April 19, 1994

Docket No. 52-003

MEMORANDUM FOR: Richard W. Borchardt, Director
Standardization Project Directorate
Associate Directorate for Advanced Reactors
and License Renewal, NRR

FROM: Conrad E. McCracken, Chief
Plant Systems Branch
Division of Systems Safety and Analysis, NRR

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION (RAI) ON AP600 STANDARD SAFETY ANALYSIS REPORT (TACO NOS. M83803, M83809, M83810)

Enclosed are the RAIs from the Plant Systems Branch (SPLB). This request is based on our review of AP600 SSAR in the areas of Equipment Qualification, Flood Protection, Missile Protection, Fire Protection, Fission Product Control Systems, Spent Fuel Storage and Cooling Systems, Water Systems, Compressed and Instrument Air Systems, Drainage Systems, Diesel Generator Support Systems, Steam and Power Conversion Systems. There will be additional RAIs on HVAC systems from SPLB under separate cover.

Original signed by

Conrad E. McCracken, Chief
Plant Systems Branch
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Enclosure:
As stated

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Enclosure

REQUEST FOR ADDITIONAL INFORMATION
FROM THE PLANT SYSTEMS BRANCH
REGARDING AP600 SSAR

Environmental Qualification of Mechanical and Electrical Equipment

270.2a In section 3.11.1.2 it is stated that the methodology for environmental qualification of electrical equipment is based on guidelines provided in IEEE Standard 323-1983. To date the NRC staff has not endorsed 323-1983, therefore references to this standard in its entirety or in part are not acceptable. As indicated in a foot note to 10CFR 50.49 and stated in NUREG-0588 and Regulatory Guide 1.89, the guidance in IEEE standard 323-1974 is acceptable to the NRC staff for qualifying equipment within the scope of 10CFR 50.49. This question was addressed in a previous RAI, Q270.2 however the response is not acceptable because the NRC staff does not agree with the position that qualification to the 1983 revision of IEEE 323 is equivalent to qualification to the 1974 revision.

270.3a SSAR Sections 3.11.1.2 and 3.11.2.1 imply that qualification by analysis alone is not permitted for AP600; Appendix 3D page 3D-1 implies qualification by analysis only is permitted; Section 3D.6.2 states that the AP600 equipment qualification program does not establish qualification on the basis of analyses alone; in the sample equipment qualification data package (EQDP) page 3D-69 it is stated that the AP600 EQ program does permit qualification solely on the basis of analyses. However, in accordance with 10CFR 50.49(F) and NUREG-0588 paragraphs 2.1(2) and 22.1(4) and in accordance with previous NRC staff practice, qualification by analyses only is not acceptable. Environmental qualification of electrical equipment important to safety for AP600 should be in accordance with the requirements of 10CFR 50.49. Clarify your position. This question was also addressed in a previous RAI, Q270.3, however, as indicated here the updated SSAR that was intended to addressed this issue is inconsistent.

270.4 Section 3.11.1.1 states that a master list of safety-related electrical and mechanical equipment and a summary of electrical and mechanical equipment qualification results are maintained as part of the equipment qualification file. The SSAR should identify who will be responsible for establishing and maintaining these files.

270.5 In Section 3.11.1.2 it is stated that "Demonstration of qualified life by test and analysis (or both), with adequate justification, is provided by equipment suppliers, including the effects of aging when applicable." It is the NRC staff position that compliance with environmental qualification requirements is the responsibility the

COL applicant, not the equipment suppliers. The SSAR should be corrected to clearly state who is responsible for compliance with requirements.

270.6 In SSAR Section 3D.4.3 it is stated that "Equipment located in radiation-harsh zone experiences a total integrated dose (TID) of radiation in excess of 10^4 rads gamma (10^3 for integrated circuits [ICs] and microprocessors) during its install life." The NRC staff position is that equipment located in a radiation-harsh zone experiences a total integrated dose of radiation in excess of 10^4 rads gamma (10^3 for electronic equipment) during its install life. Electronic equipment includes Integrated circuits and microprocessors, however, Integrated circuits and microprocessors does not necessarily include all electronic equipment, therefore the SSAR should be updated to conform with the staff position.

270.7 In Section 3D.4.4 where clarifications to the IEEE 323-1983 recommended test sequence are discussed, item 2, "Performance Extremes Test", states "For equipment where seismic testing has previously been completed employing the recommended methods of IEEE 344-1987, seismic testing is not repeated. Testing of the equipment to demonstrate qualification at performance extremes is separately performed as permitted by IEEE 323-1983 Section 6.3.2(3)." This position is not consistent with IEEE 323-1974 Section 6.3.2(5) and is therefore unacceptable, because the staff has reviewed and approved the use of IEEE 323-1974 but has not approved the use of IEEE 323-1983. The SSAR should be updated to conform with the staff position. The position on Aging Simulation and Testing, outlined in item 3 of this section is also unacceptable because it is not consistent with IEEE 323-1974.

270.8 SSAR Section 3D.4.5.4 is title "Qualified Life Extension"; the NRC has not developed a final position on life extension, therefore, there is no provisions for approval or disapproval of this section as part of the design certification review. Consequently, the staff recommends removal of this section from the AP600 design certification review, and suggests that it be submitted for review under a life extension program.

270.9 SSAR sections 3D.4.6, 3D.4.7 and 3D.4.8 include discussions on operability time, performance criterion, and margin respectively. Although the SSAR states that these discussions are consistent with the staff positions on these issues, the staff has determined that these discussions are not consistent with staff practice as outlined in NUREG-0588 and Regulatory Guide 1.89. The staff believes that this is due, in part, to the SSAR's use of IEEE Standard 323-1983 rather than IEEE 323-1974. In order to eliminate the differences between the SSAR and staff positions, Westinghouse should use NUREG-0588 and Regulatory Guide 1.89 in conjunction with IEEE Standard 323-1974 with the understanding that, if the IEEE Standard differs from the NUREG and the Regulatory Guide then the guidance of the NUREG and Regulatory Guide should be followed. Note that the staff position is that operability time, performance criterion, and margin should be base on the AP600 accident analysis. The SSAR should be updated to conform with the staff's position on these issues.

270.10 Similarity is discussed in SSAR Section 3.D.10.2. It is not clear that the SSAR's discussion is consistent with staff practice on similarity. One of the most important aspects of the staff's position on this issue is that it is unlikely that similarity can be adequately demonstrated between equipment from different manufacturers. The SSAR's position should include consideration of the staff's practice on this issue.

270.11 In SSAR Section 3D.5 where the SSAR states that "normal conditions are those sets and ranges of plant conditions that are expected to occur regularly and for which plant equipment is expected to perform its safety-related function, as required, on a continuous, steady-state basis. Abnormal refers to the operating range in which the equipment is designed to operate for a period of time without any special calibration or maintenance effort. Design basis event conditions refers to environmental parameters to which the equipment may be subjected without impairment of its defined operating characteristics for those conditions." The descriptions of the three conditions are in terms of expected equipment performance rather than reactor operating conditions, consequently, the descriptions provide no information on the expected environmental conditions anticipated under each of the three conditions. In order for the staff to conduct a more meaningful review, the SSAR should discuss the anticipated environmental conditions associated with Normal, Abnormal, and Design basis event conditions.

270.12 In SSAR section 3D.5.5.1.1 where "Radiation Environment-Loss of Coolant Accident" is discussed, there is no specific identification of what accident source term is being use in the AP600 accident analysis. For example, is AP600 using the TID 14844 source term, the draft NUREG-1465 source term, the EPRI source term, or something entirely different from these three? The SSAR should clearly and specifically identify the source term used in the AP600 accident analysis.

270.13 In SSAR Section D.4.1.1 where "External Ambient Temperature (Ta)" is discussed, provide the SSAR's rationale for the following two sets of conditions: "(a) For equipment located in areas supplied by an air-conditioning system, a typical value assumed for (Ta) throughout the qualified life is 77°F (25°C). For air-conditioning systems, two excursions per year to 91°F (33.3°C), each lasting 72 hours, has a negligible additional effect. (b) For equipment located in areas supplied by a ventilation system, a typical value assumed (Ta) throughout the qualified life is 68°F (20°C). Two excursions per year to 122°F (50°C), each lasting 72 hours, has a negligible additional aging effect."

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 In Appendix 9A, SSAR Section 9A.2.7.1, "Independence of Affected Fire Areas", it states, "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 AP-600.

b. How does the AP-600 credited safety related equipment provide at least the same safety margin when compared to current 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 In Appendix 9A, SSAR Section 9A.2.7.1, "Manual Operation" it states, "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, 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

280.4 SECY 93-087 Policy, Technical, and Licensing Issues Pertaining to Evolutionary and Advance Light Water Reactor (ALWR) Designs identifies the fire protection provisions that are expected for AP-600 which in some cases are different than current guidelines. Section 9.5.1.1.2

Power Generation Design Basis indicates the codes and documents that it utilizes for AP-600 but does not reference SECY 93-087. Section 9.5.1.1.2 should reference SECY 93-087 and provide a description of how the provisions are met by the AP-600 design.

280.5 Does the AP-600 utilize fire wrap, or fire barrier systems for cables or equipment? If fire wrap is utilized, describe location, equipment and reason for providing fire wrap/fire barrier system.

280.6 Indicate location of eight hour battery packs (safety and non-safety).

280.7 Section 9.5.1.2.1.3, "Fire Water Supply System," indicates that there are two 100 percent fire pumps. Describe the fire area which 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 SSAR Section 9.2.1.1.2 and 9.2.1.2.2, the function of the service water system is described as supplying cooling water to remove heat from 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 AP600 PRA Figure C14-1, 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, SSAR Section 14.2.8.1.5 describes 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, your 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/PRA accordingly.

410.108 In SSAR Section 9.2.1.4, Tests and Inspections, it is stated 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 " hardly provides any commitment for operational tests or inspections. However Section C14.2.3 and Table C14-5 of 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 SSAR Section 9.2.1.4 to delineate the testing and inspection program. In addition, since 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 provides defense-in-depth functions during shutdown, reduced inventory operations. Demonstrate to the staff that the following criteria for the defense-in-depth systems are met by the system, or justify the deviation, if any.

1. Have an electric supply from both normal station ac and on-site non-safety-related ac power supplies that is separated;

2. Are designed and arranged for conditions or an environment anticipated during and after events;

3. Are protected against internal flooding and other in-plant hazards, such as the effects of pipe ruptures, jet impingement, fires, and missiles;

4. Can 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;

5. Have a quality assurance program applied to them 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;

6. Are included in the reliability assurance and maintenance programs for proper maintenance, surveillance, and inservice inspection and testing to ensure the systems' reliability is consistent with the determined goals;

7. Have availability control mechanisms including allowable outage time and surveillance requirements;

8. Have proper administrative controls for shutdown configurations; and

9. Have sufficient redundance 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 SSAR Section 9.2.1.5 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 It is stated in SSAR Section 9.2.2.1.1 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, which has safety-related function. 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. These components that were referred in the above statement are not defined in the non-proprietary version of the SSAR, but are listed in the proprietary version.

Without the 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 cannot be treated as proprietary information. Revise the SSAR to bring this information into the non-proprietary version.

410.119 Based on the AP600 design of CCS and SWS, identify, if any, interface requirements for COL applicants?

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

1. Have an electric supply from both normal station ac and on-site non-safety-related ac power supplies that is separated;

2. Are designed and arranged for conditions or an environment anticipated during and after events;

3. Are protected against internal flooding and other in-plant hazards, such as the effects of pipe ruptures, jet impingement, fires, and missiles;

4. Can 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;

5. Have a quality assurance program applied to them 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;

6. Are included in the reliability assurance and maintenance programs for proper maintenance, surveillance, and inservice inspection and testing to ensure the systems' reliability is consistent with the determined goals;

7. Have availability control mechanisms including allowable

outage time and surveillance requirements;

8. Have proper administrative controls for shutdown configurations; and

9. Have sufficient redundance to ensure defense-in-depth functions, assuming a single active failure of equipment or unavailability due to maintenance.

480.121 For the SWS, SSAR Section 9.2.1.1 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. For CCS, we can not find a similar statement in the SSAR.

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

480.122 It is indicated in WCAP-13054 for SRP 9.2.2 that AP600 will meet the requirement of GDC 4. GDC 4 requires that SSC important to safety shall be designed to accommodate the environmental and dynamic effects. Demonstrate in the SSAR how GDC 4 is met by AP600 CCS.

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

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

410.125 In SSAR Section 9.2.2.6, Inspection and Testing Requirements, it describes operational testing of CCS components without much specifics such as test frequency and acceptance criteria. However Section C11.2.3 and Table C11-5 of 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 for the PRA are a design requirement for COL applicants to carry out. If that is the case, revise SSAR Section 9.2.2.6 to delineate the testing and inspection program. In addition, since 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 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 CCS.

Turbine Building Closed Cooling Water System

410.128 SSAR Section 9.2.8.4 indicates that the performance of system components is demonstrated by continuous operation. SSAR Section 9.2.8.5 describes all 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 SSAR Section 9.2.8.4 instrumentation description. If not, explain how the system heat removal function can be demonstrated by continuous operation without any temperature indicators.

Explain how leakage in the system can be detected and isolated.

410.129 SSAR Section 9.2.8.2.2 states that codes and standards applicable to the turbine building closed cooling water system are listed in Section 3.2. Section 3.2, Table 3.2-3, 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, SSAR Section 9.2.1.1 states that failure of the service water system or its components will not affect the ability of safety-related system to perform their intended safety function. For the turbine building closed cooling water system, we can not find a similar statement in the SSAR.

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

410.131 Describe how 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 SSAR Table 9.2.8-1 listed all the components cooled by the turbine building closed cooling water system. SSAR Figure 9.2.8.1 is the P&ID for the system. We can not 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 what the isophase bus cooling units and miscellaneous pumps are.

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 an diagram of the steam and power conversion system in the non-proprietary SSAR, including a heat balance, in accordance with the guidance in RG 1.70.

410.136 SSAR Section 10.1.2 lists six protective features for the steam and power conversion system. Are any of these protective features safety-related?

Turbine Generator

410.137 SSAR Section 10.2.1.2 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 of "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 consistent with the load demand from the reactor power control system? Is it specifically for 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 SSAR Section 10.2.1.2 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 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 about the functional limitations imposed by the design or operational characteristics of the reactor coolant system (rate at which electrical load may be increased or decreased with and without reactor control rod motion or steam bypass).

410.140 SSAR Section 10.2.2 describes that the turbine-generator consists of turbines, a generator, external moisture separator reheaters, 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 what the exciter is about.

410.141 SSAR Section 10.2.2 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 SSAR Section 10.2.5 provides a list of the turbine-generator instrumentation. However, it does not state where the instrumentation are located. Are all 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 AP600 meets SRP Section 10.2, Criteria 1 through 7 with a few identified exceptions. Describe in SSAR Section 10.2 how each of the seven criteria is met.

410.144 Section 1.5.1, Chapter 13 of 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 of passive ALWRs. Describe how the turbine-generator design for AP600 meets each of these 22 requirements.

Main Steam Supply System

410.145 Section 10.3.2.2.1 states that the main steam lines between the steam generator and the containment penetration are designed to meet the leak before break criteria. The application of "leak before break" 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 "leak before break" for 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 AP600 SSAR states that Section 3.2 provides the quality group classification, the required design and fabrication codes, and seismic category applicable to safety-portion of this system (main steam supply) and supporting systems. 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, we can not find the information on the quality group classification, code requirements, and seismic category of the main steam supply system in Table 3.2-3 or Section 3.2. Provide the above information.

410.147 SRP Section 10.3, 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.

In the SSAR, the applicant does not address any activity or program regarding personnel awareness of potential occurrence of steam hammer dynamics. The applicant should clearly note the need for such a program as an activity for the COL applicant and 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 AP600 SSAR states that Section 3.2 provides the quality group and associated quality standards for the condenser air removal system. However, we can not find the information on the quality group and associated quality standards of the condenser air removal system in Table 3.2-3 or Section 3.2. 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? We can't find them in Chapter 14 or any other SSAR section.

Auxiliary Steam System

410.150 Section 10.4.10.2.2 of AP600 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, we can not find the information on the code and standards of the auxiliary steam system in Table 3.2-3 or Section 3.2. 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? We can't find it in Chapter 14 or any other SSAR section.

Compressed and Instrument Air Systems

410.152 Provide rational for why the compressed and instrument air systems (CAS) design in SSAR Section 9.3.1 differs from Section 7 of Chapter 9 of the EPRI Passive Utility Requirements Document which specifies that the CAS will consist of three **separate** and **isolated** subsystems: the plant service air system, the instrument air system, and the breathing air system?

410.153 Provide rational for how you plan to ensure in SSAR Section 9.3.1 that (1) the compressed and instrument air systems are free of all corrosive contaminants and hazardous gases, flammable or toxic, which may be drawn into the airstream and (2) the breathing air subsystem is free of radioactive contamination (See Information Notice 85-06)? Are the compressor intakes located in an area free of corrosive contaminants and hazardous gasses? Will regular periodic checks be made to assure high quality air?

410.154 Revise SSAR Section 9.3.1 to reflect the following:

a. Provide a list of the building(s) in which the major components of the compressed and instrument air systems are located.

b. Provide the minimum particle size that the compressor intake filter is designed to remove.

c. State that each individual air compressor is designed for 100% capacity.

d. Provide a more detailed list of the instrumentation and controls that are provided in the main control room.

e. Provide information about (1) sample lines and valves for obtaining air samples and (2) a periodic air quality sampling program.

f. Provide information regarding the air quality of the breathing air subsystem. Does the air quality meet ANSI/CGA G-7.1 requirements?

g. State how the compressed and instrument air system complies with Generic Issue 43. (Including Generic Letter 88-14 and NUREG-1275)

410.155 Appendix CC2 of the PRA contains more specific information than is found in SSAR Section 9.3.1. Revise the SSAR to incorporate the following information:

a. Table C22-8 discusses three separate pressure transmitters, one per compressor, that are internal to the compressors and measure discharge header pressure.

b. Section C22.2.2 discusses a low pressure signal, from a pressure transmitter on the common line downstream of the three air compressor trains, that provides the signal to auto actuate the standby compressors.

c. Section C22.6.1 states that the air receivers are large enough to provide sufficient air at the proper pressure to maintain the operation of the valves in a loss of offsite power event until the air compressors are sequenced on the DG's.

410.156 Provide rational for why SSAR Section 9.3.1.1.2 states "... and **essentially** oil-free air for pneumatic instruments" when SSAR Section 9.3.1.2.2 states that "The three **oil-free** rotary compressors ...?" If the air compressors are not truly oil-free, then what is the maximum total oil or hydrocarbon content, excluding the non-condensables?

410.157 The information contained in SSAR Table 9.3.1-1 is incomplete. Provide the following additional information in Table 9.3.1-1: a brief description, the function, and the normal and fail-safe positions of each safety-related pneumatically operated valve.

410.158 Provide rational for why SSAR Figure 9.3.1-1 (Sheet 2 of 2) shows (1) the instrument air dryers (1A and 1B) and (2) the breathing air emergency backup bottles with a dotted line? Does this mean they are not part of the system?

410.159 Revise SSAR Section 9.3.1.2.2 to reflect the following:

a. Revise the last sentence in the second paragraph to state "The test performance criteria shall be -28°F dewpoint at line pressure in accordance with **ANSI/ISA-S7.3-1975 (R1981)**."

b. Revise the last sentence in the third paragraph to state "The afterfilters are a disposable cartridge filter capable of removing 98 percent of one micron and larger particulates and 100 percent of three micron and larger particulates in accordance with **ANSI/ISA-S7.3-1975 (R1981)**."

c. State that the air quality (-28°F dewpoint and particulates $\leq$ 3 microns) meets the manufacturer's air supply requirements for all pneumatic equipment that is either safety-related or relied upon to perform a safety function.

410.160 SSAR Section 9.3.1.3 describes the use of safety-grade air accumulators or other devices to provide short-term operation of the safety-related pneumatic valves following loss of air.

a. Explain what are the "**other devices**."

b. Provide a list of all safety-related pneumatically operated valves (required to change valve position to achieve safe shutdown and accident mitigation) that are furnished with safety-related backup air accumulators and/or other devices.

c. Explain how you plan to ensure the adequacy and reliability of the safety-related backup accumulators and or other devices. NUREG-1275, Vol. 2 recommends (a) periodic testing of safety-grade backup accumulator check valves for leakage; (b) monitoring and/or alarming accumulator pressure; and (c) verifying the adequacy of safety-related accumulators.

410.161 Revise SSAR Section 9.3.1.4 to state "During the initial plant testing prior to reactor startup ... upon **a complete and sudden** loss**, a gradual loss, and an increase of compressed air pressure** as described in **Regulatory Guide 1.68.3**." This information should also be provided in Section 14 of the SSAR.

410.162 Section 6.3.2.2.7.6 of the proprietary version of the SSAR discusses the use of backup safety-related air accumulators for the fourth stage ADS valves. Revise the SSAR to incorporate the following:

a. Include the information provided in the proprietary version of Section 6.3.2.2.7.6, regarding the backup safety-related air accumulators for the fourth stage ADS valves, in the text of the non-proprietary version of the SSAR.

b. Include these backup safety-related accumulators in a non-proprietary figure.

c. Revise the SSAR to include information about (1) leak testing the accumulators, (2) seismic qualification of the accumulators, (3) the ability of the accumulators to open the valves against maximum containment pressure, (4) the capacity of the accumulators, and (5) testing of the accumulators in accordance to Regulatory Guide 1.68.3.

d. IE Bulletin No. 80-01 concerns the operability of the pneumatic supply for ADS valves for Licensees of GE BWR facilities. However, the bulletin may be relevant to the AP600 design regarding the use of backup safety-related air accumulators. Do the AP600 backup safety-related air accumulators conform with IE Bulletin No. 80-01?

Equipment and Floor Drainage Systems

410.163 Revise SSAR Figure 9.2.9-1 to agree with the system description in Section 9.2.9. For example, the turbine building drain tanks and pumps, referred to in the system description, are not given the same title in the figure.

410.164 Provide rational for how the radioactive waste drain system in SSAR

Section 9.3.5 is routed and/or sealed to prevent cross flow of airborne radioactivity between building rooms and/or compartments where such cross flow is undesirable?

410.165 Do any of the equipment and floor drainage systems in SSAR Section 9.3.5 collect equipment and floor drains from any building, rooms, and/or compartments that contain any safety-related systems or components? If so, provide rational for the following:

1. Why are redundant sumps not provided for the equipment and floor drainage systems? Why are the equipment and floor drainage systems not divisionally separated?

2. Are any of the sumps in the equipment and floor drainage systems utilized for detecting leakage in safety systems? If so, is this the only means for such leakage detection?

3. Why is flood protection not integrated into the equipment and floor drainage systems?

410.166 Provide rational for how backflooding is prevented in the radioactive waste drain system (Section 9.3.5) and in the liquid radwaste system (Section 11.2)?

410.167 Explain why SSAR Section 9.3.5 discusses sumps and drain tanks and Figure 9.3.5-1 only shows sumps?

410.168 Revise the third paragraph in SSAR Section 9.3.5.1.1 to state: "Safety-related systems, structures, or components are not damaged as a result of equipment and floor drain components failure from a seismic event."

410.169 SSAR Section 9.3.5.1.1 states that "In general, drain systems that carry radioactive wastes do not contain piping connections that could allow inadvertent transfer of radioactive fluid into nonradioactive piping systems. Where connections exist, backflow prevention is provided in the nonradioactive piping." Provide a list of these connections and their locations. Describe the backflow prevention that is being used. What is the safety and seismic classification of the backflow prevention?

410.170 SSAR Section 9.3.5.3 states that the containment wall collection gutter subsystem and backflow preventers are described in Section 11.2. However, they are not described in Section 11.2. Provide this information in the SSAR.

Diesel Generator Support Systems

410.171 In accordance with WCAP-13856, the onsite standby power system is classified as a "Defence In Depth (DID)" system. Therefore, the diesel generator support systems should also be classified as DID systems. SSAR Section 9.5.4 only discusses the diesel generator fuel oil storage and transfer system and Section 8.3.1.1.2.1 only lists the titles of all of the diesel generator support systems. Provide more detailed information in the SSAR on the following other diesel generator support systems: diesel engine cooling subsystem, diesel engine starting subsystem, diesel engine lubrication subsystem, and diesel engine combustion air intake and exhaust subsystem. In accordance with the NRC staff review approach for non-safety-related systems identified as important by the RTNSS process or as "DID" systems, the following criteria should be met:

a. Sufficient redundancy.

b. Electric supply from separate buses of both normal station ac and on-site non-safety-related ac power supplies as practicable.

c. Functional operability, maintenance accessibility, and plant recovery during and after accident conditions including severe accidents (if required).

d. Protection against internal flooding and other plant hazards, such as the effects of pipe ruptures, jet impingement, fires, and missiles.

e. Withstand the effects of natural phenomena such as a seismic event.

f. Quality assurance program comparable to Generic Letter 85-06 for ATWS and R.G. 1.155 for "Station Blackout."

g. Reliability assurance and maintenance programs for proper maintenance, surveillance, and inservice inspection and testing.

h. Availability control mechanisms such as, simple technical specification control, including allowable outage time and surveillance requirements.

i. Proper administrative controls for shutdown configurations.

Provide your detailed rationale regarding conformance with the above criteria in order for staff to conclude that the diesel generator support systems are qualified to be "DID" systems. Revise AP600 SSAR accordingly to reflect the above rationale to categorized these systems as "DID" systems.

410.172 Explain how the deleterious effects that dust and dirt have on diesel generator operation and reliability will be minimized. (Including the effects on electrical equipment)

410.173 Provide a list of all of the diesel generator trips and state whether they are in effect only during testing or during all operational modes.

Diesel Generator Fuel Oil Storage and Transfer System

410.174 Provide rational for the following regarding SSAR Section 9.5.4:

a. Why is cathodic protection, in accordance with NACE Standard RP-01-69, not provided for all external surfaces of buried metallic piping and tanks.

b. Why is the fuel oil system designed without an overflow line on the day tanks.

c. How is the fuel oil in the fuel oil storage tanks and day tanks in SSAR Section 9.5.4 maintained above the cloud point. What is the minimum expected outdoor temperature?

d. Is the day tank physically located at an elevation that assures a slight positive pressure at the suction of the engine-driven fuel oil pump?

e. Are the two above-ground fuel oil storage tanks protected from excessive heat which can contribute to the degradation of the fuel oil? (Are they sheltered or painted with reflective paint?)

410.175 Revise SSAR Section 9.5.4 to reflect the following:

a. State the grade of the diesel fuel oil that will be used. (Including: cloud point, flash point, and viscosity)

b. Describe the method used for the addition of new fuel oil to the fuel oil storage tank to minimize the creation of turbulence of accumulated residual sediment in the bottom of the tank.

c. Provide the distance that the tap for the fuel oil storage system is from the bottom of the fuel oil storage tank.

d. Revise the SSAR to state that the fuel oil storage tank and the day tank will be periodically checked for accumulation of water.

410.176 Revise SSAR Figure 9.5.4-1 to show the whole system including the day tank and the piping from the day tank to the Diesel Generator.

410.177 SSAR Section 9.5.4.2.3 states that the fuel oil storage tank fill line is approximately 4 feet above grade. Is this higher than the PMF flood level?

410.178 Provide a response for the following questions regarding SSAR Section 9.5.4.5.1:

a. Is new fuel oil sampled in accordance with ASTM D4057?

b. Is the fuel oil tested in accordance with ASTM D975, ASTM 1552, and ASTM 2622?

c. Is particulate concentrations determined in accordance with ASTM D2276?

410.179 Provide responses to the following questions regarding the diesel engine combustion air intake and exhaust system:

a. Describe how diesel generator exhaust gases are prevented from diluting or contaminating the combustion air intake. Are there any louvers, dampers, grills, etc. from which the exhaust gases could circulate back into the diesel generator building?

b. Is the combustion air filter module capable of reoucing airborne particulate material over the entire time period that power is required assuming the maximum airborne particulate concentration at the combustion air intake?

410.180 Provide responses to the following questions regarding the diesel engine starting air system:

a. What is the number of successive times that the starting air system is capable of starting a cold diesel engine without recharging the receiver(s)?

b. Are alarms provided in the main control room that alert the operators that the air receivers have fallen bellow the minimum allowable value?

c. Is the starting air system supply air maintained with a dew point of at least 10°F less than the lowest expected ambient temperature?

d. Is the starting air system capable of removing air particulate that could foul components in the system?

410.181 Provide responses to the following questions regarding the diesel engine cooling water system:

a. Does the cooling water system provide the diesel with circulation of heated water while the engine is in standby to increase the eng.ne first try starting reliability?

b. Is the cooling water system provided with temperature sensors to alert the operator when cooling water temperatures exceed the limits recommended by the manufacturer?

c. Is the cooling water system capable of being vented to assure that all spaces are filled with water?

d. Can the cooling water system and the diesel generator perform for extended periods of time when less than full electrical power generation is required without degradation of performance or reliability?

410.182 Provide responses to the following questions regarding the diesel engine lubrication system:

a. Does the lubrication system provide the diesel with circulation of heated lubricating oil while the engine is in standby to increase the engine first try starting reliability?

b. Are alarms provided in the main control room that alert the operators that the temperature, pressure, and level have exceeded the ranges recommended by the manufacturer?

410.183 Describe how the AP600 design addresses the following recommendations of NUREG/CR-0660:

a. Moisture in starting air system
b. Dust and dirt in diesel generator room
c. Personnel training
d. Automatic prelube
e. Testing, test loading, and preventive maintenance
f. Improve identification of cause of failures
g. Diesel generator ventilation and combustion air systems
h. Fuel storage and handling
i. High-temperature insulation
j. Engine cooling water
k. Vibration of instruments

Fission Product Control Systems

410.184 SSAR Section 6.5.3 does not provide information on system and component descriptions for the fission product control systems. If there is no such system for AP600, SSAR Section 6.5.3 should be either rewritten to explain which systems or components will perform the fission product control function or deleted.

Waste Water System

410.185 Regarding waste water drainage in the plant, SSAR Section 9.2.9 states, in part, that level controls are provided for the building sumps, surge tank, and waste water retention basin to prevent overflow. The staff is concerned that the drainage system to the sump or surge tank may fail because of events such as an earthquake. Provide information on flood levels and the methods for draining out the water after a limiting pipe break assuming a period of water leakage while the operator isolates the problem area. Also, identify any safety-related equipment in other plant areas will be affected by such flooding due to pipe rupture.

Circulating Water System

410.186 SSAR Section 10.4.5.2 states that the circulating water system (CWS) and cooling tower are applicable to a broad range of sites. On other ALWRs, the heat sinks for the CWS are site dependent. A conceptual design and interface requirements are provided for the normal heat sink and, in some cases, for portions of the CWS that are outside of the design certification scope. The SSAR did not provide sufficient information on CWS design or alternative design requirements, such as protecting safety-related equipment in the event of failure of the CWS, and locating the cooling tower far enough from safety-related structures to prevent damage in the event of cooling tower failure. Provide design descriptions and interface requirements for the CWS as required by 10 CFR Part 52.

410.187 SSAR Section 10.4.5.2.2 states, in part, that the CWS is designed to withstand the maximum operating discharge pressure of the CW pumps. However, flooding may occur in the turbine building if the CWS piping fails. Provide analysis for the effects of a postulated failure of the CWS piping or expansion joints and verify that any safety-related structures, systems, and components in the turbine building will be protected from the resulting flood water level.

Startup Feedwater System

410.188 SSAR Section 10.4.9.1.2 states, in part, that the startup feedwater system (SFS) is a non-safety system serving as a first-line of defense for loss of feedwater events, but the passive core cooling system is a safety system which provides safety grade protection for such events. Demonstrate to the staff that the following criteria for the defense-in-depth systems are met by the system, or justify the deviation, if any.

1. Have an electric supply from both normal station ac and on-site non-safety-related ac power supplies that is separated;

2. Are designed and arranged for conditions or an environment anticipated during and after events;

3. Are protected against internal flooding and other in-plant hazards, such as the effects of pipe ruptures, jet impingement, fires, and missiles;

4. Can 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;

5. Have a quality assurance program applied to them 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;

6. Are included in the reliability assurance and maintenance programs for proper maintenance, surveillance, and inservice inspection and testing to ensure the systems' reliability is consistent with the determined goals;

7. Have availability control mechanisms including allowable outage time and surveillance requirements;

8. Have proper administrative controls for shutdown configurations; and

9. Have sufficient redundance to ensure defense-in-depth functions, assuming a single active failure of equipment or unavailability due to maintenance.

410.189 SSAR Section 10.4.9.1.2 indicates tnat the instruments and electric valves for each of the two startup feedwater pumps are powered by the standby source motor control center circuitry. Describe the failure position of the electrically operated valves at pump suction and discharge lines.

410.190 SSAR Section 10.4.7.1.1 indicates that double valve startup feedwater isolation is provided by the startup feedwater control valve (SFCV) and the startup feedwater isolation valve (SFIV). The SFIV serves as a containment isolation valve and closes on a containment isolation signal or backflow in the line. Explain whether the SFCV will close on a containment isolation signal and subject to Appendix J leak testing. If not, what are the closure actuation and leakage test requirements for the SFCV.

<u>Flood Protection</u>

410.191 Are there penetrations in the walls between electrical equipment rooms? How is flood water in an electrical equipment area that may result from firefighting activities or flood water due to a crack in a Fire Protection System (FPS) water line in the corridor of the electrical equipment areas of the auxiliary bldg prevented from spreading to other rooms?.

410.192 Where are the areas housing the 2 non-Class 1E electrical equipment and penetration rooms and how are they protected from water spray if the Fire Protection System actuates? How is Class 1E electrical equipment protected from spray if the FPS actuates?

410.193 How are battery rooms protected from water (both flood and spray) if the 1" Demineralized Water System (DMWS) piping fails in the auxiliary building corridor? Although the DMW lines are routed in the corridor, water spray can still affect the equipment in the battery rooms if the doors are not closed. Are there requirements for closure of these doors? Also, if these doors are not watertight, how is flooding in the corridors from a failure of the FPS or DMWS piping prevented from affecting multiple battery rooms?

410.194 Where is flood water routed should the Spent Fuel System (SFS) fail? There are no sumps shown in the SFS area on SSAR Fig. 1.2-2.

410.195 The response to RAI 410.11 states that the Operator's area of MCR on Level 4 (1 7'-6") uses potable water and that water is contained such that leakage won't damage electrical equipment in the MCR. How is this accomplished?

410.196 Westinghouse should add the table provided in response to RAI 410.27 which lists the safety-related equipment requiring flood protection to the SSAR. In addition, Westinghouse should add the information in the response to RAI 435.56 regarding flood protection for I&C equipment to SSAR Section 3.4.1. Include the caveats regarding information not in the table (i.e. regarding safety-related equipment above the maximum flood level and passive components).

410.197 Provide design criteria for penetrations between Nuclear Island (NI) buildings and non-NI buildings and between NI buildings which prevent a flooding between these buildings.

410.198 The SSAR should include Westinghouse's response to RAI 410.39 regarding interior wall design and hydrostatic loads. In addition, the SSAR should state that all walls, floors, doors, and penetrations should be able to withstand the maximum anticipated hydrodynamic loads associated with a pipe failure.

410.199 Provide information on how the control room will be protected from flooding.

410.200 How will roof design prevent ponding beyond the structural capacity of the roofs of SR buildings?

410.201 Include an evaluation of the flood effects on safety-related equipment if flooding occurs with the drains blocked. Provide design classification for the drain system.

410.202 Identify location of HVAC ductwork serving areas which house safety-related (SR) equipment and components in relation to the maximum flood height. Is HVAC ductwork divisionally separated?

410.203 Include COL information which requires the COL applicant to provide an updated flood analysis incorporating as-built information in the SSAR.

410.204 Westinghouse's response to RAI 410.45 states that flooding in auxiliary building is detected by non-safety-related sump level sensors. There is 1 sensor for each of the 4 sumps on Level 1 of the auxiliary building. Each alarms in the control room when level reaches sump pump actuation setpoint. Safety-related instrumentation is not required because flooding is controlled so that it doesn't affect safety-related (SR) equipment. How is this accomplished?

Internally-Generated Missiles Outside Containment

410.205 Identify those systems which are classified as moderate-energy systems based on the 2% and 1% rules.

410.206 Westinghouse's response to Q410.60 states that hydrogen is supplied to the CVS inside containment from 1-550 scf H_2 bottle located in the plant gases storage tank area. The maximum concentration within the CVS compartment was found to be 4.3%, less than the detonation limits in NUREG/CR-2017. Areas other than the CVS compartment were also considered with maximum concentration being ~4.4% in the valve/piping penetration room at 100' elevation of the Aux Bldg (12420 ft^3). However, this apparently assumes uniform mixing within the containment. How is this assured?

Additionally, the CVS has high-energy (HE) portions in the auxiliary building which are not designed to Code requirements. Specifically, this includes the portion of CVS from the makeup pumps to the CIVs. Are these HE portions separated from safety-related equipment in the auxiliary building? If so, what is the nature of the separation? Is it by physical spacing, by separate enclosures, or by the use of barriers? How will safety-related (SR) SSCs be protected from missiles generated during a postulated failure of this portion of the CVS?

410.207 Provide justification for why rotating components that are operated less than 2% of the time are also excluded as missile sources.

410.208 SSAR Section 7.4 identifies safety-related equipment located outside containment. This should be referenced in 3.5. There is no equipment important to safety whose failure could adversely affect safety-related equipment (Q410.27). Clarify why this is the case. Further, SSAR Section 3.7.3.13 discusses methods of protecting safety-related SSCs from adverse interaction with non-safety-related SSCs. 3.7.3.13.1 says that physical separation is provided between safety-related and non-safety-related SSCs <u>to the maximum extent possible.</u> Clarify how safety-related SSCs are protected if the physical separation cannot be achieved. Any nonseismic component identified as a source is evaluated according to guidelines in 3.7.3.13.1 through 3.7.3.13.3 and appropriate protection is provided. SSAR Section 3.5.1.1 should reference 3.7.3.13.

410.209 In response to RAI 410.54, Westinghouse stated that protection of safety-related SSCs from failure of non-safety-related SSCs is accomplished by separation, as discussed in SSAR Subsection 3.7.3.13.1. 3.7.3.13 clarifies the approach used to protect safety-related SSCs from the failure of nonseismic SSCs. However, it is still unclear whether protection of safety-related SSCS from nonseismic SSCs is ever achieved through the use of enclosure of safety-related SSCs in compartments.

410.210 Discuss gravitational missiles in regard to their potential for generating missiles.

410.211 Westinghouse states in the response tp 410.52 that protection of safety-related equipment from turbine generator (TG) missiles is described in SSAR Section 3.5.1.3 and is achieved by proper orientation of the TG set and the use of fully integral low-pressure turbine rotors. The report on rotors with shrunk-on discs was approved by NRC in reference 2 of 3.5.1.3 and the methodology for fully integral motors was submitted in reference 1 of 3.5.1.3. These references have been deleted from the SSAR and should be put back as should reference 3 referred to in the response.

410.212 Is there any safety-related equipment in the 25^{0} strike zone of the TG?

410.213 Westinghouse states that AP-600 uses only safety-related systems and equipment to establish and maintain safe-shutdown conditions. There is no equipment important to safety (as defined in Q410.27) that requires missile protection. Provide justification for this statement.

410.214 Are any safety-related systems or systems important to safety protected from missiles through the use of barriers? If so, what are the barrier dimensions (wall thicknesses, etc.).

410.215 Are any safety-related systems or systems important to safety protected from missiles solely by providing sufficient distance between them and the missile source? If so, what is the minimum safe distance?

410.216 How are the main control room (MCR) and Remote Shutdown Workstation (RSW) protected from internally-generated missiles (outside containment)?

410.217 Provide justification for the statement that rotating equipment in the auxiliary building is not a credible missile source if the equipment is used less than 2% of the time. This includes pumps that operate < 2% of the time and motors for valve operators and mechanical handling equipment and pumps.

410.218 What methodology is used to determine if a pump or motor casing can contain a missile generated by the failure of rotating equipment?

Internally-Generated Missiles Inside Containment

410.219 Westinghouse's response to Q410.63 states that no safety-related

(SR) equipment or equipment important to safety requires protection from internally-generated missiles since there are no credible missile sources. This is an incorrect characterization. In fact, there is safety-related equipment which requires missile protection. The means of providing protection is by ensuring that there are no credible missile sources. SSAR Section 3.5 should clearly state what safe shutdown structures, systems, and components must be protected from missiles [internally-generated (outside containment), internally-generated (inside containment), turbine generator, those generated by natural phenomena, and externally-generated]. If the same SSCs must be protected for all these missile hazards, it should be so stated in SSAR Section 3.5. If different safety-related SSCs must be protected for different missile hazards, then the SSCs should be identified in the appropriate missile Subsection.

More specifically, the staff needs to know what safe-shutdown equipment is located in containment, what missile sources exist in containment which could adversely affect this equipment, and how this equipment is protected from these missiles. Also, there is no discussion regarding separation of redundant divisions of SR systems. Is there physical separation between redundant divisions of SR systems inside containment? If so, what is the nature of the separation (physical distance, enclosure in separate compartments, or the use of barriers)?

410.220 In response to Q410.67, Westinghouse states that rotating equipment in containment is eliminated as a missile source for one or more of the following reasons: (1) equipment used < 2% of the time is not considered a missile source. This includes the reactor coolant drain pumps, containment sump pumps and motors for valve operators, and mechanical handling equipment and pumps. (2) Pumps and fans such as the reactor cavity supply fans, are located in compartments surrounded by structural concrete walls and contain no SR systems or equipment and so are not considered missile sources. (3) Rotating equipment with housing or enclosure that would contain fragments of postulated impeller failure is not considered credible. (4) Non-SR rotating equipment in compartments with SR equipment that don't provide other separation features have design requirements for housings or enclosures to retain fragments from postulated failures of rotating elements. Provide justification for not considering as credible missiles equipment used less than 2% of the time.

410.221 The response tp Q410.65 implies that mass around the impeller and rotating parts of the motor is the primary means used to prevent missiles in the shaft seal pump. Is this true?

410.222 The response to Q410.64 states that no sources of primary and credible secondary missiles from which SR equipment inside containment must be protected have been identified. A limited number of fans may require design provisions to confirm they aren't a missile source. Where is this discussed in the SSAR?

410.223 Discuss gravitational missiles inside containment in regard to their potential for generating missiles.

410.224 Are any safety-related systems or systems important to safety protected from missiles through the use of barriers? If so, what are the barrier dimensions (wall thicknesses, etc.).

410.225 Identify safety-related equipment and equipment important to safety which are subject to missiles from non seismic Category I structures, systems, and components inside containment and discuss how this equipment will be protected (discuss nonsafety-related systems inside containment in regard to their potential for generating missiles which could damage safety-related equipment).

410.226 Are any safety-related systems or systems important to safety protected from missiles solely by providing sufficient distance between them and the missile source? If so, what is the minimum safe distance?

410.227 How will the control room be protected from missiles generated inside containment?

Missiles Generated by Natural Phenomena

410.228 Include in the SSAR a list of the systems that must be protected from missiles generated by natural phenomena.

410.229 Westinghouse states in response to Q410.70 that the estimated probability of wind speeds greater than the 300 mph DBT is 10^{-6} and 10^{-7} per year for AP-600 at a worst location anywhere in the contiguous U.S. This should be included in the SSAR.

410.230 How will the control room be protected from missiles generated by natural phenomena?

410.231 Provide justification for the use of 2 psi pressure drop rather than the 2.25 psi pressure drop specified in Regulatory Guide (RG) 1.76.

Spent Fuel Storage

410.232 SSAR section 9.1.2.2 states that the spent fuel storage facility is located within the seismic Category I auxiliary building fuel handling area. However, it is not clear that the spent fuel facility itself is a seismic Category I structure. If the spent fuel storage facility is not a seismic Category I structure, provide your rationale for concluding that the design of the facility is in compliance with the guidance of the Standard Review Plan (SRP), Regulatory Guides (RGs) 1.13 and 1.29 and the requirements of General Design Criterion 2.

Spent Fuel Pit Cooling System

410.233 In accordance with SSAR Section 9.1.3.2 the spent fuel pit cooling system is a non-safety-related system; demineralized water can be added for makeup purposes including replacement of evaporative losses, from the demineralized water transfer and storage system. In accordance with SSAR Table 3.2.1, the spent fuel pit cooling system and the demineralized water transfer and storage system are non seismic. Provide your rationale for concluding that the design of the Spent Fuel Pool Cooling and Cleanup System is in compliance with General Design Criterion 2 and 4, and the guidance of the RGs 1.13, 1.29 and the SRP which state, in part, that the cooling portion of the system should be designed to seismic Category I, Quality Group C requirements. If the spent fuel pool cooling system is non-seismic Category I, Quality Group C, the following systems should be designed to seismic Category I requirements and protected against tornadoes: the fuel pool make-up water system and its source; and, the fuel pool building and its ventilation and filtration system. The makeup, ventilation and filtration systems must also withstand a single active failure.