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

May 23, 1994

Docket No. 52-003

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

Dear Mr. Liparulo:

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION ON THE AP600

As a result of its review of the June 1992, application for design certification of the AP600, the staff has determined that it needs additional information in order to complete its review. The additional information is needed in the areas of industry codes and standards (Q100.13),* drainage systems (Q410.163-Q410.170), diesel generator support systems (Q410.171-Q410.183), fission product control systems (Q410.184), water systems (Q410.185-Q410.190), flood protection (Q410.191-Q410.204), missile protection (Q410.205-Q410.231), spent fuel storage and cooling systems (Q410.232-Q410.233), and heating, ventilation, and air conditioning systems (Q410.234-Q410.248, Q450.10). Enclosed are the staff's questions. Please respond to this request by June 30, 1994, to support the staff's review of the AP600 design.

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

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

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

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

Sincerely,

Original Signed By

Thomas J. Kenyon, Project Manager
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Associate Directorate for Advanced Reactors
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Enclosure:
As stated

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Docket No. 52-003
AP600

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REQUEST FOR ADDITIONAL INFORMATION
ON THE WESTINGHOUSE AP600 DESIGN

GENERAL

100.13 Provide a listing of all industry codes and standards used in AP600 design in the SSAR.

EQUIPMENT AND FLOOR DRAINAGE SYSTEMS

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

410.164 Describe how the radioactive waste drain system in Section 9.3.5 of the SSAR is routed and/or sealed to prevent cross flow of airborne radioactivity between building rooms and/or compartments where such cross flow is undesirable.

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

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

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

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

410.166 How is backflooding prevented in the radioactive waste drain system (Section 9.3.5) and in the liquid radwaste system (Section 11.2)?

410.167 Why does Section 9.3.5 of the SSAR discuss sumps and drain tanks and Figure 9.3.5-1 only shows sumps? Include the drain tanks in the figure.

410.168 Is the third paragraph in Section 9.3.5.1.1 of the SSAR meant to indicate that safety-related systems, structures, or components are not damaged as a result of equipment and floor drain components failure from a seismic event? Clarify the paragraph.

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

410.170 Section 9.3.5.3 of the SSAR states that the containment wall collection gutter subsystem and backflow preventers are described in Section 11.2. However, the staff cannot locate this description. Provide this information in the SSAR.

DIESEL GENERATOR SUPPORT SYSTEMS

410.171 In accordance with WCAP-13856, the onsite standby power system is classified as a "Defense-In-Depth (DID)" system. Therefore, the diesel generator support systems should also be classified as DID systems. Section 9.5.4 of the SSAR only discusses the diesel generator fuel oil storage and transfer system and Section 8.3.1.1.2.1 only lists the titles of all of the diesel generator support systems. Provide more detailed information in the SSAR on the following other diesel generator support systems:

a. diesel engine cooling subsystem,
b. diesel engine starting subsystem,
c. diesel engine lubrication subsystem, and
d. diesel engine combustion air intake and exhaust subsystem.

Provide the following information with appropriate justification to demonstrate that the criteria identified in the questions are met by these subsystems, or justify the deviation, if any.

a. Does the system have an electric supply from both normal station ac and on-site non-safety-related ac power supplies that is separated, to the extent practicable?

b. Is the system designed and arranged for conditions or an environment anticipated during and after events to ensure functional operability, maintenance accessibility, and plant recovery?

c. Is the system protected against internal flooding and other inplant hazards, such as the effects of pipe ruptures, jet impingement, fires, and missiles?

d. Can the system withstand the effects of natural phenomena that have a reasonable likelihood? Important systems and components should be designed to remain functional after a natural phenomena, such as a seismic event, that is of reasonable likelihood or may persist longer than 72 hours.

e. Is there a quality assurance program applied to the system that follows guidelines comparable to those of Generic Letter 85-06 for ATWS, and Appendices A and B of Regulatory Guide 1.155, "Station Blackout," for station blackout non-safety-related equipment?

f. Is the system included in the reliability assurance and maintenance programs for proper maintenance, surveillance, and inservice inspection and testing to ensure the system's reliability is consistent with the determined goals for this system?

g. Does the system have availability control mechanisms, including allowable outage time and surveillance requiremants?

h. Does the system have proper administrative controls for shutdown configurations?

i. Does the system have sufficient redundancy to ensure defense-in-depth functions, assuming a single active failure of equipment or unavailability due to maintenance.

Provide detailed rationale regarding conformance with the above criteria for the staff to use to evaluate the defense-in-depth capabilities of the diesel generator support systems. Revise the SSAR accordingly to reflect the above rationale to categorize these systems as "DID" systems.

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

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

DIESEL GENERATOR FUEL OIL STORAGE AND TRANSFER SYSTEM

410.174 Address the following questions concerning Section 9.5.4 of the SSAR "Onsite Standby Diesel Generator Fuel Oil Storage and Transfer System:"

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

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

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

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

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

410.175 Provide the following information in Section 9.5.4 of the SSAR:

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

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

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

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

410.176 Revise Figure 9.5.4-1 of the SSAR to show the whole system, including the day tank and the piping from the day tank to the diesel generator.

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

410.178 Address the following questions on Section 9.5.4.5.1 of the SSAR:

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

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

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

410.179 Address the following questions regarding the diesel engine combustion air intake and exhaust system:

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

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

410.180 Address the following questions regarding the diesel engine starting air system:

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

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

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

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

410.181 Address the following questions regarding the diesel engine cooling water system:

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

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

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

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

410.182 Address the following questions regarding the diesel engine lubrication system:

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

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

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

a. Moisture in starting air system

b. Dust and dirt in diesel generator room

c. Personnel training

d. Automatic prelube

e. Testing, test loading, and preventive maintenance

f. Improve identification of cause of failures

g. Diesel generator ventilation and combustion air systems

h. Fuel storage and handling

i. High-temperature insulation

j. Engine cooling water

k. Vibration of instruments

FISSION PRODUCT CONTROL SYSTEMS

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

WASTE WATER SYSTEM

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

CIRCULATING WATER SYSTEM

410.186 Section 10.4.5.2 of the SSAR states that the circulating water system (CWS) and cooling tower are applicable to a broad range of sites. On other ALWRs, the heat sinks for the CWS are site dependent. A conceptual design and interface requirements are provided for the normal heat sink and, in some cases, for portions of the CWS that are outside of the design certification scope. The AP600 SSAR did not provide sufficient information on the CWS design or alternative design requirements, such as protecting safety-related equipment in the event of failure of the CWS, and locating the cooling tower far enough from safety-related structures to prevent damage in the event of a cooling tower failure. Provide design descriptions and interface requirements for the CWS as required by 10 CFR Part 52.

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

STARTUP FEEDWATER SYSTEM

410.188 Section 10.4.9.1.2 of the SSAR states, in part, that the startup feedwater system (SFS) is a non-safety system serving as a first-line of defense for loss of feedwater events, but the passive core cooling system is a safety system which provides safety grade protection for such events. Provide the following information with appropriate justification to demonstrate that the criteria identified in the questions are met by this system, or justify the deviation, if any.

a. Does the system have an electric supply from both normal station ac and on-site non-safety-related ac power supplies that is separated, to the extent practicable?

b. Is the system designed and arranged for conditions or an environment anticipated during and after events to ensure functional operability, maintenance accessibility, and plant recovery?

c. Is the system protected against internal flooding and other in-plant hazards, such as the effects of pipe ruptures, jet impingement, fires, and missiles?

d. Can the system withstand the effects of natural phenomena that have a reasonable likelihood? Important systems and components should be designed to remain functional after a natural phenomena, such as a seismic event, that is of reasonable likelihood or may persist longer than 72 hours.

e. Is there a quality assurance program applied to the system that follows guidelines comparable to those of Generic Letter 85-06 for ATWS, and Appendices A and B of Regulatory Guide 1.155, "Station Blackout," for station blackout non-safety-related equipment?

f. Is the system included in the reliability assurance and maintenance programs for proper maintenance, surveillance, and inservice inspection and testing to ensure the system's reliability is consistent with the determined goals for this system?

g. Does the system have availability control mechanisms, including allowable outage time and surveillance requirements?

h. Does the system have proper administrative controls for shutdown configurations?

i. Does the system have sufficient redundancy to ensure defense-in-depth functions, assuming a single active failure of equipment or unavailability due to maintenance.

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

410.190 Section 10.4.7.1.1 of the SSAR indicates that double valve startup feedwater isolation is provided by the startup feedwater control valve (SFCV) and the startup feedwater isolation valve (SFIV). The SFIV serves as a containment isolation valve and closes on a containment isolation signal or backflow in the line. Describe whether the SFCV will close on a containment isolation signal, and is subject to leak testing in accordance with Appendix J of 10 CFR Part 50. If not, what are the closure actuation and leakage test requirements for the SFCV?

FLOOD PROTECTION

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

410.192 Where are the areas housing the two non-Class 1E electrical equipment and penetration rooms, and how are they protected from water spray if the fire protection system actuates? How is Class 1E electrical equipment protected from spray if the FPS actuates?

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

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

410.195 The January 22, 1993, response to Q410.11 states that the operator's area of the main control room (MCR) on Level 4 (117'-6") uses potable water, and that water is contained such that leakage won't damage electrical equipment in the MCR. How is this accomplished?

410.196 Include the table provided in the March 18, 1993, response to Q410.27 that lists the safety-related equipment requiring flood protection in the appropriate section of the SSAR. In addition, include the information in the February 9, 1993, response to Q435.56 regarding flood protection for I&C equipment in Section 3.4.1 of the SSAR. Include the caveats regarding information not in the table (i.e., regarding safety-related equipment above the maximum flood level and passive components).

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

410.198 Include the February 25, 1993, response to Q410.39 regarding interior wall design and hydrostatic loads in the appropriate section of the SSAR. In addition, the SSAR should state that all walls, floors, doors, and penetrations should be able to withstand the maximum anticipated hydrodynamic loads associated with a pipe failure.

410.199 How will the control room be protected from flooding?

410.200 How will the roof design prevent ponding beyond the structural capacity of the roofs of safety-related buildings?

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

410.202 Identify the location of the HVAC ductwork that serve areas which house safety-related equipment and components in relation to the maximum flood height. Is this HVAC ductwork divisionally separated?

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

410.204 The February 25, 1993, response to Q410.45 states that flooding in the auxiliary building is detected by non-safety-related sump level sensors. There is one sensor for each of the four sumps on Level 1 of the auxiliary building. Each alarms in the control room when level reaches sump pump actuation setpoint. Safety-related instrumentation is not required because flooding is controlled so that it doesn't affect safety-related equipment. How is this accomplished?

INTERNALLY-GENERATED MISSILES OUTSIDE CONTAINMENT

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

410.206 The February 25, 1993, response to Q410.60 states that hydrogen is supplied to the CVS inside containment from one 550 scf H_2 bottle located in the plant gases storage tank area. The maximum concentration within the CVS compartment was found to be 4.3 percent, less than the detonation limits in NUREG/CR-2017. Areas other than the CVS compartment were also considered with the maximum concentration being ~4.4 percent in the valve/piping penetration room at the 100' elevation of the Auxiliary Building (12420 ft^3). However, this apparently assumes uniform mixing within the containment. How is this assured?

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

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

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

410.209 The March 18, 1993, response to Q410.54 states that protection of safety-related SSCs from failure of non-safety-related SSCs is accomplished by separation, as discussed in Section 3.7.3.13.1 of the SSAR. Section 3.7.3.13 clarifies the approach used to protect safety-related SSCs from the failure of nonseismic SSCs. However, it is still unclear whether protection of safety-related SSCs from nonseismic SSCs is ever achieved through the use of enclosure of safety-related SSCs in compartments. Clarify this issue.

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

410.211 The March 18, 1993, response to Q410.52 states that protection of safety-related equipment from turbine generator (TG) missiles is described in Section 3.5.1.3 of the SSAR, and is achieved by proper orientation of the TG set and the use of fully integral low-pressure turbine rotors. The report on rotors with shrunk-on discs was approved by the NRC in Reference 2 of Section 3.5.1.3 and the methodology for fully integral motors was submitted in Reference 1 of Section 3.5.1.3. These references have been deleted from the SSAR. The staff believes that these references are appropriate, and should be included in the SSAR. In addition, the March 18, 1993, response mentions a Reference 3, which the staff cannot locate. Identify the reference and include that in the SSAR.

410.212 Is there any safety-related equipment in the 25^0 strike zone of the turbine generator?

410.213 Westinghouse states that the AP600 uses only safety-related systems and equipment to establish and maintain safe-shutdown conditions, and that there is no equipment important-to-safety (as defined in Q410.27) outside the containment that requires missile protection. Justify this statement. Is this statement also true for the defense-in-depth systems and equipment that are identified in Table 3.2-3 of the SSAR, and for the systems and equipment identified as important by the analysis to determine the need for the regulatory treatment of non-safety-related systems? If so, justify. If not, describe the systems and the protection provided.

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

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

410.216 How are the main control room (MCR) and remote shutdown workstation (RSW) protected from internally-generated missiles (outside containment)?

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

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

INTERNALLY-GENERATED MISSILES INSIDE CONTAINMENT

410.219 The March 18, 1993, response to Q410.63 states that no safety-related equipment or equipment important-to-safety requires protection from internally-generated missiles because there are no credible missile sources. The staff believes that this is an incorrect characterization. There is safety-related equipment that requires missile protection. The means of providing protection is by ensuring that there are no credible missile sources. Section 3.5 of the SSAR should clearly state what safe shutdown structures, systems, and components must be protected from missiles [internally-generated (outside containment), internally-generated (inside containment), turbine generator, those generated by natural phenomena, and externally-generated]. If the same SSCs must be protected for all these missile hazards, it should be so stated in Section 3.5 of the SSAR. If different safety-related SSCs must be protected for different missile hazards, then the SSCs should be identified in the appropriate missile section of the SSAR.

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

410.220 The March 18, 1993, response to Q410.67 states that rotating equipment in containment is eliminated as a missile source for one or more of the following reasons:

a. Equipment used < 2 percent of the time is not considered a missile source. This includes the reactor coolant drain pumps, containment sump pumps and motors for valve operators, and mechanical handling equipment and pumps;

b. Pumps and fans, such as the reactor cavity supply fans, are located in compartments surrounded by structural concrete walls and contain no safety-related systems or equipment and so are not considered missile sources;

c. Rotating equipment with a housing or enclosure that would contain fragments of postulated impeller failure is not considered credible;

d. Non-safety-related rotating equipment in compartments with safety-related equipment that do not provide other separation features have design requirements for housings or enclosures to retain fragments from postulated failures of rotating elements.

Provide justification for not considering equipment inside containment used less than 2 percent of the time to be credible missiles .

410.221 The January 22, 1993, response to Q410.65 implies that mass around the impeller and rotating parts of the motor is the primary means used to prevent missiles in the shaft seal pump. Is this interpretation correct?

410.222 The March 18, 1993, response to Q410.64 states that no sources of primary and credible secondary missiles from which safety-related equipment inside containment must be protected have been identified. A limited number of fans may require design provisions to confirm that they are not a missile source. Where is this discussed in the SSAR? Address this issue.

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

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

410.225 Identify safety-related equipment and equipment important-to-safety that are subject to missiles from non-seismic Category 1 structures, systems, and components inside containment, and discuss how this equipment will be protected (discuss non-safety-related systems inside containment with regard to their potential for generating missiles which could damage safety-related equipment).

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

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

MISSILES GENERATED BY NATURAL PHENOMENA

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

410.229 The March 18, 1993, response to Q410.70 states that the estimated probability of wind speeds greater than the 300 mph DBT is between 10^{-6} and 10^{-7} per year for the AP600 design at a worst location anywhere in the contiguous U.S. This should be included in the appropriate section of the SSAR.

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

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

SPENT FUEL STORAGE

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

SPENT FUEL PIT COOLING SYSTEM

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

HEATING, VENTILATION, AND AIR CONDITIONING SYSTEMS

410.234 The information furnished on AP600 heating, ventilation, and air conditioning (HVAC) systems during the March 22 and 23, 1994, meetings indicated that the following systems are classified as defense-in-depth (DID) systems:

- Nuclear island nonradioactive ventilation system (VBS) with all three subsystems (MCR/TSC, Class 1E electrical rooms, and PCS valve room)
- Auxiliary/Annex building subsystem of radiologically controlled area ventilation system (VAS)
- Low capacity subsystem of central chilled water system (VWS)

Provide the following information with appropriate justification to demonstrate that the criteria identified in the questions are met by these systems, or justify the deviation, if any.

a. Does the system have an electric supply from both normal station ac and on-site non-safety-related ac power supplies that is separated, to the extent practicable?

b. Is the system designed and arranged for conditions or an environment anticipated during and after events to ensure functional operability, maintenance accessibility, and plant recovery?

c. Is the system protected against internal flooding and other in-plant hazards, such as the effects of pipe ruptures, jet impingement, fires, and missiles?

d. Can the system withstand the effects of natural phenomena that have a reasonable likelihood? Important systems and components should be designed to remain functional after a natural phenomena, such as a seismic event, that is of reasonable likelihood or may persist longer than 72 hours.

e. Is there a quality assurance program applied to the system that follows guidelines comparable to those of Generic Letter 85-06 for ATWS, and Appendices A and B of Regulatory Guide 1.155, "Station Blackout," for station blackout non-safety-related equipment?

f. Is the system included in the reliability assurance and maintenance programs for proper maintenance, surveillance, and inservice inspection and testing to ensure the system's reliability is consistent with the determined goals for this system?

g. Does the system have availability control mechanisms, including allowable outage time and surveillance requirements?

h. Does the system have proper administrative controls for shutdown configurations?

i. Does the system have sufficient redundancy to ensure defense-in-depth functions, assuming a single active failure of equipment or unavailability due to maintenance.

Provide a detailed assessment regarding conformance with the above criteria in order for the staff to evaluate the defense-in-depth capabilities of the above systems. Revise the SSAR accordingly to reflect this information.

410.235 Provide failure modes and effects analyses for those HVAC systems which are classified DID systems in a text or tabulated form in the appropriate sections of the SSAR.

410.236 Confirm that the HEPA filters for the non-safety-related radiation chemistry laboratory subsystem of the radiologically controlled area ventilation system (VAS) conform with the guidelines of RG 1.140 and revise Section 9.4.3 of the SSAR and associated table(s) accordingly.

410.237 Figure 1.7-2 of the SSAR refers to "Reference C," but no such reference is provided. Provide Reference C.

410.238 Provide legible half-size P&IDs and flow diagrams with associated data for HVAC systems for the VES, VBS, VXS, VAS, VCS, VFS, VRS, VTS, VZS, VHS, VWS and VYS. All drawings should refer to appropriate cross-referenced drawing numbers with coordinates. Also, confirm that associated component data for above systems are provided in the tables of the SSAR.

410.239 Provide all of the site-specific interface requirements and combined operating license (COL) applicant information, as appropriate, for the HVAC systems in the corresponding sections of the SSAR.

410.240 Provide the following information regarding HEPA filters and charcoal adsorbers for HVAC systems:

a. Provide data in a tabulated form as part of the tables in Section 9.4 of the SSAR for the areas served by HVAC systems having HEPA filters and/or charcoal adsorbers, indicating the design/testing standard (i.e., RG 1.52 and/or RG 1.140), the ventilation flow/division, the recirculation flow/division, the HEPA filter efficiency, the carbon adsorber thickness and efficiency, and the maximum in-leakage flow.

b. Provide a table in Section 9.4 of the SSAR that describes how the HVAC system HEPA filters and charcoal adsorbers comply with the guidance of RG 1.52 and/or RG 1.140.

c. Provide a table in Section 9.4 of the SSAR that describes how the instrumentation and controls for the HVAC system HEPA filters and charcoal adsorbers comply with Tables 4-1 and/or 4-2 of ANSI/ASME N509-1989.

410.241 Provide tabulated data for those HVAC systems which maintain their served areas at certain positive or negative pressures with respect to surrounding spaces and/or outdoor atmosphere, including the flow data in cubic feet per minute required to maintain these conditions.

410.242 Provide data in a tabulated form in Section 11.3 of the SSAR for the HVAC systems having HEPA filters and/or charcoal adsorbers indicating humidity control, operational mode(s), the design/testing standard (i.e., RG 1.52 and/or RG 1.140), the HEPA filter particulate removal efficiency, the carbon adsorber thickness, and the decontamination efficiency.

410.243 Address the following concerns regarding the nuclear island non-radioactive ventilation system (VBS). The staff expects that under all postulated radiation conditions, the VBS will be able to continue to operate and protect the control room operators as long as there is power available. The following questions are based on this premise.

a. Charcoal adsorber efficiency for organic iodine removal should be 95 percent, not 90 percent, to be able to take credit for the VBS to function as a first line of defense under the "Defense-in-Depth" concept. In order to specify a 95-percent iodine removal efficiency, specify that an iodine penetration of ≤ 1 percent for a 4-inch depth of activated carbon cell when laboratory testing is performed at 30 °C and ≤ 70-percent relative humidity, or an iodine penetration of ≤ 0.7143 percent for a 4-inch depth of activated carbon cell when laboratory testing is performed at 30 °C and ≤ 95% relative humidity, in accordance with ASTM D3803-89 standards. Revise the SSAR accordingly.

b. The November 16, 1993, response to Q100.10 indicates that the VBS is credited initially following a "HIGH" (not "HIGH HIGH") radiation signal in conjunction with the VES to meet GDC 19 dose limits. Therefore, the VBS filtration subsystem should be safety-related, and comply with RG 1.52 positions and Table 4-1 of ANSI/ASME N509-1989 for instrumentation and controls.

If the VBS is not credited in conjunction with the VES to meet GDC 19 dose limits following a "HIGH" and/or "HIGH HIGH" radiation signal, then the VBS filtration subsystem is non-safety-related, and needs to conform only to the guidance of RG 1.140. However, detailed categorical conformance with RG 1.140 positions and Table 4-2 of ANSI/ASME N509-1989 should be provided for instrumentation and controls.

Revise Section 9.4.1 of the SSAR and WCAP-13054 regarding conformance to Sections 6.4 and 9.4.1 of the SRP to show conformance with RG 1.52 or RG 1.140 (as applicable based upon the response to the above comments), ANSI/ASME standards N509-1989, N510-1989 and ASTM D3803-1989 and ASME code AG-1-1991.

c. Provide the rationale for installing the supply air filter fan upstream of the air filtration unit in contrast to the conventional design at current operating plants. The rationale should address continued fan operability during the accident conditions without clogging due to foreign debris, including radioactive debris, during accident conditions. Note that the conventional design of filtration units provides filtered inlet flow to the supply fan(s). Revise the SSAR accordingly.

d. The following concerns pertain to the VBS Flow Diagram Figure, VBS MS 006:

1. For the "Normal Operation" mode:

A. "Data Point 108" - The supply flow for the clean and reference material store area is 1340 SCFM and the return flow is 930 SCFM. Provide the rationale for this difference, and/or revise the figure accordingly.

B. The supply flows to the MCR kitchen and toilet room are 300 and 100 SCFM, respectively. The discharge flows are 380 and 120 SCFM. Provide the rationale for these values, and/or revise the figure accordingly.

C. The supply flows to the TSC men's room, women's room and kitchen are 350, 350, and 400 SCFM, respectively. The discharge flows are 400, 400, and 450 SCFM, respectively. Provide the rationale for these values, and/or revise the figure accordingly.

2. For the "Smoke Removal Mode" for the MCR:

The tagging room supply flow at data points 51 and 52 is 235 SCFM each, and the return flow at data point 106 is 700 SCFM. Provide the rationale for these values, and/or revise the figure accordingly.

3. For the "Smoke Removal Mode" for the TSC:

The supply flow to the offices at data point 93 is 1480 SCFM, and the return flow at data point 125 is 2080 SCFM. Provide the rationale for these values, and/or revise the figure accordingly.

e. Provide the following information on Sheets 3, 4, and 5 of 6 of Figure 9.4.1, and Table 9.4.1-1 of the SSAR:

1. Provide flow diagrams and corresponding data for the Division A and C, and B and D Class 1E electrical rooms HVAC subsystem and Division A and C, and B and D emergency battery rooms exhaust.

2. Provide the rationale for providing only 25-percent efficiency for Division A and C, and B and D air handling unit (AHU) prefilters.

3. Explain why Division B and D emergency battery room exhaust fans have 5 horse power (HP) motors verses Division A and C exhaust fans have 3 HP motors with identical flows of 2,400 SCFM per fan, as identified in Table 9.4.1-1 of the SSAR.

4. Clarify the system capacity for the Division B and D Class 1E electrical room HVAC subsystem, which is shown as "15,00 SCFM" on page 9.4-42 of Table 9.4.1-1 of the SSAR. Revise the SSAR accordingly.

410.244 Provide the following information regarding the radwaste building HVAC system (VRS):

a. Provide data for the men's and women's locker room exhaust fans, and revise Table 9.4.8-1 of the SSAR accordingly.

b. Figure 9.4.8-1 of the SSAR shows both high efficiency filters and low efficiency filters, while Table 9.4.8-1, Sheet 2 of 2, only discusses prefilters. Provide efficiency data for both high and low efficiency filters in Table 9.4.8-1, Sheet 2 of 2 for the VRS. Also, show all HEPA filters and prefilters (18 of each type as indicated in Table 9.4.8-1, Sheet 2 of 2) on Figure 9.4.8-1, Sheets 1 and 2 of 2.

410.245 Provide the following information regarding the diesel generator building heating and ventilation system (VZS):

a. The March 30, 1993, response to Q410.103 states that the information contained in NUREG/CR-0660 was considered in the design of the VZS. Provide pertinent information considered, including intake louver locations.

b. Provide an assessment of the operability of the equipment located inside the diesel generator area exposed to 130 °F while the diesel generator is in operation.

c. Why is the VZS not classified as a DID system since other DID systems, including the VBS and subsystems of the VAS and the VWS, are primarily powered during loss of offsite power from an onsite power system consisting of the two diesel generators which are cooled by VZS. The staff believes that this system should be classified as a DID system. Therefore, provide the following information with appropriate justification to demonstrate that the criteria identified in the questions are met by this system, or justify the deviation, if any.

1. Does the system have an electric supply from both normal station ac and on-site non-safety-related ac power supplies that is separated, to the extent practicable?

2. Is the system designed and arranged for conditions or an environment anticipated during and after events to ensure functional operability, maintenance accessibility, and plant recovery?

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

4. Can the system withstand the effects of natural phenomena that have a reasonable likelihood? Important systems and components should be designed to remain functional after a natural phenomena, such as a seismic event, that is of reasonable likelihood or may persist longer than 72 hours.

5. Is there a quality assurance program applied to the system that follows guidelines comparable to those of Generic Letter 85-06 for ATWS, and Appendices A and B of Regulatory Guide 1.155, "Station Blackout," for station blackout non-safety-related equipment?

6. Is the system included in the reliability assurance and maintenance programs for proper maintenance, surveillance, and inservice inspection and testing to ensure the system's reliability is consistent with the determined goals for this system?

7. Does the system have availability control mechanisms, including allowable outage time and surveillance requirements?

8. Does the system have proper administrative controls for shutdown configurations?

9. Does the system have sufficient redundancy to ensure defense-in-depth functions, assuming a single active failure of equipment or unavailability due to maintenance.

Provide a detailed assessment regarding conformance with the above criteria in order for the staff to evaluate the defense-in-depth capabilities of the VZS system. Revise the SSAR accordingly to reflect this information.

410.246 Table 9.4.11-1, Sheet 2 of 2, of the SSAR regarding the health physics and hot machine shop HVAC system (VHS) should state "filter requirements," not "heating coil requirements." Also, show the six HEPA filters in Figure 9.4.11-1 for the VHS.

410.247 Provide the following information regarding the annex/auxiliary non-radioactive ventilation system (VXS):

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

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

c. Explain how 2,400 SCFM is accounted for from the equipment room HVAC system AHU since it supplies 27,600 SCFM, while the return flow is only 25,200 SCFM and 1,200 SCFM is exhausted from the battery room. Table 9.4.2-3 of the SSAR shows two 100-percent capacity battery room exhaust fans, each rated at 1,200 SCFM.

d. Provide the rationale for selecting the MSIV compartment HVAC system's <u>only filter</u> with an efficiency of 25 percent. Is this correct? If not, revise Table 9.4.2-5 of the SSAR accordingly.

e. Table 9.4.2-6 of the SSAR for the demineralized water degasifier room HVAC system shows two 50-percent AHUs while Figure 9.4.2-3 shows a single AHU. Reconcile the difference and revise the SSAR accordingly. Also, provide data for the low efficiency filter efficiency in this table.

f. Table 9.4.2-7 of the SSAR for the valve/piping penetration room HVAC system shows two 100-percent AHUs while Figure 9.4.2-3 shows a single AHU. Reconcile the difference and revise the SSAR accordingly.

410.248 Provide the following information regarding conformance with generic letters, NRC bulletins, unresolved safety issues, generic safety issues, and industrial codes and standards:

a. Table 1.9-2 of the SSAR (page 1.9-131) states that Generic Safety Issue 83, "Control Room Habitability," is discussed in Section 1.9.4 of the SSAR. However, the discussion on control room habitability does not specifically address GSI 83. Provide an evaluation of GSI 83 in Section 1.9.4 of the SSAR.

b. Section 1.9.4 of the SSAR provides a general overview of the applicability of unresolved safety issues and generic safety issues, including Issues B-36 and B-66. However, the detailed conformance and proposed resolution is not evaluated. Provide appropriate evaluations of these issues in this section.

c. The VBS should be evaluated in accordance with Generic Safety Issue B-36. Provide that evaluation.

d. The acceptance criteria to resolve Issue B-66 should include conformance of the VBS design with the guidance of Sections 6.4, 9.4.1, and 15.6.5.5 of the SRP. Section 9.4.1 of the SSAR should state that all ducts and equipment housings outside of the MCR envelope of the VBS are of welded construction, and that flanged connections will be pressure tight and periodically visually examined and tested to maintain a positive pressure with respect to the adjacent areas, such that any unfiltered inleakages inside the MCR envelope are precluded.

e. Section 9.4.1 of the SSAR should state that the VBS charcoal trays and screen will be all welded construction to preclude the potential loss of charcoal from the adsorber cells, in accordance with IE Bulletin 80-03 for VBS adsorbers.

MAIN CONTROL ROOM HABITABILITY SYSTEM

450.10 Address the following concerns regarding the main control room habitability system (VES):

a. Table 9.4.1-1 of the SSAR (page 9.4-40) shows <u>inleakage</u> of 10 SCFM through the MCR access doors and 36 SCFM through the MCR/TSC equipment ductwork (operating), and <u>outleakages</u> of 20 SCFM through the MCR structure and 443 SCFM through the MCR/TSC HVAC equipment and ductwork (operating). This indicates that in the emergency mode, there is a possibility of a total of 46 SCFM inleakage into the MCR envelope which is not filtered. Has this amount of inleakage been included in the dose calculations? What are the provisions for limiting unfiltered inleakage into the MCR?

b. The VES is designed for a 20 SCFM flow, which does not assure proper cooling needs for the limited number of MCR operators to function appropriately within human tolerance thresholds, including consideration of their survivability in a high stress environment and the need for MCR equipment operability <u>during and beyond 72 hours</u>. This conclusion is based on an MCR envelope initial temperature of 80 °F and initial temperature rise of 15 °F during the first 72 hours of a postulated LOCA scenario. Also, based on its experience with currently operating plants and the evolutionary plant designs, the staff believes that a five person limited MCR occupancy with long shift hours (12 hrs.) is not a realistic assumption. Address these issues, provide any revised assumptions, and show how the design of the AP600 provides the safety-related ventilation and cooling functions for the MCR equipment and its occupants during accident conditions.

c. The VES design provides safety-related connections to hook up non-safety-related portable equipment that will cool the MCR envelop after the initial 72 hours. Provide a detailed evaluation describing how this arrangement replaces the safety-related cooling functions during the entire duration of a given LOCA scenario for the MCR occupants and equipment operability. Also, provide the scope of responsibilities for Westinghouse and the COL applicant for the above arrangement, and revise the SSAR accordingly.

d. Describe how a positive pressure of 1/8-inch water gauge is maintained for given LOCA conditions, considering worst case unfiltered inleakages of 46 SCFM and outleakages of 463 SCFM, while providing only 20 SCFM bottled air supply inside MCR. Include this in the SSAR.

e. Westinghouse has indicated that a temperature increase of 15 °F over a 72 hour period is a bounding condition for the MCR design. Provide the rationale for the capability to maintain this threshold condition beyond 72 hours if accident conditions continue. Also, during the March 23, 1993, meeting, Westinghouse indicated that the MCR temperature profiles would be completed within 2 to 3 months using the WGOTHIC model. Provide a description of the assumptions and the results of the MCR modeling. Include this in the SSAR.

f. In the January 22, 1993, response to Q450.1, the acceptable CO_2 concentration level was evaluated based on only five persons inside the MCR envelope with a net MCR envelope volume of 42,260 ft^3. Based on its experience with currently operating plants and the evolutionary plant designs, the staff believes that a five person limited MCR occupancy with long shift hours (12 hrs.) is not a realistic assumption. Re-evaluate the allowable CO_2 concentration level that will provide a habitable environment for the MCR occupants based on a more realistic maximum bounding number of people occupying the MCR envelope during accident conditions.

g. Describe in Section 1.9.3 of the SSAR how the AP600 conforms with the guidance of Sections 2.2.1 through 2.2.3 and 6.4 of the SRP, and Attachment 1 to NUREG-0737, TMI Task Action Plan Item III.D.3.4, to assure that control room operators are adequately protected against the effects of accidental releases of toxic and radioactive gases, and can safely operate the plant under normal conditions or shutdown the plant under design basis accident conditions.