



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

May 5, 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 areas of fire protection (Q280.1-Q280.8),* water systems (Q410.107-Q410.134), and steam and power conversion systems (Q410.135-Q440.151). Enclosed 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, by letter dated June 26, 1992, Westinghouse submitted a proprietary and nonproprietary version of the AP600 Standard Safety Analysis Report (SSAR). The application requested that the proprietary version be withheld from public disclosure pursuant to 10 CFR Section 2.790.

An application and an affidavit dated June 26, 1992, from Westinghouse, the owner of the information, was included. The affidavit states that the release of the document would result in substantial harm to Westinghouse's competitive position if it were to be made available for public review.

While the staff has not completed its review of your request in accordance with the requirements of 10 CFR 2.790, the staff, in consultation with our Office of General Counsel, has determined that the affidavit has provided an insufficient basis for withholding the information identified in Q410.118, Q410.135, and Q410.140 from public disclosure. The staff does not believe that disclosure of this information to the public would cause substantial harm to the competitive position of Westinghouse. Also, much of the identified information is found in other similar SARs. Furthermore, the right of the public to know about these matters outweighs any concern for the protection of the competitive position of Westinghouse. Therefore, we have concluded that those portions of the document that are identified in Q410.118, Q410.135, and Q410.140 are not proprietary. Due to our determination, we request that you amend the appropriate sections of the SSAR.

In accordance with the requirements of 10 CFR 2.790, the proprietary portion of the submitted information is being withheld from public disclosure pending

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

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Mr. Nicholas J. Liparulo

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the staff's final determination. The staff concludes that other than the issues discussed above, 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.

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

Enclosure:
As stated

cc w/enclosure:
See next page

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Westinghouse Electric Corporation

Docket No. 52-003
AP600

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REQUEST FOR ADDITIONAL INFORMATION
ON THE WESTINGHOUSE AP600 DESIGN

Fire Protection

- 280.1 Describe how defense-in-depth equipment is physically and electrically separated from its redundant defense-in-depth equipment in the event of a fire. Indicate the defense-in-depth equipment, cables, and associated non-safety circuits that are not physically and electrically separated.
- 280.2 Section 9A.2.7.1 of Appendix 9A of the SSAR, "Independence of Affected Fire Areas," states that "For this fire protection analysis, only safety-related components and systems are assumed to be available to achieve safe shutdown."
- a. What is the definition of safe shutdown for the AP600?
 - b. How does the AP600-credited safety-related equipment provide at least the same safety margin when compared to currently credited safety-related equipment in operating reactors in the event of a fire in the control room or any other fire area? Provide several examples and consider similar worst case scenarios.
- 280.3 Section 9A.2.7.1 of Appendix 9A of the SSAR, "Manual Operation," states that
- Manual actions by operations personnel include manipulations of equipment located anywhere outside the fire area, if accessibility and staffing level permit such actions. Entry into the fire area for repairs or operator actions is assumed to be impossible.
- Manual operations of valves, circuit breakers, and hand-switches are utilized in exercising control over shutdown systems, provided sufficient time and personnel exist to perform the manual operation.
- a. In the event of a control room fire, is there a need to perform any manual actions other than at the remote shutdown work station to prevent adverse spurious operation of equipment that will affect the ability to bring the plant to a stable shutdown condition?
 - b. Provide worst case fire scenarios in which manual operations are needed.

Enclosure

- 280.4 SECY-93-087, "Policy, Technical, and Licensing Issues Pertaining to Evolutionary and Advance Light Water Reactor (ALWR) Designs," dated April 2, 1993, identifies the fire protection provisions that are expected for the AP600 that, in some cases, are different than current guidelines. Section 9.5.1.1.2 of the SSAR, Power Generation Design Basis, indicates the codes and documents that it utilizes for the AP600, but does not reference SECY-93-087. Section 9.5.1.1.2 of the SSAR should reference SECY-93-087 and provide a description of how the provisions are met by the AP600 design.
- 280.5 Does the AP600 design utilize fire wrap or fire barrier systems for cables or equipment? If fire wrap is utilized, describe the location, equipment and reason for providing fire wrap/fire barrier system.
- 280.6 Indicate the location of the eight hour battery packs (safety- and non-safety-related).
- 280.7 Section 9.5.1.2.1.3 of the SSAR, "Fire Water Supply System," indicates that there are two 100-percent fire pumps. Describe the fire area that will require the maximum fire water supply demand. Indicate approximate flows and pressures expected to meet the anticipated fire demand. What administrative controls are in place to assure that the fire pump and driver are properly sized for a specific site? Will each fire pump provide design flow and pressure to the most hydraulically demanding fire area with the shortest leg of the fire main out of service?
- 280.8 Describe the smoke control systems used to prevent smoke and hot gasses from affecting redundant safety-related and defense-in-depth equipment. Include references to codes and design manuals.

Service Water System

- 410.107 In Sections 9.2.1.1.2 and 9.2.1.2.2 of the SSAR, the function of the service water system is described as supplying cooling water to remove heat from the component cooling water system heat exchangers. In Figure 9.2.1-1, "SWS Piping and Instrumentation Diagram," it is shown that CCS Heat Exchangers A & B are served by the SWS.

In Figure C14-1 of the AP600 PRA, "SWS Simplified Piping and Instrumentation Diagram," the SWS serves not only the component cooling heat exchangers but also the turbine building closed cooling heat exchangers. Also, Section 14.2.8.1.5 of the SSAR states that the objective of the SWS preoperational testing is to demonstrate operation of the service water system to support the component cooling water system and the turbine building closed cooling water system. Furthermore, the March 30, 1993, response to Q410.105 states that the heat sink for the turbine building closed cooling water system is the service water system.

Is the turbine building closed cooling water system cooled by the service water system? Clarify the discrepancy and revise the SSAR and the PRA accordingly.

410.108 Section 9.2.1.4 of the SSAR, "Tests and Inspections," states that the performance, structure, and leaktight integrity of system components is demonstrated by operation of the system. It appears to the staff that the "operation of the system" does not provide any commitment for operational tests or inspections. However, Section C14.2.3 and Table C14-5 of the PRA states that it is assumed that most of components (pumps, heat exchangers, and valves involved in train operation change) are tested quarterly, and other components are assumed to be tested every 24 months at plant shutdown for refueling.

Confirm that the tests assumed for the PRA are a design requirement for COL applicants to carry out. If that is the case, revise Section 9.2.1.4 of the SSAR to delineate the testing and inspection program. In addition, because there are no technical specifications for the SWS, where will the test requirements in terms of the test frequency and acceptance criteria be specified?

410.109 In WCAP-13856, the AP600 RTNSS evaluation identified that the service water system (SWS) provides defense-in-depth functions during shutdown when in reduced inventory operations. Demonstrate that the following criteria are met by the system, or justify the deviation, if any.

- a. Does the SWS have an electric supply from both normal station ac and on-site non-safety-related ac power supplies that is separated, to the extent practicable?
- b. Is the SWS designed and arranged for conditions or an environment anticipated during and after events to ensure functional operability, maintenance accessibility, and plant recovery?
- c. Is the SWS protected against internal flooding and other in-plant hazards, such as the effects of pipe ruptures, jet impingement, fires, and missiles?
- d. Can the SWS withstand the effects of natural phenomena that have a reasonable likelihood? Important systems and components should be designed to remain functional after a natural phenomena, such as a seismic event, that is of reasonable likelihood or may persist longer than 72 hours.

- e. Is there a quality assurance program applied to the SWS that follows guidelines comparable to those of Generic Letter 85-06 for ATWS, and Appendices A and B of Regulatory Guide 1.155, "Station Blackout," for station blackout non-safety-related equipment?
- f. Is the SWS included in the reliability assurance and maintenance programs for proper maintenance, surveillance, and inservice inspection and testing to ensure the system's reliability is consistent with the determined goals for this system?
- g. Does the SWS have availability control mechanisms, including allowable outage time and surveillance requirements?
- h. Does the SWS have proper administrative controls for shutdown configurations?
- i. Does the SWS have sufficient redundancy to ensure defense-in-depth functions, assuming a single active failure of equipment or unavailability due to maintenance.

- 410.110 Provide additional information regarding the capability for detection, control, and isolation of radioactive leakage into and out of the SWS, and prevention of accidental release to the environment. The discussion should include both normal operation and post-accident operation.
- 410.111 Provide additional information regarding measures to preclude long-term corrosion and organic fouling that tend to degrade SWS performance. Is there any water treatment for the service water?
- 410.112 Provide additional information in Section 9.2.1.5 of the SSAR on the instrumentation that will indicate the valve positions of the SWS.
- 410.113 Describe how the SWS component allowable operational degradation is determined. Describe the procedures that will be followed to detect the degraded conditions when they become excessive.
- 410.114 Demonstrate that the SWS pumps have sufficient available net positive suction head (NPSH) at the pump suction locations considering low water levels. How much margin is there for the NPSH? Provide sufficient information for the staff to verify your conclusion.
- 410.115 Describe how AP600 SWS is designed to minimize the potential for water hammer.
- 410.116 Provide information with respect to the analysis of postulated cracks in moderate-energy piping systems for SWS.

Component Cooling Water System

410.117 Section 9.2.2.1.1 of the SSAR states that the component cooling water system (CCS) serves no safety-related function except for containment isolation. Explain why AP600 CCS does not have any safety-related function, other than containment isolation, as compared to the CCS of the current PWR plants, that has safety-related functions. Explain the function of each of the components in AP600 CCS to demonstrate that none of them perform any safety function. The discussion should consider CCS function during normal plant operation, LOCA or transient, LOOP, and shutdown plant operation.

410.118 Section 9.2.2 of the SSAR states that the component cooling water system is a non-safety-related, closed loop cooling system that transfers heat from various plant components to the service water system during normal phases of operation and removes core decay heat and sensible heat for normal reactor shutdown and cooldown from various plant components. The components that were referred to in the above statement are listed only in the proprietary version of the SSAR.

Without a description of those components, it is not possible to discuss and determine that the CCS is a non-safety-related system. The staff has determined that the description of those components should not be treated as proprietary information. Revise the SSAR to bring this information into the non-proprietary version of the SSAR.

410.119 Identify any interface requirements of the CCS and the SWS for COL applicants.

410.120 In WCAP-13856, the AP600 RTNSS evaluation identified that the component cooling water system (CCS) provides defense-in-depth functions during shutdown, reduced inventory operations. Demonstrate that the following criteria are met by the system, or justify the deviation, if any.

- a. Does the CCS have an electric supply from both normal station ac and on-site non-safety-related ac power supplies that is separated, to the extent practicable?
- b. Is the CCS designed and arranged for conditions or an environment anticipated during and after events to ensure functional operability, maintenance accessibility, and plant recovery?
- c. Is the CCS protected against internal flooding and other in-plant hazards, such as the effects of pipe ruptures, jet impingement, fires, and missiles?

- d. Can the CCS withstand the effects of natural phenomena that have a reasonable likelihood? Important systems and components should be designed to remain functional after a natural phenomena, such as a seismic event, that is of reasonable likelihood or may persist longer than 72 hours.
- e. Is there a quality assurance program applied to the CCS that follows guidelines comparable to those of Generic Letter 85-06 for ATWS, and Appendices A and B of Regulatory Guide 1.155, "Station Blackout," for station blackout non-safety-related equipment?
- f. Is the CCS included in the reliability assurance and maintenance programs for proper maintenance, surveillance, and inservice inspection and testing to ensure the system's reliability is consistent with the determined goals for this system?
- g. Does the CCS have availability control mechanisms, including allowable outage time and surveillance requirements?
- h. Does the CCS have proper administrative controls for shutdown configurations?
- i. Does the CCS have sufficient redundancy to ensure defense-in-depth functions, assuming a single active failure of equipment or unavailability due to maintenance.

480.121 For the SWS, Section 9.2.1.1 of the SSAR states that failure of the service water system or its components will not affect the ability of safety-related systems to perform their intended safety function. There is no similar statement in the SSAR for the CCS.

Clarify if the same statement is applicable for the CCS. Does the CCS meet the guidance of Position C.2 of RG 1.29 for the non-safety-related portions? Provide the bases for this position.

480.122 It is indicated in WCAP-13054 regarding compliance with Section 9.2.2 of the SRP that the AP600 design will meet the requirements of GDC 4. GDC 4 requires that SSCs important to safety shall be designed to accommodate environmental and dynamic effects. Demonstrate in the SSAR how GDC 4 is met by the CCS.

480.123 It is indicated in WCAP-13054 regarding compliance with Section 9.2.2 of the SRP that the AP600 design will meet the requirements of GDC 44, 45, and 46 for the CCS. Demonstrate in the SSAR how the above GDC are met by the CCS.

480.124 It is indicated in WCAP-13054 regarding compliance with Section 9.2.2 of the SRP that the AP600 design will meet IEEE 279 for CCS instrumentation. Demonstrate in the SSAR how this commitment for the AP600 CCS instrumentation is met. Specifically, provide additional information to address the staff review guidance stated in Paragraph III.4.d of Section 9.2.2 of the SRP with respect to meeting IEEE 279.

410.125 Section 9.2.2.6 of the SSAR, "Inspection and Testing Requirements," describes operational testing of CCS components without specifics, such as test frequency and acceptance criteria. However, Section C11.2.3 and Table C11-5 of the PRA states that it is assumed that most of components (pumps, heat exchangers, and valves involved in train operation change) are tested quarterly, and other maintenance valves are assumed to be tested once every refueling cycle.

Confirm that the tests assumed in the PRA are a design requirement for COL applicants to carry out. If that is the case, revise Section 9.2.2.6 of the SSAR to delineate the testing and inspection program. In addition, because there are no technical specifications for the CCS, where will the test requirements in terms of the test frequency and acceptance criteria be specified?

410.126 Describe how the AP600 CCS is designed to minimize the potential for water hammer.

410.127 Provide information with respect to the analysis of postulated cracks in moderate-energy piping systems for the CCS.

Turbine Building Closed Cooling Water System

410.128 Section 9.2.8.4 of the SSAR indicates that the performance of system components is demonstrated by continuous operation. Section 9.2.8.5 of the SSAR describes all of the instrumentation for the turbine building closed cooling water system. The instrumentation described does not include any temperature or valve position indicators. The staff finds that there are temperature indicators shown in the P&ID. If this is the case, revise the instrumentation description in Section 9.2.8.4 of the SSAR. If not, explain how the system heat removal function can be demonstrated by continuous operation without any temperature indicators. In addition, explain how leakage in the system can be detected and isolated.

410.129 Section 9.2.8.2.2 of the SSAR states that codes and standards applicable to the turbine building closed cooling water system are listed in Section 3.2. Table 3.2-3 of Section 3.2, "Classification of Components and Systems," is supposed to list this information. However, the staff finds that the turbine

building closed cooling water system is not included in the table. Revise Table 3.2-3 to include the above information for the turbine building closed cooling water system.

- 480.130 For the SWS, Section 9.2.1.1 of the SSAR states that failure of the service water system or its components will not affect the ability of safety-related system to perform its intended safety function. There is no similar statement in the SSAR for the turbine building closed cooling water system.

Clarify if the above statement for the SWS is applicable for the turbine building closed cooling water system. Does the turbine building closed cooling water system meet the guidance of Position C.2 of RG 1.29 for non-safety-related portions? Provide the bases for this position.

- 410.131 Describe how the AP600 turbine building closed cooling water system is designed to minimize the potential for water hammer.
- 410.132 Demonstrate that the turbine building closed cooling water system pumps have sufficient available net positive suction head (NPSH) at the pump suction locations.
- 410.133 Table 9.2.8-1 of the SSAR lists all of the components cooled by the turbine building closed cooling water system. Figure 9.2.8.1 of the SSAR is the P&ID for the system. The staff cannot find the isophase bus cooling units and miscellaneous pump motors in Figure 9.2.8.1, although they are listed in the table. Clarify the discrepancy and explain the function of these isophase bus cooling units and miscellaneous pumps.
- 410.134 Provide information with respect to the analysis of postulated cracks in moderate-energy piping systems for the turbine building closed cooling water system.

Steam and Power Conversion System

- 410.135 Provide a diagram of the steam and power conversion system in the non-proprietary portion of the SSAR, including a heat balance, in accordance with the guidance in RG 1.70.
- 410.136 Section 10.1.2 of the SSAR lists six protective features for the steam and power conversion system. Are any of these protective features safety-related?

Turbine Generator

- 410.137 Section 10.2.1.2 of the SSAR states that the turbine-generator is intended for baseload operation and also has load follow capability consistent with the capabilities of the Westinghouse NSSS. Clarify the term "load follow capability consistent with the capabilities of the Westinghouse NSSS." Is it a defined load?

Where is it defined? Is it the load that is consistent with the load demand from the reactor power control system? Is it specifically for the AP600 reactor, or is it subject to Westinghouse NSSS future design changes? Does it include the performance requirements of upset, emergency, and faulted conditions in accordance with RG 1.70?

- 410.138 Section 10.2.1.2 of the SSAR states that the main turbine system is designed in accordance with applicable interface requirements and system design requirements of the Westinghouse NSSS. What are the "applicable interface requirements" and "system design requirements" of the Westinghouse NSSS? Where are those requirements defined? Are there any specific SSAR sections that can be cross-referenced? Does the term "Westinghouse NSSS" mean the AP600 reactor and reactor control design?
- 410.139 Provide in the design bases of the turbine-generator section the information identified in RG 1.70 regarding the functional limitations imposed by the design or operational characteristics of the reactor coolant system (the rate at which the electrical load may be increased or decreased with and without reactor control rod motion or steam bypass).
- 410.140 Section 10.2.2 of the SSAR states that the turbine-generator consists of turbines, a generator, external moisture separator reheaters, an exciter, controls, and auxiliary subsystems as shown in Figure 10.2-1. The described components should be in a non-proprietary figure. The function of the exciter is not discussed anywhere in the SSAR. Describe the functions of the exciter in the SSAR.
- 410.141 Section 10.2.2 of the SSAR states that there are no safety-related systems or components located within the turbine building. Are there any safety-related structures that need to be considered for turbine-missile protection?
- 410.142 Section 10.2.5 of the SSAR provides a list of the turbine-generator instrumentation. However, it does not state where the instrumentation is located. Are all of the instrumentation listed in this section located in the control room? If not, where are they located?
- 410.143 WCAP-13054 indicates that the turbine-generator design for the AP600 design meets Criteria 1 through 7 of Section 10.2 of the SRP, with a few identified exceptions. Describe in Section 10.2 how each of the seven criteria is met.

410.144 Section 1.5.1 of Chapter 13 of the EPRI Utility Requirements Document (Volume III) specifies 22 key requirements (Sections 1.5.1.1 through 1.5.1.22) for design life, operability, reliability, accessibility, maintainability, and inspectability for the turbine-generator design for passive ALWRs. Describe how the turbine-generator design for the AP600 design meets each of these 22 requirements.

Main Steam Supply System

410.145 Section 10.3.2.2.1 of the SSAR states that the main steam lines between the steam generator and the containment penetration are designed to meet the leak-before-break (LBB) criteria. The application of LBB in current PWRs is only for the reactor coolant system, which has a reactor coolant pressure boundary leakage detection system in accordance with RG 1.45. In order to apply LBB to the main steam lines, it has to have a steam line leak detection that is comparable to the reactor coolant pressure boundary leakage detection. Describe the main steam leak detection systems, instrumentation, acceptable leak criteria, and the requirements to be included in the plant technical specifications.

410.146 Section 10.3.3 of the SSAR states that Section 3.2 provides the quality group classification, the required design and fabrication codes, and the seismic category applicable to the safety-related portion of the main steam supply and supporting systems. Section 3.2.4 states that Table 3.2-3 lists mechanical and fluid system components and their associated equipment class and seismic category as well as other related information. However, the staff cannot find the information on the quality group classification, the code requirements, and seismic category for the main steam supply system in Table 3.2-3 or Section 3.2. Provide the above information.

410.147 Section 10.3 of the SRP, "Main Steam Supply System," states that the system design should adequately consider steam hammer to assure that system safety functions can be achieved and that operating and maintenance procedures include adequate precautions to avoid steam hammer and relief valve discharge loads. Address the design considerations to prevent adverse effects of steam hammer in the SSAR.

The SSAR does not address any activity or program regarding personnel awareness of potential occurrence of steam hammer dynamics. The SSAR should include a statement that such a program should be developed and implemented by the COL applicant. Provide guidance for developing plant operating and maintenance procedures that will protect against a potential occurrence of steam hammer.

Main Condenser Evacuation System

410.148 Section 10.4.2.2.2 of the SSAR states that Section 3.2 provides the quality group and associated quality standards for the condenser air removal system. However, the staff cannot find the information on the quality group and associated quality standards of the condenser air removal system in Table 2-3 or Section 3.2 of the SSAR. Provide the above information.

Turbine Steam Sealing System

410.149 Section 10.4.3.4 of the SSAR states that the turbine steam sealing system is tested in accordance with written procedures during the initial testing and operation program. What and where are the written procedures for the initial testing and operation program? The staff cannot locate them in Chapter 14 or any other SSAR Chapter.

Auxiliary Steam System

410.150 Section 10.4.10.2.2 of the SSAR states that Section 3.2 provides the codes and standards for the auxiliary steam system. Section 3.2.4 states that Table 3.2-3 lists mechanical and fluid system component and its associated equipment class and seismic category as well as other related information. However, the staff cannot find the information on the code and standards of the auxiliary steam system in Table 3.2-3 or Section 3.2 of the SSAR. Provide the above information.

410.151 Section 10.4.10.4 of the SSAR states that the auxiliary steam system is tested prior to initial plant operation. How will the test be performed? Where is the test program? The staff cannot locate it in Chapter 14 or any other SSAR Chapter.