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November 30, 1982

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T.F. B7.1.2

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

Attention: Mr. George W. Knighton, Chief
Licensing Branch No. 3
Division of Licensing

References:
(a) Construction Permits 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, "Response to 440 Series RAIs; (Reactor Systems Branch)," J. DeVincentis to F. J. Miraglia
(d) PSNH Letter, dated November 15, 1982, "Revised Response to RAIs 440.22, 440.45, and 440.52," J. DeVincentis to G. W. Knighton

Subject: Second Revision to RAI 440.52; (Reactor Systems Branch)

Dear Sir:

We have enclosed a second revision to the subject Request for Additional Information (RAI) which was forwarded in Reference (b).

The original response to RAI 440.52 was submitted in Reference (c). A further revision to RAI 440.52 was submitted in Reference (d).

The enclosed response will be included in OL Application Amendment 48.

Very truly yours,

YANKEE ATOMIC ELECTRIC COMPANY

David A. Maidrand

J. DeVincentis for
Project Manager

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ALL/fsf

cc: Atomic Safety and Licensing Board Service List

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440.52 During our review of license applications we have identified concerns related to the containment sump design and its effect on long-term cooling following a loss-of-coolant accident (LOCA).

These concerns are related to (1) creation of debris which could potentially block the sump screens and flow passages in the ECCS and the core; (2) inadequate NPSH of the pumps taking suction from the containment sump; (3) air entrainment from streams of water of steam which can cause loss of adequate NPSH; (4) formation of vortices which can cause loss of adequate NPSH, air entrainment and suction of floating debris into the ECCS; and (5) inadequate emergency procedures and operator training to enable a correct response to these problems. Preoperational recirculation tests performed by utilities have consistently identified the need for plant modifications.

The NRC has begun a generic program to resolve this issue. However, more immediate actions are required to assure greater reliability of safety system operation. We therefore require you take the following actions to provide additional assurance that long-term cooling of the reactor core can be achieved and maintained following a postulated LOCA.

1. Establish a procedure to perform an inspection of the containment, and the containment sump area in particular, to identify any materials which have the potential for becoming debris capable of blocking the containment sump when required for recirculation of coolant water. Typically, these materials consist of: plastic bags, step-off pads, health physics instrumentation, welding equipment, scaffolding, metal chips and screws, portable inspection lights, unsecured wood, construction materials and tools, as well as other miscellaneous loose equipment.

   "As Licensed" cleanliness should be assured prior to each startup.

   This inspection shall be performed at the end of each shutdown as soon as practical before containment isolation.

2. Institute an inspection program according to the requirements of Regulatory Guide 1.82, Item 14. This item addresses inspection of the containment sump components including screens and intake structures.

3. Develop and implement procedures for the operator which address both a possible vortexing problem (with consequent pump cavitation) and sump blockage due to debris. These procedures should address all likely scenarios and should list all instrumentation available to the operator (and its location) to aid in detecting problems which may arise, indications the operator should look for, and operator actions to mitigate these problems.

4. Pipe breaks, drain flow and channeling of spray flow released below or impinging on the containment water surface in the area of the sump can cause a variety of problems; for example, air entrainment, cavitation and vortex formation.

   Describe any changes you plan to make to reduce vortical flow in the neighborhood of the sump. Ideally, flow should approach uniformly from all directions.

5. Evaluate the extent to which the containment sump(s) in your plant meet the requirements for each of the items previously identified; namely debris, indadequate NPSH, air entrainment, vortex formation, and operator actions.

   The following additional guidance is provided for performing this evaluation:

   (1) Refer to the recommendations in Regulatory Guide 1.82 (Section C) which may be of assistance in performing this evaluation.

   (2) Provide a drawing showing the location of the drain sump relative to the containment sumps.

   (3) Provide the following information with your evaluation of debris:

      (a) Provide the size of openings in the fine screens and compare this with the minimum dimensions in the pumps which take suction from the sump (or torus), the minimum dimension in any spray nozzles and in the fuel assemblies in the reactor core or any other line in the recirculation flow path whose size is comparable to or smaller than the sump screen mesh size in order to show that no flow blockage will occur at any point past the screen.

      (b) Estimate the extent to which debris could block the trash rack or screens (50 percent limit). If a blockage problem is identified, describe the corrective actions you plan to take (replace insulation, enlarge cages, etc.).

      (c) For each type of thermal insulation used in the containment, provide the following information:

         (i) Type of material including composition and density,

         (ii) Manufacturer and brand name,

         (iii) Method of attachment,

(iv) Location and quantity in containment of each type,

(v) An estimate of the tendency of each type to form particles small enough to pass through the fine screen in the suction lines.

(d) Estimate what the effect of these insulation particles would be on the operability and performance of all pumps used for recirculation cooling. Address effects on pump seals and bearings.

RESPONSE: These concerns were presented as Enclosure 10 of Requests for Additional Information in a USNRC letter dated September 30, 1981, "Acceptance Review for Operating Licenses for Seabrook Station, Units 1 and 2", D. G. Eisenhut to W. C. Tallman. The response to Enclosure 10 was provided in Enclosure 3 to a PSNH letter dated November 27, 1981, "Response to Acceptance Review Requests for Additional Information (RAI's)" J. DeVincentis to D. G. Eisenhut.

The response to Enclosure 10, which is also found in Part B of the section on RAI's, was revised in Amendment 47 to provide information pertaining to the types of thermal insulation being used inside the containment. This revision to Enclosure 10 references Owens-Corning Fiberglass Topical Report OFC-1 submitted to the NRC for review in August 1977. This report documents the testing performed on the Nu'k'on thermal insulation and shows that this type of insulation will not block containment sump screens, drain or spray nozzles.

Although the extensive sump model testing performed by Alden Laboratories confirmed that vortexing would not be a problem, even with up to 50% blockage of the sump screens due to debris, procedures will be developed which address both a possible vortexing problem and sump screen blockage. These procedures will address all likely scenarios, will list all instrumentation available to the operator (and their location) to aid in detecting problems which may arise, will provide indications which the operator should look for, and will provide recommended actions to mitigate these problems.

There are several lines in the west quadrant of the containment which are classed as high energy during normal plant operation:

1.	CS-328-2"	RC pump seal injection
2.	CS-329-2"	RC pump seal injection
3.	CS-360-4"	Letdown
4.	CS-355-3"	Charging
5.	NG-1652-1"	Accumulator nitrogen supply
6.	RC-13-12"	RHR pump suction
7.	RC-58-12"	RHR pump suction

All of these lines are, or can be, isolated if ruptured prior to the recirculation mode of post-accident operations.

There are also several lines which are classed as high energy following an accident (but not during normal plant operation):

1. SI-272-3" C.L. Injection from charging pump
2. SI-273-1-1/2" C.L. Injection from charging pump
3. SI-251-4" C.L. Injection from SI pump
4. RH-155-8" C.L. Injection from RHR pump
5. RH-158-8" C.L. Injection from RHR pump
6. RH-160-8" H.L. Injection from RHR pump

If a break occurs in one of these lines during recirculation mode, that train (or line) can be shutdown.

Since there are no high energy lines in the western quadrant which cannot be isolated, the potential for vortexing air entrainment due to a pipe break is negligible.

The effect of the volume of water entrapped in the containment which would otherwise contribute to NPSH available to the ESF pumps has been factored into the NPSH calculation for the pumps, as described in Section 6.2.1.1.(b).6. In addition to the entrapped water, there are drain lines equipped with strainers (also described in this section) which permit a flow path between the reactor cavity and refueling canals to elevations above the water level in the rest of the containment. Should the strainers on these lines become blocked, an additional volume of 5760 cubic feet of water would be trapped. The resulting reduction of water height would be 5.76 inches. This height reduction has not been factored into the NPSH available calculation as presented in Sections 6.2.2.2.g and j for the CBS pumps and Section 6.3.2.2.d for the RHR pumps. However, incorporation of this height reduction still results in the available NPSH being greater than the required NPSH at maximum design runout flow conditions (see the above referenced sections and revised RAI 440.39 response forwarded by PSNH letter dated November 8, 1982, "Revised Responses to 440 Series RAI's Reactor Systems Branch", J. DeVincentis to G. W. Knighton).

The effect of the volume of water entrapped in the containment on decay heat removal capability is limited to potential peak sump water temperature effects since adequate NPSH as discussed above results in adequate ESF pump flowrates for cooldown following the accident. The sump water peak temperature analyses as illustrated for various accident scenarios on Figures 6.2-3, 6.2-6, 6.2-9, 6.2-12, 6.2-15 and 6.2-18 include the potential entrapped water volumes as part of the recirculated inventory immediately upon initiation of the recirculation mode. In actuality, the entrapped water would not immediately enter the recirculated water inventory, but would eventually mix with this inventory because spray and water flow from the break would displace the entrapped water by overflow as recirculation continues. since initial entrapped water would be high temperature LOCA fluid and the mixing of this water with the cooler recirculated water is delayed, the highest sump temperature during the recirculation mode would occur at a later time than calculated, thereby resulting in lower peak temperatures during this mode because of the further progression of the cooldown.