September 30, 1994

MEMORANDUM TO: R. W. Borchardt, Director
Standardization Project Directorate
Associate Directorate for Advanced Reactors

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

SUBJECT: AP600 DSER OPEN ITEMS

Attached is a list of open items and additional questions that we want to discuss with Westinghouse. As you have probably noticed, the Plant Systems Branch (SPLB) AP600 DSER input does not have a lot of open items. This was done on purpose. Our experience with the ABWR and System 80+ reviews was that the FSER became a litany of what the DSER/DFSER open items were and how they were resolved, rather than a discussion of what the design was and why it was acceptable. To prevent that, most of our AP600 DSER input provides a description of the systems and an evaluation of those issues that we find acceptable, but end with a statement to the effect that we didn't have enough information to complete our review.

I propose that we send the list to Westinghouse as the agenda for a meeting to be held in Pittsburgh. At the meeting, SPLB reviewers will be available to discuss each of the items with Westinghouse. The purpose of the meeting will be to resolve each issue if possible, or at least make clear what our concern is. The result of this meeting will be a punchlist of items that will require resolution before the FSER could be written.

Docket No. 52-003

Attachments: As stated

CONTACT: C. Y. Li, NRR
301-504-2830

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

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Attachment

AP600 DSER OPEN ITEMS
PLANT SYSTEMS BRANCH

3.4.1 - FLOOD PROTECTION

3.4.1-1. Provide a list similar to that provided in response to RAI 410.27 of RTNSS and DID systems in containment and the auxiliary building which require protection from floods.

3.4.1-2. Discuss the approach taken in the AP-600 design to protect RTNSS and DID systems from internal and external floods.

3.4.1-3. Clarify in the SSAR that the COL will identify flood hazards beyond those postulated in the design and will provide protective features for safety-related and applicable RTNSS and DID systems.

3.4.1-4. The condensate storage tank is shown near the turbine building in SSAR Fig. 1.2-2. The response to RAI 410.2 says its near the containment and auxiliary buildings. This discrepancy should be corrected.

3.4.1-5. The SSAR refers to the flood analysis in SSAR Section 10.4.5. If the CWS experiences a gross system failure, level sensors in the turbine building sump will actuate a high level alarm. Are the CWS pumps tripped on high sump level? What effect, if any, does turbine building flooding have on the auxiliary building since some areas of the auxiliary building drain to the turbine building (it appears that backflow could occur).

3.4.1-6. Provide information to show that the AP-600 design conforms with the guidelines of Position C.2 of RG 1.102 regarding TSs and EOPs needed to utilize Position C.2 of RG 1.59.

3.4.1-7. The SSAR should state that interior walls and penetrations which provide internal flood protection for safety-related equipment can withstand maximum hydrodynamic loads (associated with pipe breaks, etc.) in addition to maximum hydrostatic loads.

3.4.1-8. The SSAR states that the safe shutdown equipment that requires flood protection are identified in SSAR Section 7.4, but the components listed in 7.4 don't quite match those identified in 3.4.1. This should be corrected.

3.4.1-9. 3.4.1.2.2.1 says that the set of normally closed air operated CMT isolation valves receive a signal during safe shutdown operation. What signal opens these valves? Also, it states that these valves are located at elevation 97'-6" in each PXS. This appears to contradict an earlier statement that says that all other valves are above the maximum flood height of 108'-2". Please clarify the discrepancy.

3.4.1-10. We assume that the normally open accumulator and IRWST isolation valves are above 108'-2" and the 2 normally closed MOVs that are part of the PXS recirculation system. Is this correct?

3.4.1-11. In response to RAI 410.202, it says that duct penetrations into the CVS and PXS compartments are designed to prevent flooding of these rooms from the maintenance floor. How is this done?

3.4.1-12. Identify what safety-related, RTNSS, and DID systems are in each of the following areas within the auxiliary building: NRCA; the mechanical equipment area, the non-Class 1E electrical equipment area, the Class 1E electrical equipment area; RCA.

3.4.1-13. Are there penetrations through the walls separating the NRCA and the RCA?

3.4.1-14. Provide a discussion on backflow protection from flooding in buildings adjacent to those housing safety-related, RTNSS, and DID systems.

3.4.1-15. Are the eyewash stations supposed to be inside or outside the battery rooms (see Figs. 1.2-4 and 1.2-5)? The figures show the eyewash stations inside the rooms whereas the responses to RAI 410.193 and 410.11 state that the DMW lines and eyewash stations are in the corridor. Also, 410.193 refers to SRP 3.6.2, Revision 2, para. B.3.c. (1). The correct reference is BTP MEB 3-1, Subsection B.3.c (1).

3.4.1-16. The information in the SSAR Section 3.4.1 and that in the response to RAI.202 regarding the maximum flood height should be resolved. Does the maximum flood height assume drainage from higher elevations? If so, the SSAR should say that.

3.4.1-17. Discuss where the various sumps pumps pump flood water to, and discuss the backflow protection for the sumps.

3.4.1-18. The response to 410.202 says that safety-related equipment is located in the upper levels of the vertical pipe chase. Since this pipe chase is also used as a drainage pathway, is the safety-related equipment in the pipe chase vulnerable to damage from water. Also, identify the equipment on Level 2 in the RCA and in the pipe chase. The responses to RAIs 410.11 and 410.193 discuss how equipment in the NRCA is protected from wetting. Similar discussions should be provided regarding protection from spray wetting for components in containment and in the RCA.

3.4.1-19. The response to RAI 410.40 says that some doorways between the auxiliary building and adjacent buildings are double doors and are not watertight. Flood water from adjacent areas is directed away from or is otherwise prevented from entering the auxiliary building. How is this done?

3.4.1-20. The response to RAI 410.44 says that there are no below-grade tunnels connecting the containment and auxiliary building to any other buildings. What systems route water to the rad-waste building? In what buildings are these systems housed, and what protection features are in place to protect safety, RTNSS, and DID systems from flooding from a failure in these systems?

3.4.1-21. It doesn't appear that the CVS filters and demineralizers are adequately protected from flooding.

3.4.1-22. The response to RAI 410.223 states that an updated flood analysis report is not necessary because the COL applicant is responsible for verifying that the site meets the interface requirements given in SSAR Section 2.4. However, the flood analysis report that I'm referring to is an analysis verifying that the as-built information conforms with the assumptions made for the <u>interior</u> flood evaluation provided in the SSAR. Therefore, a COL Action Item should be included in the SSAR requiring the applicant referencing the AP-600 design to provide this updated analysis to verify that the as-built plant conforms with the original assumptions.

3.4.1-23. Clarify in the SSAR that the protective features (waterproofing, etc.) constitute the "hardened protection" approach as defined in RG 1.59.

3.4.1-24. We see only 2 hatches on 107'-2". 410.47 says there are 4.

3.4.1-25. Where is water pumped that enters the IRWST sump?

3.4.1-26. Clarification on the last paragraph of 410.10 is needed.

3.4.1-27. How is "open-cycle" being defined? It doesn't seem that FPS, DMWS, and CVS are open-cycle systems.

3.4.1-28. The description of the containment and auxiliary building sumps is still unclear. We assume that the flow monitors for individual components are used to determine identified leakage and the containment sump and floodup level monitors are used to determine unidentified leakage. However, if identified leakage goes to the same sump as unidentified leakage, how can the unidentified leakage be determined. Also, shouldn't the individual flow sensors that monitor safety-related components for identified leakage be safety-related as are the sump and floodup monitors (by the way, SSAR Section 3.4.1.2.2.2 never specifically identifies these monitors as being safety-related). We also need to understand how identified vs unidentified leakage is determined for leakage in the auxiliary building. Finally, the response to RAI 410.7 states that each [illegible] line has a non-safety-related flow sensor. Is this appropriate?

Shouldn't some of these sensors be safety-related? Also, need to discuss responses to 410.45 and 410.204.

3.4.1-29. The responses to the following RAIs should be incorporated into the SSAR: 220.42, 410.1, 410.2, 410.4, 410.5, 410.7, 410.11, 410.27, 410.30, 410.38, 410.40, 410.44, 410.45, 410.46, 410.50, 410.95, 410.193, 410.199, 410.201, 410.202, 435.56.

<u>3.5.1.1 - INTERNALLY-GENERATED MISSILES (OUTSIDE CONTAINMENT)</u>

3.5.1.1-1. Add the responses to the following RAIs to the SSAR: 410.51, 410.53, 410.54, 410.60, 410.61, 410.62, 410.210, 410.214

3.5.1.1-2. Provide a list of the safety-related, RTNSS, and DID systems that must be protected from internally-generated missiles (outside containment).

3.5.1.1-3. Discuss the approach taken in the AP-600 design to protect RTNSS and DID systems from internally-generated missiles (outside containment).

3.5.1.1-4. There seems to be a contradiction between the information in SSAR Section 3.5.1.1.2.4 and the response to RAI 410.61. The SSAR states that the portion of the CVS system from the makeup pumps to the containment is a high energy system in the auxiliary building that contains pressurized components that are not qualified to ASME Code, Section III standards, whereas the RAI response states that high-energy systems in the auxiliary building are constructed to Section III standards. Resolve this apparent discrepancy.

3.5.1.1-5. The response for RAI 410.60 states that uniform mixing was assumed in determining the 4.4% hydrogen concentration in containment. In general, uniform mixing is not considered a conservative assumption. Please provide justification as to why uniform mixing should be assumed.

3.5 1.1-6. The staff has not yet received a response to RAI 410.206.

<u>3.5.1.2 - INTERNALLY-GENERATED MISSILES (INSIDE CONTAINMENT)</u>

3.5.1.2-1. Add the responses to the following RAIs to the SSAR: 410.63, 410.64, 410.67, 410.223, 410.227.

3.5.1.2-2. Include a statement in 3.5.1.2.1.1 that missiles generated as a result of the failure of ASME Code, Section III vessel ruptures is not credible due to design, fabrication, etc. as was discussed in 3.5.1.1.

3.5.1.2-3. Provide a list of the safety-related, RTNSS, and DID systems that must be protected from internally-generated missiles (inside containment).

3.5.1.2-4. Discuss the approach taken in the AP-600 design to protect RTNSS and DID systems from internally-generated missiles (inside containment).

3.5.1.4 - MISSILES GENERATED BY NATURAL PHENOMENA

3.5.1.4-1. Add the responses to the following RAIs to the SSAR: 410.68, 410.69, 410.70, 410.71, 410.229, 410.230, 410.231.

3.5.1.4-2. Provide a list of the safety-related, RTNSS, and DID systems that must be protected from missiles generated by natural phenomena.

3.5.1.4-3. Discuss the approach taken in the AP-600 design to protect RTNSS and DID systems from missiles generated by natural phenomena.

3.5.2 - EXTERNALLY-GENERATED MISSILES

3.5.2-1. Provide a list of the safety-related, RTNSS, and DID systems that must be protected from externally-generated missiles.

3.5.2-2. Discuss the approach taken in the AP-600 design to protect RTNSS and DID systems from externally-generated missiles.

3.5.2-3. There doesn't appear to be a one-to-one correlation between the safe shutdown systems identified in SSAR Section 3.5.2 and those identified in SSAR Section 7.4 and SSAR Table 7.4-1. The discrepancy should be corrected.

3.5.2-4. Provide information on the ultimate heat sink or specify in the SSAR that the design is the responsibility of the COL applicant and provide interface requirements.

3.5.2-5. Are any safety-related, RTNSS, or DID systems protected by locating them underground?

3.6.1 - PIPING FAILURES OUTSIDE CONTAINMENT

3.6.1-1. Identify all systems excluded from pipe break analysis based on Leak-Before-Break.

3.6.1-2. Identify all systems with high-energy lines outside containment.

3.6.1-3. Identify all system with moderate-energy lines outside containment.

3.6.1-4. What safety-related systems are near high-energy and moderate-energy systems?

3.6.1-5. How are safety-related systems protected from failures in high-energy or moderate-energy system? Identify whether the protection is due to separation, barriers, a combination of both, or another means is used for protection (including the use of restraints).

3.6.1-6. Provide pipe break analyses. The response to RAI 410.76 was an interim response. The staff has not yet received the final response.

3.6.1-7. Are any high-energy or moderate-energy systems routed near the MCR?

3.6.1-8. Provide analysis of the failure of non-seismic Category I systems.

3.6.1-9. Where restraints are used to ensure protection of safety-related equipment from the dynamic effects of pipe failure, Westinghouse should provide justification why separation and protective structures were not used. Where restraints are used, Westinghouse should show that use of the restraint will not affect the piping system response when subjected to loads from normal and upset plant conditions and that the restraints will not interfere with inservice inspections of pipe welds.

3.6.1-10. Identify the break exclusion zones on Figure 3E-1 and identify whether these zones meet the guidelines of B.2.c of BTP ASB 3-1.

3.6.1-11. Clarify the piping classifications that are required by RG 1.26. These classifications should extend beyond the outboard restraint unless the restraint is at an isolation valve.

3.6.1-12. Clarify how RTNSS and DID systems will be protected from pipe failures and how SR systems will be protected from pipe failures in these systems. Identify all RTNSS and DID systems that require protection from pipe failures.

3.11 EQUIPMENT QUALIFICATION

3.11-1. The NRC staff does not agree with the assertion in the response to Q. 270.2 that qualification to the 1983 revision is equivalent to qualification to the 1974 revision. There are significant differences between the two versions, for example, see the staff's comment on the response to Q. 270.14 below (3.11-11). Therefore, this response in unacceptable.

3.11-2. The response to Q. 270.3 proposed a revision to the SSAR to clarify the intent of Section 3.11.2.1. If it is the intent of Westinghouse to comply with the requirements of 10 CFR 50.49 the first sentence of the secord paragraph of Subsection 3.11.2.1

should be changed and made to be consistent with the position(s) stated in 10 CFR 50.49 (f).

3.11-3. With respect to the response to Q. 270.4, the list of equipment in Table 3.11-1 may include all equipment to be supplied by Westinghouse, however, COL applicants will probably supplement that list in accordance with the requirement of plants at various locations. Consequently, the staff has determine that the list of equipment in Table 3.11-1 is not necessarily a complete list and therefore the SSAR should be modified to reflect the staff's concern.

3.11-4. The expression "Demonstration of qualified life by test and analysis (or both)...." provided in the response to Q. 270.5 is not clear. If the intent is to state that "demonstration of qualified life by test or test and analysis...." then the intent is acceptable and the SSAR should be corrected to say this. In addition the COL Applicant should not be obligated to suppliers as implicated in the above SSAR revision, they should be able to conduct qualification test themselves if they choose to do so.

3.11-5. With respect to the response to Q. 270.6, the staff position is that to be in compliance with the requirements of 10 CFR 50.49, qualification must be demonstrated for equipment that has not been demonstrated to be qualified. If it can be demonstrated that any equipment (including electronic) is qualified in accordance with applicable requirements it will be found acceptable. To date the accepted position, for electronic equipment, by both industry and the NRC is that electronic equipment that experience a total integrated radiation dose in excess of 10^3R is considered to be in a harsh environment. Westinghouse's position on this issue is unacceptable.

3.11-6. With respect to the response to Q. 270.7, as indicated above, the NRC staff does not agree that IEEE Standard 323-1974 is essentially identical to IEEE Standard 323-1983 and has not approve the use of IEEE Standard 323-1983. Therefore Westinghouse's position on this issue is unacceptable.

3.11-7. It is the NRC staff's position that review of Section 3D.4.5.4 of the SSAR requires the staff to develop it's position on the extension of the life of nuclear power plants beyond 40 years before it can address this topic in the AP600 design in a meaningful way. The staff believes that the development of it's position will conflict with the AP600 review schedule. Therefore, the staff recommends removal of this section from the AP600 design certification review.

3.11-8. The staff does not agree that the discussions in SSAR Subsections 3D.4.6, 3D.4.7, and 3D.4.8 are consistent with NUREG-0588, Regulatory Guide 1.89, and past NRC positions and approvals as stated in the response to Q. 270.9. One of the primary reasons is that the staff has not approved the use of IEEE 323-1983 which is being use to demonstrate compliance. Further discussions between the NRC staff and Westinghouse must be conducted in order to resolve these issues.

3.11-9. There is no evidence anywhere in Industry or in NRC acceptance practice to support the position stated in the SSAR or in the response to the Q. 270.10 in regards to similarity between equipment from different manufacturers. Similarity between manufacturers is not arbitrarily excluded, however, the staff is simply pointing out that it has not been satisfactorily demonstrated previously in order to prevent the raising of false hopes and unnecessary expense for potential COL Applicants.

3.11-10. Question 270.11 is directed at the description of normal, abnormal, and design basis event conditions as outlined in the first paragraph of Section 3D.5. For example, "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"; this description also applies to normal and design basis event conditions, therefore, no meaningful information is provided with this statement. The staff reviewed, and generally approves of the information provided in Sections 3D.5.1, 3D.5.2 etc. However, the staff is suggesting the 3D.5 can be rewritten with more clarity.

3.11-11. Considering the response to Q. 270.14, provide an explanation of what is meant in the expression at the beginning of the sixth paragraph on page 3D-1 that states "Safety-related electrical and mechanical equipment is typically qualified using analysis, testing, or a combination of these methods".

If the response to Q. 270.14 accurately states the intent of the AP600 design, the SSAR should be rewritten to clarify the apparent inconsistencies between the statements on pages 3D-1, sixth paragraph; 3D-19, Section 3D.6.2, second paragraph; and 3D-69, EQDP. In addition, at the beginning of Section 3D.6 it is stated that "The recognized methods available for qualifying safety-related electrical equipment are established in IEEE 323. These are type testing, operating experience, analysis, on-going qualification, or a combination of these methods". This may be true for IEEE 323-1983, however, the requirements as outlined in 10 CFR 50.49(f) do not permit qualification by analysis alone. The SSAR should be updated to be consistent with the requirements of the Code of Federal Regulations.

<u>5.2.5 - REACTOR COOLANT PRESSURE BOUNDARY LEAKAGE</u>

5.2.5-1. Is the system safety-related, RTNSS, or DID?

5.2.5-2. What is the scope of the system (where does it begin and where does it end)?

5.2.5-3. Is the system fully or partially within the AP-600 scope?

5.2.5-4. Provide the name of the system and its abbreviation (nothing is listed in SSAR Table 1.1-1).

5.2.5-5. Provide the TS leakage limits and the operational leakage limits.

5.2.5-6. Discuss leakage detection outside containment.

5.2.5-7. Discuss the system components, their locations, seismic and safety classifications, and provide a figure where the system can be found. Identify P&IDs, IBDs, etc.

5.2.5-8. Characterize the components which are considered identified leakage sources. SSAR Section 5.2.5.2 implies that there are pumps which are provided with monitors to detect identified leakage. Identify which valves and pumps are monitored for identified leakage.

5.2.5-9. Provide the sensitivity and response times for equipment which monitors identified leakage.

5.2.5-10. Clarify which methods of identified and unidentified leakage provide indication only, which provide alarms only, and which provide both.

5.2.5-11. Clarify which methods of leak detection quantify the amount of leakage. At least two of the leak detection methods should quantify the leakage. Based on how the TS reads, it seems that the second monitor should be the containment atmosphere monitor.

5.2.5-12. Clarify which detection methods are measures of gross RCPB leakage.

5.2.5-13. Identify each system that's susceptible to intersystem leakage, discuss the method of leak detection, and protective features.

5.2.5-14. Discuss how the design satisfies RG 1.45, Positions C.1 through C.9.

5.2.5-15. In general, I need a discussion in the SSAR which identifies all sources of identified leakage inside and outside containment, the instruments used to monitor the leakage (including their sensitivities); whether the monitors provide MCR indication only, MCR alarm only, or both; whether the monitors are safety-related and seismically qualified; which methods are available to detect gross RCPB leakage; and any automatic actions associated with the detection of RCPB leakage beyond instrument setpoints.

5.2.5-16. The SSAR does not provide a complete discussion of the seismic and safety classifications of the system. This should be included in SSAR Section 5.2.5.

5.2.5-17. Provide information to show that leakage from identified sources can be collected and monitored separately from unidentified leakage.

5.2.5-18. SSAR Section 5.2.5 provides the sensitivity of the LDS but does not discuss the minimum amount of RCPB leakage that can be detected.

5.2.5-19. The SSAR implies that only the containment sump level monitor can quantify RCPB leakage. However, TS 3.4.7 states that the containment air monitor can detect 0.5 gpm unidentified leakage. The staff believes that at least 2 of the 3 methods available for leakage detection should be capable of quantifying RCPB leakage.

5.2.5-20. Identify each system connected to the RCS which could experience intersystem leakage and provide a discussion of the leak detection method, including protective features to ensure that the system does not over-pressurize.

5.2.5-21. SSAR Section 5.2.5.3 refers to radiogas monitors. What are these? There appears to be a problem throughout this SSAR Section with inconsistency in the name for the containment atmospheric monitor. It is called the containment particulate radioactivity monitor, containment atmosphere radioactivity monitor, radiogas monitor, etc.

5.2.5-22. Provide justification for the leakage limits in TS 3.4.13. They are less conservative than the limits in the WOG STSs.

5.2.5-23. Surveillance Requirement (SR) 3.4.7.3 should be 3.4.7.1.

5.2.5-24. Does the AP-600 design use an RHR autoclosure feature as discussed in Section 3.4.14 of the STSs?

5.2.5-25. TS 3.4.8 bases section "Applicable Safety Analyses" refers to reference 4 instead of reference 3.

5.2.5-26. TS 3.4.8 bases section "Actions" refers to subsection B.2, which doesn't exist.

5.2.5-27. The sixth paragraph of TS 3.4.8 bases "Surveillance Requirements" should refer to RNS, not RHR.

5.2.5-28. STS 3.4.15 states that, should the containment air cooler condensate flow rate monitor become inoperable, a channel check should be performed on the containment atmosphere radioactivity monitor once per 8 hours. The AP-600 TS 3.4.9 states that a grab sample should be performed once per 24 hours. Westinghouse should provide justification regarding the acceptability of the alternate action.

5.2.5-29. STS 3.4.15 includes SR 3.4.15.2 which states that a channel operational test (COT) should be performed on the containment atmosphere radioactivity monitor every 31 days. AP-600 TS 3.4.5 includes SR 3.4.9.2 which states that the COT should be performed every 92 days. Westinghouse should provide justification for the deviation from STSs.

5.2.5-30. AP-600 TS 3.4.9 bases section titled "Actions", under subsection "B.1.1, B.1.2, B.2.1, and B.2.2", second and third paragraphs, refer to "30 hours" instead of "30 days".

5.2.5-31. AP-600 TS 3.4.9 bases section titled "Actions" incorrectly refers to subsections E.1 and E.2. Section E.2 does not exist.

5.2.5-32. Does the AP-600 design use the TID-14844 source term. If not, the response in SSAR Section 1.9.3 regarding TMI Item II.D.1.1 should be changed to refer to the correct source term and should address the possibility of having primary water outside of containment via a failure of that portion of CVS that is in the auxiliary building.

5.2.5-33. Add the responses to the following RAIs to the SSAR: 410.16, 410.17, 410.18, 410.19, 410.20

5.4.11 - PRESSURIZER RELIEF DISCHARGE

5.4.11-1. What are the safety valve relief capacities and the ADS valve discharge capacities.

5.4.11-2. What is the worst-case load that the system (including the IRWST) will experience. Section 5.4.11 discusses only the gas venting function. Is this the limiting event?

5.4.11-3. Does the IRWST use a spray system?

5.4.11-4. What is the system scope (where does it begin and end)?

5.4.11-5. Section 5.4.11.3 states that the IRWST is sized based on the heat load and steam volume following an actuation of the ADS. Does this include steam, water, and noncondensable gases from all three ADS stages? Provide the analysis.

5.4.11-5. Where are the inspection and testing requirements for the IRWST discussed?

5.4.11-6. Where is the instrumentation for the ADS valve discharge lines discussed?

5.4.11-7. Provide information which addresses features in the IRWST which prevent tank collapse as a result of vacuum created by the condensation of steam and the cooling of hot water in the tank.

5.4.11-8. Provide explanation of the seismic and class breakdowns shown on the P&IDs.

5.4.11-9. Can the rupture disk become a missile?

5.4.11-10. What happens if an ADS valve fails to close?

5.4.11-11. How are the two divisions of ADS separated?

5.4.11-12. What is the tank volume and quantity of water initially stored in the tank. It should be such that no steam or water will be released to containment under normal or anticipated abnormal conditions. The initial temperature of water in the tank should be assumed to be no lower than 120F.

5.4.11-13. Does the system have an abbreviation?

5.4.11-14. Is the system SR, RTNSS, or DID?

6.4 HABITABILITY SYSTEMS

6 1. Provide criteria for air supply equipment and state that COL applicant will provide procedures regarding the availability and use of portable air supply equipment for conditions beyond 72 hours of the accident.

6.4-2. Provide criteria for sizing the portable cooling equipment and state in the SSAR that the COL applicant will provide procedures for the availability and use of portable cooling equipment to maintain long term occupancy of personnel in the MCRE and long term operation of equipment in the instrumentation and control rooms and dc equipment rooms.

6.4-3. Provide the qualification criteria and surveillance provisions for the proposed epoxy crack sealer, and pressure resistant sealant materials such as silicone foam, ceramic fiber, rubber boots, silicone elastomer, silicone caulk sealants.

6.4-4. The staff considers that testing the pressurization and ventilation capabilities in technical specifications every 10 years is non-conservative. The VES should be tested in accordance with ASME AG-1 Code every refueling outage as required by the current Westinghouse Standard Technical Specifications (W-STS) to demonstrate that there is sufficient air in the air storage bottles to pressurize the MCRE to a positive pressure of 3.2 mm (1/8-in) water gauge with respect to the surroundings and maintain that pressure during accident conditions for a period of 72 hours and beyond. Also, technical specifications and VES ITAAC should include initial testing that demonstrates these capabilities for the entire 72 hours. Additionally, AP600 SSAR Technical Specification Surveillance Requirements 3.7.6.8 should state that a positive pressure of equal to or greater than 3.2 mm (1/8-in) water gauge "with respect to the surroundings" is maintained.

6.4-5. Westinghouse states that the VES HVAC piping is assumed to be schedule 40 welded construction to preclude unfiltered inleakage inside MCRE. However, Westinghouse should specify that this piping will be leak tested in accordance with ASME N509.

6.4-6. Verify that (1) all VBS ducting and equipment housings outside the MCRE are of welded construction and flange connections will be pressure tight, and periodically visually examined and tested such that any unfiltered inleakages inside MCRE are precluded during VES operation for accident conditions and (2) no other ducts other than VBS ducts pass through the MCRE and (3) clarify how the normal ventilation flow is used in the accident analysis.

6.4-7. Address the expected number of personnel and provide guidance for the MCR occupancy during the accident conditions for up to 72 hours and beyond, maximum allowed CO_2 concentration levels to provide habitable environment for the MCR occupants based on maximum occupancy during accident conditions and revise the MCRE ventilation and pressurization requirements accordingly.

6.4-8. The staff assumes that no radioactive materials will be piped or stored near the MCRE. However, Westinghouse needs to state this in the SSAR.

6.4-9. State that the COL applicant will (1) perform the toxic chemical release analysis conforming RGs 1.78 and 1.95, (2) prepare detailed operating procedure to cope with the toxic gas accident and (3) determine and provide toxic gas monitoring. The COL applicant will also develop operating procedures to cope with the closure of air intake due to a high concentration of smoke.

6.4-10. Clearly identify that the COL applicant will provide verification of the as-built design and the operating, maintenance, and emergency procedures and training, and performance characteristics of the VES and VBS and technical specifications are consistent with the licensing basis documentation.

9.1.1 NEW FUEL STORAGE

9.1.1-1. Identify the specific location in the SSAR where it is stated that the spent fuel pool is a seismic Category I structure.

9.1.1-2. The position outlined response to Question 410.233 is not in compliance with GDC 2 and 4. However, the staff is reviewing it's position on these issues and must complete it's review before a final determination on the acceptability of the above stated position can be reach.

9.1.1-3. As stated in SRP Section 9.1.1, Item III-2-b, the SSAR should discuss provisions in the AP600 design for draining the vault to prevent the accumulation of a fluid moderator.

9.1.1-4. Westinghouse should provide a discussion that demonstrates that the AP600 design is such that a fuel assembly cannot be inserted anywhere in the rack other than in the design locations.

9.1.1-5. Westinghouse should perform an analysis to ensure that the failure of non-seismic Category I systems or structures located in the vicinity of the new-fuel storage racks cannot cause an increase in k_{eff} beyond the maximum allowable k_{eff}.

9.1.1-6. In SSAR Section 9.1.1.3 it is stated that the new fuel rack is located in the new fuel storage pit, which has a cover to protect the new fuel from dropped objects and debris. SRP Section 9.1.1-III.e indicates that the vault and racks should be design to preclude damage from dropped heavy objects. Westinghouse should provide a discussion on the structural integrity and the capacity of the cover for the new fuel storage pit to resist damage from heavy dropped objects.

9.1.1-7. Provide the seismic classification of the new fuel storage structure itself.

9.1.1-8. On page 9.1-1 a reference is made to Figures 1.2.2-18 through 1.2.1-20, provide copies of these figures.

9.1.1-9. Provide assurance that essential portions of the new fuel racks and storage vault are protected from the effects of hurricanes, and internally generated missiles.

9.1.1-10. Provide Layout Drawings for the new fuel storage vault and fuel storage racks.

9.1.2 SPENT FUEL STORAGE

9.1.2-1. The SSAR should be updated to include the statement that the spent fuel pool is seismic Category I and is protected from internal missiles.

9.1.2-2. Provide a discussion on the design and anticipated performance of components located in the vicinity of the spent fuel storage pit, not designed to seismic Category I standards and whose failure could damage the fuel or safety-related systems and equipment. The design of these components should ensure that they will not fail during a seismic event, are seismically restrained, or are removed from the area during normal operation.

9.1.2-3. Provide a discussion on the location of drains, makeup, or other penetrations in the fuel pool, and insure that such penetrations are in compliance with the guidance of ANS 57.2. The discussion should also include building clearence for maintenance such as laydown space for tools and slings and spent fuel shipping cask head and other accessories, flood damage to make-up systems and commingling of surface waters with spent fuel storage pool water, and internal missiles.

9.1.2-4. To demonstrate compliance with GDC 63 as related to the monitoring of the status of the stored spent fuel, Westinghouse should discuss radiation monitoring devices for protection of personnel in the building, continuous air monitoring in the spent fuel area, and the availability of uninterruptible communications between the fuel handling machines, refueling machines and the control room.

9.1.2-5. Explain how leakage from the spent fuel pool will be detected, and must discuss design features to prevent water inventory loss beyond minimum safe shielding and cooling limits because of pool drains or other connections.

9.1.2-6. Explain how placement of a fuel assembly in an incorrect location is prevented.

9.1.2-7. Provide Layout Drawings for the spent fuel storage pit.

9.1.3 SPENT FUEL PIT COOLING SYSTEM

9.1.3-1. Section 9.1.3.3.5 states that spent fuel pit cooling system packed valves larger than two inches and designated for radioactive service are provided with stuffing boxes and lantern leakoff connections. How are other valves, designated for radioactive service, handled in this system?

9.1.3-2. Section 9.1.3.4.3.4 Station Blackout - What is the location of the makeup connection identified in this section? What is the source of this makeup?

9.1.3-3. In accordance with Table 9.1-4, the water level (in the spent fuel pit or what? Table should be labeled) drops to 6.3 feet as a result of a seismic event immediately following a normal refueling. What is the minimum height required for shielding? How is the minimum height maintained, and what is the source of makeup under these conditions?

9.2.1 SERVICE WATER SYSTEM

9.2.1-1. The staff reviewed Westinghouse's response to RAI Q410.107 and determined that the response is acceptable pending the information is reflected in Revision 2 of the AP600 PRA.

9.2.1-2. Westinghouse's response to Q410.109 indicates that SWS performs no safety-related functions and need not meet the listed criteria. The acceptability of the response is pending on the policy position for the requirements of DID and RTNSS.

9.2.1-3. The staff asked questions regarding testing and inspections of the SWS in Q410.108. Westinghouse's response to the question indicates that the SWS provides no safety-related function and does not require any testing or inspection plan. The performance of system components is demonstrated by operation of the system and periodic switching over between two trains. The reliability and maintenance plans for the defense-in-depth systems, such as SWS, include provisions to check for operability, including appropriate testing and inspection, and to repair out-of-service components. These provisions are documented and administered in the plant reliability assurance plan and operating and maintenance procedures.

It is not clear to the staff that the adequacy of the "testing and inspection" is demonstrated in the "plant reliability assurance plan and operating and maintenance procedures." These are two separate programs. The Westinghouse is requested to explain how the later program would assure the adequacy of the former program. The acceptability of the response is pending on the generic staff position on the testing and inspections of DID and RTNSS.

9.2.1-4. The staff reviewed Westinghouse's response to RAI Q410.110 and determined that the response is acceptable pending SSAR revision to include the additional information.

9.2.1-5. The staff reviewed Westinghouse's responses to RAIs Q410.111 and Q410.112 and determined that the responses are acceptable pending SSAR revision as committed in the responses.

9.2.1-6. The staff reviewed Westinghouse's response to RAI Q410.113, and has an follow-up question. Describe the provisions for preventing organic fouling and inorganic buildups that may degrade system performance.

9.2.1-7. The staff reviewed Westinghouse's responses to RAIs Q410.114 and Q410.115, and determined those responses acceptable pending SSAR revision to include the additional information.

9.2.2 COMPONENT COOLING WATER SYSTEM

9.2.2-1. The staff reviewed Westinghouse's response to RAI Q410.118 and determined it is not acceptable. The staff finds that the system description of component cooling water system in the non-proprietary SSAR is not adequate. The components cooled by the component cooling water system are not described in the non-proprietary version of the SSAR.

9.2.2-2. The staff reviewed Westinghouse's responses to RAIs Q410.116, Q410.119, Q410.126, and Q410.127 and find those responses acceptable:

9.2.2-3. In response to RAI Q410.15, Westinghouse states that "in-service testing of component cooling water system equipment is periodically performed during both normal plant operation and maintenance periods" and that "Table C11-5 of PRA Section C11.1 shows the PRA test frequency for the CCS." On the other hand, in response to RAI 410.125 Westinghouse states that "there are no in-service testing design requirements imposed to support PRA reliability assumptions." The staff finds that Westinghouse's position on the in-service testing of CCS in the response of Q410.125 is not consistent with its position in the response of Q410.15 and its PRA assumptions. Further, in response to RAI Q410.125 Westinghouse states that the CCS provides a significant function during reduced reactor coolant system inventory shutdown operation, the surveillance to demonstrate the system availability prior to entering reduced reactor coolant system inventory shutdown operation will be performed. Westinghouse is requested to resolve the above inconsistency.

9.2.2-4. Westinghouse is requested in RAI Q410.120 to confirm that the staff review criteria for the RTNSS are met by the system. Westinghouse's response to Q410.120 indicates that CCS performs no safety-related functions and need not meet the listed criteria. The acceptability of the response is pending on the policy position for the requirements of DID and RTNSS.

9.2.2-5. The staff reviewed Westinghouse's responses to RAIs Q410.121, Q410.123, and Q410.124 and determined those responses acceptable pending revision of SSAR and WCAP-13054 as committed in the responses.

9.2.8 TURBINE BUILDING CLOSED COOLING SYSTEM

9.2.8-1. The responses to RAI Q410.128 and Q410.133 were received after the DSER was prepared, and are under staff review. Open items and questions may be developed as a result of the review of those responses.

9.3.1 COMPRESSED AND INSTRUMENT AIR SYSTEM

9.3.1-1. To date, the staff has not received Westinghouse's response to RAI 410.1[illegible]. Westinghouse needs to provide this response.

9.3.1-2. The staff reviewed Westinghouse's response to RAI 410.152 and determined that the response is acceptable pending incorporation of the information in the response into SSAR Section 9.3.1. Westinghouse also needs to revise SSAR Figure 9.3.1-1 to incorporate the separation of the three CAS subsystems. Additionally, the staff has the following question regarding this RAI. Are the three CAS subsystems completely separate and isolated from each other?

9.3.1-3. The staff reviewed Westinghouse's response to RAI 410.153 and determined that the sentence stating that provisions are made for sampling lines to determine air quality should be provided in SSAR Section 9.3.1. Also, the sample lines should be shown in SSAR Figure 9.3.1-1. In addition, Westinghouse needs to state in the

SSAR that regular periodic checks will be made to assure high quality air.

9.3.1-4. The staff reviewed Westinghouse's response to RAI 410.154 and determined that items "a" through "f" are acceptable pending incorporation of the information in the response into SSAR Section 9.3.1. However, the staff determined that item "g" was unacceptable because compressed air system failures can prevent safety-related equipment from performing their safety-related functions. Because of the materials and the small clearances of the internal moving parts of pneumatic equipment, clean, dry, and oil free air is required for reliable, trouble-free operation. The level of contamination at which pneumatic equipment performance degrades or fails completely depends upon the equipment's specific design features. For example, particulate contamination has been found to be responsible for many solenoid air pilot valve and system check valve malfunctions. Observed pilot valve failures have included particulates blocking the internal air passageways and air exit ports. Particulate buildup has also been known to prevent air line check valves from seating properly. Leakage of accumulator check valves has resulted in compromising the safety function of backup accumulators and has adversely affected safety-grade equipment. Air system oil contamination has been responsible for gum or varnish buildup which resulted in sticking valves. Oil contamination has also been responsible for degradation and failure of solenoid air pilot valve seals. In addition, assumptions that safety-related, pneumatically-operated equipment respond to the loss of IA in a mode which is in accordance with the equipment design may not be justified. For example, valves may be designed to fail open, fail closed, fail as-is, or continue to operate with the assistance of safety-grade accumulators. However, design, installation, or maintenance errors can invalidate such assumptions, resulting in equipment operating in a manner different from that assumed in safety-analyses. Such reported errors include: inadequate accumulator sizing, inadequate seismic supports for lines connected to the accumulators, valves with incorrect loss-of-air failure modes, and incorrectly installed inlet and exit air supply lines from testable check valve air operators. NUREG-1275 lists the following recommendations:

(1) Ensure that air system quality is consistent with equipment specifications and is periodically monitored and tested.
(2) Ensure adequate operator response by formulating and implementing anticipated transient and system recovery procedures for loss-of-air events.
(3) Improve training to ensure that plant operations and maintenance personnel are sensitized to the importance of air systems to common mode failures.
(4) Confirm the adequacy and reliability of safety-related backup accumulators.

(5) Verify equipment response to gradual losses of air to ensure that such losses do not result in events which fall outside SAR analysis.

How does the AP600 design satisfy these recommendations?

9.3.1-5. The staff reviewed Westinghouse's response to RAI 410.155 and determined that item "a" is acceptable and that items "b" and "c" are not addressed in the response to RAI 410.152.

9.3.1-6. The staff reviewed Westinghouse's response to RAI 410.158 and determined that the response is acceptable pending the addition of a note on SSAR Figure 9.3.1-1 stating the purpose of the dotted lines.

9.3.1-7. The staff reviewed Westinghouse's response to RAI 410.159 and determined that items "a" and "b" are acceptable pending incorporation of the information in the response into SSAR Section 9.3.1. However, the staff determined that item "c" was unacceptable. See the staff's position to RAI 410.154g.

9.3.1-8. The staff reviewed Westinghouse's response to RAI 410.160 and determined that item "a" is acceptable pending incorporation of the information in the response into SSAR Section 9.3.1 and the addition of the air accumulators in the SSAR P&IDs of the corresponding systems. The staff has the following questions regarding item "b". Are all of these valves (MSIV, MFIV, & 4th stage ADS) always operated with the assistance of the pressurized N_2? Where does the supply of pressurized N_2 come from? Is IA connected in any way to these valves? Westinghouse's response implies that the AP600 design only uses N_2 accumulators not air accumulators. If this is so, then the SSAR should be revised to only refer to N_2 accumulators instead of air accumulators. Will instrumentation be provided to indicate low accumulator pressure for the fourth stage ADS valves? Will it alarm in the main control room? The staff determined that item "c" is acceptable pending incorporation of the information in the response into the SSAR.

9.3.1-9. The staff reviewed Westinghouse's response to RAI 410.161 and determined that the response is unacceptable. The CAS needs to have preoperational testing as described in RG 1.68.3. The purpose of this testing is to ensure that all air operated safety-related equipment does actually fail to the safe position during a loss of IA even though the air operated equipment does not rely upon IA to perform its safety function. Westinghouse needs to add the revised sentence back into SSAR Section 9.3.1.4. Also, the word "Dessicant" in the second paragraph of Section 9.3.1.4 is spelled incorrectly.

9.3.1-10. The staff reviewed Westinghouse's response to RAI 410.162 and determined that item "a" is acceptable pending resolution of general issue of proprietary classification with NRC staff, item "b" should be a COL Action Item, and that items "c" and "d" are acceptable pending incorporation of the information in the response into the

SSAR. However, number (5) of item "c" appears to disagree with the response to RAI 410.161.

9.3.5 EQUIPMENT AND FLOOR DRAINS

9.3.5-1. The staff reviewed Westinghouse's response to RAI 410.163 and determined that the response is acceptable pending review of SSAR Revision 2.

9.3.5-2. The staff reviewed Westinghouse's response to RAI 410.167 and determined that the response is acceptable pending review of Figure 9.2.9-1 in SSAR Revision 2.

9.3.5-3. The staff reviewed Westinghouse's response to RAI 410.168 and determined that the response is acceptable pending revision of the first sentence in the third paragraph of SSAR Section 9.3.5.1.1.

9.3.5-4. The staff reviewed Westinghouse's response to RAI 410.169 and determined that the response is acceptable pending review of SSAR Revision 2.

9.3.5-5. The staff reviewed Westinghouse's response to RAI 410.170 and determined that the response is unacceptable. The staff considers the EFDS to include all piping from equipment or floor drains to the sump, the sump pumps, and the associated pumps and piping network necessary to route effluents to the drain tanks and then to the WLS. So the containment sump, the containment sump pumps, and the containment sump containment isolation valves should be discussed in SSAR Section 9.3.5 and shown in SSAR Figure 9.3.5-1. In addition, the third paragraph of Section 9.3.5.2.1 needs to remove the reference to the containment wall gutter and reactor coolant drain tank.

9.3.5-6. Are the containment sump backflow check valves capable of being tested?

9.3.5-7. SSAR Section 9.3.5 states that "Sump pumps discharge at a flowrate adequate to prevent sump overflow for drain rates anticipated during normal plant operation, maintenance, and decontamination activities." Are the WRS sumps sized to accommodate drainage required during normal plant operation, maintenance, testing, and postulated accidents (pipe break, tank ruptures)?

9.3.5-8. SSAR Section 9.3.5.2.1 states that the waste water system collects nonradioactive waste from the DG building sumps. However, SSAR Section 9.2.9 does not discuss the DG sumps and does not show them in Figure 9.2.9-1.

9.3.5-9. All of the equipment and floor drains as well as the sumps shown in SSAR Figure 9.3.5 need to be shown in the general arrangement Figure 1.2.

9.3.5-10. The containment sump shown in Figure 11.2-1 needs to show more detail including all of the drainage inputs, the backflow check valves, and the safety classification of the piping and valves.

9.3.5-11. Are the WRS drains and sumps designed to withstand the adverse effects (including high pressure) associated with pipe and equipment failures in building compartments.

9.3.5-12. IE Bulletin No. 80-10 identified an issue concerning the potential contamination of nonradioactive systems which could result in unmonitored, uncontrolled releases of radioactivity to the environment. How does the design of the EFDS prevent such an occurrence?

9.3.5-13. The first paragraph in SSAR Section 9.3.5.2.1 lists Figure 11.2.1-2 and Table 11.2.1-2. These should be changed to Figure 11.2-1 and Table 11.2-2, respectively.

9.3.5-14. The third paragraph in SSAR Section 9.3.5.2.1 states that liquid waste from the containment wall gutter inside containment drains to the containment sump. However, the response to RAI 410.170 states that the wall collection gutter system is not part of the EFDS and should not be referenced in Section 9.3.5. Explain?

9.3.5-15. The second paragraph in SSAR Section 9.3.5.1.1 states "Systems that dispose of discharged water from fire suppression systems during testing and firefighting activities prevent flooding of safety-related equipment." What systems? The EFDS?

9.4.1 NUCLEAR ISLAND NON-RADIOACTIVE VENTILATION SYSTEM

9.4.1-1. Westinghouse needs to address the arrangement of the fan and filter for fan operability without clogging the fan due to the foreign debris including radioactive debris during accident conditions and revise AP600 SSAR accordingly.

9.4.1-2. Confirm that the filtration subsystem charcoal tray and screen are of all-welded construction to preclude the potential loss of charcoal from adsorber cells, as discussed in NRC IE Bulletin 80-03, Loss of Charcoal from Absorber Cells, February 6, 1980.

9.4.1-3. Verify that the ductwork will be periodically visually examined and pressure tested to maintain positive pressure with respect to the adjacent areas such that any unfiltered inleakages inside MCRE shall be less than the maximum allowable for the associated design.

9.4.1-4. The VBS charcoal adsorber is credited to remove 90% of the organic iodine. Westinghouse should commit to complying with the laboratory testing guidance in R.G. 1.152 or 1.140.

9.4.2 ANNEX/AUXILIARY BUILDINGS NON-RADIOACTIVE HVAC SYSTEMS

9.4.2-1. What is the protection limit for the buildup of hydrogen concentration in non-class 1E battery rooms in the annex I building? Provide the ambient summer and winter design temperatures for which the VXS subsystems are designed.

9.4.2-2. Westinghouse Drawing VXS M003, Revision J shows two AHUs per MSIV compartment, while AP600 SSAR Section 9.4.2.2.3 describes only one AHU per MSIV compartment. Clarify the number of AHUs provided in the MSIV HVAC subsystem and revise affected documents and figures accordingly.

9.4.2-3. Westinghouse Drawing VXS M003, Revision J and AP600 SSAR Section 9.2.2.4 and Tables 9.4.2-6 and 9.4.2-7 show two AHUs per LHVAC subsystem, while AP600 SSAR Figure 9.4.2-3 shows only one AHU. Clarify the number of AHU provided in each LHVAC subsystem and revise affected documents and figures accordingly.

9.4.2-4. Clarify MSIV area design temperature since AP600 SSAR states MSIV area design temperature limit to 104 °F while SSAR Table states it as 105 °F.

9.4.2-5. Provide men's and women's locker room exhaust fans data for general area HVAC system in Table 9.4.2-2.

9.4.2-6. Provide air and water temperature data for entrance and exit conditions for air handling unit (AHU) heating and cooling coils for general area HVAC system, equipment room HVAC system, switchgear room HVAC system, MSIV compartment HVAC system, demineralized water degasifier room HVAC system and valve/piping penetration room HVAC system in Table 9.4.2-2 through 9.4.2-7 respectively.

9.4.2-7. AP600 SSAR Figure 9.4.2-2 shows three hot water unit heaters with temperature switches serving the mechanical equipment room in the annex I building with a provision for the hot water to be provided from the VYS. Additionally, the mechanical equipment room HVAC subsystem also serves the RCC and ICC non-class 1E penetration rooms and reactor trip switchgear I and II rooms in the auxiliary building. Westinghouse needs to reflect the above information with its associated details in the AP600 SSAR Section 9.4.2.2.2.

9.4.2-8. Explain how 2400 SCFM is accounted for from equipment room HVAC system AHU since it supplies 27,600 SCFM while return flow is only 25,200 SCFM and 1200 SCFM is exhausted from battery room (Table 9.4.2-3 shows 2-100% capacity battery room exhaust fans, each 1200 SCFM).

9.4.2-9. Provide rationale for selection of MSIV compartment HVAC system's <u>only filter</u> having an efficiency of 25%. Revise AP600 SSAR Table 9.4.2-5 accordingly.

9.4.2-10. Table 9.4.2-7 for valve/piping penetration room HVAC system shows 2-100% AHU. While Figure 9.4.2-3 shows a single AHU. Reconcile the difference and revise AP600 SSAR accordingly.

9.4.3 RADIOLOGICALLY CONTROLLED AREA VENTILATION SYSTEM

9.4.3-1. Provide unit heaters component description in AP600 SSAR Section 9.4.3.2, data in Table 9.4.3-1 and also provide annex II building unit heaters classification data in AP600 SSAR Table 3.2-3.

9.4.3-2. Revise AP600 SSAR Section 9.4.12 to include the reference of UL 1025 for the unit heaters, as indicated on AP600 SSAR Table 3.2-3.

9.4.3-3. Provide local effluent holdup tank exhaust unit component description in AP600 SSAR Section 9.4.3.2 and data in Tables 9.4.3-1 and 9.4-1

9.4.3-4. Provide efficiency and flow information data in AP600 SSAR Table 9.4-1 for AABVS and FHAVS HEPA filters.

9.4.3-5. Revise AP600 SSAR Table 9.4.3-1 to include component data for RCLVS supply units and revise exhaust units data as two 100 percent units, as stated in AP600 SSAR Section 9.4.3.4.

9.4.3-6. Revise SSAR Section 9.4.3.2 to provide AHU outlet design temperature for AABVS, FHAVS, and RCLVS and state that the AHUs are controlled by temperature controllers with their sensors in the corresponding subsystem supply duct to maintain the specified temperature.

9.4.3-7. Revise AP600 SSAR table 3.2-3 to provide classification of all major components as shown in AP600 SSAR Figure 9.4.3-1 including fire dampers.

9.4.3-8. State the specific applicable codes and standards for all VAS equipment in AP600 SSAR Section 9.4.3 as well as in Table 3.2-3.

9.4.3-9. Provide clarification of the number of fire dampers provided for RCLVS and revise applicable AP600 SSAR documents accordingly.

9.4.3-10. Provide ventilation details and safe hydrogen level for the gaseous rad-waste module area to keep the equipment compartment below the predetermined limit of safe hydrogen concentration level.

9.4.6 CONTAINMENT RECIRCULATION COOLING SYSTEM

9.4.6-1. Westinghouse states that the VCS conforms to the applicable codes and standards as listed in AP600 SSAR Section 3.2. However, AP600 SSAR Table 3.2-3 does not list the classification of VCS components.

9.4.6-2. Westinghouse needs to provide (1) radiation monitor inside each steam generator compartment, (2) component details and conformance with ASME N509-1989 standards, including T-ble 4-2, ASME N510-1989 standards and RG 1.140 for portable exhaust air filtration unit, and (3) update AP600 SSAR Tables 3.2-3 by providing classification of components data, 9.4.6-1 to list design parameters, 9.4-1 for air flow rate and efficiency data and 9.4-2 for minimum instrumentation.

9.4.6-3. AP600 SSAR Figure 9.4.6-1, Note 6, indicates that the duct mounted relief dampers will be located when duct layout is finalized. The staff considers the relief damper locations on VCS AP600 SSAR Figure 9.4.6-1 as a discrepancy.

9.4.7 CONTAINMENT AIR FILTRATION SYSTEM

9.4.7-1. What are the ambient summer and winter design temperatures for which the VFS supply air subsystems are designed, specified temperature maintained at AHUs (controlled by temperature controllers with their sensors in the supply duct), and temperature ranges maintained in the served areas?

9.4.7-2. AP600 SSAR Table 3.2-3 does not list the VFS components classification.

9.4.7-3. What are the specific applicable codes and standards for the VFS equipment in AP600 SSAR Section 9.4.7, as well as in Table 3.2-3?

9.4.7-4. What are the locations of the air intakes? State whether they are protected against the tornado-generated external missiles.

9.4.8 RADWASTE BUILDING HVAC SYSTEM

9.4.8-1. Revise AP600 SSAR Table 3.2-3 for VRS components including unlisted system dampers and high and low efficiency filters.

9.4.8-2. List separately the VRS efficiency data for all VRS high and low efficiency filters in Table 9.4.8-1 and show all them on Figure 9.4.8-1 accordingly.

9.4.3-3. Revise AP600 SSAR Section 9.4.8 to provide industry code data for VRS components concerning their design, construction and testing

9.4.8-4. Provide data for men's and women's locker room exhaust fans in AP600 SSAR Table 9.4.8-1.

9.4.8-5. Update AP600 SSAR Section 9.4.8 to provide code data for the system components.

9.4.8-6. What are the ambient summer and winter design temperatures for which the VXS subsystems are designed?

9.4.9 TURBINE BUILDING VENTILATION SYSTEM

9.4.9-1. AP600 SSAR Section 9.4.9 described the system briefly. Provide design parameters for system components or piping, instrumentation diagram, and classification of the VTS system and components in AP600 SSAR Table 3.2-3.

9.4.10 DIESEL GENERATOR BUILDING HVAC SYSTEM

9.4.10-1. Provide the specific AHU outlet temperature maintained and state that AHUs are controlled by temperature controllers with their sensors in the supply duct to maintain the air supply at this specified temperature.

9.4.10-2. To determine the extent of conformance with GDC 17, as it relates to ensuring proper functioning of the standby onsite ac electric power system, Westinghouse should confirm that the VZS standby exhaust ventilation systems are equipped with the air filters and that the louver locations for outside air intake conform with the guidance of NUREG/CR-0660 [6.1 m (20 ft) above grade] to control the dust and other particulates. Revise AP600 SSAR Figure 10.4.10-1 accordingly.

9.4.10-3. Evaluate the equipment operability for the equipment located inside DG area exposed to 130 °F while DG in operation.

9.4.11 HEALTH PHYSICS AND HOT MACHINE SHOP HVAC SYSTEM

9.4.11-1. Update AP600 SSAR Table 3.2-3 for VHS components including unlisted system dampers and hot machine shop filtration unit subsystem components.

9.4.11-2. Provide the specified AHU outlet temperature and state that AHUs are controlled by temperature controllers with their sensors in the supply duct to maintain the air supply at this specified temperature.

9.4.11-3. Clarify the number of radiation monitors with associated MCR high and high-high alarms and number of filtration unit for the hot machine shop are provided and revise affected SSAR section, figure, table, and drawing, accordingly.

9.4.11-4. Revise Table 9.4.11-1, Sheet 2 of 2 to state "filter requirements," not "heating coil requirements." Also, the table needs to list the correct number of HEPA filters for VHS or AP600 SSAR section and figure need to be revised, accordingly.

9.5.1 FIRE PROTECTION

9.5.1-1. The staff has not completed it's review of the AP600 safe shutdown capability in the event of a disabling fire. Westinghouse appears to take credit for the use of non-safety related systems as indicated in SSAR, Chapter 9A.2.7.1 "Criteria and Assumptions", section titled, "Offsite Power" which states the following:

> "For the safe shutdown evaluation it is assumed that either offsite power is available continuously or offsite power is unavailable for first 72 hours, which ever is more conservative. If offsite power is available, non-safety related systems are assumed to operate if a more conservative evaluation would result"

Redundant safety related equipment is separated by three hour rated fire walls, which is an acceptable way of protecting redundant safe-shutdown equipment. However, Westinghouse will utilize defense-in-depth equipment that may not be provided with electrical protection and separated by three hour barriers which is not in accordance with SECY 93-087 or the BTP CMEB 9.5-1. Westinghouse will be required to demonstrate that the reactor can be safely shutdown in a controlled manner with or without offsite power using the safety related equipment.

In addition, Westinghouse is requested to explain their use of defense-in-depth equipment in the event of a major fire in the control room (other areas where the redundant defense-in-depth equipment and/or support equipment are in the same fire area) to bring the reactor to a controlled and stable shutdown condition. Westinghouse should be prepared to explain operator identification [illegible] and mitigation of spurious signals and spurious operation of [illegible]ense in depth equipment. Westinghouse should provide their operator guidelines for adverse conditions as part of this discussion.

9.5.1-2. In the SSAR, Chapter 9A.2.7.1 "Criteria and Assumptions", section titled "Spurious Actuation of Equipment" states the following:

> "It is assumed that a fire results in the loss of all automatic functions signals and logic from the circuits located in the fire area, in conjunction with one worst case spurious actuation or signal from the fire.
>
> "Spurious actuations of the redundant valves in any one high-low pressure interface line are postulated if the circuits for those valves are located in the fire area."

Westinghouse is to clarify whether the above stated criteria of considering one worst case spurious operation is postulated for all fire areas or only for fires requiring the use of the safe shutdown work station?

9.5.1-3. The SRM dated July 21, 1993 From S. Chilk, Secretary to J. Taylor specifies that the Commission (with all Commissioners agreeing) has approved the staff's position (SECY-93-087) that the passive plants should also be reviewed against the enhanced fire protection criteria approved int Commission's SRM June 26, 1990.

The SECY 93-087 provides the staff recommendations approved by the commissions concerning Advance Evolutionary Reactors. SECY 93-087 indicates that,"The staff proposed to require that evolutionary ALWR designers must ensure that safe shutdown can be achieved assuming that all equipment in any one fire area will be rendered inoperable by fire and that re-entry into the fire area for repairs and operator actions is not possible. The AP600 may require repair to bring the unit to cold shutdown conditions.

Westinghouse is requested to discuss in detail repairs on the defense-in-depth equipment and operator actions needed to bring the unit to cold shutdown conditions. Westinghouse should also provide the technical bases of why safe shutdown equipment is not needed to go to cold shutdown as required by SECY 93-087 and BTP CMEB 9.5-1.

9.5.1-4. Fire Protection Analysis

In the SSAR, Section 9A.2.7.1, "Zone of Influence," States, "A postulated fire does not exceed the boundary of the area. For fire areas outside the containment, the fire is assumed to disable all equipment and electrical cabling located in the fire area, unless the fire protection analysis demonstrates otherwise. However, no credit is taken for complete fire damage in cases in which complete damage is beneficial and partial damage is not. Inside containment, potential fire damage is evaluated on a zone-by-zone basis.

Westinghouse is requested to provide a list of all areas where the fire protection analysis demonstrates that a fire does not disable all equipment (other shutdown equipment) within a fire area (fire Zone of Influence).

9.5.1-5. In the SSAR, Section 9A.2.4, "Combustible Loading and Equivalent Fire Duration Calculation," states the following:

Fire detection and suppression needs are established based on combustible loading, using the following guidelines:

Combustible Loading (BTU/sq.ft)	Detection Capability		Suppression Capability
0 - 8,000	None		Manual
8,000 - 80,000	Yes	(1 hr)	Manual
Above - 80,000	Yes		Automatic and Manual

Westinghouse is not providing fire suppression for areas that have a combustible loading of less than 80,000 BTU square foot.

This strict use of the combustible loading and the fire resistive rating of the fire wall is not conservative in addressing the fire load within in the area. NFPA 251, 1-1.3 and 1-1.4, states the following:

> "This standard shall be used to measure and describe the properties of materials, products, or assemblies in response to heat and flame under controlled laboratory conditions and shall not be used to describe or appraise the fire hazard or fire risk of materials, products or assemblies under actual fire conditions. However, results of the tests may be used as elements of a fire risk assessment which takes into account all of the factors which are pertinent to an assessment of the fire hazard of a particular material's, product's or assembly's intended use.
>
> "The results of these tests are one factor in assessing fire performance of building construction and assemblies. These methods prescribe a standard fire exposure for comparing the performance of building construction assemblies. Application of these test results to predict the performance of actual building construction requires careful evaluation of test conditions."

Westinghouse is requested to revaluate their methodology concerning the installation of automatic detection and suppression systems for the AP600 design and develop more conservative criteria.

9.5.1-6. Westinghouse's response to the BTP 9.5-1 Section C.5.a(1)(b) in the AP600 SSAR indicated that the Westinghouse AP600 design will provide 3-hour-rated fire barriers to separate redundant divisions except for the containment and the control room. Westinghouse did not include the remote shutdown work station as an area where separate redundant divisions are not separated by 3-hour-rated fire barriers.

Should the remote shutdown work station be included in the exception list?

If the remote shutdown work station is not included in the exception list then the reasons of why it is not included in this list should be provided.

9.5.1-7. In the SSAR, Section 9.5.1.2.1.1, Westinghouse indicated that, "Fire protection features within the containment fire area provide confidence that one train of safe shutdown equipment will remain undamaged following a fire. The quantity of combustible material is minimized. The use of canned reactor coolant pumps has eliminated the need for an oil lubrication system.

Westinghouse should indicate the location of the redundant trains of safe shutdown components and where they are separated by existing structural walls, or by distance. In addition, Westinghouse should specify the location of the fire suppression and fire detection systems.

9.5.1-8. In the SSAR, Section 9.5.5, Table 9.5.1-1, BTP CMEB 9.5-1 Guidelines 112-120, "Fire Detection," Westinghouse indicated that the automatic fire detection systems will be designed and installed in accordance with NFPA Standard 72 in areas that contain or present a fire exposure to safety-related equipment and for all significant hazards. In addition, the fire detectors will be installed as a Class A system defined in NFPA 72D and Class I circuits as defined in NFPA 70. Westinghouse also indicated that there may be design considerations, that may result in exceptions to specific guidance.

The staff assumes that the selection and installation of fire detectors are also based on consideration of the type of hazard, combustible loading, the type of combustion products and detector response characteristics. The staff also assumes that Westinghouse will provide detection capability for major cable concentrations, safe-shutdown-related/defense-in-depth major pumps, switchgear, motor-control centers, battery and inverter areas, relay rooms, fuel areas, radwaste areas, and all other areas containing in-situ or potentially transient combustibles. Detector devices will be selected on the basis of type of anticipated fire and will be located on the basis of ventilation, ceiling height, ambient conditions, and burning characteristics of the involved materials. Detection systems will alarm and annunciate in the control room and will give a distinctive audible and, if necessary (to facilitate fire brigade identification of fire location), visual local alarm.

The staff has made assumptions regarding the detection capability. If these assumptions are not valid, then indicate what assumptions are not valid.

Westinghouse is requested to identify and provide a list of all known BTP CMEB 9.5-1 and NFPA fire detector exemptions.

9.5.1-9. In the SSAR, Section 9.5.1.2.1.3, "Fire Water Supply System," Westinghouse stated that, "The fire water supply system is designed in accordance with the BTP 9.5-1 and the applicable NFPA standards."

Also, in Section 9.5.5 of the AP600 SSAR, Table 9.5.1-1, BTP CMEB 9.5-1 Guidelines 121-144, "Fire Protection Water Supply System," Westinghouse committed to follow the BTP CMEB 9.5-1 Guidelines, but noted that due to conflicting design considerations, there may be a need to take exception to specific guidance. These deviations are to be addressed in the Fire Hazards Analysis submitted by the COL applicant.

Westinghouse is requested to identify and provide a list of all known BTP CMEB 9.5-1 and NFPA exemptions concerning the water supply.

9.5.1-10. In the SSAR, Section 9.5.1.2.1.3, Westinghouse indicated that the fire protection water supply is comprised of two separate fresh water storage tanks. The primary tank is totally dedicated to provide water to the fire protection water supply system. A second fire protection water storage tank serves the raw water system but also contains a dedicated volume of water for use by the fire protection system if the primary fire protection water tank is unavailable. Guideline 137 (BTP CMEB 9.5-1, Section C.6.b (9)) states that two separate fresh water supplies with a minimum of 300,000 gallons each should be utilized for fire service.

Does the second fire protection water storage tank contain a dedicated 300,000 gallon storage capacity for fire service?

9.5.1-11. In the SSAR, Section 9.5.1.2.1.4, Westinghouse indicated that automatic fire suppression systems will consist of (1) automatic wet-pipe sprinkler systems, (2) preaction sprinkler systems, (3) deluge sprinkler or water spray systems, and (4) automatic foam suppression systems. Westinghouse indicated that these systems will be installed and maintained in accordance with the BTP CMEB 9.5-1 and the applicable NFPA standards. Westinghouse further indicated that the fixed automatic fire suppression systems are provided based on the results of the fire protection analysis.

Westinghouse is requested to identify and provided a list of all known BTP 9.5-1 and NFPA deviations concerning the automatic fire suppression systems.

9.5.1-12. In Section 9.5.5 of the AP600 SSAR, Table 9.5.1-1, BTP CMEB 9.5-1 Guidelines 155, titled "Water Sprinkler and Hose Standpipe Systems," Westinghouse indicated that water will be supplied to standpipes and hose connections for manual fire fighting in areas containing equipment required for safe plant shutdown in the event of a safe shutdown earthquake. The piping systems serving these hose stations will be analyzed for SSE loading and will be provided with supports to ensure systems pressure integrity. The piping and valves for the portion of hose standpipe system affected by this functional requirement will, as a minimum, satisfy ANSI B31.1, "Power Piping." The water supply will be capable of delivering at least 75 gallons per minute for two hose stations.

What quantity of water is dedicated to the manual hose stations from the passive containment water storage tank.

What is the minimum pressure required to produce at least two effective hose streams inside containment utilizing the passive containment water storage tank water supply. Is the containment water dedicated fire water capable of supplying minimum pressure and flow to produce an effective hose stream?

Is there a possibility for channeling water from fire-extinguishing operations in one redundant fire area into another redundant fire area.

9.5.1-13. In the SSAR, Section 9.5.1.2.1.5, "Manual Fire Suppression," Westinghouse indicated that, "Portable fire extinguishers are provided throughout the plant. Portable extinguishers are readily accessible for use in high radiation areas but are not located within those areas unless the fire protection analysis indicates that a specific requirement exists."

In Section 9.5.5 of the AP600 SSAR, Table 9.5.1-1, BTP CMEB 9.5-1 Guidelines 164-165, "Portable Extinguishers," Westinghouse indicated that extinguishers will be provided in areas that contain, or present, a fire exposure hazard to safety related equipment in accordance with the guidelines of NFPA 10, "Portable Fire Extinguishers, Installation, Maintenance and Use." The staff expects that these deviations to the BTP CMEB 9.5-1 and/or the NFPA 10 will be addressed in the Fire Hazards Analysis to be submitted by the COL applicant.

Is the staff's expectations of the applicant providing deviations valid?

9.5.1-14. BTP CMEB 9.5-1, Section C.5.g, states that fixed self-contained lighting of florescent or sealed-beam units with individual 8-hour minimum battery power supplies should be provided in areas that must be manned for safe shutdown and for access and egress to and from all fire areas. Safe shutdown areas include those areas required to be manned if the control room must be evacuated.

In Section 9.5.5 of the AP600 SSAR, Table 9.5.1-1, BTP CMEB 9.5-1 Guidelines 108, "Lighting and Communication," Westinghouse indicated that they comply with Section C.5.g of the BTP 9.5-1, however, an alternative emergency lighting source is provided for the main control room and the remote shutdown work station. In Section 9.5.3.2.2, "Emergency Lighting," Westinghouse states, "Main control room and remote shutdown area emergency lighting consists of 120 Vac florescent lighting fixtures which are continuously energized. The fixtures are powered from the Class 1E 125Vdc switchboards through the Class 1E 208Y/120Vac inverters."

Westinghouse is to demonstrate that the control room emergency lights and the remote shutdown work station emergency lights are electrically and physically protected from a fire. A complete description of this protection should be provided.

9.5.1-15. The BTP CMEB 9.5-1, Section C.5.g states that a portable radio communication system be provided for use by the fire brigade and other operations personnel required to achieve safe plant shutdown. This system should not interfere with the communications capabilities of the plant security force. Fixed repeaters installed to permit use of portable radio communication units should be protected from exposure fire damage.

Does Westinghouse commit to meeting the emergency communication guidelines of BTP CMEB 9.5-1 Section C.5.g(4) regarding the use of a portable radio communications system by the fire brigade and other operational personnel required to achieve safe plant shutdown?

9.5.1-16. BTP CMEB 9.5-1, Section C.3 states, in part, that "... an onsite 6-hour supply of reserve air should be provided and arranged to permit quick and complete replenishment of exhausted air supply bottles as they are returned. If compressors are used as a source of breathing air, only units approved for breathing air shall be used; compressors shall be operable assuming a loss of offsite power. Special care must be taken to locate the compressor in areas free of dust and contaminants."

In the SSAR, Section 9.5.5, Table 9.5.1-1, BTP CMEB Guideline 32, "Fire Brigade," Westinghouse stated that the AP600 is expected to conform to the guidelines or the intent of the guidelines. The COL applicant will provide additional information. The guidelines also indicated that the procedures and administrative controls governing the fire protection program during plant operations are developed for specific plants and covered in the Combined License application.

Westinghouse should provide additional information concerning reserve air to permit quick and complete replenishment of exhausted air supply bottles as they are returned.

Westinghouse is requested to identify the location of air compressors or other equipment such as cascading air bottles that will be used to replenish the breathing air.

9.5.1-17. BTP CMEB 9.5-1, Section C.5.a(14) states that, "Floor drains sized to remove expected fire fighting water flow without flooding safety-related equipment should be provided in those areas where fixed water fire suppression systems are installed."

In the SSAR, Section 9.5.5, Table 9.5.1-1, BTP CMEB Guidelines 67-71, "Building Design," Westinghouse indicated that the AP600 is committed to compliance with the BTP CMEB 9.5-1. Guideline 71 states that, "Water drainage from areas that may contain radioactivity should be collected, sampled and analyzed before discharge to the environment." Westinghouse indicated that procedures and administrative controls governing the fire protection program during plant operation, are developed for specific plants and covered in the Combined License application.

Westinghouse is requested to provide the methodology in determining the floor drains sized to remove water flow without flooding safety-related equipment.

9.5.1-18. SECY-90-016 and 93-087 indicated that ALWR designers must ensure that smoke, hot gases, or the fire suppressant will not migrate to other fire areas to the extent they could adversely affect safe shutdown capabilities including operator action.

In the SSAR, Section 9A.3.1.1, Westinghouse indicated that "Smoke and Hot gasses are removed from the fire area by portable exhaust fans and flexible ductwork." In other areas, Westinghouse smoke control features consists of fire dampers closing on high temperatures to control the spread of fire and combustion products. Smoke and hot gases are removed from the fire area by reopening the fire dampers after a fire. The nuclear island nonradioactive ventilation system is manually aligned to the smoke purge mode to exhaust smoke and hot gases to the atmosphere.

The 14th edition of the NFPA Handbook, Section 6, Chapter 8, "Confinement of Fire and Smoke in Buildings," indicated that one method of smoke control involves confinement and the use of physical barriers such as doors, walls or dampers. Although the physical barrier blocks the movement of smoke, no workable system have been devised that are able to confine smoke by means of physical barriers alone. An alternative to physical barrier confinement is the use of a pressure differential between the smoky atmosphere and the protected area. This pressurization, with or without simultaneous exhausting creates an effective barrier. The combination of pressurization with physical barriers seems to be the most practical method of protecting an area from the intrusion of any products of combustion.

Westinghouse is requested to describe in detail how smoke will be prevented from migrating to other fire areas such that hot gases will not adversely affect safe shutdown, including operator action, for all safe shutdown and safety related areas.

9.5.1-19. BTP CMEB 9.5-1 Section 5.f(1) states that, "To facilitate manual fire fighting, separate smoke and heat vents should be provided in specific areas such as cable spreading rooms, diesel fuel storage areas, switchgear rooms, and other areas where the potential exists for heavy smoke conditions. In the SSAR, Westinghouse indicated in the Fire Protection Program Compliance with BTP CMEB 9.5-1 that, "No areas requiring separate smoke and heat vents are identified."

Westinghouse is requested to describe in detail, the method(s) used to remove smoke to facilitate manual fire fighting in areas such as the diesel storage areas, switchgear rooms, and other areas where the potential for heavy smoke conditions exists.

9.5.1-20. BTP CMEB 9.5-1, Section C.1.b(8) states that appropriate protection for inadvertent operation of fire suppression systems.

In the SSAR, Section 9.5.5, Table 9.5.1-1, BTP CMEB Guidelines 17, "Fire Protection Analysis," Westinghouse indicated that the AP600 is in compliance with BTP 9.5-1 regarding protection for inadvertent operation of fire suppression systems.

Westinghouse is requested to describe, in detail, the protection provided regarding the inadvertent operation of fire protection systems.

9.5.4 DIESEL GENERATOR AUXILIARY SYSTEMS

9.5.4-1. The staff reviewed Westinghouse's response to RAI 410.171 and determined that information provided is acceptable, but a separate section and figure in the SSAR for each DG auxiliary support system was not provided. More information needs to be provided in the SSAR for each DG auxiliary support system comparable to what was done for the standby diesel fuel oil system in SSAR Section 9.5.4. The staff will review SSAR Revision 2 to verify incorporation of the information into SSAR Section 8.3.1.1.2.1.

9.5.4-2. The staff reviewed Westinghouse's response to RAI 410.172 and determined that number (1) should be a COL Action Item (Equipment Procurement Specifications) and should be added to the SSAR, number (2) is acceptable, and number (3) is unacceptable because SSAR Section 9.4.10 does not discuss inlet air filters and they are not shown in Figure 9.4.10-1.

9.5.4-3. The staff reviewed Westinghouse's response to RAI 410.173 and determined that the response is acceptable pending incorporation into the SSAR.

9.5.4-4. The staff reviewed Westinghouse's response to RAI 410.174 and determined that item "a" should be a COL Action Item and should be added to the SSAR, items "b", "c" and "d" are acceptable pending incorporation of the information in the response into SSAR Section 9.5.4 and Figure 9.5.4-1, and item "e" should be a COL Action Item (Plant Installation Specifications) and should be added to the SSAR.

9.5.4-5. The staff reviewed Westinghouse's response to RAI 410.175 and determined that item "a" should be a COL Action Item and should be added to SSAR, item "b" and "c" are acceptable pending incorporation of the information in the response into SSAR Section 9.5.4, and item "d" is acceptable pending review of SSAR Revision 2. The staff developed the following additional questions in regarding item "b". Are there any provisions or a program to assure that the quality of the stored fuel oil meets minimum requirements at all times? For example, to allow time for sediment to settle before fuel oil is transferred from the storage tank to the day tank, refueling occurs only when the day tank is full.

9.5.4-6. The staff reviewed Westinghouse's response to RAI 410.176 and determined that the response is acceptable pending review of Figure 9.5.4-1 in SSAR Revision 2.

9.5.4-7. The staff reviewed Westinghouse's response to RAI 410.178 and determined that the response should be a COL Action Item and should be added to the SSAR.

9.5.4-8. The staff reviewed Westinghouse's response to RAI 410.183 and determined the following:

a. Acceptable, pending incorporation of the information in the response into the SSAR.
b. Westinghouse stated that the AP600 equipment procurement specifications for electrical equipment will require dust tight enclosures. This should be a COL Action Item (Equipment Procurement Specifications) and should be added to the SSAR. Westinghouse also stated that the VZS utilizes inlet air filters. However, SSAR Section 9.4.10 does not include reference to inlet filters. [See response to RAI 410.172(3)] Westinghouse needs to resolve this discrepancy. Also, Westinghouse needs to state in the AP600 SSAR that the fresh air intake on the VZS is located 20 feet above grade to minimize the intake of dust into the building in order to comply with NUREG/CR-0660. See staff's position to RAI 410.183g.
c. Acceptable. Westinghouse stated that personnel training of DG operating staff is the responsibility of the COL applicant. This should be a COL Action Item and should be added to the SSAR.
d. Westinghouse stated that the equipment procurement specifications for the DG engine will require that the engine be provided with a continuous keep warm and prelube system which remains in operation while the engine is in standby mode. This should be a COL Action Item (Equipment Procurement Specifications) and should be added to the SSAR. Also, this response does not address the DG engine problems caused by excessively long pre-lube periods. See staff's position on RAI 410.182a.
e. Westinghouse stated that the program for testing, test loading, and preventive maintenance is the responsibility of the COL applicant. This should be a COL Action Item and should be added to the SSAR. However, Westinghouse did not address minimizing no load and light load operation. See staff's position to RAI 410.181d.
f. Westinghouse stated that instrumentation is provided to support diagnostics during operation. However, this does not sufficiently address this recommendation as discussed in NUREG/CR-0660. Westinghouse needs to provide additional information for how the AP600 design addresses this recommendation. This recommendation should be a COL Action Item and should be added to the SSAR.
g. Westinghouse needs to state in the AP600 SSAR that the fresh air intake on the VZS is located 20 feet above grade to minimize the intake of dust into the building in order to comply with this NUREG/CR-0660 recommendation. See staff's position on RAI 410.183b.
h. Acceptable, pending incorporation into the SSAR.
i. Westinghouse stated that the equipment procurement specifications for the DG electrical equipment will address the need for high temperature insulation. This should be a COL Action Item (Equipment Procurement Specifications) and should be added to the SSAR.
j. Westinghouse stated that the standby diesel engine cooling water system is designed to use three-way thermostat water temperature

control valves. These valves split the water flow between the cooling radiator circuit and the engine return inlet circuit such that the engine cooling inlet circuit temperatures remain nearly constant under various engine loads and ambient temperature conditions. However, Westinghouse needs to verify that the three-way thermostat is of the "Amot" brand or equal with an expanding wax type temperature sensitive element. In addition, this information should be incorporated into the SSAR.

k. Westinghouse stated that the effects of engine vibration on engine mounted monitoring and control instrumentation will be addressed in the equipment procurement specifications. This should be a COL Action Item (Equipment Procurement Specifications) and should be added to the SSAR.

NUREG/CR-0660 also recommends that the floors be painted with concrete or masonry type paint in all rooms of the DG buildings which house any devices with electrical contacts. This recommendation was mistakenly omitted from RAI 410.183. However, Westinghouse still needs to describe how the AP600 design addresses this NUREG/CR-0660 recommendation.

9.5.4-9. What temperature is the diesel oil transfer module enclosure maintained at for all temperature extremes? SSAR Section 9.4.10 says that the DG building is maintained above 50°F. However, what about the fuel oil transfer module enclosure? Note 5 on SSAR Figure 9.5.4-1 states that only the piping and equipment in the main flow path are heat traced inside diesel oil transfer module. Does the heat tracing prevent the strainers (S01A & S01B) in the transfer lines from clogging due to low ambient temperatures causing the fuel oil to go bellow its cloud point?

9.5.4-10. Why are filters not provided in the fill line to each fuel oil storage tank (Only strainers are provided)? The filters should meet the fuel oil supplier's specifications to prevent coagulated fuel oil from entering the fuel oil storage tank.

9.5.4-11. Are all exposed DG building interior surfaces painted to aid in dust control?

9.5.4-12. When the day tank low level is alarmed, how long will the DG be able to operate at full load with the remaining fuel in the day tank without pumping more fuel oil from the storage tank?

9.5.4-13. Revise the AP600 SSAR to make Table 8.3.1-1 and Table 9.5.4-2 agree.

(a) Add the fuel oil storage tank (Lo) level alarm to SSAR Table 8.3.1-1.
(b) Show the day tank level as alarming locally in SSAR Table 8.3.1-1.
(c) SSAR Table 8.3.1-1 does not show low fuel oil pressure, moisture separator differential pressure, filter differential pressure, pump suction strainer differential pressure, heater in

service, heater low temp out, and fuel oil tank fill strainer differential pressure as alarming locally in the DG building and as a combined trouble alarm in the control room.

9.5.4-14. Does the standby diesel fuel oil system comply with the Diesel Engine Manufacturer's Association (DEMA) Standard? Do all of the DG auxiliary support systems?

9.5.4-15. How do the standby DG auxiliary systems meet the intent of RGs 1.108, 1.137, 1.9, IEEE Standard 387, and ANSI Standard N195?

9.5.4-16. Revise AP600 SSAR Table 3.2-3 to include the classification of the standby diesel fuel oil system components.

9.5.5 DIESEL GENERATOR COOLING WATER SYSTEM

9.5.5-1. The staff reviewed Westinghouse's response to RAI 410.181 and determined that items "a", "b" and "c" are is acceptable pending incorporation of the information in the response into the SSAR. The staff developed the following additional question regarding item "d". Both Item III.7 of SRP Section 9.5.5 and NUREG/CR-0060 discuss problems associated with the operation of the diesel engine at no load and light load conditions for extended periods of time. How does the AP600 design address this concern? See staff's position on RAI 410.183e.

9.5.5-2. At what temperature does the electric jacket water heater and the electric motor driven jacket water heater pump automatically maintain the engine jacket water of the idle DG?

9.5.5-3. Does the standby diesel cooling water system have the capability to detect and control system leakage, including isolating portions of the system in the event of excessive leakage or component malfunctions? In addition, does the system have measures to preclude long-term corrosion and organic fouling that would degrade system performance? Also, have provisions been made to permit inspection of components?

9.5.5-4. Specific design criteria, such as expansion tank capacity, pump characteristics, system volume, flow rates, temperature sensor selection, and heat removal capabilities, plus expected water loss over a 7-day period, is not provided in the SSAR. Provide this information in the SSAR.

9.5.6 DIESEL GENERATOR STARTING AIR SYSTEM

9.5.6-1. The staff reviewed Westinghouse's response to RAI 410.180 and determined that for item "a" Westinghouse should provide justification for why only three consecutive starts of the standby diesel starting air system is adequate. The staff also determined that items "b", "c", and "d" are acceptable, pending incorporation of the information in the response into the SSAR.

9.5.6-2. Are provision made for the periodic or automatic blowdown of accumulated moisture and foreign material in the air receivers and other critical points of the system?

9.5.6-3. Specific design criteria, such as the devices to crank the engine, air start requirements with regard to the duration of the cranking cycle, and the number of engine revolutions per start attempt is not provided in the SSAR. These requirements will, in turn, dictate such design parameters as the volume and design pressures of the air receivers and compressor size. Provide this information in the SSAR.

9.5.7 DIESEL GENERATOR ENGINE LUBE OIL SYSTEM

9.5.7-1. The staff reviewed Westinghouse's response to RAI 410.182 and determined that the response is acceptable pending incorporation of the information in the response into the SSAR. In regards to item "a", does the AP600 design address the problems associated with using excessively long prelube periods with the Fairbanks Morse Opposed Piston Diesel Generator Engine as discussed in NUREG/CR-0660? See staff's position on RAI 410.183d.

9.5.7-2. Does the standby diesel lube oil system have the capability to detect and control system leakage, including isolating portions of the system in the event of excessive leakage or component malfunctions? Are measures provided to assure the quality of the lube oil? Are measures provided for cooling the system and removing system heat load? Will protective measures (such as relief ports) be used to prevent unacceptable crankcase explosions and to mitigate the consequences of such an event?

9.5.7-3. A detailed P&ID for the standby diesel lube oil system needs to be shown in a figure in the SSAR.

9.5.7-4. Are alarms provided to alert the operator to pump failure or low system pressure during the keep warm mode where continuous prelube is provided?

9.5.7-5. Specific design criteria, such as pump flows, operating pressure, temperature differentials, cooling system heat removal capability, and electric heater characteristics, is not provided in the SSAR. Provide this information in the SSAR.

9.5.8 DIESEL GENERATOR AIR INTAKE AND EXHAUST SYSTEM

9.5.8-1. The staff reviewed Westinghouse's response to RAI 410.179 and determined that item "a" is acceptable pending incorporation of the information in the response into the SSAR and item "b" should be a COL Action Item (Equipment Procurement Specifications) and should be added to the SSAR.

9.5.8-2. AP600 SSAR Table 8.3.1-1 does not show any alarms for the standby diesel air intake and exhaust system. Are any alarms provided remotely in the control room or locally in the DG building for the standby diesel air intake and exhaust system?

9.5.8-3. Is the silencer module and other system components protected from possible clogging from adverse atmospheric conditions, such as: dust storms, rain, ice, snow, etc?

9.5.8-4. Specific design criteria, such as air flow capacity is not provided in the SSAR. Provide this information in the SSAR.

10.2 TURBINE GENERATOR

10.2-1. The AP600 turbine generator does not have a mechanical overspeed trip device as described in SRP Section 10.2 Paragraph III.2.c. The applicant is requested to provide the bases for not having a mechanical overspeed trip device. Specifically, the concern of diversity and common mode failure needs to be addressed.

10.2-2. The closing time for extraction nonreturn valves is 2 seconds. It is not clear that this is sufficient to satisfy Criterion II.3 that the extraction steam check valves provided at extraction connections shall be capable of closing within a appropriate time limit to maintain stable turbine speeds in the event of a turbine trip signal. The applicant is requested to clarify this point.

10.2-3. SSAR Section 10.2.3.6 states that at least one main steam stop valve, one main steam control valve, one reheat stop valve, and one intercept valve is dismantled approximately every 5 years during scheduled refueling or maintenance shutdowns. The staff finds that the 5-year interval deviates from the 3-1/3-year interval specified in SRP Section 10.2 Acceptance Criterion II.5.a. Westinghouse refers to EPRI Utility Requirements Document, Volume III, Chapter 13, Section 2.2.3, where EPRI states that the turbine valves shall have a design goal for the capability to operate for a minimum of six years between inspections. The staff SER for EPRI URD states that this is acceptable based on the added commitment in the maintenance program described in Section 2.3.8.3.2 of the URD. It states that the "Plant Designer shall provide recommendations for the plant maintenance program ...These recommendations will be based on both turbine missile generation probability analyses as well as plant availability. The basis shall be provided to the plant owner." Westinghouse has not provide such a recommendation in the SSAR to the COL applicant on a maintenance program.

10.2-4. Main stop valves, control valves, reheat stop and intercept valves are tested with the turbine online. Pushbuttons on the DEH control test panel are used to stroke the valves from full-open to full-closed. Turbine valve testing is performed at the intervals as specified by the designer. The staff finds that the "the intervals as specified by the designer" deviates from the specified test intervals of once per week in SRP Section 10.2 Criterion II.5.b.

10.2-5. The nominal rating of turbine generator is listed as 570,000 kW and 707,000 kW respectively in SSAR Section 10.1.1 and Table 10.2-1. Resolve this discrepancy.

10.2-6. The responses to RAI Q410.139, Q410.143, and Q410.144 were received after the DSER was prepared, and are under staff review. Open items and questions may be developed as a result of the review of those responses.

10.3 MAIN STEAM SUPPLY SYSTEM

10.3-1. The staff finds that the term, "safety-related portion of the main steam supply system (MSSS)," is not well defined in the SSAR. Westinghouse responded in RAI Q410.249 explaining the meaning of the term without any SSAR revision. In addition, the staff finds the description in SSAR Section 10.3.3 about quality group classification is confusing. Westinghouse states in the response to RAI Q410.146 that the safety-related portions of the MSSS, and the main and startup feedwater supply are included in the steam generator system of Table 3.2-3. Westinghouse has not revised SSAR description. The staff finds the response inadequate and SSAR description still confusing, and requires further discussion.

10.3-2. The responses to RAI Q410.145 and Q410.253 were received after the DSER was prepared, and are under staff review. Open items and questions may be developed as a result of the review of those responses.

10.4.1 MAIN CONDENSER

10.4.1-1. The response to RAI Q410.255 was received after the DSER was prepared, and is under staff review. Open items and questions may be developed as a result of the review of those responses.

10.4.2 MAIN CONDENSER EVACUATION SYSTEM

10.4.2-1. WCAP-13054 states that RG 1.33 is not applicable to AP600 and that RG 1.123 has been withdrawn. However, the applicant has not discussed the reasons that RG 1.33 is not applicable and what alternative quality assurance program would apply to the main condenser evacuation system in lieu of RG 1.123.

10.4.2-2. The response to RAI Q410.257 was received after the DSER was prepared, and is under staff review. Open items and questions may be developed as a result of the review of those responses.

10.4.3 TURBINE STEAM SEALING SYSTEM

10.4.3-1. WCAP-13054 states that RG 1.33 is not applicable to AP600 and that RG 1.123 has been withdrawn. However, the applicant has not discussed the reasons that RG 1.33 is not applicable and what alternative quality assurance program would apply to the turbine steam sealing system in lieu of RG 1.123.

10.4.3-2. The responses to RAI Q410.258 and Q410.259 were received after the DSER was prepared, and are under staff review. Open items and questions may be developed as a result of the review of those responses.

10.4.4 TURBINE BYPASS SYSTEM

10.4.4-1. Provide responses to RAI Q410.264, and incorporate responses to the SSAR as deemed appropriate.

10.4.7 CONDENSATE AND FEEDWATER SYSTEMS

10.4.7-1. SSAR Section 10.4.7 addresses the dynamic effects associated with possible fluid flow instability by having the feedwater system designed in accordance with the guidance contained in BTP (ASB) 10-2. However, the SSAR did not address the plant procedures for performing tests to verify that unacceptable feedwater hammer will not occur. Provide test procedures for testing feedwater hammer occurrence or make a COL action item.

10.4.9 STARTUP FEEDWATER SYSTEM

10.4.9-1. SSAR Section 10.4.9 states that in situations where startup feedwater is actuated, the flow control valves automatically control flow to each steam generator. However, the applicant did not address that the required initial flow will not result in plant damage due to water hammer. The applicant is required to address this issue in the SSAR.

10.4.10 AUXILIARY STEAM SYSTEM

10.4.10-1. The response to RAI Q410.260 was received after the DSER was prepared, and is under staff review. Open items and questions may be developed as a result of the review of those responses.

11.2 LIQUID WASTE MANAGEMENT SYSTEM (LWMS)

11.2-1. Response to Q. 460.20 which deals with meeting the guidelines of RG.143 is incomplete. The seismic criterion (C.1.1.3) for the detergent waste and chemical waste tanks should be given. The final disposition of the overflow from the waste holdup tank which is contained in a water-tight room should be given. Applicability of Position C.1.2.2 to drains and sample lines should be addressed. Applicability of Position C.1.2.3 to indoor tanks and floor drains should be addressed.

11.2-2. Response to Q.460.25 which deals with re-run of the GALE code is incomplete. The code should be re-run with proper inputs for SG blowdown, PCA fraction for the dirty waste stream (should be 0.0157), DFs, collection times and process times.

11.2-3. Response to Q.460.21 which deals with demonstrating LWMS compliance with 10CFR20.1302 is incomplete. Westinghouse should demonstrate the compliance assuming 1% failed fuel for fission products and annual average effluent concentrations of radionuclides in an unrestricted area.

11.2-4. Response to Q.460.18 which deals with identification of COL action items in the SSAR is un-satisfactory. The staff considers that the cost-benefit analysis provided in Appendix 1B does not support Westinghouse's contention that a cost-benefit analysis need not be provided by the COL applicant to demonstrate compliance with Appendix I regarding population doses due to liquid effluents. Westinghouse should identify a COL action item in this regard.

11.2-5. Fig. WLS M6-004 for detergent waste subsystem (4/29/94) mistakenly shows two detergent monitor tanks. The diversion of waste water or chemical waste tank contents to the general waste subsystem, in the event of radioactivity detection in the applicable, waste is not explicitly stated in the SSAR or shown in the LWMS figure. These should be corrected.

11.3. GASEOUS WASTE MANAGEMENT SYSTEM (GWMS)

11.3-1. Response to Q.460.10 relating to delay times for xenon and krypton and instrumentation for gaseous radwaste system is incomplete. Westinghouse should provide provisions for monitoring and a list of alarmed process parameters for the GRS similar to the one provided in EPRI's URD Volume III Table 12.3-1. Westinghouse should justify the delay times to be used in the GALE run.

11.3-2. Response to Q.460.25 which deals with GALE re-run is incomplete. Westinghouse should re-run the code with proper input for delay times. The staff expects that the revised SSAR Table 11.3-3 will report the GALE run generated values for all radionuclides including Kr-85, unaltered. In this context, it should be noted that Oconee 3 units released 1970 Ci of Kr-85 via gaseous effluents in 1987.

11.3-3. Response to Q.460.21 is incomplete. Westinghouse should demonstrate compliance of GWMS with 10CFR20.1302 by assuming 1% failed fuel for fission products and annual average atmospheric dispersion factor for calculating gaseous effluent concentrations of radionuclides in an unrestricted area.

11.3-4. Westinghouse should clarify whether the dual oxygen analyzers provided for the GRS are independent and can, therefore, provide independent measurements of oxygen concentrations in the GRS process stream upstream of the charcoal beds. Also, the staff considers that the system should be designed such that oxygen source gets isolated and nitrogen gets injected automatically on high-high alarm setting of the oxygen analyzers.

11.3-5. Response to Q.460.18 is unsatisfactory. Westinghouse should identify a COL action item regarding demonstration of GWMS compliance with Appendix I population dose criterion.

11.4 SOLID WASTE MANAGEMENT SYSTEM (SWMS)

11.4-1. Westinghouse has not provided details on packaging of secondary system wet wastes and has not indicated what design feature has been provided to contain the contents of the secondary spent resin tank in the event of its failure. This should be provided.

11.4-2. Response to Q.460.18 is unsatisfactory. The staff considers that Westinghouse should identify the need for developing a process control program (PCP) for processing the wet solid wastes and demonstration of SWMS compliance with 10CFR Sections 61.55 and 61.56 and 10CFR Part 71 as a COL action item.

11.4-3. The first sentence under SSAR Section 11.4.2.3.1 does not explain how the demineralized water accomplishes the transfer of spent resins from the various ion exchangers and bed filters. Also, the applicable SSAR Section 9.2.4 and the system figure does not indicate how the transfer is performed. If the transfer is performed by using the demineralized water transfer and storage system transfer pump, it should be so stated in the SSAR Section 11.4.2.3.1.

11.4-4. SSAR page 11.4-10 refers to moderate activity filter transfer cask; but such a cask is not listed in component data Table 11.4-12. This inconsistency should be corrected.

11.4-5. Table 11.4-4 gives HIC disposal volume as 179 cubic feet. Response to Q.460.5 states that 70 cu.ft HIC can be put in one onsite storage cask. Westinghouse should clarify whether an onsite storage cask can hold a 179 cu.ft HIC.

11.5 PROCESS AND EFFLUENT RADIOLOGICAL MONITORING AND SAMPLING SYSTEM

11.5-1. Response to Q.460.7 which deals with monitoring service water effluent is incomplete. SSAR Section 11.5 does not explain why the containment atmosphere particulate detector is non-seismic Category I and receives power from non-1E power supply. The staff also finds that SSAR Table 3.2-3 does not include the RMS and the SSAR Sections 11.5.2.3.1 through 11.5.2.3.3 make incorrect references to SSAR figures. Since the subject SSAR table does include non-safety-related systems also, there is no justification for excluding the RMS from the subject table.

11.5-2. The staff is concerned that the following are not included as part of sampling during normal plant operation:

- grab sampling provision for tritium activity in the effluent via the plant vent
- grab sampling and continuous sampling provisions for condenser air removal system effluent stream (provision of continuous monitoring capability for the stream is not equivalent to provision of continuous sampling capability for that stream)
- grab sampling provision for the turbine gland seal system exhaust
- grab sampling provisions for noble gas and tritium in the building ventilation and containment purge exhausts
- grab sampling provision for iodine activity in the containment purge exhaust; non-inclusion of continuous sampling and analysis provisions for service water system effluent
- the purpose of sampling and analysis for component cooling water system, service water system effluent stream, SG blowdown stream, turbine building drains and waste water drains
- grab sampling, and analysis provisions for tritium activity for the above system, streams, and drains
- grab sampling and analysis provisions for spent fuel pool treated water
- grab sampling and analysis provisions for secondary resin slurry stream
- grab sampling and analysis provisions for tritium activity in the LWMS tanks, chemical waste tank, and primary spent resin tanks
- continuous sampling provision for iodine in the containment purge exhaust

11.5-3. Response to Q.460.18 is unsatisfactory. Westinghouse should identify the need for demonstrating specific compliance of the radiological monitoring and sampling programs for the individual AP600 reactor with the guidelines of ANSI N13.1, RGs 1.21 and 4.15, as a COL action item.

11.5-4. AP600 has only grab sampling and analysis provisions for iodine and particulates during and following an accident. The staff considers that a reasonable estimate of the iodine and particulate radioactive release via the plant vent to the environs due to an accident will not be possible without continuous sampling provision. Westinghouse should resolve this concern of the staff.