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Docket No.: STN-52-003

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U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

ATTENTION: R. W. BORCHARDT

SUBJECT: WESTINGHOUSE RESPONSES TO NRC REQUESTS FOR ADDITIONAL INFORMATION ON THE AP600

Dear Mr. Borchardt:

Enclosed are three copies of the Westinghouse responses to NRC requests for additional information on the AP600 from your letters of April 29, 1994, May 5, 1994, May 11, 1994, May 18, 1994, May 19, 1994 and May 23, 1994. This completes the responses for the letter dated May 19, 1994.

A listing of the NRC requests for additional information responded to in this letter is contained in Attachment A. Attachment B is a complete listing of the questions associated with the May 19, 1994 and the corresponding letters that provide our response.

These responses are also provided as electronic files in WordPerfect 5.1 format with Mr. Kenyon's copy.

If you have any questions on this material, please contact Mr. Brian A. McIntyre at 412-374-4334.

Brian A McIntyre /for

Nicholas J. Liparulo, Manager
Nuclear Safety Regulatory And Licensing Activities

/nja

Enclosure

cc: B. A. McIntyre - Westinghouse
T. Kenyon - NRR

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NTD-NRC-94-4202
ATTACHMENT A
AP600 RAI RESPONSES
SUBMITTED JULY 15, 1994

RAI No.		Issue
270.006	¦	Electronic equipment
270.007	¦	Use of IEEE 323-83
270.008	¦	Qualified life extension
270.009	¦	Use of IEEE 323-83
270.010	¦	Similarity
270.011	¦	Definition of expected conditions
270.012	¦	Source term
270.013	¦	HVAC conditions
270.014	¦	Qualification by analysis
280.002	¦	Safe shutdown/fire protection
280.003	¦	Need for manual operations during fire
280.007	¦	Administrative controls for fire pumps & drivers
410.164	¦	Prevention of airborne radioactivity cross flow
410.175	¦	Fuel oil characteristics, handling
410.181	¦	Diesel engine cooling water system
410.182	¦	Diesel engine lubrication system
410.192	¦	Protection of Class 1E equipment from spray
410.195	¦	Protection of elect equipment in MCR
410.199	¦	Flooding protection for MCR
410.200	¦	Roof design to prevent ponding
410.201	¦	Effects of flooding safety related equipment
410.202	¦	HVAC ductwork elevation vs max flood height
410.204	¦	Flooding protection for safety related equipment
410.214	¦	Protection by barriers
410.241	¦	HVAC areas at positive/negative pressure
410.242	¦	HVAC systems with HEPA filters/charcoal absorbers

NTD-NRC-94-4202
ATTACHMENT A
AP600 RAI RESPONSES
SUBMITTED JULY 15, 1994

RAI No.		Issue
410.249	:	Safety related portion of MSSS
410.254	:	MSSS compliance with GDC 60
440.079	:	Tests for NRHRS relief valves
440.142	:	Procedures for venting RCS
480.075	:	Containment leakage testing

ATTACHMENT B
CROSS REFERENCE OF WESTINGHOUSE RAI RESPONSE TRANSMITTALS TO NRC LETTERS OF MAY 19, 1994

Question No.	Issue	NRC Letter	Westinghouse Transmittal Date
270.004	Equipment list resp	05/19/94	06/27/94
270.005	Compliance with EQ requirments	05/19/94	06/27/94
270.006	Electronic equipment	05/19/94	07/15/94
270.007	Use of IEEE 323-83	05/19/94	07/15/94
270.008	Qualified life extension	05/19/94	07/15/94
270.009	Use of IEEE 323-83	05/19/94	07/15/94
270.010	Similarity	05/19/94	07/15/94
270.011	Definition of expected conditions	05/19/94	07/15/94
270.012	Source term	05/19/94	07/15/94
270.013	HVAC conditions	05/19/94	07/15/94
270.014	Qualification by analysis	05/19/94	07/15/94

Records printed: 11

Question 270.6

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

Response:

The electronics that are known to potentially have a limited life in a radiation environment are indicated in SSAR Subsection 3D.4.3 and Appendix 3D, Attachment C. Expanding this list arbitrarily to additional electronic equipment is overly restrictive since industry experience indicates that most parts (such as resistors and capacitors) are not susceptible to common-mode failures at these low radiation levels.

SSAR Revision: NONE

Question 270.7

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

Response:

IEEE Standard 323-1974, Section 6.3.2(3) is essentially identical (minor wording changes) to IEEE Standard 323-1983, Section 6.3.2(3). This section applies under item 2 of SSAR Subsection 3D.4.4. Section 6.3.2(5) in both standards discusses mechanical vibration.

The position discussed in item 3 of SSAR Subsection 3D.4.4 is based on industry practice for equipment located in a mild environment. Where no aging/seismic relationship is demonstrated, it is acceptable to perform the seismic test on unaged equipment. This industry practice is reflected in IEEE Standard 323-1983 which was prepared to clarify the requirements of IEEE Standard 323-1974.

SSAR Revision: NONE

Question 270.8

Section 3D.4.5.4 of the SSAR is titled "Qualified Life Extension." The NRC has not developed a final position on the extension of the life of a plant beyond 40 years. Therefore, there are no provisions for approval or disapproval of this section as part of the design certification review. Consequently, the staff will not review this section as part of the design certification review. The staff recommends removal of this section from the AP600 design certification review.

Response:

Subsection 3D.4.5.4 of the SSAR does not discuss extension of the life of a plant beyond 40 years. It simply discusses how one might extend a qualified life to 20 years by determining conservatisms in the original determination of the qualified life of an equipment item.

SSAR Revision: NONE

Question 270.9

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

Response:

The discussions in SSAR Subsections 3D.4.6, 3D.4.7, and 3D.4.8 are consistent with NUREG-0588, Regulatory Guide 1.89, past NRC positions and approvals, and current industry practice. Operability time, performance criterion, and margin are based on the AP600 accident analysis. Responses to other questions (e.g. 270.11), provide reference to specific AP600 information.

SSAR Revision: NONE

Question 270.10

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

Response:

SSAR Subsection 3D.6.2.1 discusses similarities among manufacturers models implying that similarity is most easily addressed with equipment from the same manufacturer. Similarity between manufacturers should not be arbitrarily excluded, but should be judged on a case by case basis.

SSAR Revison: NONE

Question 270.11

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

Response:

SSAR Subsections 3D.5.1 (Normal Operating Conditions), 3D.5.2 (Abnormal Operationg Conditions), 3D.5.3 (Seismic Events), 3D.5.4 (Containment Test Environment), and 3D.5.5 (Design Basis Event Conditions) provide information on the expected environmental conditions.

SSAR Revision: NONE

Question 270.12

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

Response:

The accident source term used in subsection 3D.5.5.1.1 is the EPRI source term (DOE/ID-10321).

SSAR Revision:

The second paragraph of subsection 3D.5.5.1.1 is revised as follows:

Sources are based on the emergency safeguards system core thermal power rating and the degraded core source term model from DOE/ID-10321 (reference 8). This basis is summarized by the following analytical assumptions:

Also, reference 8 is added to the list of references in section 3D.8:

8. DOE/ID-10321, "Passive ALWR Source Term," D. E. Leaver, et al., February 1991.

Question 270.13

In Paragraph D.4.1.1 of Attachment D to Appendix 3D of the SSAR, "External Ambient Temperature (Ta)," provide the rationale for the following two sets of conditions described in this paragraph:

a. For equipment located in areas supplied by an air-conditioning system, a typical value assumed for (Ta) throughout the qualified life is 77°F (25°C). For air-conditioning systems, two excursions per year to 91°F (33.3°C), each lasting 72 hours, has a negligible additional effect.

b. For equipment located in areas supplied by a ventilation system, a typical value assumed (Ta) throughout the qualified life is 68°F (20°C). Two excursions per year to 122°F (50°C), each lasting 72 hours, has a negligible additional aging effect."

Response:

SSAR Subsection D.4.1.1 of Attachment D to Appendix 3D provides examples of normal and abnormal temperatures for certain areas. The temperature values provided for the normal temperatures have been reversed and will be corrected. The typical value in areas supplied by an air-conditioning system should be 68°F (20°C) and for ventilation systems 77°F (25°C).

Subsection D.4.3.1 may be used as an example of the negligible aging effect of the abnormal condtions described in SSAR Subsection D.4.1.1. If T_a is increased to 122°F (50°C) for 1440 hours per year for 10 years, the additional aging time for simulation would be about 100 hours which is negligible based on the total simulation time calculated in this subsection.

SSAR Revision:

Revise SSAR Subsection D.4.1.1 of Attachment D to Appendix 3D as follows:

D.4.1.1 External Ambient Temperature (T_a)

a) For equipment located in areas supplied by an air-conditioning system, a typical value assumed for (T_a) throughout the qualified life is ~~77°F (25°C)~~68°F (20°C). For air-conditioning systems, two excursions per year to 91°F (33.3°C), each lasting 72 hours, has a negligible additional aging effect.

b) For equipment located in areas supplied by a ventilation system, a typical value assumed (T_a) throughout the qualified life is ~~68°F (20°C)~~77°F (25°C). Two excursions per year to 122°F (50°C), each lasting 72 hours, has a negligible additional aging effect.

Question 270.14

Sections 3.11.1.2 and 3.11.2.1 of the SSAR imply that qualification by analysis alone is not permitted for the AP600 design. Page 3D-1 of Appendix 3D to the SSAR implies qualification by analysis only is permitted. Section 3D.6.2 states that the AP600 equipment qualification program does not establish qualification on the basis of analyses alone. In the sample equipment qualification data package (EQDP) on page 3D-69, it is stated that the AP600 EQ program does permit qualification solely on the basis of analyses. However, in accordance with 10 CFR 50.49(f), paragraphs 2.1(2) and 22.1(4) of NUREG-0588, and previous NRC staff practice, qualification by analyses only is not acceptable. Environmental qualification of electrical equipment important to safety for the AP600 design should be in accordance with the requirements of 10 CFR 50.49. Clarify your position. This question was also addressed in the November 30, 1992 response to Q270.3. However, the updated SSAR that was intended to address this issue is inconsistent.

Response:

Analysis only to establish qualification is permitted for mechanical items such as tanks and valves as discussed on SSAR page 3D-1 and in Subsection 3D.6.2. The EQDP on page 3D-69 provides a place to document this analysis when permitted. Subsection 3D.6.2 states that the seismic and environmental qualification of electrical and electromechanical equipment will not be based on analysis alone. The SSAR is consistent with respect to the use of analysis and the approach is consistent with the requirements of 10 CFR 50.49.

SSAR Revision: NONE

Question 280.2

Section 9A.2.7.1 of Appendix 9A of the SSAR, "Independence of Affected Fire Areas," states that "For this fire protection analysis, only safety-related components and systems are assumed to be available to achieve safe shutdown."

a. What is the definition of safe shutdown for the AP600?

b. How does the AP600-credited safety-related equipment provide at least the same safety margin when compared to currently credited safety-related equipment in operating reactors in the event of a fire in the control room or any other fire area? Provide several examples and consider similar worst case scenarios.

Response:

a) Safe shutdown for the AP600 is defined in SSAR Subsections 6.3.1.1.4 and 7.4 as follows:

The functional requirements for the passive core cooling system specify that the plant be brought to a stable condition using the passive residual heat removal heat exchangers for events not involving a loss of coolant. For these events, the safety-related passive core cooling system, has the capability to establish safe shutdown conditions, cooling the reactor coolant system to about 400°F in 72 hours, with or without the reactor coolant pumps operating.

As discussed in the response to RAI 440.92, the URD also identifies a safe shutdown condition as cooling the reactor coolant system to 420°F in 36 hours. The passive core cooling system has the capability to cool the reactor coolant system to 420°F in 36 hours.

For the 400°F and 420°F cooldown cases, reactor coolant system pressure will trend down, due to contraction of the reactor coolant system inventory and heat losses from the pressurizer, to saturated conditions over the cooldown period of 72 hours and 36 hour respectively. These conditions would be 247 psia and 309 psia respectively.

In order for the cooldown cases listed above to occur, ac power needs to be recovered within 24 hours. If ac power sources are not reinstated, there is a timer that automatically actuates the automatic depressurization system (ADS). The dc batteries supply power to the automatic depressurization system valves for a minimum of 24 hours. If at approximately 23 hours, ac power has not been recovered, the first stage of the automatic depressurization system will be actuated. Actuation of automatic depressurization system brings the plant to a safe shutdown condition with somewhat lower temperatures and pressures.

For a description of the processes that establish safe shutdown conditions for the AP600, using the safety-related passive systems, with no operator actions, see SSAR Subsection 7.4.1.

b) For postulated fire the AP600 safety-related systems and equipment perform the same basic safety functions to achieve safe shutdown:

- Trip the reactor and maintain subcritical conditions,
- Maintain reactor coolant system inventory and circulation, and
- Remove heat from and depressurize the reactor coolant system.

These functions are discussed in detail in SSAR Section 7.4.

The AP600 Probabalistic Risk Assessment provides an indication of the AP600 safety margin with respect to severe accidents. The internal fire analysis (Appendix I) shows that the fire induced core damage frequencies for both power operations and shutdown operations are extremely low. The total fire induced core damage frequencies are shown in Sections I.2.3 and I.2.5 of the PRA.

For postulated fires in other safety-related plant areas, safe shutdown is achieved as described in Appendix 9A. Because there are fewer safe shutdown components, and because of the strict separation between redundant safe shutdown components, the effects of an individual fire on safe shutdown capability are limited. In a typical worst-case scenario, a fire may affect one of the four safety-related electrical divisions. As described in Appendix 9A, separation of redundant safe shutdown components is provided so that the fire damage does not prevent safe shutdown functions from being performed.

SSAR Revision: NONE

Question 280.3

Section 9A.2.7.1 of Appendix 9A of the SSAR, "Manual Operation," states that

> Manual actions by operations personnel include manipulations of equipment located anywhere outside the fire area, if accessibility and staffing level permit such actions. Entry into the fire area for repairs or operator actions is assumed to be impossible.
>
> Manual operations of valves, circuit breakers, and hand-switches are utilized in exercising control over shutdown systems, provided sufficient time and personnel exist to perform the manual operation.

a. In the event of a control room fire, is there a need to perform any manual actions other than at the remote shutdown work station to prevent adverse spurious operation of equipment that will affect the ability to bring the plant to a stable shutdown condition?

b. Provide worst case fire scenarios in which manual operations are needed.

Response:

a. In the event of a main control room fire, there is no need to perform such manual actions, other than at the remote shutdown workstation. Equipment required to achieve safe shutdown that can be controlled from the main control room workstations can also be controlled from the remote shutdown workstation.

b. It is conservatively assumed that only safety-related systems and components are available to achieve safe shutdown after a fire. Although the typical shutdown sequence does not require manual actions by the operator, fire damage may not be sufficient in many cases to trip the plant. The operator may take appropriate actions to expedite an orderly shutdown. These actions are performed in the main control room, unless the fire occurs in the main control room. In that event these actions are performed at the remote shutdown workstation.

   For individual fire locations, specific manual actions may be required to prevent or respond to spurious equipment actuation. Examples of worst case fire scenarios include:

   Main Control Room: As described in Subsection 9A.3.1.2.5.1, for a fire requiring evacuation of the main control room, control is transferred to the remote shutdown workstation. These actions are manual. Once control is transferred, spurious control signals potentially caused by the fire are isolated from the actuated devices. If a spurious signal has caused an unwanted equipment actuation, the operator takes corrective manual action using controls available at the remote shutdown workstation.

   Remote Shutdown Workstation Room: In the unlikely event that a fire in the remote shutdown workstation room causes spurious actuation of the transfer switch function, manual actions may be required as described in the response to RAI 420.73.

SSAR Revision:

The SSAR Subsection 9A.2.7.1 discussion of manual actions will be revised as follows:

Manual Operation

One of the required manual actions to achieve plant shutdown for a postulated fire event in a fire area is to scram the reactor. ~~from the main control room (MCR), which is assumed to occur at time zero.~~

Manual actions by operations personnel include manipulation of equipment located anywhere outside the fire area, if accessibility and staffing levels permit such actions. Entry into the fire area for repairs or operator actions is assumed to be impossible.

Although the typical shutdown sequence does not require manual actions by the operator, fire damage may not be sufficient in many cases to trip the plant. The operator may take appropriate actions to expedite an orderly shutdown. These actions are performed in the main control room, unless the fire occurs in the main control room. In that event these actions are performed at the remote shutdown workstation

~~Manual operation of valves, circuit breakers, and hand switches are utilized in exercising control over shutdown systems, provided sufficient time and personnel exist to perform the manual operation.~~

Affected portions of SSAR Subsection 9A.3.1.2.5.2 will be revised as follows to describe the manual actions needed to respond to potential spurious actuation of the transfer switch function:

Principal Safety-Related Components in the Fire Area

- Remote shutdown workstation
- Transfer switch set

Safe Shutdown Evaluation

The remote shutdown ~~room~~workstation area contains circuits from the four Class 1E electrical divisions. Electrical separation to and inside the remote shutdown workstation is maintained per industry standards. The remote shutdown room is an alternate to the main control room. The transfer of operations to the remote shutdown workstation is controlled by a transfer switch set located in the remote shutdown workstation room. ~~outside the main control room. Since control from the remote shutdown workstation is not normally activated, it is assumed that no spurious signals are generated in the event of a fire in the area. However, it is assumed that the equipment in the remote shutdown room is damaged.~~ In the unlikely event that the fire damages the transfer switch set, causing transfer of control from the main control room to the remote shutdown workstation, the operator restores control to the main control room by de-energizing the remote shutdown multiplexer cabinets in the instrumentation and control rooms. ~~For this event, control is maintained from the main control room.~~ Safe shutdown is achieved using the safe shutdown equipment listed in Tables 9A-2 through 9A-5.

Neither a fire nor fire suppression activities in this fire area affect the safe shutdown capability of components located in adjacent fire areas.

Question 280.7

Section 9.5.1.2.1.3 of the SSAR, "Fire Water Supply System," indicates that there are two 100-percent fire pumps. Describe the fire area that will require the maximum fire water supply demand. Indicate approximate flows and pressures expected to meet the anticipated fire demand. What administrative controls are in place to assure that the fire pump and driver are properly sized for a specific site? Will each fire pump provide design flow and pressure to the most hydraulically demanding fire area with the shortest leg of the fire main out of service?

Response:

The sprinkler systems in the turbine building oil spill areas (fire area 2000 AF 01) require the maximum fire water flow. Fire pump design flow is based on this sprinkler demand plus a 750 gpm allowance for hose streams. The corresponding fire pump head requirement is based on the hydraulically most demanding of these sprinkler systems with the shortest path through the fire main out of service. See SSAR Table 9.5.1-2 for fire pump data.

The fire pumps and drivers are part of the AP600 standardized design and their size will be the same from site to site. Site-specific fire suppression systems protecting warehouses and other outlying buildings will be accommodated to fit the capabilities of the standard fire water supply.

SSAR Revision: NONE

Question 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.

Response:

The design features of the radioactive drain system to prevent cross flow of airborne radioactivity between building rooms and/or compartments are addressed in the response to RAI 471.9.

SSAR Revision: NONE

Question 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.

Response:

a. The diesel engine fuel will be ASTM-D-975 - grade No. -2D or No. -2, as required and/or recommended by the diesel engine manufacturer. The cloud point required for the standard site design conditions shall be not more than 0°F. The fuel flash point and viscosity will be in accordance with ASTM-D-975 and the engine manufacturer's requirements.

b. The design for the fuel oil storage tank will include a fill connection above the tank full level near the top of the tank. New fuel deliveries added to the tank will therefore cause minimum turbulence and agitation at the lower liquid levels or to the accumulated residuals at the bottom of the tank.

c. The design for the fuel oil storage tank will be in accordance with API-650 and the connection at the bottom of the fuel oil storage tank will be at least 6" above the tank bottom. Additional tank storage capacity is included in the tank design for this purpose.

d. The SSAR will be revised to state that "provisions are included in the design of the fuel oil storage tanks and day tanks to check for and remove accumulated water".

SSAR Revision:

Revise SSAR Subsection 9.5.4.2.3 as follows:

The following sentence is appended to the end of this section.

Provisions are included in the design of the fuel oil storage tanks and day tanks to check for and remove accumulated water.

Question 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?

Response:

a. The diesel engine jacket water system will be provided with an electric heater and a circulating jacket water pump to automatically maintain the engine jacket water temperature of the idle engine at a temperature suitable for fast starts.

b. The cooling water system is provided with sensors to alert the operator when the cooling water temperature exceeds the limits recommended by the manufacturer. The sensors are annunciated on "Hi" temperature (locally) and on "Hi Hi" temperature both locally and remotely as shown on SSAR Table 8.3.1-1.

c. The cooling water system jacket water radiator and after cooler/oil cooler radiator are located at the highest points of the system (on the diesel generator building roof) and are provided with vents and drains so that the system can be completely filled and vented prior to start-up.

d. The cooling water system and diesel generator are designed to operate with the diesel engine at part load for extended periods of time without degradation of performance or reliability.

SSAR Revision: NONE

Question 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?

Response:

a. The diesel engine lubrication system is designed to maintain the engine lubrication system in a keep warm mode and includes an electric heater and a continuous prelube pump that circulates heated lube oil through the engine while it is in the standby mode to provide first start capability.

b. Alarms are provided in the control room for "LO-LO" lube oil pressure and "HI-HI" lube oil temperature. Local alarms are provided at the diesel generator building for "LO" and "LO-LO" lube oil pressure, "LO", "HI" and "HI-HI" lube oil temperature and "LO" engine sump oil level. This is tabulated in SSAR Table 8.3.1-1.

SSAR Revision: NONE

Question 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?

Response:

The two non-Class 1E electrical equipment and penetration rooms are located in the auxiliary building on the east side of containment, one above the other, on levels 3 and 4. In SSAR Figures 1.2-7 and 1.2-8, these rooms are identified as the "ICC/Non-1E Penetration Room" (Room# 12321) and the "RCC/Non-1E Pene. Room" (Room# 12421), respectively. The equipment in these rooms is not safety-related and is not required for safe shutdown, therefore, protection from water spray is not required. There is no safety-related Class 1E electrical equipment in these rooms subject to spray if the fire protection system actuates. None of the Class 1E electrical equipment rooms is served by fire protection system sprinkler systems. The fire protection analysis has determined that only manual hose stations are required for fire fighting in the Class 1E electrical equipment rooms.

SSAR Revision: NONE.

Question 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?

Response:

The kitchen/operator's area in the main control room utilizes potable water. The potable water line is 1 inch (nominal size) or smaller and is, therefore, excluded from the pipe break analysis per Standard Review Plan 3.6.2, Revision 2, Paragraph B.3.c.(1). Also, the line to the kitchen is routed outside the main control area. The safety-related electrical equipment in the main control area is separated/protected from potential spray effects by the kitchen and main control room walls.

SSAR Revision: NONE

Question 410.199

How will the control room be protected from flooding?

Response:

Flooding in the main control room complex (MCR) is discussed in SSAR Subsection 3.4.1. For a discussion of potential flooding in the kitchen area of the main control complex see the responses to RAI 410.011 and RAI 410.195.

The limiting source of flooding for the main control room will be from firefighting using manual hose stations. Water accumulation in the main control room can be limited by opening the emergency egress door. Flow through the door would drain, via floor drains, the stairwell, and the elevator shaft, to level 1. Also, the main control room has a normally closed floor drain that can be manually opened to drain water to the auxiliary building sump at level 1. Flooding from sources outside the main control room is prevented by appropriate barriers at the entrances to the main control room and by watertight penetration seals where required.

SSAR Revision: NONE

Question 410.200

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

Response:

Please see the response to RAI 220.042.

SSAR Revision: NONE

Question 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.

Response:

Inside containment, separate drains are provided from the passive core cooling system and the chemical and volume control system compartments to the containment sump, as described in SSAR Subsection 3.4.1.2.2.1. These compartments are watertight. The drain function is not safety-related. In the event a drain is blocked, the individual compartment will flood up to the stairwell curb at elevation 108'-2" and overflow to the maintenance floor (elevation 107'-2"). The overflow then drains to the containment sump. The drain backflow preventers and upstream piping are AP600 Equipment Class B (per SSAR Table 3.2-3). The balance of the drain piping is AP600 Equipment Class D.

In the radiologically controlled area (RCA) of the auxiliary building, no credit is taken for floor drains in mitigating the consequences of flooding, as described in SSAR Subsection 3.4.1.2.2.2. In the flooding evaluation, drains are assumed to be either open or closed depending on which assumption produces the most conservative result. Since these drains may contain radioactive fluids they are AP600 Equipment Class D (SSAR Table 3.2-3).

The upper annulus of the shield building is provided with redundant safety-related drains to limit the accumulation of water in this area. The drains are physically separated. The simultaneous blocking of redundant drain paths is not a design basis. The upper annulus drains are required for passive containment cooling system operation and are AP600 Equipment Class C.

For the Class 1E electrical area of the non-RCA portion of the auxiliary building, floor drains contribute to limiting the spread of flooding. Each electrical division is provided with separate drains to the auxiliary building (non-RCA) sump to prevent cross flooding via the floor drains. Since the doors in the electrical area are not watertight, it is assumed that any flooding will be distributed uniformly along a corridor and the adjacent rooms. The blockage of all the floor drains on a particular level is not a design basis. One floor drain of the total available on a given level plus a stairwell, elevator shaft and/or doorway provide sufficient drainage down to level 1 to prevent damage to safety-related equipment. Therefore, these drains are AP600 Equipment Class E (nonsafety-related, per SSAR Table 3.2-3).

For the main steam isolation valve compartments, mechanical equipment rooms, and valve/piping penetration room in the non-RCA portion of the auxiliary building, flooding is limited by drainage through doors or blowout panels to the turbine building. The floor drains are not required to be functional, therefore, these drains are AP600 Equipment Class E (nonsafety-related, per SSAR Table 3.2-3).

AP600 Equipment Class B and C drains are classified seismic Category I. AP600 Equipment Class D and E drains are nonseismic, however, those drains in the proximity of safety-related equipment are classified as seismic Category II, if their failure or collapse would adversely affect the safety-related equipment.

SSAR Revision: NONE

Question 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?

Response:

Inside containment there are several duct penetrations into the chemical volume and control system and passive core cooling system compartments. These penetrations (through the floor at 107'-2") are designed to prevent the flooding of these rooms from the maintenance floor level.

In the non-radiologically controlled area (non-RCA) of the auxiliary building, the four Class 1E electrical divisions are separated by 3-hour fire barriers. Portions of these fire barriers also serve as flood barriers. Only those HVAC ducts that penetrate through these barriers and are below the maximum flood height (as through some floors) are required to be watertight. Since the maximum flood height in most of the Class 1E electrical areas is only 3 inches (12 inches on level 1), none of the wall penetrations will need to be watertight. Floor penetrations between rooms of the same division are not required to be watertight.

Fire dampers and watertight penetrations provide divisional separation for HVAC ductwork. The division A & C electrical rooms and the division B & D electrical rooms are served by separate HVAC subsystems providing additional divisional separation. Also, see the response to RAI 410.191.

In the radiologically-controlled area (RCA) of the auxiliary building, the only areas that contain safety-related equipment are level 2 and the upper levels of the vertical pipe chase. The maximum flood height for these areas is 4 inches. Duct penetrations in the walls that surround these areas are above the maximum flood height. The HVAC ductwork in the RCA is not divisionally separated.

SSAR Revision: NONE

Question 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?

Response:

There are two sumps in the auxiliary building: one in the Radiologically Controlled Area (RCA) and one in the Non-Radiologically Controlled Area . The flooding analysis for these areas is described in SSAR Subsection 3.4.1.

For the RCA portion of the auxiliary building, the maximum flood height is below the elevation of the lowest safety-related containment isolation valve (on floor elevation 82'-6"). Most of the fluid systems in the RCA are closed systems, thus flooding is limited to system volume plus a reasonable period of makeup. Unless otherwise limited, it is assumed that leakage is isolated within 30 minutes of main control room indication. The sump level sensor is only one of several means of detection, others include: system low level alarms, prolonged makeup, system malfunctions (pump trips, high temperature alarms due to loss of cooling flow, etc.), and routine operator surveillance.

The non-RCA sump serves only the clean electrical equipment areas of the non-RCA. The mechanical and piping compartments drain to other buildings. There are only a few sources of water in the areas that drain to the non-RCA sump. These are the fire protection system, demineralized water system, and (for the main control room) potable water system. The demineralized water and potable water piping are 1 inch or smaller, so are not included in the pipe break analysis per Standard Review Plan 3.6.2, Paragraph B.3.c.(1). Flooding due to fire fighting or fire protection system leaks is limited to the 18,000 gallons reserved for fire protection in the non-RCA. As described in SSAR Subsection 3.4.1, it is assumed in the flooding analysis that the entire contents are released and ultimately collected on level 1. There is no reliance on flood detection to mitigate the consequence of this event and no safety-related equipment is adversely impacted.

SSAR Revision: NONE

Question 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.)?

Response:

As noted in SSAR Subsection 3.5.1.1.2.4, safety-related systems and components located in the auxiliary building are protected from missiles generated in other portions of the plant by the thick structural concrete exterior walls (and roof) of the auxiliary building. There is no nonsafety-related equipment whose failure could adversely affect the ability of safety-related equipment to perform its safety function that requires protection from missiles generated from non-seismic Category I structures, systems, and components. Safety-related systems and components located in the auxiliary building are protected from missiles generated in other portions of the auxiliary building by the structural concrete interior walls and floors. The exterior walls and roof are 24 and 15 inches thick respectively, as given in SSAR Subsection 3.5.3. Typical structural concrete interior walls are 24 inches thick. The procedures used to determine that the barrier design is adequate are outlined in SSAR Subsection 3.5.3.

SSAR Revision: NONE

Question 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.

Response:

The ventilation airflow rates to the various plant areas is governed primarily by the cooling loads required to maintain the plant areas within their normal design temperature range. A positive or negative ambient pressure differential is provided by automatic pressure controls and/or manual adjustment of the supply and exhaust airflow rates to create the desired ambient pressure. Below is a summary of the nominal system airflow rates based on the equipment design parameters provided in SSAR Chapter 9.

SUMMARY OF NORMAL VENTILATION DESIGN AIRFLOW RATES

System	Nominal Outside Supply Airflow (cfm)	Nominal Exhaust Airflow (cfm)	Ambient Pressure
Fuel Handling Area (Aux Building) - VAS	21,200	23,400	Negative
Auxiliary/Annex Buildings - VAS	55,200	60,600	Negative
Radiation Chemistry Laboratory - VAS	2,000	1,800	Positive
MCR/TSC - VBS	2,000	1,000	Positive
Health Physics and Hot Machine Shop- VHS	13,110	14,610	Negative
Radwaste Building - VRS	18,000	20,000	Negative

SSAR Revision: NONE

Question 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.

Response:

As discussed in the response to RAI 410.240, a table will be added to SSAR Section 9.4 that summarizes the rated HEPA and charcoal decontamination efficiencies, design airflow rates and applicable Regulatory Guide(s) for the filtration systems. The only HVAC filtration systems with charcoal adsorbers are the containment air filtration exhaust (SSAR Figure 9.4.7-1) and the Nuclear Island Nonradioactive Ventilation System (SSAR Figure 9.4.1-1). These filtration systems also include electric heaters for humidity control as discussed in SSAR Sections 9.4.1.2.2, 9.4.7.2.2 and the response to RAI 410.240. SSAR Chapter 11 will be revised to reference Chapter 9, Table 9.4-1 as shown below, to reflect gaseous radwaste management performance.

SSAR Revision:

At the end of introduction to SSAR Section 11.3 (after the second bullet) add the following paragraph:

- Collect gaseous wastes that are potentially radioactive or hydrogen bearing.
- Process and discharge the waste gas, keeping offsite releases of radioactivity within acceptable limits.

In addition to the gaseous radwaste system release pathway, release of radioactive material to the environment occurs through various building ventilation systems. These systems are described in Section 9.4 with a summary of system airflow rates and filter efficiencies provided in Table 9.4-1. The estimated annual releases reported in Subsection 11.3.3 include contributions from the major building ventilation pathways.

Question 410.249

In Section 10.3 of the SSAR, the term "safety-related portion of the main steam supply system (MSSS)" is used often. Where is the term defined in the SSAR? Is it the portion that is designed to ASME Section III, Class 2 as defined in Paragraphs 1 and 2 of Section 10.3.1.1.B of the SSAR, or something else?

Response:

The term "safety-related portion of the main steam supply system (MSSS)" is used to refer to the piping and components that are classified as one of the safety-related classifications (A,B, or C). The only components of the MSSS that are classified as safety-related are those in the SGS (steam generator system), and these components include not only those listed in SSAR Section 10.3.1.1.B as designed in accordance with ASME Code, Section III, Class 2, and seismic Category I requirements, but also the components listed as designed in accordance with ASME Code, Section III, Class 3 and seismic Category I requirements.

SSAR Revision: NONE

Question 410.254

WCAP-13054 indicates that the AP600 design meets the requirements of GDC 60 as related to Sections 10.4.1, 10.4.2, and 10.4.3 of the SRP. Section 10.4.1 of the SRP states that the design of the main condenser system is acceptable if the integrated design of the system meets the requirements of GDC 60 as related to failures in the design of the system which do not result in excessive releases of radioactivity to the environment. Sections 10.4.2 and 10.4.3 of the SRP state that the design of the main condenser evacuation system and turbine gland sealing system are acceptable if GDC 60 is satisfied as it relates to the main condenser evacuation and turbine gland sealing designs for the control of release of radioactive materials to the environment.

How is GDC 60 met by the AP600 design as related to the guidance in Sections 10.4.1, 10.4.2, and 10.4.3 of the SRP?

Response:

GDC 60 is met by the following design attributes:

As stated in SSAR Subsection 10.4.1.3, the main condenser has no significant inventory of radioactive contaminants during normal operation and plant shutdown. Early detection of concentrated levels of radioactivity is provided by the main steam system (MSS) and steam generator blowdown system (BDS) radiation monitoring devices. In addition to this monitoring, radioactive effluent monitoring equipment is provided in the turbine island vents, drains, and relief system (TDS) at the combined exhaust of the condenser air removal system (CMS) and the turbine gland seal system (GSS). The plant operator may secure the discharge of the radioactive effluents upon detection of high radioactivity level. Refer also to SSAR Subsections 11.3.3 and 11.5.2 on radioactive releases, release points and process radiation monitoring for the turbine building.

SSAR Revision: NONE

Question 440.79

10 CFR 50.34(f)(2)(x) requires an applicant to provide a test program and associated model development, and conduct tests to qualify RCS relief and safety valves for all fluid conditions expected under operating conditions, transients, and accidents. Clarify and provide the bases for the statement in Section 5.2.2.4 of the SSAR that these requirements do not apply to relief valves of the size and type represented by the relief valve on the NRHRS.

Response:

The relief valve in the pump common suction header of the normal residual heat removal system provides normal residual heat removal system overpressure protection in accordance with Section III of the ASME Boiler and Pressure Vessel Code for Class 2 and 3 components. In addition, the relief valve provides protection against reactor coolant system pressure exceeding the limiting conditions for operation established in Technical Specification 3.4.3 for reactor coolant system temperatures less than 350°F.

Based on previous NSSS experience and reactor coolant system low temperature overpressure analyses results for the AP600, the fluid conditions for these functions are expected to fall within the National Board of Boiler and Pressure Vessel Inspectors's standard fluid capacities tables for standard orifice designs for a spring-loaded, bellows-type, water relief valve. The AP600 normal residual heat removal system suction relief valve will be designed, manufactured, and tested to ASME Section III, Class 2 requirements. There are no special testing requirements.

SSAR Revision: NONE

Question 440.142

Describe the procedures for venting the RCS system, including the criteria for opening and closing the RVHVS and ADS first stage valves, respectively, the necessary instrumentation, and the bases for these criteria and procedures.

Response:

The AP600 Design Change Report dated June 30, 1994 describes modifications to the reactor vessel head vent. As described in the report, the reactor vessel head vent has been modified to provide the plant with a safety-related, single-failure tolerant vent path that could be used to prevent pressurizer overfill during certain design basis events. The design bases for the head vent has been broadened to include the ability to relieve water from the RCS at a flow rate sufficient to prevent pressurizer overfill during an event where the mass addition from the core makeup tanks causes an increase in pressurizer inventory that otherwise might overfill the pressurizer. In addition, the head vent retains the capability to vent non-condensible gasses that may accumulate in the RCS due to a severe accident.

The reactor vessel head vent valves are opened during plant startup operations to vent air from the reactor vessel head. Once the reactor vessel head is in place and bolted, the reactor coolant system is filled water solid, with the high point vents (including the reactior vessel head vents and the manual pressurizer high point vents) opened to allow air to be vented from the system. After the vents are closed, a reactor coolant pump in each steam generator is started and allowed to run for a short time, and is then stopped. The high point vent lines are then reopened, to allow any air that collects in the high points to be vented. The vents are then reclosed, and the venting procedure is repeated until all of the air is removed from the RCS.

In addition to the normal venting procedures during plant startup, the reactor vessel head vent could also be used under a design basis accident scenario. Following long-term (> 30 minutes) operation of the CMTs in response to a transient (non-LOCA) event, the pressurizer water level can increase and conservative Chapter 15 accident analyses indicate the pressurizer can eventually become water solid. To avoid this occurrence, the operator opens the head vent valves, based on indication of high pressurizer level, and reduces the inventory in the RCS, and prevents pressurizer overfill. When pressurizer level is sufficiently reduced, the operator recloses the head vent valves. In this case the operator uses pressurizer level as the primary indication to control operation of the reactor vessel head vent.

Other reactor vessel head vent operations are as a result of multiple failures in the passive safety-related systems including multiple ADS failures, or possibly multiple failures in the passive RHR system. In these cases, manual operation is based on the operator recognizing the multiple failures in the passive safety-related systems, or is be based on high pressurizer level (in the case of multiple PRHR failures) as described above. In these cases, operation of the reactor vessel head vent prevents a buildup of noncondensible gasses in the RCS. The venting of noncondensible gasses is not a safety-related function required to mitigate design basis events.

Manual operation of the first stage ADS valves is not required to mitigate design basis accidents. Manual operation of the first stage ADS valves is performed in the case of multiple failures of safety-related systems, or is performed as a recovery action from a design basis event. Examples include manual operation of the first stage ADS in

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response to a steam generator tube rupture event if other means of RCS depressurization have failed, or manual operation to reduce the pressure in the RCS following a transient to allow initiation of the nonsafety-related normal RHR system. Manual operation of the ADS valves is also performed on indication of high core exit temperature indicative of a core damage event, or in the case of failure of the ADS valves to operate when required. Venting of the ADS valves under these circumstances helps mitigate these events by depressurizing the RCS and preventing the buildup of noncondensible gasses. Reference 440.142-1 describes the operation of the AP600 systems for various accident events and describes manual operation of the first stage ADS valves when required..

References:

440.142-1 WCAP-13793, "AP600 Systems / Events Matrix", June 1994.

SSAR Revision:

SSAR section 5.4.12 has been updated per the response to RAI 440.141 and will be included in Revision 2 of the SSAR.

Question 480.75

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

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

Response:

Deviations from Appendix J testing requirements and justification are detailed in SSAR Table 6.2.5-1 "Exceptions to 10 CFR 50 Appendix J Leak Testing Requirement."

SSAR Revision: NONE

PRA Revision: NONE