioned above, 15 operating facilities would be susceptible to an "Oconee-like" occurrence during conditions of maximum probable flood. Based on this limited investigation, it does not appear that the consequences of a circulating water system pipe break during maximum probable flood conditions has been evaluated. However, in general, the consequences of a maximum probable flood would most likely conservatively bound the consequences of the simultaneous occurrence of these two events. Most of the affected facilities have Technical Specification requirements and/or emergency operating procedures which require reactor shutdown before the onset of maximum probable flood conditions. (Quad Cities Unit Nos. 1 & 2 and Nine Mile Point Unit No. 1 apparently do not have such requirements/procedures).

As a result of this investigation, which was limited to circulating water system piping breaks, several general observations can be made regarding the generic review of "Flooding of Equipment Important To Safety":

a. Two facilities (Vermont Yankee and Kewaunee) have not taken circulating water system piping breaks/failures of any type into consideration.

b. Five facilities (Connecticut Yankee, Palisades, Peach Bottom 2/3, and Three Mile Island Unit No. 1.) limited considerations of circulating water system failures to seal f failures.

c. For four facilities (Zion Units Nos. 1&2 and Calvert Cliffs

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c. For four facilities (Zion Units Nos. 1&2 and Calvert Cliffs Units Nos. 1&2) documentation is not available to determine what failures, if any, were considered.

d. In several cases the SER write-offs for this generic concern are too sketchy to determine what failures were considered.

John Guibert
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Division of Operating Reactors

Enclosures:
1) Summary of Turbine Building
2) Flooding Investigations for Operating Reactors

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Enclosure 1

SUMMARY OF TURBINE BUILDING FLOODING INVESTIGATIONS - OPERATING REACTORS

FACILITY	PREVIOUSLY CONSIDERED BREAKS IN CIRCULATING WATER SYSTEM PIPING	CONSIDERATIONS WERE LIMITED TO FAILURE OF SEALS AND/OR EXPANSION BELLOWS	ELEVATION OF CIRCULATING WATER SYSTEM PIPING IS LOWER THAN THAT OF WATER SOURCE
Browns Ferry 1, 2, 3	Yes	No	No[1]
Brunswick 1, 2	SER Write-Off	SER Write-Off	No
Connecticut Yankee	Yes	Yes	No
Ginna	Yes	No	No[1]
Kewaunee	No	Not Applicable	No
Palisades	Yes	Yes	Yes[2]
San Onofre 1	Yes	No	No
Trojan	SER Write-Off	SER Write-Off	Yes[2]
Yankee Station	Yes	No	No
Zion 1, 2	Not Known	Not Known	Yes[2]
Arkansas 1	FSAR Only Info. Avail.		No
Big Rock Point	Yes	No	No
Calvert Cliffs 1, 2	Yes	Not Known	No
Cook 1	SER Write-Off	SER Write-Off	Yes[2]
Cooper	SER Write-Off	SER Write-Off	No[1]
Dresden 1	Yes	No	No[1]
Dresden 2, 3	Yes	No	No[1]
Monticello	Yes	No	Yes[2]
Pilgrim 1	Yes	No	Yes[2]
Vermont Yankee	No	Not Applicable	No

(1) Except during maximum probable flood conditions

(2) Facility design protects safety-related equipment

SUMMARY OF TURBINE BUILDING FLOODING INVESTIGATIONS - OPERATING REACTORS (Cont'd.)

FACILITY	PREVIOUSLY CONSIDERED BREAKS IN CIRCULATING WATER SYSTEM PIPING	CONSIDERATIONS WERE LIMITED TO FAILURE OF SEALS AND/OR EXPANSION BELLOWS	ELEVATION OF CIRCULATING WATER SYSTEM PIPING IS LOWER THAN THAT OF WATER SOURCE
Prairie Island 1, 2	Yes	No	No(1)
Quad Cities 1. 2	Yes	No	No(1)
St. Lucie 1	Yes	No	No
Duane Arnold	Yes	No	No(1)
Fort Calhoun	Yes	No	No(1)
Hatch 1	——— SER Write-Off ———		No
Millstone 1	——— SER Write-Off ———		No
Millstone 2	——— SER Write-Off ———		No
Nine Mile Point 1	——— SER Write-Off ———		Yes(2)
Oyster Creek	Yes	No	No(1)
Peach Bottom 2/3	Yes	Yes	No
Point Beach 1, 2	Yes	No	No
Turkey Point 3, 4	Yes	No	No
Beaver Valley 1	——— SER Write-Off ———		
Fitzpatrick	——— Seismic Class I Piping ———		No
Humboldt Bay	Yes	No	Yes(2)
Indian Point 2, 3	Yes	No	No
LaCrosse	Yes	No	No
Maine Yankee	Yes	No	No
Rancho Seco	Yes	No	Yes(2)
Robinson 2	Yes	No	No
Su[illegible]y 1, 2	——— Seismic Class I Piping ———		
Three Mile Island 1	Yes	Yes	No