Docket File
52-003

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

October 6, 1997

Mr. Nicholas J. Liparulo, Manager
Nuclear Safety and Regulatory Analysis
Nuclear and Advanced Technology Division
Westinghouse Electric Corporation
P.O. Box 355
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SUBJECT: OPEN ITEMS ASSOCIATED WITH CHAPTER 20 OF THE AP600 SAFETY EVALUATION REPORT (SER)

Dear Mr. Liparulo

The Containment Systems and Severe Accident Branch has provided an SER for Chapter 20. However, the input to these sections contained some open items. These open items have been extracted from the SER and can been found in the enclosure to this letter.

One of the enclosed open items involves the review of a Bulletin that was issued after revision 1 to WCAP-13559 "Operational Assessment for AP600" was submitted to the staff for review. The updating of this WCAP is addressed in the Draft Safety Evaluation Report as Open Item 20.7-1, and has been discussed in a previous letter to Westinghouse transmitting Chapter 20 SER open items, dated June 11, 1997.

You have requested that portions of the information submitted in the June 1992, application for design certification be exempt from mandatory public disclosure. While the staff has not completed its review of your request in accordance with the requirements of 10 CFR 2.790, that portion of the submitted information is being withheld from public disclosure pending the staff's final determination. The staff concludes that these follow on questions do not contain those portions of the information for which exemption is sought. However, the staff will withhold this letter from public disclosure for 30 calendar days from the date of this letter to allow Westinghouse the opportunity to verify the staff's conclusions. If, after that time, you do not request that all or portions of the information in the enclosures be withheld from public disclosure in accordance with 10 CFR 2.790, this letter will be placed in the Nuclear Regulatory Commission Public Document Room.

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If you have any questions regarding this matter, you may contact me at (301) 415-1132.

Sincerely,

original signed by:

Joseph M. Sebrosky, Project Manager
Standardization Project Directorate
Division of Reactor Program Management
Office of Nuclear Reactor Regulation

Docket No. 52-003

Enclosure: As stated

cc w/encl: See next page

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Docket No. 52-003
AP600

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OPEN ITEM ASSOCIATED WITH CHAPTER 20

650.10F Issue A-43: Containment Emergency Sump Performance

The staff issued its proposed resolution of Issue A-43 for public comment on May 10, 1983. The public comment package included draft NUREG-0869 ("USI A-43 Regulatory Analysis," dated October 1985), the staff's technical findings report draft NUREG-0897 ("Containment Emergency Sump Performance," dated October 1985), proposed Revision 1 to RG 1.82 ("Water Sources for Long-Term Recirculation Cooling Following a Loss-of-Coolant Accident"), and proposed Revision 4 to SRP Section 6.2.2 ("Containment Heat Removal Systems"). The public comments received and the staff's responses were published in Revision 1 to Appendix A of NUREG-0869. On October 31, 1985, the staff presented the resolution of Issue A-43 to the Commission in SECY-85-349, "Resolution of Unresolved Safety Issue A-43, Containment Emergency Sump Performance." The supporting technical findings are contained in Revision 1 to NUREG-0897, "Containment Emergency Sump Performance", dated October 1985.

Since that time, several significant events have occurred at operating plants, including the plugging of containment spray system suction strainers at the Barsebäck plant in Sweden, and the clogging of emergency core cooling system (ECCS) suction strainers at the Perry Nuclear Power Plant in Ohio and the Limerick plant in Pennsylvania. This is discussed in NRC Bulletin 96-03, "Potential Plugging of Emergency Core Cooling Suction Strainers by Debris in Boiling Water Reactors" dated May 6, 1996. The Barsebäck event demonstrated the potential for a pipe break to generate insulation debris and transport a sufficient amount of this debris to the suppression pool to clog the ECCS strainers. Two events at the Perry Nuclear Power Plant demonstrated the deleterious effects on strainer pressure drop caused by the filtering of suppression pool particulates (corrosion products) by fibrous glass materials entrained on the ECCS strainer surfaces. The Limerick event demonstrated the need to ensure adequate suppression pool cleanliness. Corrosion products had combined with fibrous material to completely cover the suction strainer screens with a thin layer of "mat" which resulted in a greatly increased pressure drop across the screens. NRC Bulletin 96-03 provides guidance for the final resolution of this issue for BWRs. The Boiling Water Reactor Owners Group has prepared the Utility Resolution Guidance report, NEDO-32686 and technical support documentation, dated November 20, 1996, to provide guidance on implementing this bulletin.

The staff had originally proposed that the advanced designs should have the ability to backflush the suction strainers, which is similar to the resolution taken in Sweden for the Barsebäck plant. However, in evaluating the events, the staff decided to increase the strainer size rather than requiring a backflush capability. As a result, in the "Advance Copy of Safety Evaluation Report for the Advanced Boiling Water Reactor (ABWR)," which was sent to General Electric in a staff letter dated December 30, 1993, the staff stated that an acceptable resolution for the advanced designs would be to size the ECCS suction strainers in accordance with RG 1.82, but with the factor of three screen area margin. Since that time, understanding of the technical issues has advanced considerably due to testing and calculations done by both the USNRC and the BWR Owners Group. It is the staff's view that the factor of three in margin is not necessary because of this better understanding of the technical issues. Instead, a more mechanistic approach that still provides sufficient conservatism is acceptable. This is the approach taken for the AP600 to provide assurance of the availability of emergency cooling when required.

Section 6.2 of the SSAR provides information on the safety-related passive containment cooling system, including coolant recirculation following a LOCA. Section 6.3 of the SSAR provides further information on the operation of the passive core cooling system and a description of the debris screens. SSAR Appendix 1A describes the conformance of the sumps with RG 1.82.

Westinghouse has not determined the exact amount of fibrous insulation which will be present inside the containment. Westinghouse must provide this information and demonstrate that this amount of fibrous insulation will not, either alone or in combination with other particulate debris which may be present (unqualified coatings, concrete dust, foreign material), adversely affect the in-containment refueling water storage tank (IRWST) or recirculation flow during a LOCA.

Based on testing performed by the staff and the BWR Owners Group as part of the resolution of the issue of ECCS strainer blockage in BWR suppression pools, the choice of reflective metallic insulation (RMI) for most purposes inside the AP600 containment will significantly reduce the amount of screen blockage in comparison with fibrous insulation. Screen head loss is due primarily to the smaller RMI debris sizes resulting from the fragmentation of the inner reflective foils. It would be much less likely that the large internal foils, large pieces of intact foils, the intact RMI assemblies, end disks and cassette sheaths, side panels and other large pieces could be transported in sufficient amount to cause a significant head loss at the recirculation screens and, based on the flow path, could not be transported to the IRWST screens. In addition, the small RMI debris does not interact with particulate debris in the same way that fibrous debris does to result in a large head loss across the screens.

There are two sets of screens included in the design of the AP600. These are the IRWST screens and recirculation screens. The IRWST screens are vertical screens, each 70 ft^2 in area, located inside the IRWST at the bottom of the tank. Two separate screens are provided at opposite ends of the tank. The SSAR states in Section 6.3.2.2.7.2 that the IRWST is closed off from containment and its vents and overflows are normally closed by louvers. Thus it would be difficult for debris to enter the IRWST during normal operation. In addition, the IRWST is made of stainless steel and will not therefore generate the type of corrosion products which caused problems in operating BWR suppression pools. Thus, the potential for introducing debris is limited during plant operations. A COL cleanliness program will control foreign debris from being introduced into the tank during maintenance and inspection operations. Technical Specifications will require a visual inspection of the screens during every refueling outage. During accident conditions there is a potential for introducing debris to the IRWST. However, for the reasons discussed above, the amount of reflective metallic insulation and debris introduced should be negligible and should not have an adverse effect on the head loss across the IRWST screens. The effect of fibrous insulation must still be determined.

The containment recirculation screens are also vertically oriented and each also has a flow area of 70 ft^2. They meet the criteria in RG 1.82, Revision 1. Because the AP600 design does not use pumps to provide safety injection flow, the passive core cooling system injection flow rates are substantially lower than for plants with pumped injection flow. This lower flow results in lower flow velocities through the screens which reduce the potential of drawing debris into the screens. When the recirculation lines initially open, the water level in the IRWST is higher than the containment and water flows from the IRWST backwards through the containment recirculation screen. This backflow tends to flush debris located close to the recirculation screens away from the screens.

The water level at the beginning of recirculation is well above the top of the recirculation screens. Thus, any floating debris will remain clear of the screens. Also, there is a two foot clearance between the floor and the bottom of the screen so that any high density debris, swept along the floor, will not block the recirculation screens.

The AP600 design has a nonsafety-related containment spray system. Containment spray is capable of washing down insulation debris which might not otherwise be transported to the recirculation system. However, the AP600 containment spray system will be used only in the case of a severe accident. At this point core heat removal or coolant has been lost and the containment spray's effect in transporting more debris is not significant.

The recirculation piping inlet is slightly above the compartment floor, which is substantially below the expected flood-up water level. This reduces the potential for air ingestion in the piping because recirculation does not initiate until the flood-up water level is well above the piping inlet.

The staff has not completed its review of Unresolved Safety Issue A-43 for the AP600 design. The amount of fibrous insulation in containment and its effect on the recirculation flow together with the RMI following a LOCA must be evaluated. Open Item 20.3-4 remains unresolved.

In addition, Westinghouse does not address BL-96-03 in WCAP-13559, Revision 1 "Operational Assessment for AP600." This is an Open Item. In WCAP-13559 Revision 1, Westinghouse also states that Bulletin 93-02 "Debris Plugging of Emergency Core Cooling Suction Strainers," and Bulletin 95-02 "Unexpected Clogging of a Residual Heat Removal (RHR) Pump Strainer While Operating in Suppression Pool Cooling Mode" are not applicable to the AP600 design. Because of the unique features of the AP600 mentioned above, the staff disagrees with this assessment. Therefore, Westinghouse should revise WCAP-13559 to state that these Bulletins are applicable to the AP600 and should reference issue A-43 and the appropriate SSAR sections in the comment block for these Bulletins.

650.11F Issue C-10 Effective Operation of Containment Sprays in a LOCA

As discussed in NUREG-0933, Issue C-10 addressed the effectiveness of containment sprays to remove airborne radioactive material that could be present within the containment following a LOCA. This issue was expanded to include the possible damage to equipment located within the containment due to an inadvertent actuation of the sprays. This issue was resolved by SRP Section 6.5.2, "Containment Spray as a Fission Product Cleanup System," which references ANSI/ANS 56.5-1979, "PWR and BWR Containment Spray System Design Criteria."

In a May 28, 1993, letter, Westinghouse stated that the AP600 design does not include a containment spray system for removal of airborne radioactive materials in the containment. Section 15.6.5.3 of the SSAR provides the details of the accident source term and mitigation techniques for the AP600 design.

Status: Since issuance of the DSER, Westinghouse has committed to provide containment spray capability for mitigation of beyond design-basis-accidents. However, the design details have not been provided to the staff (Note: The design details have subsequently been provided by Westinghouse in draft form by letter NSD-NRC-97-5329, dated September 17, 1997). Therefore, this issue remains open until the design is submitted to the staff and the staff has the opportunity to evaluate the design.

650.12F Issue II.B.8: Rulemaking Proceedings on Degraded Core Accidents Description

The NRC has issued guidance for addressing severe accidents. This guidance is in: (a) the "NRC Policy Statement on Severe Reactor Accidents Regarding Future Designs and Existing Plants," (b) the "NRC Policy Statement on Safety Goals for the Operations of Nuclear Power Plants," (c) the "NRC Policy Statement on Nuclear Power Plant Standardization," (d) 10 CFR Part 52, "Early Site Permits; Standard Design Certification; and Combined Licenses for Nuclear Power Plants," (e) SECY-90-016, and the corresponding staff requirements memorandum (SRM) dated June 26, 1990, and (f) SECY-93-087, and the corresponding SRM dated July 21, 1993. Whereas, the first three documents provide guidance as to the appropriate course for addressing severe accidents, 10 CFR Part 52 contains general requirements for addressing severe accidents, and the SRMs relating to SECY-90-016 and SECY-93-087 give Commission-approved positions for implementing features in new designs for preventing severe accidents and mitigating their effects.

The basis for resolution of severe accident issues for the AP600 is 10 CFR Part 52 and SECY-93-087. 10 CFR Part 52 requires (a) compliance with the TMI requirements in 10 CFR 50.34(f), (b) resolution of unresolved safety issues and generic safety issues, and (c) completion of a design-specific probabilistic risk assessment. The staff evaluates these criteria in Sections 20.3, 20.1 and 20.2, and 19.1 of this report, respectively.

Paragraph (3)(iv) of 10 CFR 50.34(f) requires one or more dedicated containment penetrations, equivalent in size to a single .91-m (3-ft) diameter opening, in order not to preclude future installation of systems to prevent containment failure, such as a filtered vented containment system. This requirement is intended to ensure provision of a containment vent design feature with sufficient safety margin well ahead of a need that may be perceived in the future to mitigate the consequences of a severe accident situation. The staff's evaluation of AP600 compliance with the requirement is limited to the effective penetration size for venting provided in the AP600 primary containment design.

The size of the primary containment penetration that could be used during a severe accident situation for venting the containment is smaller than the specific size identified in the TMI requirement. The staff requires that Westinghouse submit a request for exemption from the requirement and supporting justification. The justification is expected to demonstrate that the penetration size is adequate and available to permit a vent relief path that is capable of providing the needed overpressure relief for the primary containment to prevent its uncontrolled failure. The needed justification to support an exemption from 10 CFR 50.34(f)(3)(iv) is an open item.