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Docket No.: STN-52-003

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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 March 1, 1994, March 16, 1994, March 18, 1994 and April 29, 1994. In addition, a revision of a previous response is included. This letter completes the responses for the March 1, 1994 and March 18, 1994 letters.

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 March 1, 1994 and March 18, 1994 letters and the corresponding letters that provided our response.

These responses are also provided as electronic files in WordPerfect 5.1 format with Mr. Hasselberg'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 Activities

/nja

Enclosure

cc: B. A. McIntyre - Westinghouse
F. Hasselberg - NRR

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NTD-NRC-94-4154
ATTACHMENT A
AP600 RAI RESPONSES
SUBMITTED JUNE 2,1994

RAI No.	Issue
210.108	Justification for use of ASME 1989 Addenda
220.061	Watertight/airtight seal in SSAR 3.8.2.1.1
420.099R01	Global Trip subsystem failures
720.262	Spectrum shape used in seismic margins analysis
720.263	SSC fragilities and HCLPFs
720.264	Plant HCLPF
720.265	Failure of non-seismically qualified SSCs
720.266	Effect of seismic failure of non-seismic equipment
720.267	Relay chatter ITAAC
720.268	Plant HCLPF during shutdown
720.269	Seismically induced ATWS events
720.270	Systems modelled in seismic margins analysis
720.271	Initiating events with HCLPF greater than 0.5g
952.060	ADS, Nominal valve inlet conditions
952.061	ADS, Nominal control valve area
952.062	ADS, Nominal control valve mass flow rate
952.063	ADS, Stage 4, valve train piping dimemsions
952.064	ADS Stage 4, Valve train geometry

ATTACHMENT B

CROSS REFERENCE OF WESTINGHOUSE RAI RESPONSE TRANSMITTALS TO NRC LETTERS OF MARCH 1, 1994 AND MARCH 18, 1994

Question No.	Issue	NRC Letter	Westinghouse Transmittal Date
720.262	Spectrum shape used in seismic margins analysis	03/18/94	06/02/94
720.263	SSC fragilities and HCLPFs	03/18/94	06/02/94
720.264	Plant HCLPF	03/18/94	06/02/94
720.265	Failure of non-seismically qualified SSCs	03/18/94	06/02/94
720.266	Effect of seismic failure of non-seismic equipment	03/18/94	06/02/94
720.267	Relay chatter ITAAC	03/18/94	06/02/94
720.268	Plant HCLPF during shutdown	03/18/94	06/02/94
720.269	Seismically induced ATWS events	03/18/94	06/02/94
720.270	Systems modelled in seismic margins analysis	03/18/94	06/02/94
720.271	Initiating events with HCLPF greater than 0.5g	03/18/94	06/02/94
952.050	SPES-2, Basis for fuel rod stored energy	03/01/94	04/21/94
952.051	SPES-2, Secondary side mass	03/01/94	04/21/94
952.052	SPES-2, Basis for pressurizer water level	03/01/94	04/21/94
952.053	SPES-2, Secondary side conditions	03/01/94	04/21/94
952.054	SPES-2, Scaling rationale	03/01/94	04/21/94
952.055	SPES-2, Delayed neutron simulation	03/01/94	04/21/94
952.056	SPES-2, Basis for heat loss compensation	03/01/94	04/21/94
952.057	SPES-2, Secondary side relief valve closing setpts	03/01/94	04/21/94
952.058	SPSE-2, Pump coastdown	03/01/94	04/21/94
952.059	SPES-2, Pressurizer heater rods	03/01/94	04/21/94
952.060	ADS, Nominal valve inlet conditions	03/01/94	06/02/94
952.061	ADS, Nominal control valve area	03/01/94	06/02/94
952.062	ADS, Nominal control valve mass flow rate	03/01/94	06/02/94
952.063	ADS, Stage 4, valve train piping dimemsions	03/01/94	06/02/94
952.064	ADS Stage 4, Valve train geometry	03/01/94	06/02/94

Records printed: 25

Question 210.108

Section 5.2.1.1 ., ' : SSAR, "Compliance with 10 CFR 50.55a," states that the Code of record for evaluations done to support the AP600 SSAR and the design certification is the 1989 Edition, 1989 Addenda of ASME Boiler and Pressure Vessel Code, Section III. At this time, 10 CFR 50.55a(b)(i) only endorses ASME Section III through the 1989 Edition. Revise Section 5.2.1.1 to delete the reference to the 1989 Addenda, or provide justification for its use.

Response:

The ASME Code, Section III, 1989 Edition, 1989 Addenda was selected as the baseline code for reasons that included the code in effect at the time design efforts were started. It is expected that the 1989 Addenda will be included in 10 CFR 50.55a by the time the final design approval is issued. The AP600 design and analysis efforts will continue to use the 1989 Addenda as the baseline code on this basis.

SSAR Revision: NONE

Question 220.61

It is stated in Section 3.8.2.1.1 of the SSAR (pg. 3.8-1) that a flexible watertight and airtight seal is provided at Elevation 123' 3") between the containment shell and the shield building. Provide clarification for the following concerns:

a. What is the safety class and seismic category of this seal?

b. If the seal is a safety class item, explain how the seal will perform its function when the containment shell is displaced laterally inward and outward at the base of the foundation.

Response:

The flexible water tight seal is utilized to seal against water leakage from the upper annulus into the middle annulus. The seal also serves to maintain an intact holdup volume within the middle annulus for containment leakage of contaminants following a severe accident scenario.

a. The seal is designated as nonsafety-related and non seismic; it is not relied upon to mitigate any design basis events.

b. The seal is, however, designed to accommodate events resulting in containment temperature and pressure excursions which result in lateral shell movement, inward or outward, as a result of normal operation, design basis accidents and severe accident scenarios. The events considered for the seal design are those discussed in SSAR Chapter 15 and the severe accident scenarios are those that do not exceed ASME service level C limits for the containment.

SSAR Revision: NONE

Question 420.99

As discussed in Q420.94, a failure in the Global Trip Subsystem would prevent a reactor trip. However, there is no discussion on the Global Trip Subsystem in the Technical Specification Bases described in Chapter 16. Provide a discussion of the required actions to deal with the Global Trip Subsystem Failures. (TS B 3.3.1 of Chapter 16)

Response (Revision 1):

A single failure of one of the four redundant global trip subsystems in the protection and safety monitoring system will not prevent a reactor trip.

The global trip subsystem is part of the reactor trip system instrumentation described in TS B 3.3.1 of SSAR Chapter 16. The actions required to deal with a global trip subsystem failure are covered by function 19, "Automatic Trip Logic," conditions M and R, "One or two channel(s)/division(s) inoperable," of Table 3.3.1-1 of SSAR Chapter 16.

The global trip subsystem communicates with the trip enable subsystems, the other global trip subsystems and the dynamic trip bus using two distinct methods. Signals to the dynamic trip bus are discrete digital outputs, while signals to the other global trip subsystems use isolated datalinks as shown in Figure 4.1-6 of Reference 420.99-1. In each of the places that global trip subsystem signals are received, means are provided to detect failure of the transmitting global trip subsystems. Upon detection of failure of a global trip subsystem, failsafe actions are taken. Failure of multiple global trip subsystems as shown on Figure 3.1 of Reference 420.99-2, will result in a reactor trip before the protection and safety monitoring System (PMS) is degraded to the point where it cannot provide a reactor trip. The postulated failure of the global trip subsystem identified in section 5.1 of the Lawrence Livermore National Laboratory (LLNL) defense-in-depth and diversity assessment (see RAI 420.94) requires failures to occur concurrently in two or more places within the global trip subsystem software in order for the dynamic trip buses and trip enable subsystems to not detect the simultaneous failures of four global trip subsystems. Such multiple, concurrent, and specific common mode failures are extremely low probability occurrences, and are addressed by including the diverse actuation system, described in SSAR subsection 7.7.1.11.

References:

420.99-1. Birsa, J. J., "AP600 Instrumentation and Control Hardware Description," WCAP-13382 (Proprietary), WCAP-13391 (Non-proprietary), May 1992.

420.99-2. Birsa, J. J., "Bypass Logic for the Westinghouse Integrated Protection System - Ap600 Bypass Logic Implementation Description," WCAP-8897, Addendum 2 (Proprietary), WCAP-8898, Addendum 2 (Non-Proprietary), February 1994.

SSAR Revision: NONE

Question 720.262

Provide a detailed explanation of the spectrum shape used in the AP600 seismic margins analysis. If the risk-based seismic analysis in the AP600 PRA does not bound the site-specific parameters of the actual site chosen, an applicant for a combined construction/ operating license will have to provide a new, site-specific risk- based seismic analysis.

Response:

The response to the subject question is provided in the seismic margin report. This report will be submitted to the NRC by June 30, 1994.

SSAR Revision: NONE

Question 720.263

Provide a list of structure, system, and component fragilities and HCLPFs. The list should include the median capacity, BC, and HCLPF, as discussed below:

a. Provide the mathematical definition of HCLPF.

b. Provide fragility/HCLPF information for plant essential structures (e.g., containment and auxiliary buildings) that house safety-related systems and functions credited in the seismic analysis (e.g., passive RHR and DC power), including passive and active systems.

c. Provide the fragilities/HCLPFs for all systems (passive and active) evaluated in the AP600 PRA seismic analysis, including RCS primary equipment and supports.

d. Provide the component fragilities/HCLPFs for the individual components modelled in the AP600 seismic analysis.

e. For each of the above, (1) indicate if the fragility estimate is based on a design-specific Westinghouse analysis, or if Westinghouse used a generic fragility, and (2) where generic fragilities were used, provide a basis for their use in the AP600 design with special attention provided to unique design components in the AP600 design (such as the core, check valves, and core makeup tanks).

Response:

The response to the subject questions are provided in the seismic margin report. This report will be submitted to the NRC by June 30, 1994.

SSAR Revision: NONE

Question 720.264

Provide the AP600 plant HCLPF based on those sequences leading to core damage.

Response:

The response to the subject question is provided in the seismic margin report. This report will be submitted to the NRC by June 30, 1994.

SSAR Revision: NONE

Question 720.265

Provide a reference in the AP600 PRA to the ITAAC requirement that failure of non-seismically qualified structures, systems, and components will not physically damage or inhibit the operation of seismically qualified equipment.

Response:

The response to the subject question is provided in the seismic margin report. This report will be submitted to the NRC by June 30, 1994.

SSAR Revision: NONE

Question 720.266

Provide an evaluation in the AP600 risk-based margins analysis of the effect of seismic failure of non-seismic equipment that interfaces with Seismic Category I equipment (e.g., mainsteam line rupture).

Response:

The response to the subject question is provided in the seismic margin report. This report will be submitted to the NRC by June 30, 1994.

SSAR Revision: NONE

Question 720.267

Provide an ITAAC that requires that the AP600 design will not contain relays that are subject to relay chatter, or provide an analysis of seismic-induced relay chatter for these relays. As an example, the relay chatter analysis should look at the possibility of spurious opening and closing of non-safety grade valves.

Response:

Section 3.10 of the AP600 SSAR requires that all safety-related equipment, electrical or mechanical, be seismically qualified per the requirements of IEEE 344-87 and 382-85 (for valves).

Operation of non-safety-related valves is not needed to bring a plant to a safe shutdown condition. Spurious opening and closing of non-safety-related valves are not being evaluated.

The AP600 is in conformance with applicable IEEE standards on Class 1E qualifications and safe shutdown requirements. ITAAC is not required.

SSAR Revision: NONE

Question 720.268

The description of the methodology for the seismic margins analysis does not specify how to treat seismic events during shutdown. During shutdown, the safety systems may not be able to function following a seismic event (e.g., due to maintenance), depending on the status of the plant. In addition, the non-safety systems may have been disabled by the same seismic event. Provide a risk-based evaluation of the plant HCLPF during shutdown, including the use of non-safety grade equipment for prevention and mitigation of core damage, containment failure, or offsite releases.

Response:

The response to the subject question is provided in the seismic margin report. This report will be submitted to the NRC by June 30, 1994.

SSAR Revision: NONE

Question 720.269

Revise the seismic margins methodology to include seismically-induced ATWS events.

Response:

The response to the subject question is provided in the seismic margin report. This report will be submitted to the NRC by June 30, 1994.

SSAR Revision: NONE

Question 720.270

Provide diagrams of the systems modelled in the seismic margins analysis that show what is and is not seismic Category I (e.g., piping, isolation valves, etc.). These should be included in the analysis.

Response:

The response to the subject question is provided in the seismic margin report. This report will be submitted to the NRC by June 30, 1994.

SSAR Revision: NONE

Question 720.271

Expand the seismic margins analysis to include initiating events that are greater than 0.5g (e.g., up to 0.75g). One of the purposes of performing a risk assessment of the AP600 design is to develop a better understanding of the response of the plant to severe accidents and any potential weak links in the design. Core damage sequences with HCLPFs greater than 0.5g will not contain any vulnerabilities, but these sequences may provide important information about the balance of prevention and mitigation in the design and may provide vital information about SSCs that should be included in the RAP or ITAAC. An extreme example of a potential sequence of interest is represented by the following:

(Initiator: 0.55g HCLPF) * (Injection: 0.2g HCLPF) *
(Depressurization: 0.35g HCLPF)

Although failure of injection or depressurization would occur at a low HCLPF value, the initiator's HCLPF is so high that the sequence would not constitute a vulnerability. In this case, the designer and the NRC must ensure that the initiator HCLPF was 0.5g or higher when an AP600 plant is completed, and must ensure that this information is maintained for use by a future COL applicant so that they would not modify the plant design in a manner that lowers the HCLPF of this initiator in the as-built plant.

Response:

The response to the subject question is provided in the seismic margin report. This report will be submitted to the NRC by June 30, 1994.

SSAR Revision: NONE

Question 952.60

Provide the nominal control valve inlet conditions [Pressure (P), temperature (T), and flow quality (x_f)] for ADS Stages 1 through 4.

Response:

The response to RAI 210.28 provides this information.

SSAR Revision: NONE

Question 952.61

Provide the nominal control valve area ($A_{nominal}$) for ADS Stages 1 through 4.

Response:

Consistent with the systems approach to standard plant design certification, the nominal valve areas for automatic depressurization system valves are not specified. Minimum and maximum flow areas are specified for the AP600 automatic depressurization system valves. See the response to RAI 952.49, item f (Attachment 1 to Westinghouse letter NTD-94-4070, dated March 31, 1994) for the ranges of flow areas. The flow areas listed represent the effective flow area which includes actual flow area and discharge coefficient.

SSAR Revision: NONE

Question 952.62

Provide the nominal control valve mass flow rate or nominal control valve discharge coefficient ($C_{D, Nominal}$) for ADS Stages 1 through 4 that accounts for vena contracta and downstream expansion effects.

The nominal control valve discharge coefficient would be used to determine nominal control valve mass flow rate from the calculation:

$$m_{Nominal} = C_{D,Nominal} A_{Nominal} G_{Critical};$$

where $G_{Critical}$ = critical mass flux = $f(P,T,x_f)$

Response:

Consistent with the systems approach to standard plant design certification, the nominal valve areas for automatic depressurization system valves are not specified. Minimum and maximum flow areas are specified for the AP600 automatic depressurization system valves. See the response to RAI 952.49, item f (Attachment 1 to Westinghouse letter NTD-94-4070, dated March 31, 1994) for the ranges of flow areas. The flow areas listed represent the effective flow area which includes actual flow area and discharge coefficient.

SSAR Revision: NONE

Question 952.63

Provide the valve train piping dimensions (nominal pipe sizes and schedule numbers and piping lengths) for ADS Stage 4.

Response:

The nominal pipe sizes and pipe lengths are provided in response to RAI 952.64 in Westinghouse letter NTD-NRC-94-4109, dated 29 April 1994. The following table provides the schedule numbers for the lines of interest:

Pipe	Schedule
12 BTA	140
10 BTA	140
10 GBC	40

SSAR Revision: NONE

Question 952.64

Provide the valve train piping geometry (location and dimensions of bends, elbows, tees, etc.) for ADS Stage 4.

Response:

This information was provided per Westinghouse letter NTD-NRC-94-4109, dated 29 April 1994.

SSAR Revision: NONE