PSNH PUBLIC SERVICE
Company of New Hampshire

SEABROOK STATION
Engineering Office:
1671 Worcester Road
Framingham, Massachusetts 01701
(617) - 872 - 8100

July 27, 1982

SBN-301

T.F. B7.1.2

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

Attention: Mr. Frank J. Miraglia, Chief
Licensing Branch No. 3
Division of Licensing

References: (a) Construction Permit CPPR-135 and CPPR-136, Docket Nos. 50-443 and 50-444
(b) USNRC Letter, dated February 12, 1982, "Request for Additional Information," F. J. Miraglia to W. C. Tallman
(c) PSNH Letter, dated March 12, 1982, "Responses to 410 Series RAI's; (Auxiliary Systems Branch)," J. DeVincentis to F. J. Miraglia

Subject: Revised Responses to 410 Series RAI's; (Auxiliary Systems Branch)

Dear Sir:

We have enclosed revised responses to the following RAI's which you forwarded in Reference (b):

- 410.8
- 410.12
- 410.24
- 410.25
- 410.28
- 410.41
- 410.44

The initial response to these RAI's was submitted in Reference (c). The enclosed revised responses were discussed with Auxiliary Systems Branch in a July 15 and 16, 1982, meeting at Seabrook Station.

Very truly yours,

YANKEE ATOMIC ELECTRIC COMPANY

Allen J. Legendre Jr.
J. DeVincentis
for: Project Manager

B001

8207300327 820727
PDR ADOCK 05000443
A PDR

410.8 Describe the provisions taken to assure that the turbine driven emergency feedwater (EFW) pump and turbine are not a missile source, or that missiles from the EFW turbine and pump will not damage the motor driven EFW train. Describe the barrier between EFW pumps, the range of credible missile sizes, trajectory and impact effects of any part of the adjoining motor driven EFW pump system including electrical and piping lines. Include consideration of indirect trajectory and impact effects of any part of the adjoining motor driven EFW pump system including electrical and piping lines. Include consideration of indirect trajectories.

RESPONSE: The turbine-driven EFW pump is identical in size and design to the motor-driven pump and operates at the same speed. As described in Section 3.5.1.1.C of the FSAR, pumps are not considered to be a credible missile for the reasons stated therein.

The turbine unit is equipped with both a speed-limiting governor and an overspeed limiting trip. The speed governing system is designed to assure rapid controlled acceleration without overspeeding. The overspeed governor consists of a mechanical pin-type device which trips shut the turbine steam inlet valve at 125 percent overspeed. Repeatability accuracy of this trip is within ± one-half percent.

The turbine itself is of a solid wheel, single stage design and is not considered a credible missile source. This unit has been designed to start or operate on 100 percent water as well as being able to withstand the severe punishment of intermittent water slugs. During testing of similar type units, water slugs were injected into the turbine while it was operating normally. These water slugs ranged from 50 to 600 gallons. Following these tests, detailed examinations confirmed that the turbine sustained no wear deformation or damage.

Further assurance of the integrity of the turbine drive unit is provided by the Quality Assurance program of the vendor. During manufacturing, the vendor follows the intent of ASME Section III standards, Appendix B to 10CFR 50 (Quality Assurance Criteria Requirements of the Code of Federal Regulations) and ANSI 45.2. Pedigree material is used on all major components so that complete traceability is possible. Welders are qualified to ASME Section IX standards and non-destructive test personnel are qualified to SNT standards. The integrity of every turbine casing is confirmed by 100 percent mag-particle testing. Every high pressure component is subjected to a thorough X-ray analysis. Every shaft, as well as every wheel is ultrasonically tested. Additionally, conversations with the turbine manufacturer have indicated that for the turbine wheel to separate, speeds in excess of 14,000 RPM would be necessary. This is approximately a 400 percent overspeed for this unit.

The motor-driven pump is oriented perpendicular to the turbine driven pump so that in the unlikely event that pump or turbine missiles are generated the other pump will not be affected. The partition between the pumps provides additional protection against indirect trajectories.

410.12 Figures 3.6(B)-1 and 2 indicate that the main steam and feedwater lines between the turbine building and the main steam and feedwater pipe chases are routed in close proximity to the control building. These lines are neither seismic Category I nor nuclear safety grade. Therefore, provide the results of an analysis and drawings as necessary to demonstrate that a failure of these lines will not result in damage to any essential systems and components in the control building, including the essential switchgear and batteries, due to pipe whip, jet effect and environmental effects.

RESPONSE: Refer to FSAR Amendment 44, pages 3.6(B)-5, -6, -6a, Appendix 3A, Summary Pages, 3A-1 through 3A-5 and Appendix 3I.

Additionally, design requirements for a guard pipe for Line 4003 beyond the north wall of the west main steam and feedwater pipe chase are as follows:

a. The guard pipe shall protect the control building wall from direct impingement of a full-flow longitudinal break in Line 4003-03 from the Code class break to a point 22 feet north of the centerline of the vertical pipe outside the north wall of the pipe chase.

b. The guard pipe shall be capable of containing the full pressure of the ruptured main steam line.

c. The guard pipe shall not interfere with the pipe supports nor with the pipe bridge.

d. The guard pipe is designed to prevent damage to essential electrical trays and equipment which might be caused by missiles generated as a result of direct steam-jet impingement on a seismic Category 1 concrete structure; however, the guard pipe itself need not be designed to seismic Category 1 criteria, provided that any failure of the steam line and the attached guard pipe caused by earthquake loading will not result in a loss of function of the guard pipe. See (a) above.

Analysis of the guard pipe design shows that any rupture of Line 4003-3 in the area protected by the guard pipe will not result in direct full-flow steam jet impingement on the control building wall in the area of interest.

The guard pipe surrounds the straight lengths of the main steam line, and cannot be removed except by making two longitudinal cuts to separate it into two halves, or by making guillotine cuts completely servering the main steam line and then sliding the guard pipe off the steam line. Neither of these events is a credible accident.

At the elbows, where a guard pipe cannot be installed completely around the steam line, deflector plates have been provided, and these are attached to the steam line by means of U-bolts. These cannot be dislodged or displaced by earthquake forces because they are restrained by the guard pipes. They can be removed only by removing the large U-bolts and nuts holding them in place. Since lock nuts are used, properly torqued, accidental removal or displacement of these deflector plates is not a credible accident.

Complete failure of the steam line supports would result in the steam line falling approximately five inches (5") onto the structural steel pipe bridge at Elevation 38'-6". This would cause an increase in pipe stresses, possibly resulting in yielding of the pipe at the 5-degree restraint. These stresses are non-cyclic, single-time events which are not presumed to cause pipe rupture.

Complete failure of the non-seismic pipe bridge as a result of earthquake forces could result in deflections of the main steam and feedwater lines which would induce yielding or formation of a hinge at the 5-degree restraint or induce reversing stresses in the main steam lines which could result in pipe rupture. Since the guard pipe and deflector plates are attached to the pipe, they would continue to function regardless of where the rupture should occur.

410.24 An examination of Figure 9.2-3 indicates that a single active failure (e.g., spurious closure of a containment isolation valve) can result in loss of primary component cooling water (PCCW) flow to two reactor coolant pumps (RCP's). It is our position that loss of cooling to the RCP's must not result in unacceptable damage to RCP bearings and/or seals that could result in fuel damage or excessive reactor coolant leakage within a period of time compatible with operator action. We require that you demonstrate compliance with one of the following alternatives:

1. Demonstrate by test data that the RCPs will withstand a complete loss of cooling water for 20 minutes and that instrumentation, designed in accordance with IEEE 279 that alarms in the control room, is provided to detect a loss of cooling water to ensure a period of 20 minutes is available so that the operator would have sufficient time to initiate manual protection of the plant; or
2. Provide instrumentation in accordance with IEEE 279 consistent with the criteria for the protection system to initiate automatic protection of the plant upon loss of cooling water to a pump. (Note: A minimum of 10 minutes for operator action is acceptable if it can be demonstrated that the proper operator action can be taken within that time period.)

RESPONSE: Primary component cooling water (PCCW) supplies cooling to the reactor coolant pumps (RCP's) for the following areas:

a. Thermal barrier heat exchanger,

b. Upper and lower motor bearing oil coolers, and

c. Motor air coolers.

(See FSAR Section 9.2.2 and Figures 9.2-2, Sheet 2 and 9.2-3, Sheet 2.)

Additionally, seal water injection flow is supplied to the thermal barrier area of the RCP's to provide a source of filtered, cool water for the controlled leak-off through the RCP seal assembly (see FSAR Sections 5.4 and 9.3.4).

In discussing the potential consequences associated with a loss of PCCW cooling to the RCP's, the cooling concerns can be broken down into two areas: 1) loss of thermal barrier cooling, and 2) loss of cooling to the RCP motor (bearings and motor windings). Each of these areas will be discussed individually.

I. Thermal Barrier System

The thermal barrier is a welded assembly consisting of a flanged cylindrical shell, a series of concentric stainless steel cans, a heat exchanger coil assembly, and two flanged water connections. Component cooling water enters the thermal barrier through a flanged connection on the thermal barrier flange. The cooling water flows through the inside of the coiled stainless steel tubing in the heat exchanger and exits through another flanged connection on the thermal barrier flange. During normal operation, the thermal barrier limits the heat transfer from the reactor coolant to the pump internals.

Seal injection flow, at a slightly higher pressure and at a lower temperature than the reactor coolant system, enters the pump through a pipe connection on the thermal barrier flange and is directed to a point above the pump radial bearing and the thermal barrier heat exchanger. Here the flow splits with a portion flowing down through the radial bearing and the thermal barrier labyrinth (where it acts as a buffer to prevent reactor coolant from entering the radial bearing and seal section of the pump) and into the reactor coolant system. The remainder of the seal injection water flows up through the shaft seals and is discharged via the seal leakoffs.

Should a loss of seal injection to the RCP's occur, the pump radial bearing and seals are lubricated by reactor coolant flowing up through the pump. Under these conditions, the PCCW continues to provide flow to the thermal barrier heat exchanger and the heat exchanger, functioning in its backup capacity, cools the reactor coolant before it enters the pump radial bearing and the shaft seal area. The loss of seal injection flow may result in a temperature increase in the pump bearing area, a temperature increase in the seal area, and a resultant increase in the number one seal leak rate; however, pump operation can be continued (for up to 24 hours), provided these parameters remain within the allowable limits.

Should a loss of PCCW to the RCP's occur, the chemical and volume control system continues to provide seal injection flow to the RCP's; the seal injection flow is sufficient to prevent damage to the seals with a loss of thermal barrier cooling. Thus it can be seen that a single failure, resulting in a loss of PCCW to the RCP's will result in minimum adverse affects (relative to the thermal barrier and seal assemblies), none of which require immediate or automatic corrective action.

II. Motor Bearing and Winding Cooling

The reactor coolant pump motor bearings are of conventional design. The radial bearings are the segmented pad type, and the thrust bearing is a double-acting Kingsbury type. All are oil-lubricated. Component cooling water is supplied to the external upper bearing oil cooler and to the integral lower bearing oil cooler.

The motor is a water/air cooled, Class B thermalastic epoxy insulated, squirrel cage induction motor. The rotor and stator are of standard construction and are cooled by air. Six resistance temperature detectors are imbedded in the stator windings to sense stator temperature.

The internal parts of the motor are cooled by air. Integral vanes on each end of the rotor draw air in through cooling slots in the motor frame. This air passes through the motor with particular emphasis on the stator end turns. It is then routed to the external water/air heat exchangers, which are supplied with component cooling water. Each motor has two such coolers, mounted diametrically opposed to each other. In passing through the coolers, the air is cooled and then directed back to the motor air inlets through external ducts on the motor so that no air is discharged into the containment from the motors.

A loss of PCCW cooling to the RCP bearing oil and motor cooler will result in an increase in oil temperature and a corresponding rise in motor bearing metal temperature.

In a Westinghouse test program, two RCP motors were tested with interrupted PCCW flow. These tests were conducted at the Westinghouse Electro Mechanical Division. In both cases, the reactor coolant pumps were operated to achieve "hot" (2230 psia, 552°F) equilibrium conditions. After the bearing temperatures stabilized, the cooling water flow to the upper and lower motor bearing oil coolers was terminated and bearing (upper thrust, lower thrust, upper guide and lower guide) temperatures were monitored. A bearing metal temperature of 185°F was established as the maximum test temperature. When that temperature was reached, the cooling water flow was restored.

In both tests, the upper thrust bearing exhibited the limiting temperatures, and 185°F was reached in approximately 10 minutes. The average heatup rates experienced in these tests were less than 3.3°F/minute and were basically linear throughout the range of the test.

Because absolute test data is not available beyond the test termination point of 185°F, an extrapolation of this heatup rate would be inappropriate. However, considering that the melting point of the babbitt bearing metal is greater than 400°F, it appears likely that considerable time remains, beyond the 10 minute time frame for the bearing temperature to reach 185°F, until bearing damage is incurred.

The results of the test data along with the recommended bearing high temperature alarm setpoint of 185°F and suggested manual RCP trip at 195°F constitute the basis of the qualification for 10 minutes operative without PCCW with no resultant pump damage.

As previously discussed, a loss of PCCW to the motor bearing oil coolers will result in an increase in oil temperature and a corresponding rise in motor bearing temperature. Westinghouse contends that the loss of PCCW to the RCPs will not result in an instantaneous seizure of a single pump and, further, that instantaneous seizure of two pumps simultaneously is not a credible ultimate consequence. Instead, it is Westinghouse's technical opinion that a more realistic ultimate consequence will be an abbreviated coastdown. If a limiting condition of the babbitt metal is considered, an increasing coefficient of friction, as well as an increasing retarding torque is expected. However, in view of the large rotational inertia of the pump/motor assembly, Westinghouse maintains that an instantaneous seizure will not result.

Because an initial seizure is not expected, it is not possible to define a precise point in time at which a sequential seizure would be anticipated. Therefore, for the purpose of defining the time expected between sequential seizures, the following discussion will be presented in terms of sequential occurrences of reaching a "high" bearing temperature. As discussed before, the upper thrust bearing exhibits the limiting temperature; therefore, an upper thrust bearing temperature of 240°F has been chosen arbitrarily as the "high" temperature. It should be noted that the use of this value does not imply pump seizure at this temperature.

Variables affecting the steady-state operating temperature of the bearings include the following:

a. Surface finish of the bearing and runner

b. Bearing (and oil pumping mechanism) clearances

c. Inlet temperature of water-to-heat exchanger (oil cooler)

d. Condition of oil-to-water heat exchanger (oil cooler) i.e., extent of fouling

e. Condition of oil

f. Amount of oil in oil pot

g. Oil temperature

These variables would be expected to interact concurrently in a manner which individualizes the performance of the bearings during actual steady-state plant operation.

In order to quantify the resultant variation in performance, Westinghouse has collected data from an operating plant. This data demonstrates that the upper thrust bearings operate at different steady-state temperatures (i.e., 128°F, 132°F, 135°F and 145°F).

Using these actual steady-state operating values (A-128°F, B-132°F, C-135°F and D-145°F) and assuming a conservative 5°F/minute linear heatup rate after a loss of PCCW, sequential occurrences of reaching the high bearing temperature could be expected at the time intervals tabulated below.

Sequential Motors	Operating Temperature (°F)	Time Interval (minutes)
A and B	4	0.8
B and C	3	0.6
C and D	10	2.0
A and C	7	1.4
B and D	13	2.6
A and D	17	3.4

To summarize, two bearings sequentially reaching a temperature of 240°F could be expected at a minimum time interval of 0.6 minutes and at a maximum time interval of 3.4 minutes.

Westinghouse has obtained motor bearing heatup data, as previously discussed. These test data show actual values of bearing temperatures following a loss of PCCW. The test runs, which were performed at different times using different motors, demonstrate similar heatup rates; this fact supports the assumption of identical linear heatup rates made in the previous discussion. In addition, the average heatup rates evidenced in the test data are less than 3.3°F/minute, which substantiates the use of 5°F/minute as a conservative value. The actual test data, although limited, is supportive of the assumptions posed in defining the time intervals tabulated above.

In conclusion, Westinghouse contends that a single or multiple pump seizure as the result of a loss of PCCW to the RCPs is not a credible event. However, in our judgement and based on the above discussion, two RCP motor upper thrust bearings could sequentially reach a "high" bearing temperature of 240°F at a minimum time interval of 0.6 minutes (or approximately 40 seconds).

Section 15.3.3 of the FSAR presents the analysis of a single RCP locked rotor. It should be pointed out that the Section 15 analysis assumes an instantaneous seizure of a reactor coolant pump rotor on a non-mechanistic basis. As discussed before, Westinghouse contends that a postulated mechanistic instantaneous seizure of a pump rotor due to a loss of PCCW to the RCP will not occur and is not a credible event.

However, in response to the NRC request, the results of a second non-mechanistic instantaneous seizure occurring at 40 seconds after a first non-mechanistic instantaneous seizure have been evaluated. It should be noted that this evaluation was performed for a three-loop plant. A sequential locked rotor loss of flow incident for a three-loop plant results in loss of 2/3 of total flow, whereas for a four-loop plant results in loss of 1/2 of total flow. Therefore, this hypothetical incident would be more limiting for a three-loop plant than for Seabrook.

Although a Section 15 approach was utilized to evaluate this situation, Westinghouse does not recognize a postulated mechanistic instantaneous locked rotor as a credible consequence of the loss of PCCW to the RCP's.

Assuming that a second pump seizure occurs 40 seconds after a first pump seizure, no noticeable change is seen in the reactor coolant system pressure and the clad temperature transients. Furthermore, even if the time interval between the sequential seizures is reduced to 10 seconds, no noticeable change is seen in the reactor coolant system pressure and the clad temperature transients.

The hypothetical seizure of one RCP results in a low flow reactor trip approximately one second after the initiation of the event. As a result of the fast reactor trip and the consequential decrease in core heat flux, the reactor coolant system pressure and the clad temperature reach the peak values at about 2.5 seconds and then start to decrease. The results for the Seabrook specific analysis as presented in FSAR Table 15.3-1 are as follows.

Event	Time (Sec.)
Rotor on one pump locks	0.0
Low flow trip point reached	0.04
Rods begin to drop	0.04
Maximum RCS pressure	3.60
Maximum clad temperature	3.81

Because the core has been shut down, at 40 seconds - or even 10 seconds - after a pump seizure, the reactor coolant system pressure and the clad temperature transients have decreased to a point at which a second pump seizure results in no noticeable change in the transients.

Available Instrumentation

Several diverse and redundant means of indication and/or alarms are available to the operator to alert him that a loss of PCCW to the RCP's has occurred. They include:

1. PCCW supply and return containment isolation valves - both inside and outside containment - valve position indication,

2. RCP seal cavity temperatures, and

3. RCP motor bearing and stator temperatures.

In addition, two Class 1E transmitters will be provided to redundantly monitor the combined flow from the upper and lower bearing oil coolers and the motor air coolers for each pair of RCPs (total of four instruments). These safety-related transmitters will provide flow indication on demand and actuate low flow alarms in the control room. Independent alarms will be provided on the annunciator and the video alarm system.

Operating procedures will be provided for a loss of component cooling water and seal injection to the reactor coolant pumps and/or motors. Included in these operating procedures will be the provision to trip the reactor if component cooling water flow, as indicated by the instrumentation discussed above, is lost to the reactor coolant pump motors, and cannot be restored within 10 minutes. The reactor coolant pumps will also be tripped following the reactor trip. Since both these operations are performed at the main control board, these evolutions can be performed within the 10-minute time frame.

410.25
(9.2.5)

(1) The ultimate heat sink cooling tower basins are only provided with a seven day water supply. No permanent makeup system is provided. It is our position, in accordance with Regulatory Guide 1.27, that the ultimate heat sink must have a continuous capability to maintain the plant in a safe shutdown condition for at least 30 days. Therefore provide data showing the maximum makeup water demand of the cooling tower throughout the 7-30 day period.

Provide a detailed description of the (plan) to use portable pumping equipment to furnish makeup water to the cooling tower in the event of total blockage of both ocean tunnels. Describe the capabilities of these portable pumps to provide continuous makeup water from natural water sources following depletion of the cooling tower basin. In this description consider the source of power for the portable pumps and the time for erection of the equipment including the restrictions to freedom of movement following a seismic event of sufficient magnitude to block both ocean tunnels. Describe the locations at which makeup water could be taken from natural sources, the low tide water levels or the fresh water capacities available at these locations, the length of portable pipe used and pump suction conditions imposed while pumping from these remote locations. Verify that a sufficient length of portable pipe is stored to reach a reliable water source and that the system could be erected over the terrain selected in the required time.

(2) FSAR Section 9.2.5.3 indicates that even after an SSE, use of the cooling tower as the ultimate heat sink would only be necessitated by 95 percent blockage of a circulating water tunnel. Discuss whether the underground 42" SSW intake pipes that convey the water from the transition structures to the service and circulating water pumphouse could be damaged by erosion as a result of failure of the circulating water system and describe any design provisions to mitigate this damage. Also discuss the effects of suspended sediment on the operability of the system for at least 30 days.

(3) FSAR Section 9.2.5.3 states that the entire ultimate heat sink cooling tower structure is designed to withstand tornado missiles. FSAR Section 1.8 under Regulatory Guide 1.117 and Section 3.5 contradict this statement. Clarify this apparent discrepancy.

RESPONSE: (1) FSAR Subsection 9.2.5.3c will be revised to reference a new Figure 9.2-9 on maximum makeup water demand of the cooling tower. A detailed description of the plan to use portable pumping equipment to furnish makeup water to the cooling tower in the event of total blockage of both ocean tunnels will be included as per the attached.

(2) In the unlikely event of an SSE which resulted in damage to the circulating water system of sufficient severity to, in turn, cause damage to the 42" service water supply lines to

the pumphouse and subsequent loss of suction to the service water pumps, the cooling tower would be automatically actuated to serve as the ultimate heat sink. Hence, any suspended sediment resulting from the break in these lines would have no effect on the operability of the system.

(3) This discrepancy will be greatly clarified if the reference to Section 3.3.2 (apparently a typographical error) is changed to read "See Section 3.5.2" in the last paragraph of Section 9.2.5.3b. The last paragraph of Section 3.5.2 contains information which clarifies the missile protection provided. The entire structure is designed to withstand tornado generated missiles as qualified by the exceptions of Section 3.5.2.

c. Tower Makeup Water

Sufficient tower makeup water is stored in the tower basin for seven days of operation during accident conditions. During this time period, provisions can be made to transport additional makeup water to the site. If necessary water can be pumped into the tower basin from any one of many (within 5000') nearby Brown's River or Hampton Harbor locations. Two diesel-driven portable pumps along with sufficient hose (50-100' lengths of 4" ID rubber-lined polyester flexible hose and associated couplings) are provided for this purpose. One pump and 2500' of hose are stored in each of the two cooling tower switchgear rooms. Each pump is of the self-priming type and of sufficient capacity and head to deliver 300 gpm through the full 5000' of hose. If required, and prior to seven days, a pump can be moved to the nearest appropriate water source. Sufficient time is available to contract helicopter service to move a pump should a pumping location with limited access be required.

The dose to station personnel filling the basin after 5 days is minimal. Direct radiation from the containment is less than 1×10^{-3} mr/hr.

The level of the cloud dose is acceptable, and can be minimized or completely avoided by taking water from sources upwind of the containment or by taking water from the pumphouse.

Two additional and more convenient sources of makeup water are also available onsite (assuming city water is not available). In the unlikely event that the intake tunnel is completely blocked, the pumphouse bay could be flooded by transferring to the discharge tunnel. Makeup water could then be easily pumped from the pumphouse to the tower basin. Assuming both tunnels are restricted due to a seismic occurrence, a seepage through the blockage of either or both tunnels of only 300 gpm (after 7 days) would satisfy tower makeup requirements in accordance with Regulatory Guide 1.27. A curve of maximum makeup water demand for the cooling tower throughout the 7-30 day period is shown on Figure 9.2-9.

Cooling tower makeup water is required to account for losses of tower coolant due to evaporation, drift losses, and tower blowdown. Of these, evaporative losses consume the largest portion of the required makeup water, and drift losses are relatively negligible.

Drift losses of 0.03% of the tower circulating water flow rate have been conservatively assumed for the tower. Sufficient makeup water is provided in the tower basin to account for this loss. Evaporative losses from the tower are based on the integrated heat loads listed in Table 9.2-14. These losses were calculated using analytical methods accounting for both the latent heat of vaporization of the coolant and sensible heat transfer from the coolant to the air assuming saturated exit air. To assure adequate makeup supply, the basin capacity was also calculated using an alternate method which conservatively neglects sensible heat transfer and assumes all of the heat transferred is used to evaporate tower coolant. This assures that sufficient makeup water is available in the tower basin for seven days of tower operation and that minimum cooling tower pump submergence requirements are satisfied at all times.

410.28
(9.2.6)

(1) In order to demonstrate that the condensate storage tank (CST) will retain the dedicated volume for EFW supply after the SSE, indicate on drawings the arrangement of both Seismic and Non-Seismic Category I piping on the CST including the elevations of the connections relative to the volume of the tank, and demonstrate that a failure of the non-seismic piping will not affect the dedicated emergency feedwater (EFW) supply.

(2) Clarify whether the CST level transmitters shown in Figure 10.4-4, Sheet 1, are Seismic Category I.

RESPONSE: (1) The chart below can be used with FSAR Figure 10.4-4, Sheet 1, to locate tank connections for non-nuclear or Safety Class 3 piping. The centerline elevation and wall thickness for each nozzle is also indicated, so that the invert elevations of each nozzle can be determined.

The lowest invert elevations of NNS pipe CO-4097-01-D4-16" is 44'-4 3/8". The invert elevation of the EFW supply pipes CO-4081-01-151-8" and CO-4082-01-151-8" is 23'-11". The difference in height is 20'-5 3/8". The CST has an inside diameter of 42'-0". Postulating a NNS pipe rupture approximately 211,900 gallons of EFW would remain in the CST. Therefore, a minimum storage of 200,000 gallons is assured.

Nozzle	Size	Wall	Thickness	Elevation	Connecting Pipe Class
A	24"	3/8"	(0.375")	25' - 3"	3
B	16"	3/8"	(0.375")	45' - 0"	NNS
C	6"	405	(0.280")	47' - 0"	NNS
G	6"	805	(0.432")	63' - 2-1/2"	NNS
H	8"	405	(0.432")	24' - 3"	3
J	8"	405	(0.322")	24' - 3"	3
L	2"	405	(0.154")	45' - 0"	NNS
R	4"	405	(0.237")	64' - 6"	NNS
S	2"	405	(0.154")	24' - 6"	3
X	1"	405	(0.133")	28' - 6"	3 (Thermowell)
Bottom of Tank	--	---	--------	23' - 6"	----

(2) System piping from the Condensate Storage Tank to the level transmitter is Safety Class 3, Seismic Category I. Both level transmitters are redundant, provide level indication on the main control board, and are protected in a Seismic Category I structure. Should any seismic event cause both transmitters to fail, and additionally require the use of the EFW system, the 200,000 gallons reserved in the tank would provide at least 14 hours of EFW system operation before an alternate water supply is necessary. This time frame provides ample time for the operators to recognize the level indication failure and provide an alternate means of level indication.

The CST is provided with the following level instrumentation:

a) Two level transmitters for level indication and high/low level alarm at the MCB.

b) A level indicating switch to control tank make-up.

c) Indirect CST level indication is also provided by Class 1E pressure transmitters at the suction of each EFW pump. This suction pressure is indicated on the main control board.

The CST is provided with a temperature indicating switch to indicate water temperature locally and to alarm at the MCB on low temperature. Temperature indication is also provided at the outlet of the condensate heat exchanger. During cold weather, the plant operators will monitor these temperatures to confirm proper operation of the tank heating system.

410.41 (10.3.1) The FSAR states that the main steam isolation valves (MSIVs) are closed by pneumatic pressure when the hydraulic fluid that opens the valves is relieved. There is no indication that accumulators are provided for these valves. Describe how the MSIVs would be closed on loss of air pressure and provide drawings showing the hydraulic and pneumatic MSIV operation systems.

RESPONSE: The actuator is a stored nitrogen unit with a hydraulic cylinder coupled directly to a precharged nitrogen accumulator which stores the closing energy. The precharged high pressure nitrogen is stored in an integral, essentially spherical accumulator which is designed as a pressure vessel meeting the requirements of ASME VIII, Div. 1. Schematic Control Drawings 506565 through 568 which are listed in FSAR Section 1.7, were provided to the NRC under a separate submittal.

For the MSIV (and FWIV) the precharged nitrogen accumulators are integral to the actuator assembly, and are designed to seismic Category 1 requirements. Separate instrument air accumulators are not required. Compressed air is supplied to air motors to operate the hydraulic pumps to reopen the valves, but this is not a safety function.

Pressure switches are provided to alarm on low accumulator gas pressure. The accumulator is designed to minimize gas leakage. If gas pressure does decrease, it is a maintenance function to recharge the accumulator using a temporary nitrogen supply.

410.44
(10.4.9)* It is our position that the EFW system must meet GDC 2 with regard to being designed to withstand the effects of natural phenomena including the SSE. We therefore require the following:

(1) The emergency feedwater pump turbine as well as a portion of its steam supply line is indicated as non-Seismic Category I (FSAR Figure 10.3-1, Sheet 1). We require that this turbine and its control features and steam supply line meet Seismic Category I, Safety Class 3 requirements. Therefore, make the necessary design changes and revise your FSAR accordingly.

(2) The EFW pump recirculation lines are indicated as non-Seismic Category I (FSAR Figure 6.8-1). Therefore, a seismic event combined with an operator error (e.g., failure to close either V67 or V73 after performance of the monthly EFW pump flow tests) can result in failure to deliver the proper flow to the steam generators, loss of condensate storage inventory, and flooding of the EFW pump rooms. We therefore require that the recirculation piping be designed to Seismic Category I*. Therefore, make the necessary design changes and revise the FSAR accordingly.

(3) Line 4626-02-D2-1", which appears to be the EFW turbine bearing oil cooler discharge line, has a normally open isolation valve and is partially non-Seismic Category I (FSAR Figure 6.8-1). We require that the entire line be Seismic Category I unless you can demonstrate that a failure of this line will not result in unacceptable loss of steam generator feedwater and in unacceptable flooding of the EFW pump rooms.

RESPONSE: (1) FSAR Figure 10.3-1, Sheet 1, erroneously implies there is significant piping between the EFW pump turbine trip valve, V129, and the turbine unit. It also indicates that the trip valve is a hydraulically actuated valve when it is, in fact, a spring-loaded, mechanically-linked overspeed trip valve which is mounted directly on the turbine unit. The FSAR will be revised to correct this discrepancy. The EFW pump turbine and its integral trip valve are commercially unavailable as ASME Section III, Class 3, design. However, these components are designed to Seismic Category I requirements and fabricated in accordance with an approved QC program. For additional information relative to the vendor's QC program, see the revised response to RAI 410.8. The steam supply line is designed to Seismic Category I requirements.

(2) The EFW pump recirculation lines are designed to Seismic Category I requirements. Valves V67 and V73 are administratively opened only for EFW pump flow tests. Position switches on these valves provide an alarm to the operators if these valves are not closed.

(3) The water lines to and from the oil cooler are designed to Seismic Category I requirements. The breakdown orifice in the line to the oil cooler limits the flow to 2-3 gpm. This

flow was considered in sizing the pump capacity. In the unlikely event of pipe failure, this flow will easily be handled by the pump room floor drains.

---

*In FSAR Section 6.8