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Nuclear Power Plants
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Washington, DC 20555-0001

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Your ref: PROJ0797
Our ref: SMR_NRC_000036

March 20, 2014

Subject: SMR Response to Request for Additional Information

Westinghouse is submitting a response to the NRC request for additional information (RAI) on SBLOCA PIRT. This RAI response information is submitted in support of the Westinghouse Small Modular Reactor (SMR) (PROJ0797).

Responses are provided herein for each of the following:

RAI-W SMR Test Plan and Scaling-1 P & NP
RAI-W SMR Test Plan and Scaling-2 P & NP
RAI-W SMR Test Plan and Scaling-3 P & NP
RAI-W SMR Test Plan and Scaling-4 P & NP
RAI-W SMR Test Plan and Scaling-5 P & NP
RAI-W SMR Test Plan and Scaling-6 P & NP
RAI-W SMR Test Plan and Scaling-7 P & NP
RAI-W SMR Test Plan and Scaling-8 P & NP
RAI-W SMR Test Plan and Scaling-9 P & NP
RAI-W SMR Test Plan and Scaling-10 P & NP
RAI-W SMR Test Plan and Scaling-11 NP only
RAI-W SMR Test Plan and Scaling-12 P & NP
RAI-W SMR Test Plan and Scaling-13 P & NP
RAI-W SMR Test Plan and Scaling-14 NP only
RAI-W SMR Test Plan and Scaling-15 P & NP
RAI-W SMR Test Plan and Scaling-16 P & NP
RAI-W SMR Test Plan and Scaling-17 NP only
RAI-W SMR Test Plan and Scaling-18 P & NP
RAI-W SMR Test Plan and Scaling-19 P & NP
RAI-W SMR Test Plan and Scaling-20 P & NP
RAI-W SMR Test Plan and Scaling-21 P & NP
RAI-W SMR Test Plan and Scaling-22 P & NP
RAI-W SMR Test Plan and Scaling-23 P & NP
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RAI-W SMR Test Plan and Scaling-25 P & NP
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RAI-W SMR Test Plan and Scaling-35 P & NP
RAI-W SMR Test Plan and Scaling-36 P & NP
RAI-W SMR Test Plan and Scaling-37 P & NP
RAI-W SMR Test Plan and Scaling-38 P & NP
RAI-W SMR Test Plan and Scaling-39 P & NP
RAI-W SMR Test Plan and Scaling-40 P & NP
RAI-W SMR Test Plan and Scaling-41 P & NP
RAI-W SMR Test Plan and Scaling-42 P & NP
RAI-W SMR Test Plan and Scaling-43 NP only
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RAI-W SMR Test Plan and Scaling-45 P & NP
RAI-W SMR Test Plan and Scaling-46 P & NP
RAI-W SMR Test Plan and Scaling-47 P & NP
RAI-W SMR Test Plan and Scaling-48 P & NP
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RAI-W SMR Test Plan and Scaling-69 P & NP
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RAI-W SMR Test Plan and Scaling-71 P & NP
RAI-W SMR Test Plan and Scaling-72 P & NP
RAI-W SMR Test Plan and Scaling-73 P & NP

RAI-W SMR Test Plan and Scaling-74 P & NP
RAI-W SMR Test Plan and Scaling-75 P & NP
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RAI-W SMR Test Plan and Scaling-86 P & NP
RAI-W SMR Test Plan and Scaling-87 P & NP

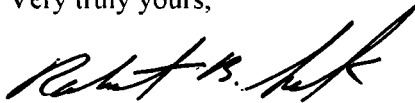
Pursuant to 10 CFR 50.30(b), proprietary and non-proprietary versions of the presentations are submitted as Enclosures 3 and Enclosure 4. Enclosure 1 is one copy of the Application for Withholding, AW-14-3903 (non-proprietary). Enclosure 2 is one copy of the associated Affidavit with Proprietary Information Notice and Copyright Notice (non-proprietary).

Enclosure 3 is the proprietary version of the responses. Enclosure 4 is the non-proprietary version of the responses.

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 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. The information being redacted is of a type customarily held in confidence by Westinghouse and not customarily disclosed to the public.

Correspondence with respect to the Affidavit or Application for Withholding should reference AW-14-3903 and should be addressed to James A. Gresham, Manager, Regulatory Compliance and Plant Licensing, Westinghouse Electric Company LLC, 1000 Westinghouse Drive, Cranberry Township, Pennsylvania, 16066.

Very truly yours,



Robert B. Sisk
Acting Director, Small Modular Reactor

/Enclosures

1. AW-14-3903 "Application for Withholding Proprietary Information from Disclosure," dated March 20, 2014
2. AW-14-3903, Affidavit, Proprietary Information Notice, Copyright Notice dated March 20, 2014
3. SMR Response to Request for Additional Information (Proprietary)
4. SMR Response to Request for Additional Information (Non-Proprietary)

cc: Arlon Costa U.S. NRC
Anna Bradford

ENCLOSURE 1

AW-14-3903

APPLICATION FOR WITHHOLDING
PROPRIETARY INFORMATION FROM DISCLOSURE



Westinghouse Electric Company
Nuclear Power Plants
1000 Westinghouse Drive
Cranberry Township, Pennsylvania 16066
USA

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Direct tel: 412-374-6206
Direct fax: 724-720-8505
e-mail: sisk1rb@westinghouse.com

Your ref: PROJ0797
Our ref: AW-14-3903

March 20, 2014

APPLICATION FOR WITHHOLDING PROPRIETARY
INFORMATION FROM PUBLIC DISCLOSURE

Subject: SMR Response to Request for Additional Information

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 is 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-14-3903 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-14-3903 and should be addressed to James A. Gresham, Manager, Regulatory Compliance and Plant Licensing, Westinghouse Electric Company LLC, 1000 Westinghouse Drive, Cranberry Township, Pennsylvania, 16066.

Very truly yours,

A handwritten signature in black ink, appearing to read 'Robert B. Sisk', written over a horizontal line.

Robert B. Sisk
Acting Director, Small Modular Reactor

ENCLOSURE 2

AFFIDAVIT

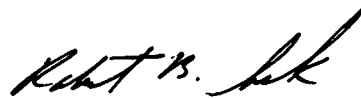
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COMMONWEALTH OF PENNSYLVANIA:

SS

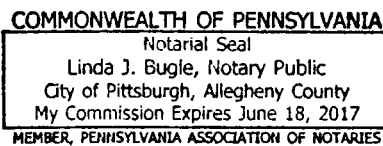
COUNTY OF BUTLER:

Before me, the undersigned authority, personally appeared Robert B. Sisk, 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:



Robert B. Sisk
Acting Director, Small Modular Reactor

Sworn to and subscribed
before me this 20th day
of March 2014.



Notary Public

- (1) I am Acting Director, Small Modular Reactor, 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 attachment to SMR_NRC_000036, "SMR Response to Request for Additional Information", to the Document Control Desk.

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

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

WESTINGHOUSE SMR REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-1
Revision: 0

Question:

Containment phenomenon such as [$J^{a,c}$ are highly dependent on the containment design and layout of the internal structures. The condensation on the containment shell and on the passive heat sinks in the presence of non-condensable gases involves multi-dimensional phenomena. The Westinghouse Small Modular Reactor (W-SMR) containment is noticeably different in its size, construction and the containment internals as compared to other PWR containments including AP600/AP1000. In addition, thermal-hydraulically, the containment is tightly coupled to the Reactor Coolant System (RCS), again unlike other PWRs. Based on the responses to RAI-TR-SBLOCA-PIRT-04 and RAI-TR-SBLOCA-PIRT-30, the containment pressure during design basis events can vary from [$J^{a,c}$ in contrast to the design pressure for AP1000 which is approximately 0.5 MPa. The conditions on the outside of the containment shell in the W-SMR also differ from those for AP1000 (i.e., a pool of water as compared to a falling and evaporating water film). Therefore, the available test data from AP600/AP1000 testing program cannot necessarily be considered to be applicable to W-SMR accident conditions [

Note that the knowledge ranking for containment phenomena has also, for similar reasons, been questioned separately in RAI-TR-SBLOCA-PIRT-78. Please provide justifications for [$J^{a,c}$

[$J^{a,c}$ The response should include delineation of specific design differences with AP600/AP1000, and substantiation of the basis for applicability of the specific AP600/AP1000 test data that is considered to be applicable to the W-SMR design.

Westinghouse Response:

[

$J^{a,c}$

¹ AP1000 and AP600 are trademarks or registered trademarks of Westinghouse Electric Company LLC, its affiliates and/or its subsidiaries in the United States of America and may be registered in other countries throughout the world. All rights reserved. Unauthorized use is strictly prohibited. Other names may be trademarks of their respective owners.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-2
Revision: 0

Question:

The proposed Integral Effects Test (IET) facility design for the containment appears to be
[

] ^{a,c} As discussed in RAI #1 above, multi-dimensional effects are considered to be important in the prediction of containment response behavior under transient and accident conditions in W-SMR. It is questionable whether the containment characterization in the proposed IET facility will adequately capture the conditions that are expected in the prototype. Furthermore, an incorrect representation of the containment response will also affect the RCS behavior for the tested scenario. Please provide the rationale for the proposed containment modeling in the IET facility addressing the aforementioned concerns.

Westinghouse Response:

[

] ^{a,c}

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.

WESTINGHOUSE SMR REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-3
Revision: 0

Question:

SETs have not been proposed for investigating the potential for debris- and chemical precipitate-induced blockage in the reactor core. [

]^{a,c} Furthermore, if it is intended to use the existing debris related test data for W-SMR, please address the following:

a. [

]^{a,c}

b. WCAP-17573-P states that the knowledge level for blockage due to chemical precipitates is [

]^{a,c} Please provide justification for not proposing SETs for W-SMR conditions and explain how the impact of debris- and chemical precipitate-induced blockage in the reactor core will be captured in the evaluation model.

Westinghouse Response:

[

]^{a,c}

¹ AP1000 is a trademark or registered trademark of Westinghouse Electric Company LLC, its affiliates and/or its subsidiaries in the United States of America and may be registered in other countries throughout the world. All rights reserved. Unauthorized use is strictly prohibited. Other names may be trademarks of their respective owners

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

[

] ^{a,c}

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-4
Revision: 0

Question:

SETs have not been proposed for the pressurizer separator plates. The unique design of the pressurizer separator plates and the [

] ^{a,c} The IET design information
(Addendum 1 to WCAP-17712-P) states that the plates in the IET will be scaled [

] ^{a,c} Please explain/justify the absence of plans
for tests applicable to the W-SMR pressurizer separator plates.

Westinghouse Response:

[

] ^{a,c}

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.

WESTINGHOUSE SMR REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-5
Revision: 0

Question:

SETs have not been proposed to determine the applicability of the existing DNBR correlations to the W-SMR conditions and fuel assembly geometry. The responses to previous RAIs (e.g., RAI-TR-SBLOCA-PIRT-67) indicate that Westinghouse currently intends to use its [

$$J^{a,c}$$

Westinghouse Response:

Justification that the use of the []^{a,c} is appropriate for the design basis accident conditions analyzed, including limiting events such as complete loss of flow, will be provided in the Westinghouse SMR design certification application.

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-6
Revision: 0

Question:

Please confirm that all the proposed tests in the IET matrix (Table 7-1 in Addendum 1 to WCAP-17712-P) will be performed to be representative of the behavior expected in the prototype. As an example, for the DVI line break, [

]^{a,c}

Westinghouse Response:

[

]^{a,c}

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.

WESTINGHOUSE SMR REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-7
Revision: 0

Question:

Please explain the rationale for not including design basis transients, especially those that are expected to be limiting, in the test matrix for the IETs presented in Table 7-1 of Addendum 1 to WCAP-17712-P. Examples include recirculation feedwater line break, and the recirculation steam line break [

]^{a,c}

Westinghouse Response:

[

]^{a,c}

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-8
Revision: 0

Question:

The IET facility test matrix (Table 7-1 in Addendum 1 to WCAP-17712-P) does not include
[

J^{a,c} The matrix for the DVI line

break does not appear to address this issue. Please elaborate.

Westinghouse Response:

[

J^{a,c}

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-9
Revision: 0

Question:

The four ADS-2 lines are designed to open in a [

]^{a,c} will be effectively captured using only a sector of the upper plenum as is currently proposed for the test facility. Please elaborate.

Westinghouse Response:

[

]^{a,c}

Reference:

None.

Design Control Document (DCD) Revision:

None.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

PRA Revision:

None.

Technical Report (TR) Revision:

None.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-11
Revision: 0

Question:

There appears to be a typographical error in Section 1.10.1 of Addendum 2 to WCAP-17712-P. The "Wright-Reyes paper (Reference 24)" is referred to in that section. The reference number, based on the list in Section 2, should be 25 instead of 24. In addition, the authors in the citation are Wright and Schulz. Please confirm and correct the LTR, if appropriate.

Westinghouse Response:

It is confirmed that Section 1.10.1 of Addendum 2 to WCAP-17712-P should read "Wright – Schultz paper (Reference 25)".

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

Addendum 2 to WCAP-17712-P will be updated to reflect this change.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-12
Revision: 0

Question:

Please explain the term []^{a,c} in Section 1.12 of Addendum 2 to WCAP-17712-P. Furthermore, please explain how these will be factored into the test matrix (i.e., what will be the value of other test parameters at the "reserved" conditions?), and the expected results that will be achieved in terms of increasing the knowledge levels of the relevant phenomena.

Westinghouse Response:

As mentioned in response to RAI-W SMR Test Plan and Scaling-10, [

]^{a,c}

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-13
Revision: 0

Question:

The results shown in Figures 1-7 through 1-14 are used to determine the range of superficial gas and liquid velocities. Please provide information on the scenario from which the cited figures have been obtained. Furthermore, please provide the justification for considering the selected scenario as being representative for determining the ranges.

Westinghouse Response:

The scenario from which the cited figures have been obtained is a [

]^{a,c}

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

Technical Report (TR) Revision:

None.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-14
Revision: 0

Question:

Figures 1-20 and 1-21 cited in Section A.1.2 of Addendum 2 to WCAP-17712-P do not exist. Please confirm and correct the LTR as appropriate.

Westinghouse Response:

Figure A-6 and A-7 are the applicable referenced figures which correspond to the erroneously cited Figures 1-20 and 1-21 respectively. Figures A-6 and A-7 can be found in Section A.1.2 on page A-5 of Addendum 2 to WCAP-17712-P.

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

Addendum 2 to WCAP-17712-P will be updated to reflect this change.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-15
Revision: 0

Question:

Based on the test matrix in Tables A-3 and A-4 of Addendum 2 to WCAP-17712-P, the ADS-2 tests appear to be planned with [

ADS-2 operation.

Westinghouse Response:

[

1a,c

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

a.c



Figure 1: Superficial liquid velocities in ADS-2 nozzle venturi.

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.

WESTINGHOUSE SMR REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-16
Revision: 0

Question:

Please address the following questions on the representation of the CMTs (via the balance line) in the ADS-2 test facility (Addendum 2 to WCAP-17712-P):

a. It is unclear from the description of the test and the test matrix how the flow splitting between the CMTs and ADS-2 will be investigated experimentally.

b. Please explain what CMT balance line boundary conditions will be imposed during the tests and how this will be achieved. The test matrix presented in Tables A-3 and A-4 of Addendum 2 to WCAP-17712-P does not include any boundary conditions related to the CMT balance line. Please explain the reason for not including the impact of CMT conditions in the test matrix.

c. The results shown in Figures 1-11 through 1-14 that are used to determine the range of conditions for the CMTs are believed to be based on computer code calculations. For each phase through the CMT balance line [

$J^{a,c}$ is expected to be influenced by natural circulation through the CMTs and condensation in the PRHR heat exchanger housed in the CMTs. The accuracy of the code predictions will affect the boundary conditions considered for the tests. Please explain whether the code has been benchmarked against any available natural circulation and tube condensation data test data for the prediction of these phenomena.

d. Please explain how the conditions imposed on the CMT balance line will be confirmed to be representative of the actual CMT behavior. Improper or non-representative CMT boundary conditions may skew the experimental results, especially related to flow splitting.

Westinghouse Response:

[

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

J^{a,c}

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WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

Reference:

[

] ^{a,c}

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-17
Revision: 0

Question:

Referring to Section A.1.3 of Addendum 2 to WCAP-17712-P, please explain what section of the reactor is considered to be part of the "upper plenum" and what constitutes the "upper head".

Westinghouse Response:

Both Tables A-1 and A-2 are applicable to the upper plenum. Both the support column region and the CRDM region are within the upper plenum. To differentiate the two regions however the author designated the region with the CRDMs as the "upper head". Therefore Table A-1 considers the parameters in the region of the support columns in the upper plenum and Table A-2 considers the parameters in the region of the CRDM in the upper plenum, but designated as the "upper head".

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

Addendum 2 to WCAP-17712-P will be updated in the future to designate the different regions instead of designating the CRDM as the "upper head".

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-18
Revision: 0

Question:

The caption for Figure A-7 in Appendix A to Addendum 2 to WCAP-17712-P appears to be incorrect. Please confirm and if appropriate, correct the LTR. Similarly, please check the caption of the section heading for references.

Westinghouse Response:

The caption for Figure A-7 in Appendix A to Addendum 2 to WCAP-17712-P should be:
[] ^{a,b,c}

The referenced Figures 1-20 and 1-21 in Section A.1.2 of Appendix A to Addendum 2 to WCAP-17712-P should be Figures A-6 and A-7.

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

Addendum 1 to WCAP-17712-P will be updated to reflect these changes.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-19
Revision: 0

Question:

The [

$J^{a,c}$ have not been used.

a. Please confirm this understanding.

b. If the understanding is correct, please explain how the [$J^{a,c}$ in Table A-3 were
selected based on the [$J^{a,c}$.

c. Please compare the [mixture levels] $J^{a,c}$ selected in Table A-3 of Addendum 2 to WCAP-17712-
P for the test matrix against the values at which [$J^{a,c}$ are expected
to occur

Westinghouse Response:

[

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

J^{a,c}

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-20
Revision: 0

Question:

According to Section A.1.3 of Addendum 2 to WCAP-17712-P, the [

] ^{a,c} Please clarify. If the [
^{a,c} is selected as the boundary condition, please clarify the
method to determine the flow through the spargers.

Westinghouse Response:

[

]^{a,c}

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-21
Revision: 0

Question:

Table A-6 of Addendum 2 to WCAP-17712-P states that sensitivities to [
]^{a,c}. Previous discussions in Appendix A to Addendum 2 to
WCAP-17712-P lead one to believe that the [

]^{a,c}.

Please clarify.

Westinghouse Response:

The Staff's understanding is correct. [

]^{a,c}

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-22
Revision: 0

Question:

Table A-6 of Addendum 2 to WCAP-17712-P provides qualitative information about the proposed sensitivities. Please confirm that it is Westinghouse's intention to include in the Addendum 2 to WCAP-17712-P, when available, a detailed discussion, including justification, of the final sensitivity cases selected and a full factorial test matrix, similar to the one in Table A-4, for the sensitivity cases.

Westinghouse Response:

[

] ^{a,c}

Westinghouse will communicate the test matrix along with sufficient technical justification to the Staff.

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-23
Revision: 0

Question:

Table ES-4 of WCAP-17573-P identifies the [

separate effects testing.]^{a,c} to

a. In Addendum 1 to WCAP-17712-P, there is no equivalent indication of what phenomena will be evaluated and if all []^{a,c} assigned to IETs will be assessed by tests listed in the matrix established for the IETs. Please propose a revision to the Addendum 1 to WCAP-17712-P introduction that indicates the phenomena to be evaluated.

b. The test matrices and test descriptions in both Addenda 1 and 2 of WCAP-17712-P do not indicate which tests in each matrix will be used to assess the individual phenomena assigned to IETs and SETs. Please propose a revision to the test matrices in Addenda 1 and 2 of WCAP-17712-P that relates the planned test to the specific phenomenon.

Westinghouse Response:

[

]^{a,b,c}

[

]^{a,b,c}

Reference:

None.

Design Control Document (DCD) Revision:

None.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

PRA Revision:

None.

Technical Report (TR) Revision:

Update Addenda 1 and 2 of WCAP-17712-P with a statement that indicates that all the identified phenomena that will be tested in the IET and SET.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-24
Revision: 0

Question:

Table ES-1 of WCAP-17712-P lists []^{a,c}. The same table also states that additional details about this phenomenon that can be studied using the SETs. Table 1-1 of Addendum 2 to WCAP-17712-P does not include this phenomenon and there is no discussion of how the SET plan and test matrix will provide information on this phenomenon.

Please explain.

Westinghouse Response:

[

]^{a,c}

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-25
Revision: 0

Question:

Since the SET section described in Addendum 2 to WCAP-17712-P is [$J^{a,c}$ may not be well reproduced. When the CMT balance line is in operation, the entrainment and counter current flow process may occur in radial location which is outside of the [$J^{a,c}$

Westinghouse Response:

As noted in response to RAI-W SMR Test Plan and Scaling-16 [

$J^{a,c}$

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-26
Revision: 0

Question:

The SET facility design pressure is [

]^{a,c} Does the pressure operating range of the test facility cover the splitting of ADS-2 flow and CMT balance line flow in the early stage of ADS-2 operation?

Westinghouse Response:

[

]^{a,c}

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.

WESTINGHOUSE SMR REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-27
Revision: 0

Question:

According to the SET plan described in Addendum 2 to WCAP-17712-P, the working fluid is an []^{a,c}. The entrainment and countercurrent flow limiting processes are related to surface tension and interfacial drag. Please justify the applicable operating range of the correlations in lieu of fluid properties and test operating conditions.

Westinghouse Response:

The correlations in references 1 and 2 are presented in []^{a,c}

See also the response to RAI-W SMR Test Plan and Scaling-30.

Reference:

[]^{a,c}

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-28
Revision: 0

Question:

In Section 1.12.1 of Addendum 2 to WCAP-17712-P, please show the superficial liquid velocity for the ADS-2 line.

Westinghouse Response:

Superficial liquid velocity as a function of transient time for the ADS-2 line is shown below:

a.c

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

Technical Report (TR) Revision:

None.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-29
Revision: 0

Question:

In Section 1.13 TEST PROCEDURE of Addendum 2 to WCAP-17712-P, the [$J^{a,c}$ may result in distortion that is difficult to quantify. Please justify this approach.

Westinghouse Response:

[

$J^{a,c}$

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-30
Revision: 0

Question:

In Section A.1.2 Entrainment Scaling of Addendum 2 to WCAP-17712-P, please explain why the test facility []^{a,c} separately in order to measure all three regimes?

Westinghouse Response:

The purpose of Section A.1.2 is to [

] ^{a,c}

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-31
Revision: 0

Question:

In Table A-4 of Addendum 2 to WCAP-17712-P, please explain the purpose of varying []^{a,c}.

Westinghouse Response:

[

]^{a,c}

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-32
Revision: 0

Question:

Appendix A-F (SPES-4 Scaling Basis) of Addendum 1 to WCAP-17712-P is incomplete and several errors were identified in the document. Some important components do not have scaling information. In addition, the report does not address the scaling of some important phase-specific local phenomena. The missing information and errors are identified with RAIs #33 through #58 below. The scaling methodology proposed in earlier Westinghouse presentation slides was []^{a,c}. Please provide a complete top-down and bottom-up scaling analysis justifying the similarity between the prototype and the scaled model.

Westinghouse Response:

$$[\quad]^{a,c}$$

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.

WESTINGHOUSE SMR REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-33
Revision: 0

Question:

The quality of Addendum 1 to WCAP-17712-P and the accuracy of calculations documented in this addendum need to be improved. Please address the following issues:

- a. The reviewer identified use of different values for the same scaling ratio in the document, []^{a,c} This inconsistency results in design inaccuracy. Please use consistent values for scaling ratios.*
- b. Please include complete information for both SPES-4 and W-SMR for comparisons. An example for missing information is the downcomer, which has design value table but no W-SMR values.*
- c. Different nomenclatures are used for scaling factor, e.g. F and SF. Please use consistent nomenclature.*
- d. Please correct the unit of the Outer Containment Pool (OCP) water level on page 67 of Addendum 1 to WCAP-17712-P.*
- e. Please show the prototype and model design values for each component in one table for side-by-side comparison.*

Westinghouse Response:

- a. A scaling ratio of []^{a,c} was consistently applied throughout the report. []^{a,c} was also applied in cases where other scaling factors such as []^{a,c} were reported. These will be made consistent.
- b. The SMR parameters for the downcomer is:

	a,c
--	-----

- c. The consistent nomenclature for the scaling factor should have been F.
- d. The Outer Containment Pool (OCP) water level on page A-67 should have been []^{a,c}.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

- e. The prototype and model design values for each component in one table for side-by-side comparison were presented in Appendix B of Addendum 1 to WCAP-17712-P.

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

Addendum 1 to WCAP-17712-P will be updated to reflect these changes.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-34
Revision: 0

Question:

Please address the scaling of stored energy in the reactor vessel components, such as the core. For a fast transient, the fuel stored energy plays an important role.

Westinghouse Response:

[

] ^{a,c}

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-35
Revision: 0

Question:

The single phase and two-phase loop flow resistance in the RPV loop and, in particular, in the core region and SG tubes were not considered. Please address this finding.

Westinghouse Response:

WCAP-17712-P was written to provide [

] ^{a,c}

Refer also to the response to RAI-W SMR Test Plan and Scaling-59 which describes the planned separate methodology report related to the scaling of the test facilities and its relationship to the scaling formulation in the addenda to WCAP-17712-P.

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-36
Revision: 0

Question:

The [^{a,c} used in Addendum 1 to WCAP-17712-P lacks [^{a,c} Please describe the compensating actions planned to address these distortions.

Westinghouse Response:

Westinghouse plans to perform a [^{a,c}

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.

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WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-37
Revision: 0

Question:

SPES-4 was modified from SPES-2 which was developed for AP-600 testing. Please justify the modifications made to SPES-2, []^{a,c}, and sufficiency for W-SMR testing based on the design differences.

Westinghouse Response:

[

] ^{a,c}

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.

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WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-38
Revision: 0

Question:

Please include core bypass scaling in Table A-7 and A-8 of Addendum 1 to WCAP-17712-P.

Westinghouse Response:

[

] ^{a,c}

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

"Core Bypass Volume" will be removed from Table A-6 of WCAP-17712-P, Addendum 1

WESTINGHOUSE SMR REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-39
Revision: 0

Question:

In section A.2.7 of Addendum 1 to WCAP-17712-P, the [$J^{a,c}$ is not well presented. The scaling calculation is not shown. The [$J^{a,c}$ do not appear to be in agreement with the flow paths shown in Figures A13, A14, and A16. On page A21, please provide the description for parameters used in the equation.

Westinghouse Response:

The separation plates in the Westinghouse SMR pressurizer [

$J^{a,c}$

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

Section A.2.7 of Addendum 1 to WCAP-17712-P will be revised.

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WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-40
Revision: 0

Question:

In section A.2.8 of Addendum 1 to WCAP-17712-P please verify and correct as necessary the [$f^{a,c}$ scaling equation set and numbers. Please check and correct inconsistencies, such as: the constant value of [$f^{a,c}$ in the first equation does not match the numbers shown in Table A-20 for L1, L2 and L3 pipe ID. Also, a scaling factor should appear in V5 and V6 terms.

Westinghouse Response:

a,c

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

a.c

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

Section A.2.8 of Addendum 1 to WCAP-17712-P will be updated to reflect these changes.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-41
Revision: 0

Question:

In section A.2.9 of Addendum 1 to WCAP-17712-P, the RCP scaling is not shown. Will the RCP scaling include the portion of the flow path from SG primary tube outlet to RCP input? As mentioned on Page 31, please also provide the pump curve and the design connecting the downcomer and the SGPSS.

Westinghouse Response:

a,b,c

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

a,b,c

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

Provide the detailed connection design connecting the downcomer and the SGPSS after detail design of the SPES 4.

WESTINGHOUSE SMR REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: W SMR Test Plan and Scaling-42
Revision: 0

Question:

The PRHR heat transfer area distortion (difference between ideal and actual) shown on Table A-23 and discussed on Page A-34 of Addendum 1 to WCAP-17712-P was evaluated as [$J^{a,c}$. Please elaborate on ways to compensate for this distortion in the design. Also, since there are only [$J^{a,c}$ (as shown on Figure A-21), the heat transfer flow boundary condition outside of the tube is changed from the prototype. Please address any distortion due to this tube pattern difference.

Westinghouse Response:

[

$J^{a,c}$

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.

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WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-43
Revision: 0

Question:

The geometry data in Table A-24 of Addendum 1 to WCAP-17712-P should be for the W-SMR's and not SPES-4. Please verify and correct, as necessary.

Westinghouse Response:

Table A-24 of Addendum 1 to WCAP-17712-P is applicable to the Westinghouse SMR CMT geometric data and not to SPES -4.

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

Update Table A-24 of Addendum 1 to WCAP-17712-P with the above correction.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-44
Revision: 0

Question:

In Table A-25 of Addendum 1 to WCAP-17712-P, the SPES-4 []^{a,c} were not scaled according to the scaling ratio. Please verify and correct, as necessary.

Westinghouse Response:

Please find the following updated scaling values for Table A-25 of Addendum 1 to WCAP-17712-P:

a,b,c

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

Update Table A-25 of Addendum 1 to WCAP-17712-P with the above correction.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-45
Revision: 0

Question:

In section A.2.11 of Addendum 1 to WCAP-17712-P, the scaling factor appears to be in the wrong part of the equations. Sign and subscripts are wrong in some places. Please verify and correct the equations, as necessary, and re-verify the SPES-4 geometry data.

Westinghouse Response:

Westinghouse agrees that portions of the equations presented in section A.2.11 of Addendum 1 were incorrect. The following equations will replace those presented on page A-38 of Addendum 1 of WCAP-17712-P.

[

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

J^{a,c}

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

The equations provided on pages A-37 and A-38 of WCAP-17712-P, Addendum 1, Revision 0 will be revised as described herein.

WESTINGHOUSE SMR REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-46
Revision: 0

Question:

A constant factor of [$J^{a,c}$ is applied to the horizontal length of CMT balance line (and other flow components) to obtain the total flow length in Addendum 1 to WCAP-17712-P. Please justify the use of this factor.

Westinghouse Response:

[

$J^{a,c}$

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-47
Revision: 0

Question:

In Table A-29 of Addendum 1 to WCAP-17712-P, the pipe ID []^{a,c} does not match the ID derived from the equation []^{a,c}. Please verify and correct, as necessary.

Westinghouse Response:

The test facility direct vessel injection line pipe inside diameter of []^{a,c} provided in Table A-29 of WCAP-17712-P, Addendum 1, Revision 0 has been confirmed to be accurate using the appropriate equation. The value listed in the equation is incorrect and will be updated accordingly.

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

The equation provided on Page A-40 of WCAP-17712-P, Addendum 1, Revision 0 will be revised as described above.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-48
Revision: 0

Question:

In section A.2.13 of Addendum 1 to WCAP-17712-P, the scaling of the Sump Injection Line is incomplete. Please review and correct, as necessary.

Westinghouse Response:

The following update in Section A.2.13 of Addendum 1 to WCAP-17712-P:

a,b,c

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

Update section A.2.13 of Addendum 1 to WCAP-17712-P with the above correction.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-49
Revision: 0

Question:

In Table A-35 of Addendum 1 to WCAP-17712-P, the pipe ID []^{a,c} does not match the ID derived from the equation []^{a,c}. Please verify and correct, as necessary.

Westinghouse Response:

Westinghouse agrees the test facility ICP injection line pipe inside diameter should be []^{a,c}

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

Table A-35 of WCAP-17712, Addendum 1 will be revised to reflect the correct pipe inside diameter.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-50
Revision: 0

Question:

*The scaling of the [$f^{a,b,c}$ is considered in detail in Addendum 1 to WCAP-17712-
P but the scaling of the [$f^{a,b,c}$ is not provided. Please provide the
missing scaling information including any minor losses.*

Westinghouse Response:

a.b

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

a,b,c

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

Update section A.2.16 of Addendum 1 to WCAP-17712-P to include the above []^{a,b,c} line scaling.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-51
Revision: 0

Question:

According to the Westinghouse SBLOCA analysis for the W-SMR, the SG isolation valve will close around [
]^{a,c} The heat transfer from the primary to the secondary side plays an important role in determining the primary side energy. The primary side volume and flow area are considered in Addendum 1 to WCAP-17712-P but it is not clear how the heat transfer from primary side to the secondary side is scaled. Please provide details on SG heat transfer scaling and quantify the scaling distortions.

Westinghouse Response:

[

]^{a,c}

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-53
Revision: 0

Question:

On page A-54 of Addendum 1 to WCAP-17712-P, please clarify the symbols of the dome surface area equation.

Westinghouse Response:

In this equation, "a" equals "b" which equals the radius of the containment. "c" is the height of the dome above the top of the cylindrical wall. "p" is a constant that is recommended to be []^{a,c}

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

Table A-47 of WCAP-17712-P, Addendum 1 will be updated as shown in the response provided.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-55
Revision: 0

Question:

In section A.2.21 of Addendum 1 to WCAP-17712-P, please provide the CMT secondary side cooling system scaling.

Westinghouse Response:

[

] ^{a,c}

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-56
Revision: 0

Question:

In Table C-2 of Addendum 1 to WCAP-17712-P, the W-SMR volume conversion from SI units to English units is not correct. Also, the volume for SPES-4 is not correct. Please review and correct as necessary.

Westinghouse Response:

The volumes provided in Table C-2 of WCAP-17712-P, Addendum 1 will be updated to those shown below.

a,c

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

Table C-2 of WCAP-17712-P, Addendum 1 will be updated as shown in the response provided.

WESTINGHOUSE SMR REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-57
Revision: 0

Question:

In Table D-1 of Addendum 1 to WCAP-17712-P, the reactor coolant flow for SPES-4 is not correct. Please double check and correct value.

Westinghouse Response:

The value associated with the reactor coolant flow for SPES-4 in US customary units was updated to reflect a consistent use of the scaling factor as described in the response to RAI-W SMR Test Plan and Scaling-33. The reactor coolant flow in metric units was updated to reflect the proper conversion between the units. The table below provides the revised values.

a,c

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

Table D-1 of WCAP-17712-P, Addendum 1 will be updated as shown in the response provided.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-59
Revision: 0

Question:

Westinghouse has indicated that a separate methodology topical report related to the scaling of the test facilities will be submitted. A brief description of the content of the planned topical report, its relationship to the scaling formulation in the addenda to WCAP-17712-P, and information about the expected submission schedule would be beneficial to the on-going pre-application review by NRC.

Westinghouse Response:

A topical report describing the scaling of SMR test facilities will be submitted to NRC [

]^{a,c,e}

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-60
Revision: 0

Question:

Please provide diameter of air operated valves on the top of SITs.

Westinghouse Response:

The air-operated valves on top of the sump injection tanks (SIT) are [
] ^{a,c}

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-61
Revision: 0

Question:

Please provide the valve sizes (size of the most restrictive section) and the form losses for check valve and ADS valve in an ADS-1 line.

Westinghouse Response:

[

] ^{a,b,c}

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-62
Revision: 0

Question:

Please provide form loss in an ADS-2 valve.

Westinghouse Response:

The form loss coefficient for the ADS-2 valves is currently modeled to be []^{a,c}

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-63
Revision: 0

Question:

Please provide wall thickness for CMT and SIT shell.

Westinghouse Response:

The wall thickness of the core makeup tank (CMT) varies anywhere from [
] ^{a,c} as indicated in Figure 63-1 below.

The wall thickness of the sump injection tank (SIT) is planned to be [^{a,c}

[^{a,c}

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-65
Revision: 0

Question:

Please confirm that the free volume in the region between upper core plate and upper support plate excluding the free volume inside the guide tubes is []^{a,c}

Westinghouse Response:

The free volume in the region between the upper core plate and upper support plate, excluding both the guide tubes and support columns, is []^{a,c}

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-66
Revision: 0

Question:

Please confirm that the height of the cylindrical section in the pressurizer []^{a,c} is relative to the top of the pressurizer surge plate.

Westinghouse Response:

The height of the cylindrical section in the pressurizer (taken from the top of the pressurizer surge plate to the bottom of the hemispherical upper head) is []^{a,c}

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.

WESTINGHOUSE SMR REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-67
Revision: 0

Question:

Please confirm that the volume of pressurizer surge plate of []^{a,c} is the free volume (i.e., the volume occupied by water).

Westinghouse Response:

The pressurizer baffle region has a designed flow region of []^{a,c}. The height of the pressurizer baffles are []^{a,c}, resulting in a total flow volume of []^{a,c} for the pressurizer surge plate. See Figure 67-1 for more information.

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

Technical Report (TR) Revision:

None.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-68
Revision: 0

Question:

The upper head of the RPV appears to be a portion of a hemisphere. Please provide the height of the upper head of the RPV/pressurizer.

Westinghouse Response:

The upper head of the pressurizer is a [

]^{a,c},



WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-69
Revision: 0

Question:

Please provide form loss coefficient for the steam generator depressurization valves (SGDVs)

Westinghouse Response:

[

] ^{a,c}

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-70
Revision: 0

Question:

Please provide material of construction for the RPV wall.

Westinghouse Response:

The Reactor Pressure Vessel (RPV) is planned to be fabricated from [
] ^{a,c}

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-72
Revision: 0

Question:

Please confirm that the support columns between upper core plate and upper support plate are solid rods; if not, please provide the inner diameter.

Westinghouse Response:

The support columns between the upper core plate and upper support plate are designed as shown in Figure 72-1 below. The support columns consist of a [
] ^{a,c}

a,c

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-73
Revision: 0

Question:

Please confirm that the control rod drive mechanisms (CRDMs) between upper core plate and upper support plate are solid structure; if not, please provide the inner diameter.

Westinghouse Response:

For the purpose of most core internal fluid analysis, the control rod drive mechanisms (CRDMs) between upper core plate and upper support plate [

] ^{a,b,c}

For the purpose of heat transfer between CRDM and Reactor Coolant System (RCS) fluid, the current available thermal properties are defined in RAI-TR-SBLOCA-PIRT-115-P.

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-74
Revision: 0

Question:

Please provide the material for the pressurizer separator plates.

Westinghouse Response:

The material for the pressurizer separator plates is []^{a,c}

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-75
Revision: 0

Question:

Please provide height of the cylindrical wall of the steam drum.

Westinghouse Response:

The steam drum is currently planned to be comprised of the following sections as shown in Figure 75-1 below: [

] ^{a,c}

^{a,c}

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-76
Revision: 0

Question:

Please provide the geometry information for the upper and lower heads of the steam drum.

Westinghouse Response:

The geometry information for the upper and lower heads of the steam drum can be found the diagram below.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

a,b,c

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-77
Revision: 0

Question:

Please discuss the comparisons performed to validate Westinghouse's current neutronics methods against measurements from facilities that used shorter active core heights and reflectors of the type envisioned for W-SMR.

Westinghouse Response:

[

] ^{a,c}

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-78
Revision: 0

Question:

Please confirm the materials to be used for fabrication of the steam drum cylindrical wall and upper/lower elliptical heads.

Westinghouse Response:

The upper elliptical head, shell barrels (cylindrical wall), and lower elliptical head of the steam drum are planned to be fabricated from []^{a,c}

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-86
Revision: 0

Question:

Follow-on to RAI-TR SBLOCA PIRT-118: Please provide the form loss coefficients in the sump injection line and sump coupling valve.

Westinghouse Response:

[

] ^{a,c}

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.

WESTINGHOUSE SMR REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-W SMR Test Plan and Scaling-87

Revision: 0

Question:

Follow-up to RAI-TR SBLOCA PIRT-132: The information provided on structures surrounding the RPV cylindrical wall and lower head is inadequate to visualize or understand the natural circulation flow that can occur around the lower head. Please provide a schematic drawing of

[

J^{a,c}.

Furthermore, please explain the role of

J^{a,c}.

Westinghouse Response:

[

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WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

J^{a.c}

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

a,c

Figure 1: Components of the Reactor Vessel Insulation System

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

a,c

Figure 2: In-Vessel Retention Cooling Flow Path

WESTINGHOUSE SMR REVIEW
Response to Request For Additional Information (RAI)

Reference:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.