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B.3.2.1
WYR 79-131

November 7, 1979

United States Nuclear Regulatory Commission
Washington, D.C. 20555

Attention: Office of Nuclear Reactor Regulation
Mr. D. L. Ziemann
Operating Reactors Branch #2

References: (a) License No. DPR-3 (Docket No. 50-29)
(b) NRC Letter to Yankee Rowe dated September 12, 1979
(c) YAEC Letter to NRC dated July 18, 1975

Dear Sir:

The enclosed information is in response to your letter, Reference (b), regarding steam generator water hammer.

We trust this information adequately addresses your concerns; however, if you should desire additional information, please contact us.

Very truly yours,

YANKEE ATOMIC ELECTRIC COMPANY

Robert H. Groce
Senior Engineer - Licensing

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Enclosures

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QUESTION 1

Provide information that demonstrates that the feedwater system and steam generator water level at your facility have been subjected to those transient conditions that are conducive to water hammer, i.e., the addition of cold feedwater or auxiliary feedwater to steam-filled feedwater piping and feedring. (See NUREG 0291, Page 4 that was forwarded to you on September 2, 1977.) Include the following:

1. Describe the expected behavior of steam generator water level as a result of reactor trip from power levels greater than 30% of full power. Include actual plant measurements of steam generator level and other available related data such as feedwater flow and auxiliary feedwater flow.

2. Provide the number and causes of loss of feedwater events during the operational history of the plant. You may refer to material submitted previously.

3. Provide the number and causes of loss of off-site power events during the operations history of the plant.

RESPONSE 1

1. On all reactor trips from a reactor power level greater than 30% of full power the Yankee Rowe boiler feed pumps are automatically tripped. Therefore, following a trip from greater than 30% of reactor power it is expected that the steam generator feed flow will decrease to zero and the level will decrease below the feed ring. The auxiliary feed flow is a manually initiated system and is not required to be initiated on a routine trip from power.

2. During the operational history of Yankee Rowe there have been five loss of feedwater flow events which were initiated by a malfunction of plant equipment which led to a reactor scram due to a loss of feedwater. Based on the operating design of the feedwater system as stated in 1. above, Yankee Rowe considers these events as loss of feedwater flow versus loss of feedwater events. These events were as follows

   a) On May 18, 1964 a manual scram from 137 MWe was initiated because of feedwater system problems. The problem was initiated while valving in an idle condensate pump which caused a dip in the condensate pump discharge header which then caused the boiler feed pumps to trip on low suction pressure. This was not a malfunction of plant equipment.

   b) On August 25, 1966 an automatic reactor scram from 160 MWe was initiated due to low steam generator water levels. The low steam generator levels were caused by the short circuiting of feedwater through a boiler feed pump when the pump was secured and its discharge check valve stuck open.

c) On August 25, 1966 while the plant was operating at a power level of 15 MWe the No. 3 steam generator wide range level began to drop. A noticeable feedwater line hammer was associated with this event. The cause of this event was due to the feedwater control valve locking in the near closed position. The locking of the feedwater control valve in position is a feature that occurs on loss of control air supply.

NOTE: This event was report as AO 66-6

d) On November 13, 1967 an automatic scram from full load was initiated due to low steam generator levels. The low steam generator levels were caused by the automatic tripping of the boiler feed pumps on low suction pressure. The low boiler feed pump suction pressure was caused by the tripping of the heater drain pumps which was initiated by a loss of control air which automatically dumped the heater drain receiver to the condenser.

e) On May 16, 1975 an automatic scram from full power was initiated due to low steam generator water levels. The low steam generator water levels were caused by the automatic tripping of the boiler feed pumps. The initial investigation of all feedwater, condensate and heater drain system controls noted no abnormalities.

Further investigation suggested that the automatic condensate recirculation solenoid trip valve could have been partially unlatched and due to vibration it could have fully unlatched, causing the recirculation valve to open and thus trip the boiler feed pumps on low suction pressure.

3. During the nineteen years of operational history for Yankee Rowe there has been one total loss of off-site power event. The plant was shutdown at the time of this event. The cause of the total loss of power was due to the total loss of AC experience by most of the Northeastern United States in November, 1965.

QUESTION 2

If administrative controls have been adopted to limit the flow of auxiliary feedwater for the purpose of reducing the probability of water hammer, show when they were adopted and give the answers to Items 1.1, 1.2 and 1.3 for before and after such controls were established.

RESPONSE 2

Yankee Rowe has not adopted any administrative controls to limit the flow of auxiliary feedwater for the purpose of reducing the probability of water hammer. The auxiliary feedwater system with a maximum flow rate of approximately 90 gpm, is manually initiated by a qualified operator.

Based on operating experience, Yankee Rowe considers the present design and operational procedures to be adequate to preclude a water hammer.

QUESTION 3

If administrative controls have been adopted to limit the flow of auxiliary feedwater for the purpose of reducing the probability of water hammer, show that an adequate water inventory and flow will be maintained to accomodate all transient and accident conditions.

RESPONSE 3

Yankee Rowe has not adopted any administrative controls to limit the flow of auxiliary feedwater for the purpose of reducing the probability of water hammer.

QUESTION 4

If auxiliary feedwater flow in your facility is not at present initiated automatically for normal and accident events, present your evaluation of whether automating the actuation of auxiliary feedwater might increase the probability of inducing steam generator water hammer. One of the signals that would automatically initiate the flow of auxiliary feedwater would be the steam generator low water level. This set point should be above the top of the main feedwater sparger to reduce the probability of steam generator water hammer.

RESPONSE 4

The auxiliary feedwater flow at Yankee Rowe is not initiated automatically for normal and accident events. An evaluation on whether automating the acutation of auxiliary feedwater versus an increase in the probability of inducing steam generator water hammer is required by NUREG-0578. Yankee Rowe will address the above Question 4 when we submit to the NRC the detailed design for automating the auxiliary feedwater system as required by NUREG-0578.

QUESTION 5

Describe the means that will be used to monitor for the occurrence of steam generator water hammer and possible damage from such an event. Include all instrumentation that will be employed. Describe the inspections that will be performed and give the frequency of such inspections.

RESPONSE 5

Based on the plant's past experience since the feedwater piping modifications performed in 1966 (described in Reference (c)), there have been relatively few and weak feedwater hammer occurrences. These occur almost exclusively (but not consistently) during a start-up from cold shutdown. For occurrences of water hammer which would cause a significant deviation from normal or expected performance of plant equipment, the present Plant Information Report format would be utilized to identify and describe the occurrence. The present Plant Information Report format requires the description of the occurrences, conditions prior to occurrence, analysis of occurrence and corrective action taken.

QUESTION 6

Describe the reporting procedures that will be used to document and report water hammer and damage to piping and piping support systems. Such reports were requested in our letter to you dated September 2, 1977.

RESPONSE 6

Significant operating abnormalities or deviations from normal or expected performance of plant equipment, as determined by the Plant Superintendent, are reported to higher management as Plant Information Reports (PIR). PIR's are available at the plant and are routinely reviewed by NRC I & E personnel. Therefore, Yankee Rowe sees no need to provide any additional reporting procedures that will be used to document and report water hammer and damage to piping and piping support systems.