



Westinghouse Electric Company  
Nuclear Power Plants  
P.O. Box 355  
Pittsburgh, Pennsylvania 15230-0355  
USA

U.S. Nuclear Regulatory Commission  
ATTENTION: Document Control Desk  
Washington, D.C. 20555

Direct tel: 412-374-6306  
Direct fax: 412-374-5005  
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Your ref: Project Number 740  
Our ref: DCP/NRC1959

July 18, 2007

Subject: AP1000 COL Response to Requests for Additional Information (TR #24)

In support of Combined License application pre-application activities, Westinghouse is submitting responses to NRC requests for additional information (RAIs) on AP1000 Standard Combined License Technical Report 24, APP-GW-GLR-060, Rev. 0, Reactor Vessel Insulation System – Verification of In-Vessel Retention Design Bases. These RAI responses are submitted as part of the NuStart Bellefonte COL Project (NRC Project Number 740). The information included in the responses is generic and is expected to apply to all COL applications referencing the AP1000 Design Certification.

Responses are provided for requests RAI-TR24-EMB2-01 through -08, transmitted in an email from David Jaffe to Sam Adams, dated May 24, 2007.

Pursuant to 10 CFR 50.30(b), the proprietary and non-proprietary responses to requests for additional information on Technical Report 24 is submitted as Enclosures 3 and 4 under the attached Oath of Affirmation.

Also enclosed is one copy of the Application for Withholding, AW-07-2305 (non-proprietary) with Proprietary Information Notice, and one copy of the associated Affidavit (non-proprietary).

This submittal contains proprietary information of Westinghouse Electric Company, LLC. In conformance with the requirements of 10 CFR Section 2.390, as amended, of the Commission's regulations, we are enclosing with this submittal an Application for Withholding from Public Disclosure and an affidavit. The affidavit sets forth the basis on which the information identified as proprietary may be withheld from public disclosure by the Commission.

Correspondence with respect to the affidavit or Application for Withholding should reference AW-07-2305 and should be addressed to James A. Gresham, Manager, Regulatory Compliance and Plant Licensing, Westinghouse Electric Company, LLC, P.O. Box 355, Pittsburgh, Pennsylvania 15230-0355.

Questions or requests for additional information related to the content and preparation of this response should be directed to Westinghouse. Please send copies of such questions or requests to the prospective applicants for combined licenses referencing the AP1000 Design Certification. A representative for each applicant is included on the cc: list of this letter.

D079  
D063  
ukd

Very truly yours,

A. Sterdis, Manager  
Licensing and Customer Interface  
Regulatory Affairs and Standardization

/Attachment

1. "Oath of Affirmation," dated July 18, 2007

/Enclosures

1. AW-07-2305 "Application for Withholding Proprietary Information from Disclosure," dated July 18, 2007
2. AW-07-2305, Affidavit, Proprietary Information Notice, Copyright Notice dated July 18, 2007
3. Response to Requests for Additional Information on Technical Report No. 24, RAI-TR24-EMB2-02 and RAI-TR24-EMB2-04 (Proprietary)
4. Response to Requests for Additional Information on Technical Report No. 24, RAI-TR24-EMB2-01 through -08 (Non-Proprietary)

cc:	D. Jaffe	- U.S. NRC	1E	1A
	E. McKenna	- U.S. NRC	1E	1A
	S. Adams	- Westinghouse	1E	1A
	G. Curtis	- TVA	1E	1A
	P. Grendys	- Westinghouse	1E	1A
	P. Hastings	- Duke Power	1E	1A
	C. Ionescu	- Progress Energy	1E	1A
	D. Lindgren	- Westinghouse	1E	1A
	A. Monroe	- SCANA	1E	1A
	M. Moran	- Florida Power & Light	1E	1A
	C. Pierce	- Southern Company	1E	1A
	E. Schmiech	- Westinghouse	1E	1A
	G. Zinke	- NuStart/Entergy	1E	1A
	C. P. Keegan	- Westinghouse	1E	1A

ATTACHMENT 1

“Oath of Affirmation”

UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION

In the Matter of: )  
NuStart Bellefonte COL Project )  
NRC Project Number 740 )

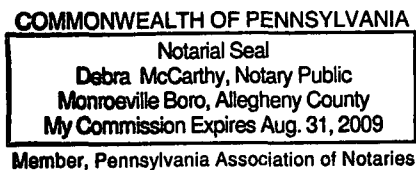
APPLICATION FOR REVIEW OF  
"AP1000 GENERAL COMBINED LICENSE INFORMATION"  
FOR COL APPLICATION PRE-APPLICATION REVIEW

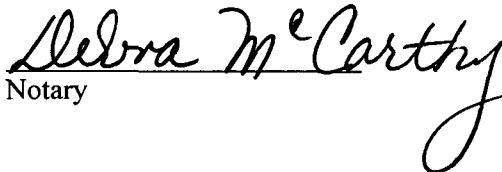
D. S. Lipman, being duly sworn, states that he is Senior Vice President, Nuclear Power Plants, for Westinghouse Electric Company; that he is authorized on the part of said company to sign and file with the Nuclear Regulatory Commission this document; that all statements made and matters set forth therein are true and correct to the best of his knowledge, information and belief.



D. S. Lipman  
Senior Vice President  
Nuclear Power Plants

Subscribed and sworn to  
before me this 18<sup>th</sup> day  
of July 2007.



  
Notary

ENCLOSURE 1

AW-07-2305

APPLICATION FOR WITHHOLDING  
PROPRIETARY INFORMATION FROM DISCLOSURE



Westinghouse Electric Company  
Nuclear Services  
P.O. Box 355  
Pittsburgh, Pennsylvania 15230-0355  
USA

U.S. Nuclear Regulatory Commission  
ATTENTION: Document Control Desk  
Washington, D.C. 20555

Direct tel: 412-374-6306  
Direct fax: 412-374-5005  
e-mail: [sterdia@westinghouse.com](mailto:sterdia@westinghouse.com)

Your ref: Project Number 740  
Our ref: AW-07-2305

July 18, 2007

APPLICATION FOR WITHHOLDING PROPRIETARY  
INFORMATION FROM PUBLIC DISCLOSURE

Subject: Transmittal of Proprietary Information, AP1000 COL Response to Requests for Additional Information (TR #24)

The Application for Withholding is submitted by Westinghouse Electric Company, LLC (Westinghouse), pursuant to the provisions of Paragraph (b) (1) of Section 2.390 of the Commission's regulations. It contains commercial strategic information proprietary to Westinghouse and customarily held in confidence.

The proprietary material for which withholding is being requested is identified in the proprietary version of the subject report. In conformance with 10 CFR Section 2.390, Affidavit AW-07-2305 accompanies this Application for Withholding, setting forth the basis on which the identified proprietary information may be withheld from public disclosure.

Accordingly, it is respectfully requested that the subject information which is proprietary to Westinghouse be withheld from public disclosure in accordance with 10 CFR Section 2.390 of the Commission's regulations.

Correspondence with respect to this Application for Withholding or the accompanying affidavit should reference AW-07-2305 and should be addressed to James A. Gresham, Manager, Regulatory Compliance and Plant Licensing, Westinghouse Electric Company, LLC, P.O. Box, Pittsburgh, Pennsylvania, 15230-0355.

Very truly yours,

A handwritten signature in black ink, appearing to read 'James W. Winters', written over a horizontal line.

James W. Winters  
Manager  
Standardization and Configuration Management

cc: J. Thompson - U.S. NRC

AW-07-2305  
July 18, 2007

bcc:	J. A. Gresham	- Westinghouse, Pittsburgh, PA, EC E4-7A	1L
	R. Bastien	- Nivelles, Belgium	1L
	C. Brinkman	- Westinghouse, Rockville, MD	1L
	RCPL Admin	- Westinghouse, Pittsburgh, PA, EC E4-7A	1L

ENCLOSURE 2

Affidavit



AFFIDAVIT

COMMONWEALTH OF PENNSYLVANIA:

SS

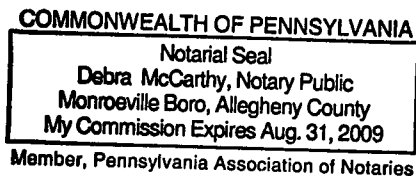
COUNTY OF ALLEGHENY:

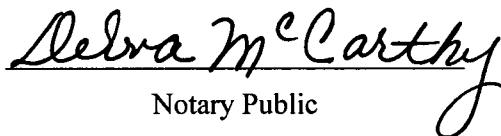
Before me, the undersigned authority, personally appeared James W. Winters, who, being by me duly sworn according to law, deposes and says that he is authorized to execute this Affidavit on behalf of Westinghouse Electric Company LLC (Westinghouse), and that the averments of fact set forth in this Affidavit are true and correct to the best of his knowledge, information, and belief:



James W. Winters  
Manager  
Standardization and Configuration Management

Sworn to and subscribed  
before me this 18<sup>th</sup> day  
of July 2007.



  
Notary Public

- (1) I am Manager, Standardization and Configuration Management, Westinghouse Electric Company, LLC (Westinghouse), and as such, I have been specifically delegated the function of reviewing the proprietary information sought to be withheld from public disclosure in connection with nuclear power plant licensing and rule making proceedings, and am authorized to apply for its withholding on behalf of Westinghouse.
- (2) I am making this Affidavit in conformance with the provisions of 10 CFR Section 2.390 of the Commission's regulations and in conjunction with the Westinghouse "Application for Withholding" accompanying this Affidavit.
- (3) I have personal knowledge of the criteria and procedures utilized by Westinghouse in designating information as a trade secret, privileged or as confidential commercial or financial information.
- (4) Pursuant to the provisions of paragraph (b)(4) of Section 2.390 of the Commission's regulations, the following is furnished for consideration by the Commission in determining whether the information sought to be withheld from public disclosure should be withheld.
  - (i) The information sought to be withheld from public disclosure is owned and has been held in confidence by Westinghouse.
  - (ii) The information is of a type customarily held in confidence by Westinghouse and not customarily disclosed to the public. Westinghouse has a rational basis for determining the types of information customarily held in confidence by it and, in that connection, utilizes a system to determine when and whether to hold certain types of information in confidence. The application of that system and the substance of that system constitutes Westinghouse policy and provides the rational basis required.

Under that system, information is held in confidence if it falls in one or more of several types, the release of which might result in the loss of an existing or potential competitive advantage, as follows:

- (a) The information reveals the distinguishing aspects of a process (or component, structure, tool, method, etc.) where prevention of its use by any of Westinghouse's competitors without license from Westinghouse constitutes a competitive economic advantage over other companies.

- (b) It consists of supporting data, including test data, relative to a process (or component, structure, tool, method, etc.), the application of which data secures a competitive economic advantage, e.g., by optimization or improved marketability.
- (c) Its use by a competitor would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing a similar product.
- (d) It reveals cost or price information, production capacities, budget levels, or commercial strategies of Westinghouse, its customers or suppliers.
- (e) It reveals aspects of past, present, or future Westinghouse or customer funded development plans and programs of potential commercial value to Westinghouse.
- (f) It contains patentable ideas, for which patent protection may be desirable.

There are sound policy reasons behind the Westinghouse system which include the following:

- (a) The use of such information by Westinghouse gives Westinghouse a competitive advantage over its competitors. It is, therefore, withheld from disclosure to protect the Westinghouse competitive position.
- (b) It is information that is marketable in many ways. The extent to which such information is available to competitors diminishes the Westinghouse ability to sell products and services involving the use of the information.
- (c) Use by our competitor would put Westinghouse at a competitive disadvantage by reducing his expenditure of resources at our expense.
- (d) Each component of proprietary information pertinent to a particular competitive advantage is potentially as valuable as the total competitive advantage. If competitors acquire components of proprietary information, any one component

may be the key to the entire puzzle, thereby depriving Westinghouse of a competitive advantage.

- (e) Unrestricted disclosure would jeopardize the position of prominence of Westinghouse in the world market, and thereby give a market advantage to the competition of those countries.
  - (f) The Westinghouse capacity to invest corporate assets in research and development depends upon the success in obtaining and maintaining a competitive advantage.
- (iii) The information is being transmitted to the Commission in confidence and, under the provisions of 10 CFR Section 2.390, it is to be received in confidence by the Commission.
- (iv) The information sought to be protected is not available in public sources or available information has not been previously employed in the same original manner or method to the best of our knowledge and belief.
- (v) The proprietary information sought to be withheld in this submittal is that which is appropriately marked in RAI-TR24-EMB2-02 and RAI-TR24-EMB2-04 (Proprietary), in support of Combined License application pre-application activities for the NuStart Bellefonte COL Project being transmitted by Westinghouse letter (DCP/NRC1959) and Application for Withholding Proprietary Information from Public Disclosure, to the Document Control Desk. The proprietary information as submitted by Westinghouse for the AP1000 NuStart Bellefonte plant is expected to be applicable in other licensee submittals in response to certain NRC requirements for justification of compliance of the safety system to regulations.

This information is part of that which will enable Westinghouse to:

- (a) Manufacture and deliver products to utilities based on proprietary system designs.
- (b) Advance the AP1000 Design and reduce the licensing risk for the application of the AP1000 Design Certification

- (c) Determine compliance with regulations and standards
- (d) Establish design requirements and specifications for the system.

Further this information has substantial commercial value as follows:

- (a) Westinghouse plans to sell the use of similar information to its customers for purposes of plant construction and operation.
- (b) Westinghouse can sell support and defense of safety systems based on the technology in the reports.
- (c) The information requested to be withheld reveals the distinguishing aspects of an approach and schedule which was developed by Westinghouse.

Public disclosure of this proprietary information is likely to cause substantial harm to the competitive position of Westinghouse because it would enhance the ability of competitors to provide similar digital technology safety systems and licensing defense services for commercial power reactors without commensurate expenses. Also, public disclosure of the information would enable others to use the information to meet NRC requirements for licensing documentation without purchasing the right to use the information.

The development of the technology described in part by the information is the result of applying the results of many years of experience in an intensive Westinghouse effort and the expenditure of a considerable sum of money.

In order for competitors of Westinghouse to duplicate this information, similar technical programs would have to be performed and a significant manpower effort, having the requisite talent and experience, would have to be expended.

Further the deponent sayeth not.

## **PROPRIETARY INFORMATION NOTICE**

Transmitted herewith are proprietary and/or non-proprietary versions of documents furnished to the NRC in connection with requests for generic and/or plant-specific review and approval.

In order to conform to the requirements of 10 CFR 2.390 of the Commission's regulations concerning the protection of proprietary information so submitted to the NRC, the information which is proprietary in the proprietary versions is contained within brackets, and where the proprietary information has been deleted in the non-proprietary versions, only the brackets remain (the information that was contained within the brackets in the proprietary versions having been deleted). The justification for claiming the information so designated as proprietary is indicated in both versions by means of lower case letters (a) through (f) located as a superscript immediately following the brackets enclosing each item of information being identified as proprietary or in the margin opposite such information. These lower case letters refer to the types of information Westinghouse customarily holds in confidence identified in Sections (4)(ii)(a) through (4)(ii)(f) of the affidavit accompanying this transmittal pursuant to 10 CFR 2.390(b)(1).

## **COPYRIGHT NOTICE**

The reports transmitted herewith each bear a Westinghouse copyright notice. The NRC is permitted to make the number of copies of the information contained in these reports which are necessary for its internal use in connection with generic and plant-specific reviews and approvals as well as the issuance, denial, amendment, transfer, renewal, modification, suspension, revocation, or violation of a license, permit, order, or regulation subject to the requirements of 10 CFR 2.390 regarding restrictions on public disclosure to the extent such information has been identified as proprietary by Westinghouse, copyright protection notwithstanding. With respect to the non-proprietary versions of these reports, the NRC is permitted to make the number of copies beyond those necessary for its internal use which are necessary in order to have one copy available for public viewing in the appropriate docket files in the public document room in Washington, DC and in local public document rooms as may be required by NRC regulations if the number of copies submitted is insufficient for this purpose. Copies made by the NRC must include the copyright notice in all instances and the proprietary notice if the original was identified as proprietary.

ENCLOSURE 4

Response to Requests for Additional Information on Technical Report No. 24

RAI-TR24-EMB2-01 through -08

(Non-Proprietary)

**WESTINGHOUSE NON-PROPRIETARY CLASS 3**  
**AP1000 TECHNICAL REPORT REVIEW**

**Response to Request For Additional Information (RAI)**

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RAI Response Number:     RAI-TR24-EMB2-01  
Revision: 0

**Question:**

In DCD Tier 2, Subsection 5.3.5.4, Westinghouse states that the natural frequency of the insulation structure is well above 2 Hz. Since the reactor vessel insulation system (RVIS) consists of many different panel configurations, discuss the method used in the natural frequency calculations, and summarize the results for all insulation panels. Discuss how the calculated natural frequencies would affect the structural analyses performed for the RVIS.

**Westinghouse Response:**

Typical panels in each layout were conservatively modeled as pin-pin beams and the first mode natural frequency was calculated for each. The lowest calculated natural frequency for any panel was greater than 300 Hz.

Because the structural analyses of the RVIS for seismic conditions used peak accelerations and amplification factors, they are not affected by the calculated natural frequencies of the panels. See RAI response number RAI-TR24-EMB2-02.

Reference: APP-MN20-Z0C-005 Rev 0, Calculation of the Natural Frequency of the AP1000 Reactor Vessel Insulation System Panels

**Design Control Document (DCD) Revision:**  
None

**PRA Revision:**  
None

**Technical Report (TR) Revision:**  
None



## AP1000 TECHNICAL REPORT REVIEW

### Response to Request For Additional Information (RAI)

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RAI Response Number: RAI-TR24-EMB2-02

Revision: 0

#### **Question:**

In Section 3.4.3.1 of the design specification, Westinghouse states that if the fundamental mode frequency of the analyzed structure is greater than 33 Hz, the following accelerations shall be used in the seismic analyses: 0.984g (North-South), 0.542g (East-West), and 0.410g (Vertical) at the reactor vessel shell; and 0.483g (North-South), 0.538g (East-West), and 0.395g (Vertical) at the reactor cavity walls and floor. Westinghouse also states that if the fundamental mode of the analyzed structure is less than 33 Hz, the following amplification factors shall be used on the above accelerations in the seismic analyses: 3 (North-South), 3 (East-West), and 4 (Vertical). Provide the bases for these specified accelerations and amplification factors. Provide a sample calculation for the stresses and deflections of the insulation panels and supports due to these seismic loadings. Discuss the procedure for revising the structural analysis of the RVIS for reconciliation with the AP1000 envelope ground design spectra when they are finalized.

#### **Westinghouse Response:**

The basis for the specified accelerations is the building seismic analysis results documented in the Nuclear Island Seismic Floor Response Spectra Report (Reference 1). The accelerations are reported directly from the time history analysis of the building model at the integrated head package and at the reactor vessel cavity.

The amplification factors are also based on Reference 1. The amplification factors represent the ratio between peak floor response spectra and ZPA accelerations.

See attached sample calculation of stresses in an RVIS insulation panel and support for seismic loadings. The Reference 2 report shows that the RVIS components do not plastically deform during a seismic event and therefore the proper annulus is retained for a subsequent severe accident. Annulus size is not important during a seismic event, therefore the structural report does not calculate deflections for that event.

The structural analysis for the RVIS is conservatively based on the peak accelerations in the building seismic analysis results at this location. Increases in these peaks are not anticipated. Per AP1000 configuration control practices, this structural evaluation would be updated if increased peak accelerations require evaluation.

**WESTINGHOUSE NON-PROPRIETARY CLASS 3**

**AP1000 TECHNICAL REPORT REVIEW**

**Response to Request For Additional Information (RAI)**

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- Reference: 1. APP-1000-52C-056, Rev. 0, Nuclear Island Seismic Floor Response Spectra Report  
2. APP-MN20-Z0R-001 Rev. 0, Reactor Vessel Insulation System Design Report

**Design Control Document (DCD) Revision:**  
None

**PRA Revision:**  
None

**Technical Report (TR) Revision:**  
None

WESTINGHOUSE NON-PROPRIETARY CLASS 3

## AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

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ATTACHED SAMPLE STRESS CALCULATIONS FOR SEISMIC DESIGN EVENT

a,b,c,e,f

WESTINGHOUSE NON-PROPRIETARY CLASS 3

## AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

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a,b,c,e,f

WESTINGHOUSE NON-PROPRIETARY CLASS 3

## AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

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a,b,c,e,f

WESTINGHOUSE NON-PROPRIETARY CLASS 3

## AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

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a,b,c,e,f

WESTINGHOUSE NON-PROPRIETARY CLASS 3

## AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

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a,b,c,e,f

## AP1000 TECHNICAL REPORT REVIEW

### Response to Request For Additional Information (RAI)

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RAI Response Number: RAI-TR24-EMB2-03  
Revision: 0

**Question:**

In DCD Tier 2, Subsection 5.3.5.2, Westinghouse states that the insulation panels are designed to have a minimum gap between the insulation and reactor vessel of not less than 2 inches when subjected to the dynamic loads in the direction towards the vessel that result during the external vessel cooling. In Section 7 of the report APP-MN20-Z0R-001 R0, Westinghouse states that the annulus between the reactor vessel and an MRI panel inside surface is nominally 6 inches wide, with the required minimum gap as 3.12 inches. Clarify this discrepancy with the minimum gap requirements of 2 inches vs. 3.12 inches.

**Westinghouse Response:**

The 2 inch limit in DCD Tier 2, Subsection 5.3.5.2 refers to the minimum allowable gap between an insulation panel inside surface and the cylindrical sidewall of the reactor vessel at any single location due to dynamic loading during a severe accident.

The acceptance criteria for DCD Tier 1 Table 2.2.3-4 Design Commitment 9.a states that the flow path that vents steam is not less than 12 ft<sup>2</sup>. The flow path that vents steam refers to the annulus along the cylindrical sidewall of the reactor vessel. A uniform gap of 3.12 inches between the cylindrical sidewall of the reactor vessel and the RVIS is equivalent to a 12 ft<sup>2</sup> flow area. The gap may vary azimuthally but 3.12 inches is the minimum average gap and 2 inches is the closest approach to the vessel.

As shown in page 8 of Appendix F of the reference below, Westinghouse conservatively designed the RVIS for the 3.12 inch gap for all conditions, which bounds the 2 inch requirement.

Reference: APP-MN20-Z0R-001 Rev. 0, Reactor Vessel Insulation System Design Report

**Design Control Document (DCD) Revision:**

None

**PRA Revision:**

None

**Technical Report (TR) Revision:**

None





## AP1000 TECHNICAL REPORT REVIEW

### Response to Request For Additional Information (RAI)

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RAI Response Number: RAI-TR24-EMB2-04

Revision: 0

**Question:**

Attachment 1 of Appendix D to the report APP- MN20-Z0R-001 R0 presents some stress calculations for the RVIS. Provide a summary of the stress results for the insulation panels and their support members, including brackets, fasteners, bolts, and welds, as well as the deflections for the support members and insulation panels, when subjected to all the design severe accident loads, as well as static and seismic loads. Provide a comparison of these calculated stress and deflection values with the corresponding design criteria and allowables provided in the design specification, for each panel elevation and location. Verify that the seismic-induced deflections of the insulation panels and supports are properly combined with those due to the severe accident loadings, when the total deflections are compared with the acceptance criteria.

**Westinghouse Response:**

A table is attached providing the requested summary of stress results and deflections. A comparison of the results to the allowables is also provided.

The seismic and severe accident events are not evaluated together because the probability of both occurring simultaneously is extremely low.

Reference: None

**Design Control Document (DCD) Revision:**

None

**PRA Revision:**

None

**Technical Report (TR) Revision:**

None



WESTINGHOUSE NON-PROPRIETARY CLASS 3

## AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

ATTACHMENT

a,b,c,e,f

WESTINGHOUSE NON-PROPRIETARY CLASS 3

## AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

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a,b,c,e,f

WESTINGHOUSE NON-PROPRIETARY CLASS 3

## AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

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a,b,c,e,f

WESTINGHOUSE NON-PROPRIETARY CLASS 3

## AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

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a,b,c,e,f

WESTINGHOUSE NON-PROPRIETARY CLASS 3

## AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

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a,b,c,e,f

## AP1000 TECHNICAL REPORT REVIEW

### Response to Request For Additional Information (RAI)

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RAI Response Number: RAI-TR24-EMB2-05  
Revision: 0

**Question:**

In DCD Tier 2, Subsection 5.3.5.4, Westinghouse states that the forces that may be expected in the reactor cavity region of the AP1000 plant during a core damage accident can be based on test results from the ULPU test program. The ULPU Configuration V tests provide data on the pressure generated in the region between the reactor vessel and the reactor vessel insulation. Appendix D to the report APP-MN20-Z0R-001 R0 and the design specification both specify the static pressure load of 12.95 feet of water (5.611 psi) and the hydrostatic/dynamic pressure of +/-1.64 feet of water (0.711 psi). Discuss how these loadings are derived, and how they are related to the ULPU Configuration V tests.

**Westinghouse Response:**

The 12.95 feet of water was conservatively calculated from the results of the ULPU Configuration III test. It is based on the AP600 configuration and was subsequently verified to be conservative for the AP1000 configuration using data from ULPU Configuration V testing. Data was specifically collected in ULPU Configuration V testing to determine structural requirements for the RVIS. The 12.95 value is shown in AP1000 DCD Tier 1 Table 2.2.3-4 item 9a) Acceptance Criteria (ii). The hydrostatic/dynamic pressure of +/- 0.5 meters (+/- 1.64 feet) of water was determined in the ULPU Configuration V testing.

**Reference:**

1. ULPU Configuration III: DOE/ID-10460, In-Vessel Coolability and Retention of a Core Melt, Appendix E
2. ULPU Configuration V: CRSS-03/06, Limits of Coolability in the AP 1000-Related ULPU-V 2400 Configuration V Facility

**Design Control Document (DCD) Revision:**

None

**PRA Revision:**

None

**Technical Report (TR) Revision:**

None



## AP1000 TECHNICAL REPORT REVIEW

### Response to Request For Additional Information (RAI)

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RAI Response Number: RAI-TR24-EMB2-06  
Revision: 0

**Question:**

In Section 10.0 of the report APP-MN20-Z0R-001 R0, Westinghouse states that the total maximum deflection of an MRI panel inside surface is 0.686 inches. This deflection was used as a basis to conclude that the available annulus space far exceeds the minimum requirement of 3.12 inches. Explain why the deflections of the insulation panels and supports due to the seismic and other static loads were not included in the above total maximum deflection calculation. In connection with RAI TR 24 - 4, also discuss the total maximum deflections calculated for other MRI panels and at different locations in both vertical and circumferential directions.

**Westinghouse Response:**

The 0.686 inch deflection is the result of a very conservative calculation of the maximum deflection of the worst case panel and its supports along the reactor vessel sidewall during a severe accident. The pressure applied is the combined static and dynamic design pressures for a severe accident. An extremely conservative set of assumptions was used and the calculated gap significantly exceeds the minimum required gap. The deflection is actually much smaller than 0.686 inches.

The seismic and severe accident events are not evaluated together because the probability of both occurring simultaneously is extremely low.

Reference: None

**Design Control Document (DCD) Revision:**  
None

**PRA Revision:**  
None

**Technical Report (TR) Revision:**  
None



## AP1000 TECHNICAL REPORT REVIEW

### Response to Request For Additional Information (RAI)

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RAI Response Number: RAI-TR24-EMB2-07  
Revision: 0

**Question:**

In Section 3.1 of the design specification, Westinghouse states that the AP1000 classification for the RVIS is non-safety related and non-seismic. Discuss the codes and standards used for the structural analysis and design of the RVIS and its support system.

**Westinghouse Response:**

The codes and standards used for the structural analysis of the RVIS were generally from the American Institute of Steel Construction (AISC) *Manual of Steel Construction* and the American Society of Mechanical Engineers (ASME) *Boiler and Pressure Vessel (B&PV) Code*. The AISC manual was used for equations and design limits, including the design limits for severe accident loadings. The ASME B&PV Code was used for material properties at temperature. A complete set of references is included in Section 1 of the structural report.

Reference: None

**Design Control Document (DCD) Revision:**  
None

**PRA Revision:**  
None

**Technical Report (TR) Revision:**  
None

## AP1000 TECHNICAL REPORT REVIEW

### Response to Request For Additional Information (RAI)

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RAI Response Number: RAI-TR24-EMB2-08  
Revision: 0

#### **Question:**

In Section 4.1.4 of the design specification, Westinghouse states that the annulus between the bottom head insulation and the bottom head shell progressively increase from nominally 3 inches at the water inlet region near the center of the bottom head to nominally 6 inches at the interface of the bottom head and the shell. Discuss the minimum gap requirement at the water inlet region and ensure that it will not be exceeded under the severe accident and seismic loads.

#### **Westinghouse Response:**

The annulus at the water inlet region duplicates the preferred configuration identified in the ULPU Configuration V test (Reference 1). The sensitivity of annulus size is discussed in detail in the Reactor Vessel Insulation System Design Report (Reference 2) in Section 4.2.3.2, *IVR Sensitivity to Annulus Dimensional Variations*. This section shows that variations in the annulus width in the lower region of the bottom head have little impact on critical heat flux. In this region, heat flux from molten debris to the reactor vessel wall does not approach critical heat flux. The ULPU Configuration V test report states that the (annulus gap in the) region from 0° to 60° is "totally unimportant for IVR performance". ULPU Configuration IV testing (Reference 3) showed that a gap of 2 inches in that region would be acceptable.

As shown in the above report, the maximum static and dynamic loads anywhere on the RVIS were applied everywhere on the RVIS in the structural analyses. Using this approach, the worst case deflection occurs in the panels on the reactor vessel sidewall and was conservatively calculated to be 0.686 inches. The ULPU Configuration IV testing showed that if this were the deflection at the inlet of the bottom head insulation, the annulus would still be acceptable (3" – 0.686" > 2"). In reality, the deflection would be much smaller in the more rigid panels of the bottom head which have significantly smaller spans and have all edges fastened to adjacent panels to form the "bowl" of the bottom head.

The seismic and severe accident events are not evaluated together because the probability of both occurring simultaneously is extremely low.

#### **Reference:**

1. CRSS-03/06, Limits of Coolability in the AP 1000-Related ULPU-2400 Configuration V Facility (Also referred to as ULPU Configuration V)
2. APP-MN20-Z0R-001, Reactor Vessel Insulation System Design Report, Revision 0
3. APP-PRA-GSR-003, Quantification of Limits to Coolability in ULPU-2000 Configuration IV (Also referred to as ULPU Configuration IV)

WESTINGHOUSE NON-PROPRIETARY CLASS 3

## AP1000 TECHNICAL REPORT REVIEW

### Response to Request For Additional Information (RAI)

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**Design Control Document (DCD) Revision:**

None

**PRA Revision:**

None

**Technical Report (TR) Revision:**

None