Central file

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

April 29, 1994

Docket No. 52-003

Mr. Nicholas J. Liparulo
Nuclear Safety and Regulatory Activities
Westinghouse Electric Corporation
P.O. Box 355
Pittsburgh, Pennsylvania 15230

Dear Mr. Liparulo:

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION ON THE AP600

As a result of its review of the June 1992, application for design certification of the AP600, the staff has determined that it needs additional information in order to complete its review. The additional information is needed in the area of containment systems for the AP600 (Q480.49-Q480.78)* Enclosure 1 are the staff's questions. Please respond to this request by June 30, 1994, to support the staff's review of the AP600 design.

In addition, during a February 23, 1994, meeting with Westinghouse, the staff agreed to provide Westinghouse with references on heat transfer correlations. Enclosure 2 contains a letter and selected references from Professor Ray Viskanta. The conclusions in the letter are preliminary and are under staff review. The conclusions do not constitute an official staff position at this time, and are being provided for your information only.

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 this request for additional information does 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 NRC's Public Document Room.

*The numbers in parentheses designate the tracking numbers assigned to the questions.

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This request for additional information affects nine or fewer respondents, and therefore is not subject to review by the Office of Management and Budget under P.L. 96-511.

If you have any questions regarding this matter, you can contact me at (301) 504-1120.

Sincerely,

(Original signed by)

Thomas J. Kenyon, Project Manager
Standardization Project Directorate
Associate Director for Advanced Reactors
and License Renewal
Office of Nuclear Reactor Regulation

Enclosure:
As stated

cc w/enclosure:
See next page

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Docket No. 52-003
AP600

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REQUEST FOR ADDITIONAL INFORMATION
ON THE WESTINGHOUSE AP600 DESIGN

480.49 Note 12 of Sheet 1 of Figure 9.4.7-1 and Table 6.2.3-1 of the SSAR do not clearly describe the provisions for Type C testing for the metal-seated containment air filtration system and chilled water system isolation valves. Provide a description of the design and Type C testing proposed for these valves.

480.50 Generally, the P&IDs in the SSAR depict the test, vent, and drain (TV&D) valves provided for Type C testing. However, the service air P&ID does not. If TV&D connections are not shown on a system P&ID, does that mean that they will not be installed and that Type C testing of the isolation valves is not planned?

480.51 Sheet 2 of Figure 9.2.2-2 of the SSAR contains a note indicating that component cooling water system isolation valves close on trip of all the reactor coolant pumps. Other information in the SSAR indicates that component cooling system isolation results from other signals. is this note correct? If not, correct this note.

480.52 Table 6.2.3-1 of the SSAR indicates that an 8-inch demineralized water transfer penetration is Type C tested with air in the forward direction. Figure 9.2.4-1 does not depict the necessary TV&D connections. Also, Table 6.2.3-1 indicates isolation on a "T" signal; however, the valve is indicated to be a manual valve. Clarify these tables or the drawing.

480.53 Table 6.2.3-1 of the SSAR references Regulatory Guide (RG) 1.11 for four containment pressure instrument line penetrations. Since the isolation valves in these lines are not automatic or remote-operated, the penetrations do not conform to this regulatory guide. The instrument lines are also described in Section 6.2.3.1.1 of the SSAR. The penetrations should conform to RG 1.11 unless an other acceptable basis is defined. Address this concern.

480.54 Figure 5.4-7 of the SSAR does not depict TV&D connections necessary for Type C testing of the residual heat removal (RHR) suction isolation valves. However, Table 6.2.3-1 indicates that Type C testing is to be performed. Are the necessary testing provisions provided? Clarify the discrepancy between Figure 5.4-7 and Table 6.2.3-1 as to which valve closes on a radiation signal.

480.55 Sheet 2 of Table 6.2.3-1 of the SSAR lists two unidentified normal residual heat removal system penetrations. One contains a 3-inch in-containment gate valve, the other a ¾-inch in-containment globe valve. Identify these penetrations by service and PI&D figure number.

480.56 An SRP criterion for use of relief valves as containment isolation barriers is that the setpoint be ≥ 105 percent of the containment design pressure. Confirm that the relief valves of Table 3.2-1 of the SSAR meet this criterion. Will these valves open under severe accident (Service Level C) conditions?

480.57 Table 6.2.3-1 of the SSAR indicates that the startup feedwater isolation valves are air-operated and close on an "LTC" signal. The table notes do not identify what an LTC signal is. Also, the P&ID for the steam system indicates that a motor-operated valve serves as the isolation valve for that test boundary. Define "LTC" and clarify the type of valve that serves as the isolation valve for this test boundary.

480.58 Note 6 of Table 6.2.3-1 of the SSAR states that airlock seal testing will be done at reduced pressure. A test pressure lower than Pa would be contrary to Appendix J criteria. Provide additional basis to support this position. This exception should be added to Table 6.2.5-1.

480.59 The method of testing the five spare penetrations (P39-P43) is unclear. Will they be tested by (a) pressurizing the volume between the two flanges, (b) pressurizing between double seals on each flange (if double seals are provided) or (c) both.

480.60 The terms "manual" and "remote manual" are used in Table 6.2.3-1 of the SSAR to describe isolation device actuation modes. The staff understands that the term "manual," when used to describe the primary actuation mode, is used to mean manual operation from the control room. In addition, it is the staff's understanding that the term "remote manual," when used to describe the secondary mode of actuation, means manual actuation at a control station other than the main control room. Confirm or clarify this understanding.

480.61 Figure 9.2.7-1 of the SSAR indicates that the chilled water return penetration has 10-inch isolation valves. Table 6.2.3-1 of the SSAR indicates that this penetration uses 6-inch valves. Clarify the valve size.

480.62 There appears to be conflicting information regarding the closure time limits for steam generator isolation valves: Table 6.2.3-1 of the SSAR indicates a 5-second closure time limit, Section 6.2.3.3.B of the SSAR indicates a 10-second time limit. Clarify the discrepancy.

480.63 This question pertains to Westinghouse's statement of conformance to paragraph 6.1.1 of the Standard Review Plan, "Engineered Safety Features Materials," Criteria B.1, Regulatory Guide (RG) 1.7, Paragraph C.3 that is identified on page 6-4 of Revision 1 to WCAP-13054, "AP600 Compliance with SRP Acceptance Criteria."

The WCAP indicates that DBA hydrogen recombiners are designed as safety-grade components, except that the power supply is non-safety. Power is supplied either from the off-site supply or the diesel-generators.

a. Provide the time when the recombiners will be required to avoid a combustible mixture within the containment when all the criteria within RG 1.7 are followed.

b. Describe what replacement power would be available other than the diesels or off-site.

c. Because the recombiner is a required safety system to mitigate a DBA, provide justification for using non-safety power other than the time required to perform its safety function.

480.64 This question pertains to Westinghouse's statement of conformance to paragraph 6.1.1 of the Standard Review Plan, "Engineered Safety Features Materials," Criteria B.1, Regulatory Guide (RG) 1.7, Paragraph C.5 that is identified on page 6-4 of Revision 1 to WCAP-13054, "AP600 Compliance with SRP Acceptance Criteria."

The WCAP states that "... the radiolysis source term for the AP600 is based on release of gap inventories."

The staff interprets this statement to indicate that the radiolysis source term is based on only the release of gap inventories. This position appears to be a significant deviation from the criteria provided in RG 1.7. To assess the degree of deviation, provide the total hydrogen generated due to radiolysis as a function of time using the AP600 assumptions and the assumptions of RG 1.7.

480.65 This question pertains to Westinghouse's statement of conformance to paragraph 6.1.1 of the Standard Review Plan, "Engineered Safety Features Materials," Criteria B.4, Regulatory Guide (RG) 1.54, and paragraph 6.1.2 of the Standard Review Plan, "Protective Coating Systems (Paints)," Criteria B.4, Regulatory Guide (RG) 1.54, that are identified on page 6-5 of Revision 1 to WCAP-13054, "AP600 Compliance with SRP Acceptance Criteria."

The WCAP indicates that coatings are non-safety-related.

Does the non-safety-related aspect of the coatings mean that debris is not considered a safety issue for the AP600 design? If debris could be a hazard, explain this position. Could this debris clog sump strainers, condensate gutters, or the drain of the in-containment refueling water storage tank?

480.66 This question pertains to Westinghouse's statement of conformance to paragraph 6.2.1.1.A of the Standard Review Plan, "PWR Dry Containments, Including Subatmospheric Containments," that is identified on page 6-6 of Revision 1 to WCAP-13054, "AP600 Compliance with SRP Acceptance Criteria."

a. What is Westinghouse's position relative to required margin between maximum calculated and design pressure? If none is considered, then how does Westinghouse ensure there will be no differences between the current design stage and the "as built" of the actual plant.

b. Provide justification for using best-estimate heat transfer coefficients in DBA calculations. Provide an uncertainty analysis for the worst case DBA accident that takes these heat transfer coefficients into account.

c. The staff understands that other parameters that are inputs to the DBA calculations are conservative, specifically boundary conditions and initial conditions such as input mass and energy release rates. Confirm this understanding.

480.67 This question pertains to Westinghouse's statement of conformance to paragraph 6.2.1.1.A of the Standard Review Plan, "PWR Dry Containments, Including Subatmospheric Containments," that is identified on page 6-6 of Revision 1 to WCAP-13054, "AP600 Compliance with SRP Acceptance Criteria."

The staff believes that the calculated heat transfer coefficients for the inside of the shell will be sensitive to the calculated velocities in the relatively thin nodes near the wall. In the AP600 calculations, a 2 foot thick node was used. In the LST, a 3" node was used. Perform sensitivity studies in which the node thickness is doubled, and cut in half to show lack of sensitivity to the node thickness.

480.68 This question pertains to Westinghouse's statement of conformance to paragraph 6.2.1.2 of the Standard Review Plan, "Subcompartment Analysis," that is identified on page 6-8 of Revision 1 to WCAP-13054, "AP600 Compliance with SRP Acceptance Criteria."

The current design basis is based on the use of leak-before-break. Are the subcompartment analyses and the associated wall capacities to be established by postulating the break of a 3" high energy line in each subcompartment, regardless of whether that subcompartment has any such lines in it?

480.69 This question pertains to Westinghouse's statement of conformance to paragraph 6.2.1.3 of the Standard Review Plan, "Mass and Energy Release Analysis for Postulated LOCAs," that is identified on pages 6-8 and 6-9 of Revision 1 to WCAP-13054, "AP600 Compliance with SRP Acceptance Criteria."

a. Provide the reference for the NRC-approved TMD code Westinghouse intends to use for M&E analyses.

b. For what reason is the TMD code being used rather than a more recognizable licensing code?

c. Document the specific assumptions used while performing this analysis.

d. Identify the experimental data that will be used in this analysis.

480.70 This question pertains to Westinghouse's statement of conformance to paragraph 6.2.1.5 of the Standard Review Plan, "Minimum Containment Pressure Analysis for Emergency Core Cooling System Performance Capability Studies," BTP CSB 6-1, that is identified on page 6-10 of Revision 1 to WCAP-13054, "AP600 Compliance with SRP Acceptance Criteria."

Provide the heat transfer coefficients used to address this criteria.

480.71 This question pertains to Westinghouse's statement of conformance to paragraph 6.2.2 of the Standard Review Plan, "Containment Heat Removal Systems," Criteria 7, that is identified on page 6-12 of Revision 1 to WCAP-13054, "AP600 Compliance with SRP Acceptance Criteria."

The WCAP indicates that the heat transfer through the shell to the surrounding air does not require any additional testing. The staff does not concur with the assessment. The staff believes that it will be necessary to validate the method with testing, such as through the PCCS testing program. The staff has not completed its review of the PCCS test program and its results. Therefore, the staff has not yet determined whether additional testing may be required. Provide justification for not performing additional testing.

480.72 This question pertains to Westinghouse's statement of conformance to paragraph 6.2.3 of the Standard Review Plan, "Secondary Containment Functional Design," that is identified on page 6-12 of Revision 1 to WCAP-13054, "AP600 Compliance with SRP Acceptance Criteria."

Clarify the comment. If the secondary containment is used for post-accident dose calculations, doesn't that mean complying with 10 CFR Part 100 guidelines? If so, shouldn't that require safety grade components? It was the staff's understanding that no credit was taken for secondary containment function during a DBA. Is this so?

480.73 This question pertains to Westinghouse's statement of conformance to paragraph 6.2.4 of the Standard Review Plan, "Containment Isolation System," Item 6.n, that is identified on page 6-16 of Revision 1 to WCAP-13054, "AP600 Compliance with SRP Acceptance Criteria."

The WCAP indicates that a closure of 60 seconds or less has been established with the new source term being used to justify the time. It is the staff's position that closure time should also be as quickly as practical. The staff believes that the containment integrity will be in question until the valves are actually closed. Therefore, closure time will be viewed from the ability to close as well as the source term. Address this concern.

480.74 This question pertains to Westinghouse's statement of conformance to paragraph 6.2.5 of the Standard Review Plan, "Combustible Gas Control in Containment," that is identified on pages 6-17 and 6-18 of Revision 1 to WCAP-13054, "AP600 Compliance with SRP Acceptance Criteria."

a. Using a non-safety-related power supply reduces the availability of the recombiner to perform its function. It is not only a question of power availability at the time of start up of the unit, but also during the time of operation. Provide any additional bases other than start-up time to support the use of a non-safety power supply.

b. Consideration of purging is viewed as a post-LOCA operation. The intent is to show that the capability exists, but it need not be safety grade or redundant. The response that purging is not included as a mitigation strategy is not acceptable to the staff. Address this concern.

480.75 This question pertains to Westinghouse's statement of conformance to paragraph 6.2.6 of the Standard Review Plan, "Containment Leakage Testing," that is identified on page 6-18 of Revision 1 to WCAP-13054, "AP600 Compliance with SRP Acceptance Criteria."

The WCAP indicates that the AP600 design deviates from the existing requirements of Appendix J of 10 CFR Part 50 consistent with proposed NRC changes to this regulation, but does not provide justification for the deviations. Address conformance with the existing rule and provide justification to support any deviation.

480.76 During the March 22, 1994 meeting, Westinghouse indicated that one of the containment isolation design features of the AP600 is the reduction in the number of penetrations (40 vs. 100). The staff believes that the bulk of this reduction has been achieved by ganging more lines together per penetration. This, in turn, may imply larger penetrations. Are any of the AP600 penetrations now so large that they are beyond "state-of-the-art?" If so, demonstrate that these lines are as safe as existing designs.

480.77 Containment isolation valves should be as close to the containment wall as is practical. From the staff's review of the AP600 design, it appears that several lines have considerable runs (greater than 10 feet) inside the containment before the interior containment isolation valve is encountered. An example is the service modules or islands that are incorporated into the AP600 design. Provide a list of lines that have runs greater than 10 feet, and justify placing the containment isolation valve so far from the containment boundary in each case.

480.78 The staff is trying to determine whether the containment design of the AP600 can meet Service Level C limits for the first 24 hours after the onset of a core melt accident. For the AP600 containment, what are the pairs of (maximum pressure, temperature) and (pressure, maximum temperature) under severe accident conditions?

ENCLOSURE 2

REFERENCES
HEAT TRANSFER CORRELATIONS