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Your ref: Docket No. 52-006
Our ref: DCP/NRC1579

April 23, 2003

SUBJECT: Transmittal of Westinghouse Responses to US NRC Requests for Additional Information on the AP1000 Application for Design Certification

This letter transmits the Westinghouse responses to NRC Requests for Additional Information (RAI) regarding our application for Design Certification of the AP1000 Standard Plant. A list of the RAI responses that are transmitted with this letter is provided in Attachment 1. Attachment 2 provides the RAI responses.

Please contact me if you have questions regarding this submittal.

Very truly yours,

M. M. Corletti
Passive Plant Projects & Development
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/Attachments

1. Table 1, "List of Westinghouse's Responses to RAIs Transmitted in DCP/NRC1579"
2. Westinghouse Non-Proprietary Response to US Nuclear Regulatory Commission Requests for Additional Information dated April 2003

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Attachment 1

"List of Westinghouse's Responses to RAIs Transmitted in DCP/NRC1579"

Attachment 1

Table 1 "List of Westinghouse's Responses to RAIs Transmitted in DCP/NRC1579"
220.017, Rev. 1 720.080, Rev. 2

Attachment 2

Westinghouse Non-Proprietary Response to US Nuclear Regulatory Commission
Requests for Additional Information dated April 2003

AP1000 DESIGN CERTIFICATION REVIEW

Response to Request For Additional Information

RAI Number: 220.017 (Revision 1)

Question:

Section 3.8.5 contains a number of apparent inconsistencies related to the designation of Tier 2* material and the status of the AP1000 basemat design.

Subsection 3.8.5.4.3, "Design Summary of Critical Sections" references both Table 3.8.5-3 and Figure 3.8.5-3 as showing the basemat reinforcement details for the basemat critical sections. The design of the critical sections is designated Tier 2* in the text of Subsection 3.8.5.4.3, and Table 3.8.5-3 is also designated Tier 2*. However, in Figure 3.8.5-3, only sheets 1,2, and 5 are designated Tier 2*, while sheets 3 and 4 are unmarked.

Table 3.8.5-3 includes Note (5), indicating that "The results are representative for the AP1000 and may be updated when structural calculations are completed." However, Figure 3.8.5-3 does not have a comparable note, implying that the information provided reflects the AP1000 final basemat design.

Please provide an explanation for these apparent inconsistencies by (1) identifying what is Tier 2*, what is not Tier 2*, and the technical basis for the proposed designation, and (2) describing the status of the AP1000 final basemat design and the relationship between the information in Table 3.8.5-3 and Figure 3.8.5-3 to the AP1000 final basemat design.

Westinghouse Response:

The final design of the two critical sections of the nuclear island basemat defined in the DCD is in progress and will be available for the structural audit. The required reinforcement in Table 3.8.5-3 will be updated once the design calculation is completed. The figures may not need to be revised since it is anticipated that the structural demand at a hard rock site is lower than that at the AP600 envelope of sites which is the basis for the reinforcement provided in Figure 3.8.5-3.

Tier 2* material was selected for the AP600 by NRC staff. The markings of Tier 2* in the AP600 DCD on Figure 3.8.5-3 also show that only sheets 1,2, and 5 are designated Tier 2*, while sheets 3 and 4 are unmarked.

The AP1000 Tier 2* designations were based on those in AP600 and will be revised. Westinghouse proposes that Tier 2* be applied to the critical sections where the design calculations will be subject to NRC staff review in the proposed structural audit. Since Figure 3.8.5-3 contains significantly more information than is covered by the critical sections, the Tier 2* designation will be removed from all sheets of the figure but will be retained on Table 3.8.5-3.

AP1000 DESIGN CERTIFICATION REVIEW

Response to Request For Additional Information

Design Control Document (DCD) Revision:

In Figure 3.8.5-3, sheets 1,2, and 5, delete Tier 2* designation

PRA Revision:

None

Westinghouse Response: (Revision 1)

The final design of the two critical sections of the nuclear island basemat defined in the DCD was reviewed during the structural audit, April 2 - 5, 2003. The required reinforcement in Table 3.8.5-3 was updated in Revision 4 of the DCD. The technical content of the figures was not revised since the structural demand at a hard rock site is lower than that at the AP600 envelope of sites which is the basis for the reinforcement provided in Figure 3.8.5-3.

The initial AP1000 Tier 2* designations were based on those in AP600. They were revised in Revision 4 of the DCD. Tier 2* has been applied to the portions of Figure 3.8.5-3, sheets 1,2, and 5, which show the critical sections where the design calculations were reviewed during the structural audit.

Design Control Document (DCD) Revision:

Revision was included in DCD Revision 4.

PRA Revision:

None

AP1000 DESIGN CERTIFICATION REVIEW

Response to Request For Additional Information

RAI Number: 720.080 (Response Revision 2)

Question:

Gamma and Beta Doses in Figures D-1 and D-2 of the AP1000 PRA are less than the corresponding figures for the AP600. Considering the power rating has gone up, one would expect these doses to increase not decrease. Why is this less?

Westinghouse Response:

Relative to the AP600, the increase in the power rating would tend to result in higher doses for the AP1000 with all other parameters of equal values. A compensating design feature of the AP1000 is the larger containment volume.

The primary difference, though, is attributable to the total core inventory released and the timing of these releases. Both the AP600 and AP1000 calculations are based on NUREG-1465. For the AP600, additional considerations were made as defined by SECY-94-300 (December 1995). For the AP1000, the guidance provided in Regulatory Guide 1.183 (July 2000) was utilized. Tables 1 and 2, illustrate the releases as a function of time for the AP600 and the AP1000, respectively.

Table 1 – AP600
Core Inventory Fraction Released into Containment versus Time Period

	0-10 Minutes	10 Minutes	10-40 Minutes	40-118 Minutes	118-238 Minutes	238-718 Minutes	Total
Noble Gases	0.00	0.03	0.02	0.95	0.00	0.00	1.00
Halogens	0.00	0.03	0.02	0.35	0.25	0.10	0.75
Alkali Metals	0.00	0.03	0.02	0.25	0.35	0.10	0.75
Tellurium Metals	0.00	0.00	0.00	0.05	0.25	0.005	0.305
Ba, Sr	0.00	0.00	0.00	0.02	0.10	0.00	0.12
Noble Metals	0.00	0.00	0.00	0.0025	0.0025	0.00	0.005
Lanthanides	0.00	0.00	0.00	0.0002	0.005	0.00	0.0052
Cerium Group	0.00	0.00	0.00	0.0005	0.005	0.00	0.0055

Table 2 – AP1000 Core Inventory Fraction Released into Containment versus Time Period				
	0-10 Minutes	10-40 Minutes	40-118 Minutes	Total
Noble Gases	0.00	0.05	0.95	1.0
Halogens	0.00	0.05	0.35	0.4
Alkali Metals	0.00	0.05	0.25	0.3
Tellurium Metals	0.00	0.00	0.05	0.05
Ba, Sr	0.00	0.00	0.02	0.02
Noble Metals	0.00	0.00	0.0025	0.0025
Lanthanides	0.00	0.00	0.0002	0.0002
Cerium Group	0.00	0.00	0.0005	0.0005

Table 1 shows that an initial, instantaneous, release of a set of nuclides was simulated for the AP600 at 10 minutes. All other releases are made over a time-span. At 40 and 118 minutes, both the AP600 and the AP1000 have equivalent cumulative releases. The higher dose rate values for the AP1000 up to 118 minutes reflect the higher power rating and containment volume. After 118 minutes, no more releases are simulated for the AP1000, while they continue for the AP600. The cumulative release for all nuclides of the AP600 are larger than the AP1000 (except for the "Noble Gasses" which are equal). The higher doses for the AP600 (after approximately 3 hours) are attributable to the higher total releases.

Design Control Document (DCD) Revision:

None

PRA Revision:

None

NRC Additional Comments:

The three release phase model used in the Westinghouse analysis is a design-basis accident model. Is it appropriate to use it for equipment survivability, or should a more conservative model be used?

Westinghouse Additional Response:

For the original AP1000 calculations, the guidance provided in Regulatory Guide 1.183 (July 2000) was used. Using this regulatory guide as a basis, the severe accident "Ex-Vessel" and

"Late In-Vessel" phases (as identified in NUREG-1465) were not included in the original AP1000 calculations.

The comparable AP600 analyses were carried out prior to issuance of Regulatory Guide 1.183 and addressed both the DBA and severe accident scenarios. Although the characterization of the radiation environment associated with a severe accident is not identified in those sections of Regulatory Guide 1.183 that address equipment qualification, Westinghouse has elected to update these figures (and supporting DCD documentation) to include the "Ex-Vessel" and "Late In-Vessel" phases. Thus, the information will be more consistent with the AP600 methodology and will provide information that could be used in addressing equipment qualification issues for a severe accident scenario. The revised figures are provided in the attached marked up sections of the AP1000 PRA.

The revised AP1000 results use the release fraction information defined in NUREG-1465. The latest information for elemental groupings provided in Table 2 of Regulatory Guide 1.183 has also been used. The key parameters used for all phases are summarized in Table 720.080R1-1 (including the time duration for each release phase).

Table 720.080R1-1
AP1000 Core Inventory Fraction Released into Containment versus Release Phase

	NUREG-1465 (Table 3.13)				
	Gap Release 0.5 Hours	Early In-Vessel 1.3 Hours	Ex-Vessel 2 Hours	Late In-Vessel 10 Hours	Total Release Fraction
Noble Gasses	0.05	0.95	0	0	1.0
Halogens	0.05	0.35	0.25	0.1	0.65
Alkali Metals	0.05	0.25	0.35	0.1	0.65
Tellurium Metals	0	0.05	0.25	0.005	0.3
Ba, Sr	0	0.02	0.1	0	0.12
Noble Metals	0	0.0025	0.0025	0	0.005
Lanthanides	0	0.0002	0.005	0	0.0052
Cerium Group	0	0.0005	0.005	0	0.0055

Design Control Document (DCD) Revision:

None.

PRA Revision:

Revise section D.7 as shown incorporated into Revision 2 of the AP1000 PRA.

AP1000 DESIGN CERTIFICATION REVIEW

Response to Request For Additional Information

NRC Additional Comments:

The final column of Table 720.080R1-1 does not appear to be consistent with the rest of the table.

Westinghouse Additional Response:

An error occurred in the production of this RAI response, so three values in the "Total Release Fraction" column of Table 720.080R1-1 were incorrect. The underlying work was correct, so the revisions included in the AP1000 PRA Rev. 2 are correct. The revised table is provided below.

Table 720.080R2-1
AP1000 Core Inventory Fraction Released into Containment versus Release Phase

	NUREG-1465 (Table 3.13)				
	Gap Release 0.5 Hours	Early In-Vessel 1.3 Hours	Ex-Vessel 2 Hours	Late In-Vessel 10 Hours	Total Release Fraction
Noble Gasses	0.05	0.95	0	0	1.0
Halogens	0.05	0.35	0.25	0.1	**0.75**
Alkali Metals	0.05	0.25	0.35	0.1	**0.75**
Tellurium Metals	0	0.05	0.25	0.005	**0.305**
Ba, Sr	0	0.02	0.1	0	0.12
Noble Metals	0	0.0025	0.0025	0	0.005
Lanthanides	0	0.0002	0.005	0	0.0052
Cerium Group	0	0.0005	0.005	0	0.0055

Additional Design Control Document (DCD) Revision:

None.

Additional PRA Revision:

None.

AP1000 DESIGN CERTIFICATION REVIEW

Response to Request For Additional Information

Design Control Document (DCD) Revision:

In Figure 3.8.5-3, sheets 1,2, and 5, delete Tier 2* designation

PRA Revision:

None

Westinghouse Response: (Revision 1)

The final design of the two critical sections of the nuclear island basemat defined in the DCD was reviewed during the structural audit, April 2 - 5, 2003. The required reinforcement in Table 3.8.5-3 was updated in Revision 4 of the DCD. The technical content of the figures was not revised since the structural demand at a hard rock site is lower than that at the AP600 envelope of sites which is the basis for the reinforcement provided in Figure 3.8.5-3.

The initial AP1000 Tier 2* designations were based on those in AP600. They were revised in Revision 4 of the DCD. Tier 2* has been applied to the portions of Figure 3.8.5-3, sheets 1,2, and 5, which show the critical sections where the design calculations were reviewed during the structural audit.

Design Control Document (DCD) Revision:

Revision was included in DCD Revision 4.

PRA Revision:

None