

January 28, 2014

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SUBJECT: AUDIT REPORT SUMMARY ASSOCIATED TO THE REVIEW THE
 WESTINGHOUSE SMR SMALL BREAK LOCA PHENOMENA
 IDENTIFICATION AND RANKING TABLE TOPICAL REPORT

On October 30, 2013, a team from the Offices of New Reactors and Nuclear Regulatory Research completed an audit of documents associated topical report WCAP-17573-NP, Revision 1, "Westinghouse SMR Small Break LOCA Phenomena Identification and Ranking Table (ADAMS accession number ML121250488). The team followed the previously issued audit plan (ML13240A232) during the four audit visits held at Westinghouse's Rockville office and issued an audit results summary report (ARSR), which is enclosed. The audit report contains information that is bracketed [blank] because Westinghouse was granted the request that the information associated with the topical report be withheld in accordance to with the requirements of 10 CFR 2.390 (ML12138A299).

Should you have any questions regarding this matter, I may be reached at 301-415-0546.

/RA/

Gregory Cranston, Acting Chief
Small Modular Reactor Licensing Branch 2
Division of Advanced Reactors and Rulemaking
Office of New Reactors

Enclosure: as stated

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R. Sisk

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Project No.: PROJ0797

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AUDIT RESULTS SUMMARY REPORT RELATED TO
WESTINGHOUSE SMALL MODULAR REACTOR

1. Introduction

Westinghouse submitted licensing topical report (LTR) WCAP-17573, Revision 1, "Westinghouse SMR Small Break LOCA Phenomena Identification and Ranking Table," on April 25, 2012. The non-proprietary version of this LTR can be located in ADAMS (ML121250488). As part of the LTR review, the Office of New Reactors (NRO) requested that the Reactor Systems Analysis Branch (RSAB) of the Office of Nuclear Regulatory Research (RES) provide technical assistance for developing in-house Westinghouse small modular reactor (W-SMR) phenomena identification and ranking tables (PIRTs) for limiting events, and evaluating acceptability of the W-SMR small-break loss-of-coolant accident (SBLOCA) PIRT described in LTR WCAP-17573. The W-SMR PIRT evaluation described in the LTR will support the evaluation of the W-SMR test programs and safety analysis methodologies in accordance with Standard Review Plan (SRP) 15.0.2, "Review of Transient and Accident Analysis Method."

The purpose of this audit was to review internal Westinghouse documentation of the W-SMR design information to allow RES/RSAB to develop in-house PIRTs of the W-SMR limiting events and independently review the Westinghouse W-SMR SBLOCA PIRT. During the audit and interactions with Westinghouse technical staff, several requests for additional information (RAIs) and follow-on RAIs were developed, and were transmitted with formal correspondence. The audit also included the review of additional design information provided by Westinghouse to support the development of TRACE/PARCS models for NRC code applicability assessments and future confirmatory analyses.

2. Audit Scope and Purposes

The audit was scheduled to last 5-10 business days (non-consecutive) and was conducted in several phases at the Westinghouse Rockville Office. The primary purpose of the audit was to obtain W-SMR design information and relevant separate effect and integral effect tests performed under AP600 and AP1000 design certification applications. This information was needed in the development of the in-house independent PIRTs of the W-SMR limiting events, and the evaluation of the Westinghouse W-SMR SBLOCA PIRT.

The RES staff prepared audit plans and transmitted them to the Office of New Reactors NRO (ML13240A232). The specific scope of this audit was to:

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1. Assure that the design information was complete and responsive to the preliminary set of information needs list (see Section 6),
2. Identify missing information (gaps) in data,
3. Identify specific information and relevant documents the staff needed to directly support the in-depth review of the W-SMR, and
4. Compile a list of additional questions and requests for clarification.

3. Audit Location

Location: Westinghouse Offices on Twinbrook Parkway
Rockville, Maryland

Point-of-Contact: Robert Sisk, WEC

4. Audit Times

The audit was conducted in four phases at the Westinghouse Electric Company (WEC)'s Twinbrook offices during the following days: April 17, 2013, May 2, 2013, August 13, 2013, and October 24, 2013. The audit exit briefing was held on November 20, 2013.

5. Participants

The audit team included several senior reactor systems engineers and reactor systems engineers from RES/RSAB and technical contractors (as required). The RES/RSAB audit team held periodic counterpart teleconference briefs with counterparts in NRO/Reactor Systems Nuclear Performance and Code Review Branch (SRSB). Prior to completion of the audit, teleconference calls were conducted with the audit team, NRO counterparts, the NRC Project Manager for the W-SMR review and the NRO technical branch chief.

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Audit participants are listed in Table 1 below. Please note that NRC participants marked with “*” did not attend all audit phases.

Table 1: Audit Participants Summary

| <i>Last Name</i> | <i>First Name</i> | <i>Affiliation</i> |
|------------------|-------------------|--------------------|
| Costa | Arlon | NRC/NRO |
| Hsii* | Gene | NRC/NRO |
| Shaikh* | Samina | NRC/NRO |
| Frankl | Istvan | NRC/RES |
| Krotiuk | William | NRC/RES |
| Krepel* | Scott | NRC/RES |
| Yarsky | Peter | NRC/RES |
| Lien | Peter | NRC/RES |
| Staudenmeier* | Joseph | NRC/RES |
| Wang* | Weidong | NRC/RES |
| Khatib-Rahbar* | Mohsen | ERI |
| Vasavada | Shilp | ERI |
| Libby | Morgan | ERI |
| Sawant* | P. | ERI |
| Yuan* | Z. | ERI |
| Sisk | Robert | WEC |
| Wright | Richard | WEC |
| Cummins | Ed | WEC |
| Smith | Matthew | WEC |
| Kucukboyaci | Vefa | WEC |
| Monahan | Jill | WEC |

6. Information Audited in the Pre-Application Phase of the W-SMR

A large amount of proprietary information about the pre-application design of the W-SMR was requested from Westinghouse by means of information needs listings and then audited, Information requested included drawings, design reports, analyses, sample nuclear input files, etc. Due to the extent of information provided by Westinghouse, the audit team converted all audit questions to draft RAIs at the end of each audit phase to obtain the responses to the audit questions and supporting documents in electronic format. RES then requested that NRO transmit the final RAIs to Westinghouse for expeditious processing.

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Westinghouse's responses to the RAIs and their associated ADAMS accession numbers are provided in References 2 through 6.

Audit Results

7.1 Preliminary Results

The following preliminary audit results were shared with NRO and Westinghouse during the audit exit briefing held on November 20, 2013

- Preliminary status/results of the LTR (WCAP-17573) audit
 - RAIs
 1. Westinghouse was responsive during the audit process and in providing the requested information on an accelerated schedule.
 2. A Total 170 RAIs were issued. As of November 20, 2013, Westinghouse had already responded to 68 RAIs. Currently Westinghouse has provided response to all 170 RAIs.
 3. Based on the interaction during the audit, it was understood that Westinghouse was in the process of finalizing and optimizing the W-SMR design. The staff noted that it would be beneficial to receive information about any anticipated design changes as compared to the design submitted during the audit.
 - RES W-SMR PIRT (in-house)
 1. Information obtained during the audits was essential for development of independent PIRTs to support the LTR review as well as applicability assessment of NRC codes and methods.
 2. The in-house PIRTs include small break loss of coolant accidents (SBLOCA) as well as selected anticipated operational occurrences (AOOs).
 - W-SMR SBLOCA PIRT LTR
 1. In general, the Westinghouse's SBLOCA PIRT, as documented in WCAP-17573-P contained useful information. The additional information in WCAP-17573-P was documented in the form of RAIs. Review of the responses to those RAIs resulted in follow-up questions.
 2. Westinghouse will revise the LTR in response to the RAIs.
 - Development of Models for NRC code applicability assessments and confirmatory analyses.
 1. The audits resulted in the collection of significant design-related information. This information is expected to be very useful in the development of confirmatory models for application to transient and accident analysis. It is believed that few, if any, gaps in design related information will exist once the responses to the outstanding information requests are provided.
 2. Model development will start after completion of current LTR and Test Plan specific reviews.
 - Preliminary feedback on W-SMR Test Plans integral effects test / separate effects test (IET/SET)

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1. The LTR for the Westinghouse's Test Plan (WCAP-17712-P and its addenda) contains detailed information related to the scaling of each
 2. facility and the resulting test plan. The staff preliminary review is based on the proposed test matrix documented in the form of several RAIs.
 3. Preliminary feedback on the Test Plan (shown below)
- Scaling
 1. Westinghouse has indicated that a separate methodology technical report related to the scaling of the test facilities will be submitted. A brief description of the content of the planned technical 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.
 2. Preliminary feedback on Scaling (shown below)

Preliminary Feedback on W-SMR Test Plan and Scaling

General Comments:

- []. The lack of such tests and the possible reliance on past (AP600/AP1000) data needs to be adequately justified.
- Adequate justification by Westinghouse is warranted for lack of W-SMR [].
- Additional details on how the [] will be captured in the planned separate effects tests are considered necessary.
- Lack of consideration of [], except for a [] event, in determining the integral effects test matrix needs additional explanation.

Appendix A: SPES*-4 Scaling Basis:

1. [].
2. [].
3. Accuracy and completeness - The document contains several errors in scaling calculation and some important components are missing.
4. [].

*Test Facility

Addendum 2: Applied Research Laboratory Test Specification

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1. [].
2. [].
3. [].
4. Operating condition and test procedure – Need to justify pressure range and [].

7.2 Final Results

All action items identified during the audit were closed out prior to the end of the audit. NRC staff concluded that the combination of the information collected during this audit and information provided by the vendor in response to RAIs and follow-on RAIs was adequate to allow the evaluation of the Westinghouse LTR for the W-SMR SBLOCA PIRT and the development of TRACE/PARCS models for NRC code applicability assessments, and will greatly benefit the development of confirmatory models in the future.

7. References

1. WEC LTR WCAP-17573-NP, Revision 1, "Westinghouse SMR Small Break LOCA Phenomena Identification and Ranking Table," April 25, 2012 (ML121250488).
2. R. Sisk (Westinghouse) to the NRC Document Control Desk, "SMR Response to Request for Additional Information (SBLOCA PIRT)," SMR_NRC_000010, June 17, 2013 (ML13192A459).
3. R. Sisk (Westinghouse) to the NRC Document Control Desk, "SMR Response to Request for Additional Information (SBLOCA PIRT)," SMR_NRC_000014, July 19, 2013 (ML13205A334).
4. R. Sisk (Westinghouse) to the NRC Document Control Desk, "SMR Response to Request for Additional Information (SBLOCA PIRT)," SMR_NRC_000017, August 1, 2013 (ML13220A146).
5. R. Sisk (Westinghouse) to the NRC Document Control Desk, "SMR Response to Request for Additional Information (SBLOCA PIRT)," SMR_NRC_000026, October 11, 2013 (ML13291A016).
6. R. Sisk (Westinghouse) to the NRC Document Control Desk, "SMR Response to Request for Additional Information (SBLOCA PIRT)," SMR_NRC_000028, November 26, 2013 (ML13339A628).
7. In reference to the bracketed information [blank], see "Response Letter to Westinghouse on Request for Withholding WAAP-7951-P, "Westinghouse Small-break LOCA Phenomena Identification & Ranking Table (PIRT) Presentation" From Public Disclosure (ML12138A299)."

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