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DCP_NRC_003327

February 5, 2018

Subject: Submittal of Closed Session Slide Package for the February 2018 WCAP 17938 Revision 2, ACRS Subcommittee – Closed Meeting (Proprietary/Non-Proprietary)

Enclosed:

1. An Application for Withholding Proprietary Information from Public Disclosure, AW-18-4707 (Non-Proprietary), with Proprietary Information Notice and Copyright Notice.

Transmitted as part of Enclosure 1 are the proprietary and non-proprietary versions of the closed session slide package for the February 2018 ACRS Subcommittee on WCAP 17938 Revision 2. The non-proprietary slide package for the open session of the meeting is also transmitted as part of Enclosure 1. The meeting will be held on February 7, 2018.

This submittal contains proprietary information of Westinghouse Electric Company LLC (“Westinghouse”). In conformance with the requirements of 10 CFR Section 2.390, as amended, of the Nuclear Regulatory Commission’s (“Commission’s”) regulations, we are enclosing with this submittal an Application for Withholding Proprietary Information 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 proprietary aspects of the Application for Withholding or the Westinghouse Affidavit should reference AW-18-4707, and should be addressed to James A. Gresham, Manager, Regulatory Compliance, Westinghouse Electric Company, 1000 Westinghouse Drive, Building 2 Suite 259, Cranberry Township, Pennsylvania 16066.

A handwritten signature in black ink, appearing to read "Zachary S. Harper".

Zachary S. Harper, Manager
AP1000 Regulatory Support, Mechanical & Structures

/Enclosures

1. Application for Withholding Proprietary Information from Disclosure, AW-18-4707

cc: Donald Habib U.S. NRC



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AW-18-4707

February 5, 2018

APPLICATION FOR WITHHOLDING PROPRIETARY
INFORMATION FROM PUBLIC DISCLOSURE

Subject: Submittal of Closed Session Slide Package for the February 2018 WCAP 17938 Revision 2, ACRS Subcommittee – Closed Meeting (Proprietary)

Reference: Letter from Zachary S. Harper to the Document Control Desk, DCP_NRC_003327, dated February 5, 2018.

The Application for Withholding Proprietary Information from Public Disclosure is submitted by Westinghouse Electric Company LLC (“Westinghouse”), pursuant to the provisions of paragraph (b)(1) of Section 2.390 of the Nuclear Regulatory Commission’s (“Commission’s”) regulations. It contains commercial strategic information proprietary to Westinghouse and customarily held in confidence.

The proprietary information for which withholding is being requested in the above-referenced presentation is further identified in Affidavit AW-18-4707 signed by the owner of the proprietary information, Westinghouse. The Affidavit, which accompanies this letter, sets forth the basis on which the information may be withheld from public disclosure by the Commission and addresses with specificity the considerations listed in paragraph (b)(4) of 10 CFR Section 2.390 of the Commission’s regulations.

Correspondence with respect to the proprietary aspects of the Application for Withholding or the accompanying Affidavit should reference AW-18-4707, and should be addressed to James A. Gresham, Manager, Regulatory Compliance, Westinghouse Electric Company, Building 2, Suite 259, 1000 Westinghouse Drive, Cranberry Township, Pennsylvania 16066.

A handwritten signature in black ink that reads "Jill S. Monahan".

Jill S. Monahan, Manager
Licensing Inspections and Special Programs



Westinghouse Electric Company
1000 Westinghouse Drive
Cranberry Township, Pennsylvania 16066
USA

Enclosures to AW-18-4707

1. AFFIDAVIT AW-18-4707
2. PROPRIETARY INFORMATION NOTICE and COPYRIGHT NOTICE
3. APP-GW-GLY-147, Revision 0 “ACRS Subcommittee on WCAP 17938 Revision 2– Public Meeting” (Non-Proprietary)
4. APP-GW-GLY-148, Revision 0 “ACRS Subcommittee on WCAP 17938 Revision 2– Closed Meeting” (Proprietary)
5. APP-GW-GLY-149, Revision 0 “ACRS Subcommittee on WCAP 17938 Revision 2– Closed Meeting” (Non-Proprietary)

ENCLOSURE 1 to AW-18-4707

AFFIDAVIT

AFFIDAVIT


COMMONWEALTH OF PENNSYLVANIA:

ss

COUNTY OF BUTLER:

I, Jill S. Monahan, am authorized to execute this Affidavit on behalf of Westinghouse Electric Company LLC ("Westinghouse") and declare that the averments of fact set forth in this Affidavit are true and correct to the best of my knowledge, information, and belief.

Executed on: 2-5-2018



Jill S. Monahan, Manager
Licensing Inspections and Special Programs

- (1) I am Manager, Licensing Inspections and Special Programs, 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 Nuclear Regulatory Commission’s (“Commission's”) regulations and in conjunction with the Westinghouse Application for Withholding Proprietary Information from Public Disclosure 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 constitute Westinghouse policy and provide 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.
- (iii) 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.
- (iv) The information is being transmitted to the Commission in confidence and, under the provisions of 10 CFR Section 2.390, is to be received in confidence by the Commission.
- (v) 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.
- (vi) The proprietary information sought to be withheld in this submittal is that which is appropriately marked in Submittal of Closed Session Slide Package for the February 2018 WCAP 17938 Revision 2, ACRS Subcommittee – Closed Meeting (Proprietary), for a meeting to be held on February 7, 2018, for submittal to the Commission, being transmitted by Westinghouse letter DCP_NRC_003327. The proprietary information as submitted by Westinghouse is that associated with Westinghouse's request for NRC approval of WCAP-17938, and may be used only for that purpose.
- (a) This information is part of that which will enable Westinghouse to manufacture and deliver products to utilities based on proprietary designs.
 - (b) Further, this information has substantial commercial value as follows:

- (i) Westinghouse plans to sell the use of similar information to its customers for the purpose of plant construction and operation.
- (ii) Westinghouse can sell support and defense of industry guidelines and acceptance criteria for plant-specific applications.
- (iii) The information requested to be withheld reveals the distinguishing aspects of a methodology 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 technical evaluation justifications 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.

ENCLOSURE 2 to AW-18-4707

PROPRIETARY INFORMATION NOTICE and COPYRIGHT NOTICE

PROPRIETARY INFORMATION NOTICE

Transmitted herewith are proprietary and non-proprietary versions of a document, 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 3 to AW-18-4707

APP-GW-GLY-147, Revision 0
“ACRS Subcommittee on WCAP 17938 Revision 2– Public Meeting”

(Non-Proprietary)

This presentation is non-proprietary

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WCAP 17938 Revision 2, ACRS Subcommittee – Public Meeting

February 7, 2018

Andrew Pfister

Shayan Sinha



Background

AP1000 GSI 191 Design Bases

- **AP1000** design significantly reduces / eliminates debris sources that are typically found in Generation II plants
- Maximum allowable fibrous debris inside containment is 6.6 lbs
 - All fibrous debris is attributable to latent debris
 - There is no fibrous debris generated during a LOCA
- Metal reflective insulation (MRI) is extensively used in containment
- DCD/FSAR provides requirements that must be demonstrated if an alternative (fibrous) insulation to MRI is utilized
 - Insulation must be demonstrated to be a suitable equivalent insulation to MRI for the purposes of GSI 191
 - To qualify a suitable equivalent testing must be performed to demonstrate that debris will not be generated or transported
 - Suitable equivalent testing must be approved by the NRC

Background

WCAP 17938 Purpose

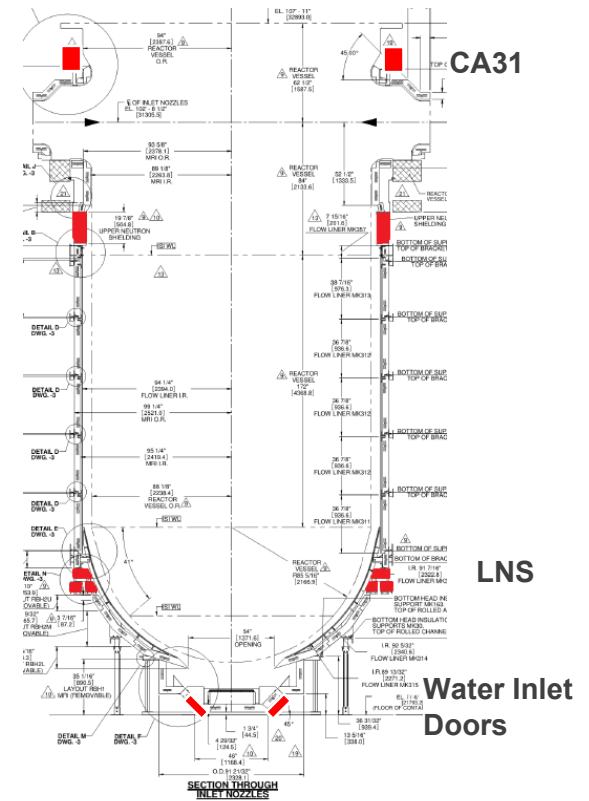
Purpose of WCAP 17938 is to obtain approval of the following:

1. Establish a ZOI applicable to all **AP1000** plant in-containment cabling to demonstrate cabling will not generate LOCA debris
2. Gain approval that the non-metallic insulation (NMI) utilized in the reactor vessel insulation systems (RVIS) is a suitable equivalent to MRI for the purpose of GSI 191 as applied in **AP1000**
3. Gain approval to utilize the approved NEI 04-07 alternative methodology for defining debris generation break sizes for **AP1000**

Testing and analysis is complete to demonstrate that neither cabling nor NMI will contribute to post LOCA debris

Background WCAP 17938

- **AP1000** cabling may contain fibrous and other materials that were not considered in initial GSI 191 debris source term evaluations
 - Corrective actions included development of a test program to establish a zone of influence (ZOI) for in-containment cabling
- NMI is required in RVIS because subcomponents of the RVIS perform functions in addition to insulation (such as shielding and in-vessel retention support)



Summary of Results

- Extensive large scale jet impingement testing established a ZOI for in-containment cables of 4 L/D
 - Cabling ZOI design requirements were incorporated into the detailed design in advance of any cable or tray installation
- WCAP invokes the alternate evaluation methodology provided in NEI 04-07 to determine a limiting RCS break size in debris generation evaluation for certain **AP1000** components
- Insights from NMI jet impingement and submergence testing resulted in strengthening design for elements of the RVIS
 - Design was changed to use thicker and more robust encapsulation

WCAP justifies no new debris generation for AP1000 from cabling or NMI



Conclusions



Conclusions

- Jet impingement testing supports a Cable ZOI of 4 L/D for **AP1000** in-containment cabling
- Application of NEI 04-07 alternative break methodology is acceptable for **AP1000**
- Cabling does not contribute to **AP1000** post LOCA debris limits
- Encapsulated NMI applications utilized within the AP1000 RVIS will not produce debris when subjected to jet impingement from limiting line breaks
- Neither cabling nor NMI within the RVIS contribute to GSI 191 chemical debris limits
- NMI utilized as part of the RVIS is a suitable equivalent to MRI for the purpose of GSI 191

WCAP justifies no new debris generation for AP1000 from cabling or NMI

ENCLOSURE 5 to AW-18-4707

APP-GW-GLY-149, Revision 0
“ACRS Subcommittee on WCAP 17938 Revision 2– Closed Meeting”

(Non-Proprietary)

This presentation is non-proprietary

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WCAP 17938 Revision 2, ACRS Subcommittee – Closed Meeting (Non-Proprietary)

February 7, 2018

Andrew Pfister

Shayan Sinha



Agenda

- Background
- Jet Impingement Considerations
 - Jet Impingement Testing
 - NEI 04-07 Alternative Methodology
- Chemical Effects
- Conclusions

Background

WCAP 17938 Purpose

1. Establish ZOI for in-containment cables
2. Gain approval that the NMI utilized in the RVIS is a suitable equivalent to MRI for the purpose of GSI 191
3. Gain approval to utilize the NEI 04-07 alternative methodology for defining debris generation break sizes for **AP1000**

a,c

a,c



Testing and analysis is complete to demonstrate that neither cabling nor NMI will contribute to post LOCA debris

Background

AP1000 In-containment Cabling

- **AP1000** cabling may contain fibrous and other materials (jacketing, wrapping, and filler materials) that were not considered in initial GSI 191 debris source term evaluations
 - e.g. multi conductor power cables were determined []^{a,c}
- Upon identification of potential debris source a corrective action was initiated and a Root Cause Analysis was completed
- Corrective actions included development of a test program to establish a zone of influence (ZOI) for in-containment cabling
 - Design changes were implemented to relocate cabling outside of established ZOIs or protect cabling against jet impingement

[]

[]^{a,c}

[]

[]^{a,c}



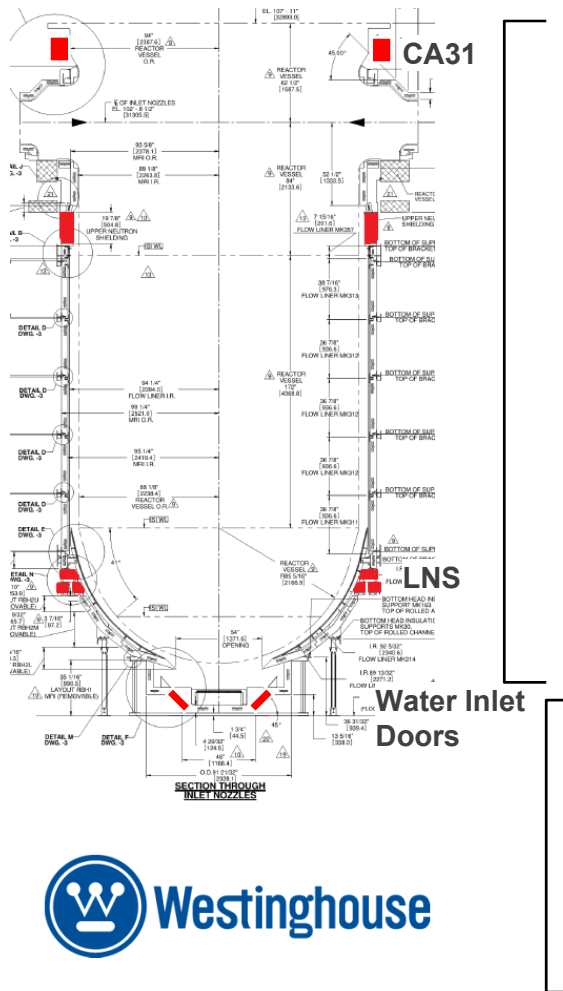
Corrective actions preclude cabling as a source of debris for AP1000

Background Applications of NMI in AP1000 RVIS

CA31 Shield Blocks

Lower Neutron Shield (LNS)

Water Inlet Doors



Background

Applications of NMI on AP1000 RVIS

- Subcomponents of the RVIS perform functions in addition to insulation such as shielding and in-vessel retention support
- NMI is required for portions of the RVIS for the following reasons:
 1. CA31 shield blocks incorporate []
 - Shield blocks limit radiation streaming upwards into containment during normal operations and shutdown
 2. LNS incorporates []
 - Shield blocks reduce radiation levels in the lower reactor cavity during normal operations and shutdown
 3. RVIS water inlet doors contain [] to provide buoyancy so that the doors will float open in the event of reactor vessel cavity flooding to support in-vessel retention



Jet Impingement Considerations

Jet Impingement Testing (JIT) Overview

- JIT program was developed with 2 goals
 - Establish a cable ZOI based on the onset of incipient damage
 - Demonstrate NMI incorporated into RVIS is a suitable equivalent to MRI when subjected to potential LOCA jet impingement forces
- Testing was conducted at NTS laboratories in Huntsville, AL
 - Testing incorporated learning from previous PWROG JIT programs
- Facility bounds **AP1000** LOCA blowdown in both stagnation pressure and mass flux



a,b,c

Jet Impingement Testing (JIT) Overview

- Facility capability was demonstrated as part of PWROG GSI ZOI testing
- Test program included jet characterization using data from instrumented rake
 - Data demonstrates significant reduction in stagnation pressures with increasing L/D
 - L/D < 2 considered within core region of jet
- Reservoir blowdown was tracked for each test to confirm facility performance

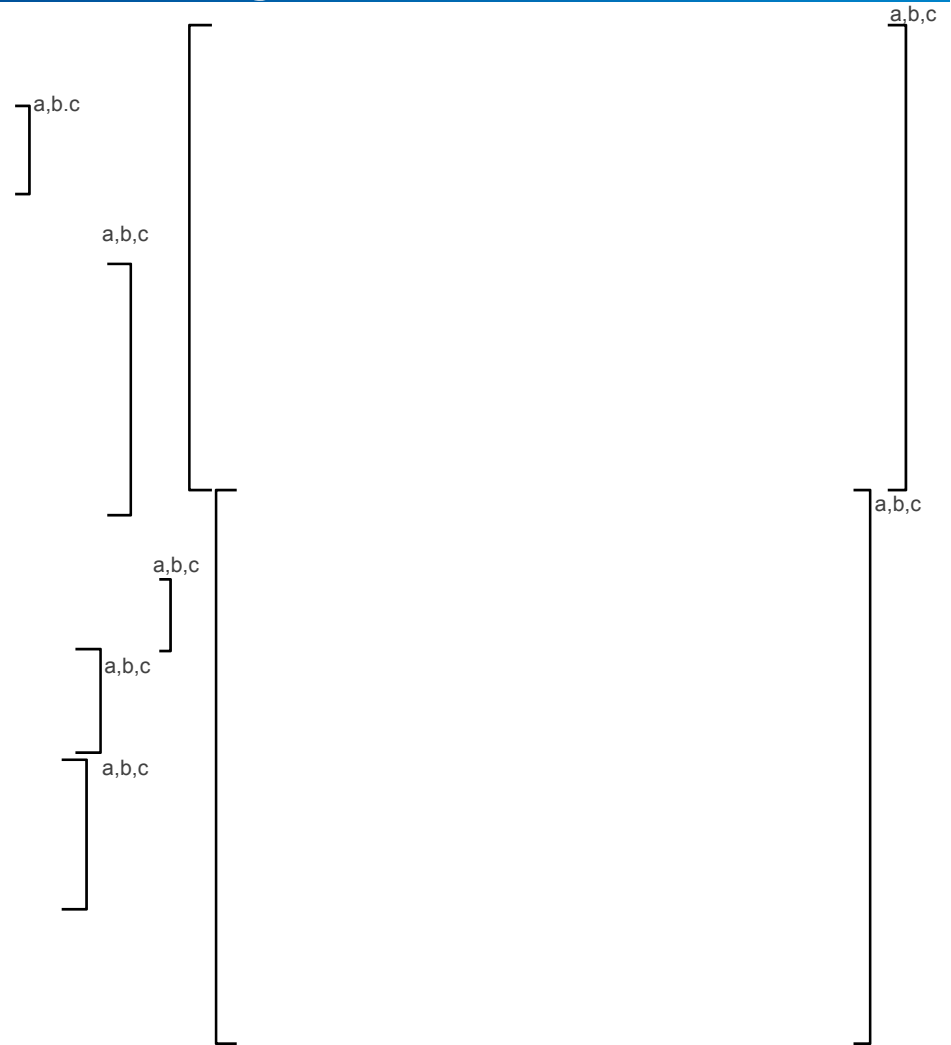
a,b,c

a,b,c



Cable Jet Impingement Test Configuration

- System parameters for blowdown: [
- Conducted JIT on:
 - [
 - [
 - Test aged and fresh cables
- Testing was conducted [
- [



Results of Cable Jet Impingement Test

a.b.c



NMI Test Configuration

- System parameters for blowdown:

[]^{a,b,c}

- Testing bounds limiting configuration for NMI location

- Conducted initial JIT on 3 design configurations []^{a,b,c}

- []^{a,b,c}
 - []^{a,b,c}
 - []^{a,b,c}

- Conducted phase 2 JIT on []^{a,b,c}

[]^{a,b,c}

- Test was conducted on blocks constructed from []^{a,b,c}

- Final block designs are []^{a,c}

[]^{a,c}



Results of Phase 1 NMI Testing

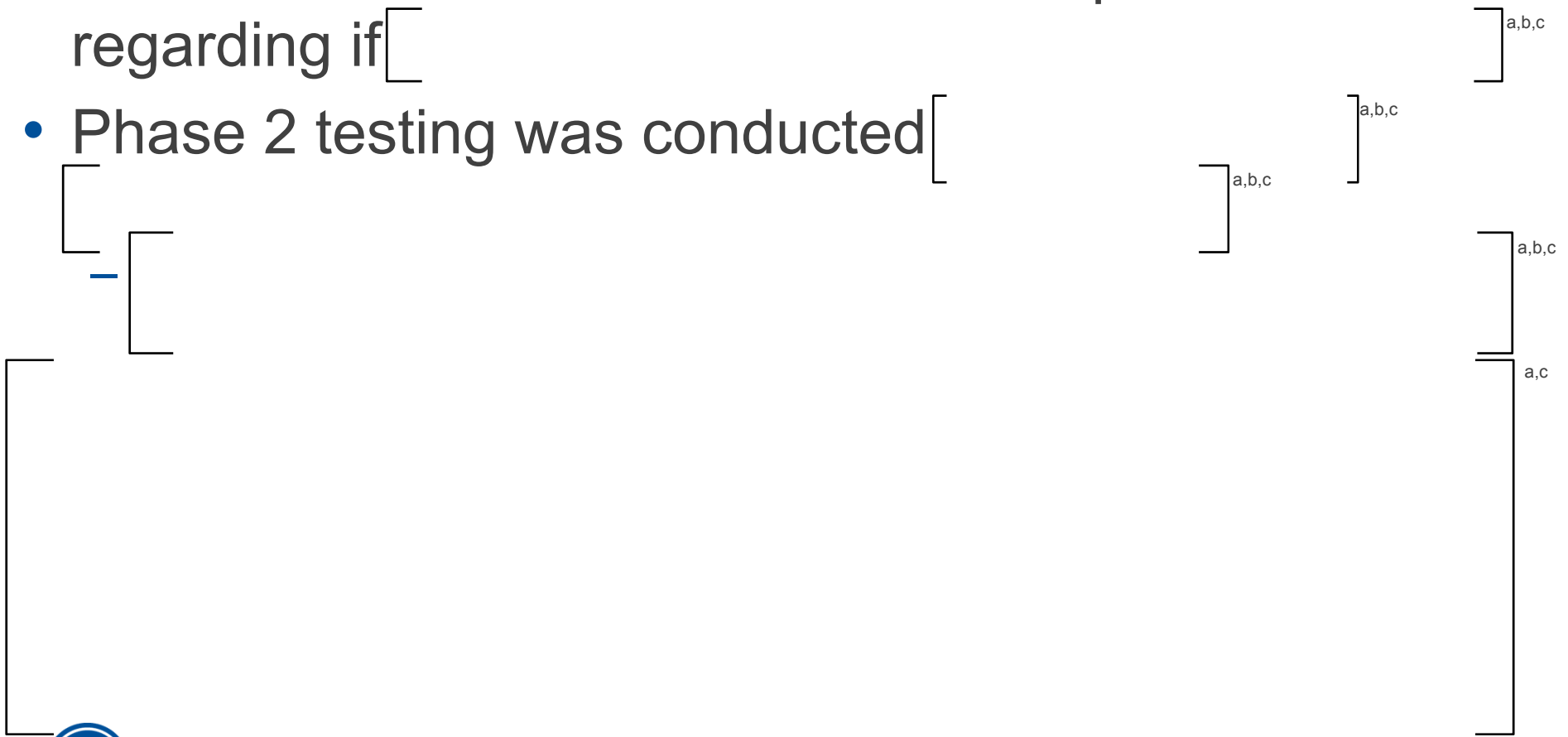
a,b,c

a,b,c



Phase 2 NMI Testing

- Additional JIT conducted to address questions regarding if [
- Phase 2 testing was conducted [

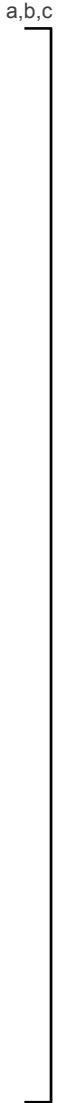
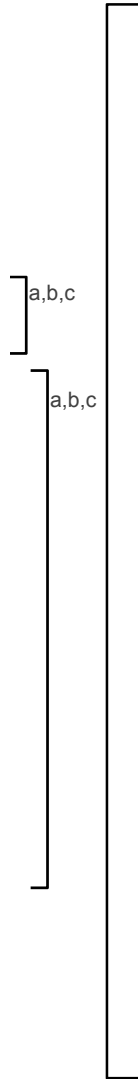


Installed insulation at Sanmen Unit 1

Phase 2 NMI Testing Results

- Both tests demonstrate shield block robustness when subjected to

- [Redacted]



Jet Impingement Testing

a,b,c



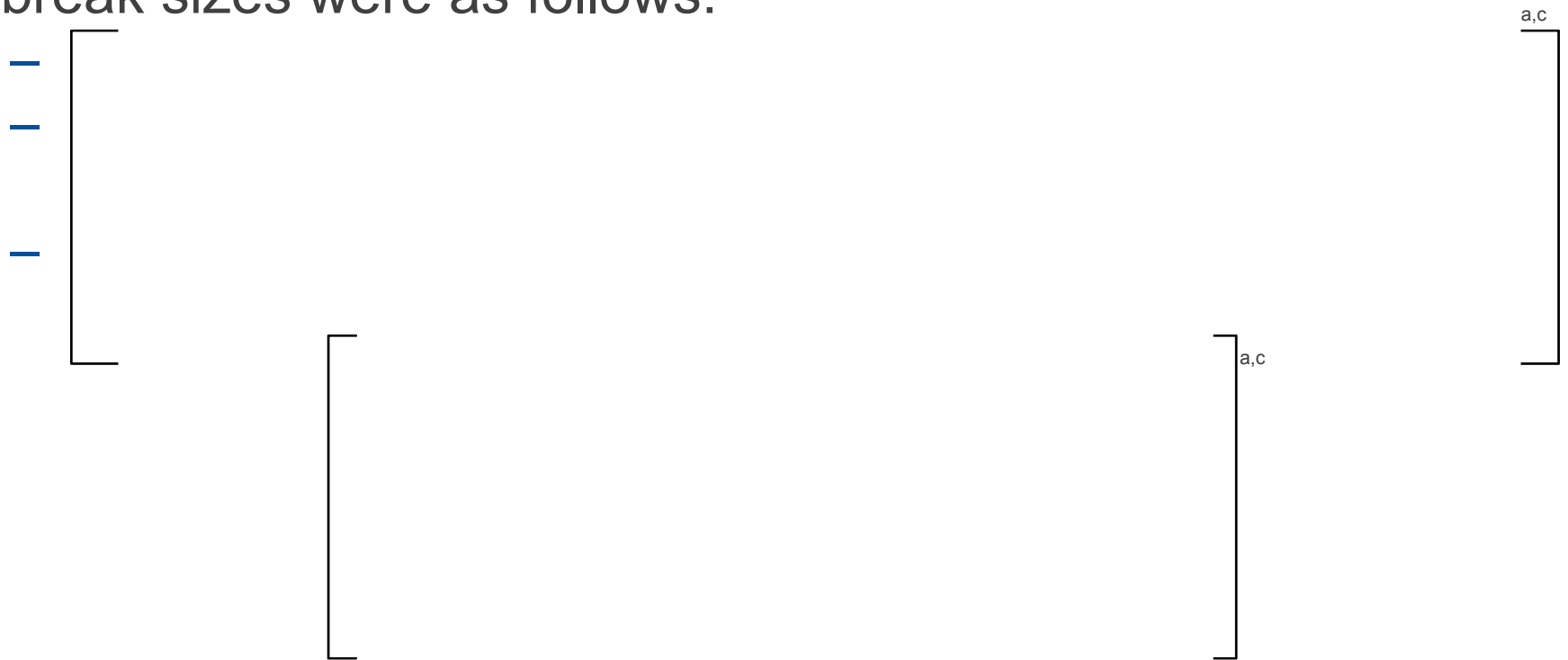
NEI 04-07 Alternate Evaluation Overview

- In conjunction with the JIT programs, WCAP invokes the alternate evaluation methodology provided in NEI 04-07 to determine a limiting RCS break size
 - Methodology is approved in SER for NEI 04-07, but it wasn't explicitly invoked in **AP1000** DCD
- Methodology permits utilizing smaller line size for ZOI determination if deterministic analysis demonstrates break opening size is less than full pipe diameter



NEI 04-07 Alternate Evaluation Overview

- Detailed finite element analysis determine limiting **AP1000** break sizes were as follows:



Alternative methodology in conjunction with JIT supports no debris generation from cabling or NMI



Chemical Effects

Date



Chemical Effects - Cables

- **AP1000** chemical debris analysis is based on WCAP 16530 which is industry approved PWR chemical debris model
 - Applicability of model was certified as part of **AP1000** DCD
- WCAP 16530 does not consider cabling an input to chemical debris generation since its impact would be small compared to other contributors
 - NRC PIRT on post-LOCA chemical effects (NUREG-1918) and NUREG/CR-6988 on the chemical effects phenomena in post-LOCA coolant reaffirm this conclusions
- Potential for chemical effects as a result of radiolysis of electrical cable insulation would be negated due to neutralization by the pH buffer in containment
- Position was endorsed by ACRS during design certification in ML103410348



**Cabling does not contribute to post
LOCA chemical debris**

Chemical Effects – Non-Metallic Insulation

- A submergence test program was developed to determine if debris would be generated by exposed components []^{a,b,c} []^{a,c} considering both broken and intact encapsulation.
- Tests included a neutron shield block []^{a,b,c} and individual components in a post-LOCA environment.
 - []^{a,b,c}
 - []^{a,b,c}
- Results from this program were integrated into the **AP1000** plant chemical effects model to determine the integrated effects on chemical precipitate formation.



Chemical Effects – NMI Test Results



Conclusions



Conclusions

- Jet impingement testing supports a Cable ZOI of 4 L/D for **AP1000** in-containment cabling
- Application of NEI 04-07 alternative break methodology is acceptable for **AP1000**
- Cabling does not contribute to **AP1000** post LOCA debris limits
- []^{a,c} NMI applications utilized within the **AP1000** RVIS will not produce debris when subjected to jet impingement from limiting line breaks
- Neither cabling nor NMI within the RVIS contribute to GSI 191 chemical debris limits
- NMI utilized as part of the RVIS is a suitable equivalent to MRI for the purpose of GSI 191



WCAP justifies no new debris generation for AP1000 from cabling or NMI