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Document Control Desk
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, June 8, 1994, and August 18, 1994. This completes the responses associated with the April 29th letter. In addition, a revision of a response previously submitted is provided. A listing of the NRC requests for additional information responded to in this letter is contained in Attachment A.

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.

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-94-4326
ATTACHMENT A
AP600 RAI AND OPEN ITEM RESPONCES
SUBMITTED OCTOBER 21, 1994

231.19 R1
410.261
435.83
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440.244

Question 231.19

Table 2.0-1 of the SSAR specifies a minimum shear wave velocity of 1000 feet/second (fps). During the January 20 and 21, 1994 meeting, Westinghouse clarified that the value of 1000 fps meant a minimum best estimate value of the low strain shear wave velocity. This criterion implies an acceptable lower bound shear wave velocity of about 707 fps assuming a 50% reduction of shear modulus specified in SRP 3.7.2 for parametric studies. If 1000 fps is a nominal value, it will be necessary to perform SSI analysis for a 707 fps soil shear wave velocity case. Based on the above, provide the following information:

a. Because no SSI analysis has been performed for shear wave velocities less than 1000 fps, modify Table 2.0-1 to indicate that 1000 fps refers to the lower bound shear wave velocity obtained by considering a 50% reduction from the best estimate value.

b. Similarly, at the other end of the spectrum where the shear wave velocity of soils/soft rock are just below that of hard rock, about 2500 fps or 3000 fps, the variability of the shear modulus must be considered by a factor of 2 per SRP 3.7.2. The staff does not accept Westinghouse's response to Q231.11 that such variation of the modulus by a factor of 2 is intended for sites that are not well investigated.

Response: (Revision 1)

a. As specified in SSAR Section 2.5, the site acceptance criterion of 1000 feet per second for the shear wave velocity is based on the low strain best estimate soil properties. A discussion of the plant response at shear wave velocities corresponding to the lower bound soil properties at a site where the best estimate properties are 1000 feet/second is covered under RAI 230.42 (b) Response Revision 1 and RAI 231.24. Table 2.0-1 is revised below.

b. A discussion of plant response for other soil shear wave velocities, such as for 1500 fps and 3500 fps, is provided in the response Revision 1 to RAI 230.53. The design soil profiles include the soft to medium stiff soil and a hard rock case, in addition to the soft rock case. Plant design is based on the envelope of these cases. ~~The subject of this RAI was discussed during a meeting among NRC staff and consultants and Westinghouse and Bechtel on seismic analyses on April 14, 1994 and will be discussed further during a meeting scheduled in June. A written response to this RAI will be prepared by June 30, 1994.~~

SSAR Revision:

Revise Table 2.0-1 (Sheet 1 of 2) of the SSAR as follows:

Shear Wave Velocity	Greater than or equal to 1000 ft/sec based on low strain best estimate soil properties

Question 410.261

Provide the following information on the hot water heating system (HHS) discussed in Section 9.2.10 of the SSAR:

a. Specify the operating pressures and temperatures of the HHS piping that supply hot water to major areas of the plant.

b. Are any of the HHS lines routed into the containment that require containment isolation? If so, specify the safety class and seismic category of the portions of the HHS piping at the containment penetrations between the containment isolation valves.

c. Specify the potential consequences of a break in the HHS piping and the protective measures to prevent damage (such as flooding) on safety-related systems.

d. Do any of the HHS lines run over or through the control room?

Response:

a. The operating pressure and temperature of the hot water heating system (VYS) is 180 °F and 60 psig. The piping design conditions are 200 °F and 100 psig.

b. No VYS lines are routed inside the containment.

c. No VYS piping is routed in rooms that contain safety-related equipment. There are no adverse consequences on safety-related components or equipment due to postulated breaks in the VYS piping routed in nonsafety-related areas.

d. The VYS lines are not routed over or through the main control room.

SSAR Revision:

a. Revise Table 9.2.10-1 to include piping design and operating temperatures and pressures.

Table 9.2.10-1 (Sheet 2 of 2)

Hot Water Heating System Design Data

VYS Pumps

Quantity	2
Capacity (gpm)	1998
Head (ft H_2O)	128
Motor (hp)	100
Fluid	Demineralized water with ethylene glycol

Chemical Mix Tank

Capacity (gal)	50
Design pressure (~~psia~~ psig)	~~40~~ 25
Operating pressure (~~psia~~ psig)	~~25~~ 10

Surge Tank

Capacity (gal)	1,800
Design pressure (~~psia~~ psig)	~~35~~ 20
Operating pressure (~~psia~~ psig)	~~20~~ 5

Piping

Design Pressure (psig)	100
Operating Pressure (psig)	60
Design Temperature (°F)	200
Operating Temperature (°F)	180

b. None

c. None

d. None

Question 435.83

Figure 8.3.1-1 of the SSAR shows automatic tap changers used on unit auxiliary transformers ZAS ET 3 and ZAS ET 2. Chapter 3 of the PRA states that the random failure data and loss of offsite power frequency are derived from Volume III of the EPRI ALWR Utility Requirements Document. The data provided in the EPRI ALWR Utility Requirements Document is generally developed from operating plants that rarely use automatic tap changers. Has the loss of offsite power frequency or unit auxiliary transformer reliability been modified in the AP600 PRA to account for what could be a lower reliability due to the use of the automatic tap changers?

Response:

The loss of offsite power initiating event frequency and the transformer failure rate have not been modified. The failure rate of 1.2 E-6 per hour for the high voltage transformers and the frequency of 0.086 event/year for the loss of off-site power were based on the data from the Advanced Light Water Reactor Utility Requirements Document (URD) (Volume III, Revision 2, dated December 1991).

The failure rate recommended in the URD (1.2E-06 per hour) for high voltage transformers is derived mainly from generic data sources for transformers without an automatic tap changer. According to the IEEE-500, a faulty tap changer output contributes approximately 3-5% to the high voltage transformer failure rate. Even if this contribution is increased to 25%, the loss of offsite power initiating event frequency increases by approximately 6% (from 0.086 to 0.091 events per year).

According to Table F-8A in Appendix F of the AP600 PRA Report, Component Importances for Risk-Decrease Measure At Power, the loss of offsite power event (basic event IEV-TE) is ranked 50th with a contribution to the total core damage frequency of 0.87% and the common cause failure of the unit auxiliary transformers (basic event ZAX-TR-HF) is not ranked among the first 285 events. The impact of an automatic tap changer on plant core damage frequency due to unit auxiliary transformer failure and on the loss of offsite power initiating event frequency is negligible.

PRA Revision: NONE

SSAR Revision: NONE

Question 440.210

It appears that the only IEs analyzed are LOOP, loss of RHR, and LOCA for hot shutdown and cold shutdown with the RCS not drained. Why are other IEs, such as loss of CCW or service water, not analyzed?

Response:

Loss of component cooling water and service water initiating events are analyzed in the Shutdown PRA for conditions when the reactor coolant system is not drained, and for conditions when the reactor coolant system is drained.

Fault trees are developed for the loss of component cooling water and loss of service water. Since failure of these systems can cause loss of normal residual heat removal function, their failure probabilities are included in the loss of normal residual heat removal initiating event. These initiators are modeled as sub-trees in the "RCN2" fault tree which is used to derive the initiating event for loss of normal residual heat removal.

PRA Revision: NONE

SSAR Revision: NONE

Question 440.211

Provide a description of how the event trees for shutdown conditions were quantified. How was the IE frequency estimated? What is the timing of the scenarios? What are the top events in the event trees? What is the emergency or abnormal procedure that provides guidance to the operators?

Response:

The event trees for shutdown conditions were quantified by the same method used for event trees for power conditions. The quantification was carried out by the fault tree linking method which uses Boolean logic on the cutsets of the model, in a bottom-up appreach. The fault trees for shutdown conditions are included in the listings of trees provided in respective system sections of the PRA. In Revision 2 of the PRA, all inputs to (and results of) the shutdown PRA will be provided in one section of the PRA.

The initiating event frequency was estimated by the following process:

- Estimate the yearly frequency of being in any of the three types of plant shutdown (i.e., non-drained maintenance, drained maintenance, or refueling shutdown). The results from analysis of historical trip performance of U.S. plants were utilized to estimate percentages of the respective outage types, that are likely to be experienced.
- Estimate the timing of the different shutdown phases from the available AP600 Integrated Refueling Outage schedule. With the exception of boron dilution events, the mission time for scenarios was estimated to be 180 hours. For the boron dilution scenario, the accumulator valves were assigned a mission time of 900 hours which is the total estimated annual residence time for all shutdown operations.
- Calculate the hardware failure and/or human error probability that could initiate the event. Published data was used in the case of loss of offsite power. The IE was obtained from the ALWR Utility Requirements Document.

Except for the loss of offsite power, the IE frequency is the product of the calculations obtained from these three processes.

The event trees for shutdown conditions are provided in Figures F-24 through F-30. The top events in these trees are described in sections F.4.5.1 through F.4.7.3.

Operator actions, modeled in the PRA, were developed with collaboration among cognizant professionals from various disciplines (Human Reliability Analysis (HRA), system analysis, design engineering, and EOP design). The operator actions reflect the success criteria of available equipment and assumed timing considerations. These operator actions are taken into consideration during development of the procedures. The HRA will be updated as necessary to reflect the AP600 procedures.

PRA Revision:

The structure will be changed in Revision 2 of the AP600 PRA to reflect a stand-alone shutdown PRA chapter.

SSAR Revision: NONE

Question 440.234

Assuming the regenerative and letdown HXs are like the SGs or PRHR HXs, the frequency of a LOCA due to their tube rupture should be comparable to that of a SGTR. Clarify whether or not the LOCA frequency calculations include ruptures in the regenerative HX, letdown HX, demineralizers, and filters in the CVS.

Response:

The ruptures of the regenerative heat exchanger, letdown heat exchanger, and filters in the CVS were not included in the LOCA initiating event frequency calculations. According to the configuration of the CVS purification loop, there are two motor-operated isolation valves in series located upstream of the regenerative heat exchanger. These valves are closed automatically on a low-low pressurizer level signal and can be operated manually from the main control room. The combined frequency of the CVS purification component failure (e.g., regenerative heat exchanger, letdown heat exchanger, filters, etc.) and the isolation valves failure to close is negligible compared to the frequency of the CVS piping rupture. The CVS piping rupture was included in LOCA initiating event frequency calculations as shown in Appendix B of the AP600 PRA Report.

SSAR Revision: NONE

PRA Revision: NONE

Question 440.244

Provide information on the transportable generators. What kind of requirements are applicable on their R/A? Are they taken credit for in the PRA?

Response:

SSAR Subsection 8.3.1.1.1 provides information on the transportable generators.

These generators are available from offsite, at a location far enough from the site to be unaffected by an external event, but close enough to be able to be transported to the site within 72 hours.

No credit was taken for these transportable generators in the PRA. These generators are intended to meet the post-72 hour power requirements, whereas the PRA concerns itself with the 24 and 72 hour periods following an initiating event.

SSAR Revision: NONE

PRA Revision: NONE