

March 30, 2016

Mr. Zachary Harper, Manager  
Regulatory Support  
Westinghouse Electric Company  
1000 Westinghouse Drive  
Cranberry Township, PA 16066

SUBJECT: AUDIT PLAN FOR REVIEW OF WCAP-17938, REVISION 1, "AP1000  
IN-CONTAINMENT CABLES AND NON-METALLIC INSULATION DEBRIS  
INTEGRATED ASSESSMENT"

Dear Mr. Harper:

The U.S. Nuclear Regulatory Commission (NRC) staff has prepared an audit plan related to the review of WCAP-17938, Revision 1, "AP1000 In-Containment Cables and Non-Metallic Insulation Debris Integrated Assessment." The audit plan describes the scope and purpose of the audit, identifies the audit team, and describes the documents required by the NRC staff. The audit plan is enclosed.

The audit will take place in two phases at the Westinghouse Electric Company's Rockville Office: 11333 Woodglen Drive, Suite 202, Rockville, Maryland 20852. Both phases of the audit will be scheduled to a mutually agreed upon time (Phase 1, March – April 2016 and Phase 2, May – August 2016).

If you have any questions, please contact the Project Manager, Bruce Baval, at (301) 415-6715 or [Bruce.Baval@nrc.gov](mailto:Bruce.Baval@nrc.gov).

Sincerely,

*/RA/*

John McKirgan, Acting Chief  
Licensing Branch 4  
Division of New Reactor Licensing  
Office of New Reactors

Project No. 0811

Enclosure:  
As stated

cc: See next page

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DATE	3/29/2016	3/23/2016	3/30/2016	

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(Revised 10/01/2015)

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**AUDIT PLAN FOR REVIEW OF WCAP-17938, REVISION 1,  
“AP1000 IN-CONTAINMENT CABLES AND NON-METALLIC INSULATION  
DEBRIS INTEGRATED ASSESSMENT”**

**A. Location**

The audit will be conducted in two phases at the same location. The first phase supports development of a preliminary safety evaluation report and, if necessary, a request for additional information (RAI). The second phase is optional, but may be needed to address follow-up RAIs and support completion of the advanced safety evaluation report.

Phase 1: March–April 2016

Westinghouse Electric Company  
11333 Woodglen Drive, Suite 202  
Rockville, MD 20852  
Telephone: 301-881-7040

Phase 2: May–August 2016

Westinghouse Electric Company  
11333 Woodglen Drive, Suite 202  
Rockville, MD 20852  
Telephone: 301-881-7040

**B. Background**

In September 2004, the staff issued NUREG-1793, “Final Safety Evaluation Report Related to Certification of the AP1000 Standard Design” (the Final Safety Evaluation Report (FSER)). The staff issued Supplement 1 to the FSER in December 2005 to address details related to rulemaking, and Supplement 2 to the FSER in September 2011 to address modifications proposed in the design certification amendment.

NUREG-1793 Supplement 2 contains the U.S. Nuclear Regulatory Commission (NRC) staff evaluation of how the AP1000 design addresses Generic Safety Issue 191, “Assessment of Debris Accumulation on Pressurized-Water Sump Performance” (GSI-191), and Generic Letter 2004-02, “Potential Impact of Debris Blockage on Emergency Recirculation During Design-Basis Accidents at Pressurized-Water Reactors” (GL 2004-02).

WCAP-17938, “AP1000 In-Containment Cables and Non-Metallic Insulation Debris Integrated Assessment,” re-evaluates the AP1000 GSI-191 and GL 2004-02 debris assessment described in Revision 19 of the Design Control Document. Specifically, WCAP-17938 assesses the potential for generation of debris from non-metallic insulation and materials in the reactor cavity (e.g., neutron shield blocks) and electrical cables in the containment.

As discussed in WCAP-17938, the AP1000 GSI-191 and GL 2004-02 debris evaluation result is that no fibrous debris is generated in a loss-of-coolant accident (LOCA). This is documented in APP-GW-GL-700 (Revision 19), “AP1000 Design Control Document,” Subsection 6.3.2.2.7.1, which states “a LOCA in the AP1000 does not generate fibrous debris due to damage to insulation or other materials included in the AP1000 design.” This is based on the use of metal

reflective insulation or a suitable equivalent and the lack of fibrous insulation and other sources of fiber located in the LOCA jet impingement zones.

As discussed in WCAP-17938, the AP1000 plant design includes non-metallic insulation and materials in the reactor cavity that are designed to be a suitable equivalent to metal reflective insulation. Additionally, the AP1000 plant design includes in-containment electrical cabling that may contain fibrous and other materials (jackets, wrappings, and filler materials), which may be directly impinged upon by a jet of water from a loss-of-coolant accident LOCA. Neither of these items (i.e., encapsulated non-metallic insulation and cabling) were considered in the applicant evaluation addressing GSI-191 and GL 2004-02 or the NRC staff's FSER (NUREG-1793 Supplement 2).

To address these items, Westinghouse Electric Company (Westinghouse) developed a program to evaluate any potential impacts to the current licensing basis from the exposure of cables to direct jet impingement by water from a LOCA and to qualify encapsulated non-metallic insulation and materials as a suitable equivalent to metal reflective insulation. The purpose of the program was to define a cable zone of influence and to confirm that the encapsulated non-metallic insulation and materials meet the requirements of suitable equivalency and may be used in place of metal reflective insulation at discrete locations in the reactor cavity. The program included jet impingement testing of neutron shield blocks (e.g., encapsulated non-metallic insulation and materials) and cabling, and submergence testing of neutron shield blocks.

NRC staff determined it would be advantageous to audit documents that support WCAP-17938 Revision 1 evaluations and conclusions.

### **C. Audit Bases**

This regulatory audit is based on the following:

- Title 10 *Code of Federal Regulations* (10 CFR), Appendix D to Part 52, "Design Certification Rule for the AP1000 Design"
- 10 CFR 50.46(b)(5), "Long-term cooling"
- General Design Criterion (GDC) 35, "Emergency core cooling"
- GDC 38, "Containment heat removal"
- Standard Review Plan (SRP) Section 6.2.2 "Containment Heat Removal System"
- SRP Section 6.3, "Emergency Core Cooling System"
- Regulatory Guide 1.82, Revision 4, "Water Sources for Long-Term Recirculation Cooling Following a Loss-of-Coolant Accident"

### **D. Audit Scope**

The audit will focus on documents associated with achieving the stated purpose of WCAP-17938. The purpose of the topical report, as discussed in the WCAP-17938 introduction section, is to obtain NRC approval for the following:

- defining the zone of influence for water jet impingement on cabling as  $4D$ , where  $D$  is the diameter of the postulated pipe break

- establishing that upper and lower neutron shielding and water inlet doors of the reactor vessel insulation system as well as neutron shield blocks of the CA31 module are equivalent to metal reflective insulation
- using an alternative methodology for defining debris generation break size for postulated accidents per NEI 04-07<sup>1</sup>

The staff will conduct this audit in accordance with the guidance provided in NRO-REG-108, "Regulatory Audits" (Reference 1).

### **E. Information and Other Material Necessary for the Audit**

For Phase 1 and 2 of the audit, the staff requires access to calculations and design information as well as knowledgeable personnel regarding the review of areas identified under Section D above, pertaining to WCAP-17938, Revision 1.

### **F. Team Assignments**

Clinton Ashley, NRO, Reactor Systems Engineer, Audit Team Lead  
 Gregory Makar, NRO, Materials Engineer  
 Boyce Travis, NRO, Reactor Systems Engineer  
 Yueh-Li (Renee) Li, NRO, Senior Mechanical Engineer  
 Malcolm Patterson, Reliability and Risk Analyst  
 Bruce Bovol, NRO, Project Manager

Other NRC staff members may be added as the need arises.

### **G. Logistics**

This audit takes place in from March through December 2016, and will be conducted at the Westinghouse facility in Rockville Maryland.

The NRC Project Manager will coordinate any changes to the audit schedule and agenda with Westinghouse.

### **H. Special Requests**

Please support the audit with

1. a conference room for the NRC staff use
2. telephones to support teleconferencing (i.e., with microphone and speaker)
3. telephone access to Westinghouse technical staff to answer questions related to the audit (with reasonable notice)
4. access to a secure Wi-Fi network or Ethernet

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<sup>1</sup> NEI 04-07, Revision 0, "PWR Sump Performance Evaluation Methodology," Nuclear Energy Institute, Washington, DC. December 2004 (Agencywide Documents Access and Management System Accession No. ML050550138).



## **I. Deliverables**

Once the regulatory audit is completed, the audit team will issue an audit summary within 90 days. If information evaluated during the audit is needed to support a regulatory decision, the staff will identify it in an RAI.

## **J. References**

1. NRO-REG-108, "Regulatory Audits," ADAMS Accession Number ML081910260, dated April 2, 2009.
2. WCAP-17938-P, "AP1000 In-Containment Cables and Non-metallic Insulation Debris Integrated Assessment," Revision 1, dated November 20, 2015.