



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

September 24, 2021

MEMORANDUM TO: James J. Shea, Acting Chief
New Reactor Licensing Branch
Division of New and Renewed Licenses
Office of Nuclear Reactor Regulation

FROM: Gregory V. Cranston, Project Manager */RA/*
New Reactor Licensing Branch
Division of New and Renewed Licenses
Office of Nuclear Reactor Regulation

SUBJECT: AUDIT PLAN FOR THE REGULATORY AUDIT OF HOLTEC SMR
TOPICAL REPORT HI-2201064 "ELIMINATION OF THE LARGE
BREAK LOSS OF COOLANT ACCIDENT (LOCA) AND
ESTABLISHMENT OF LOCA ACCEPTANCE CRITERIA,"
REVISION 2

By letter dated December 21, 2020, (Agencywide Documents Access and Management System (ADAMS) Accession No. ML20356A018), SMR, LLC (Holtec), requested U.S. Nuclear Regulatory Commission (NRC) review and approval of Topical Report (TR) HI-2201064, "Elimination of the Large Break Loss of Coolant Accident (LOCA) and Establishment of LOCA Acceptance Criteria." Holtec, submitted a revision to the TR, HI-2201064R2 (ADAMS Accession No. ML21064A037) on March 5, 2021, to provide additional information and criteria needed to describe the methodology regarding the regulatory basis to eliminate the need to analyze a large break LOCA for the SMR-160 reactor coolant system (RCS). This TR seeks to describe the requirements and regulatory basis to eliminate the need to analyze a large break LOCA for the SMR-160 RCS. This TR also provides a description of the passive core cooling system and the passive containment heat removal system. Additionally, the TR seeks to establish LOCA acceptance criteria and the basis for how these criteria are more restrictive than the requirements in Title 10 of the *Code of Federal Regulations* 50.46, "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors." The purpose of the audit is to better understand the details and bases for the information provided in the TR.

The audit will take place via teleconference with access to the Holtec Electronic Reading Room. The audit is scheduled to start on October 4, 2021 and be complete January 28, 2022. The audit exit will be held at the end of the audit based on the availability of Holtec and NRC staff. The contents of the audit plan are provided as an enclosure.

Docket No. 99902049

Enclosure:
Audit Plan

CONTACT: Gregory Cranston, NRR/DNRL
301-415-0546

SUBJECT: AUDIT PLAN FOR THE REGULATORY AUDIT OF HOLTEC SMR TOPICAL REPORT HI-2201064 "ELIMINATION OF THE LARGE BREAK LOSS OF COOLANT ACCIDENT (LOCA) AND ESTABLISHMENT OF LOCA ACCEPTANCE CRITERIA," REVISION 2
 DATED: SEPTEMBER 24, 2021

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ADAMS Accession No: ML21263A245 ***via e-concurrence** **NRR-106**

| OFFICE | DNRL/NRLB: PM | DNRL/NRLB: LA | DSS/SNRB | DNRL/NRLB: Acting BC |
|---------------|----------------------|----------------------|-----------------|-----------------------------|
| NAME | G Cranston* | S Green* | R Patton* | J Shea |
| DATE | 9/17/2021 | 9/21/2021 | 9/23/2021 | 9/24/2021 |

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**UNITED STATES NUCLEAR REGULATORY COMMISSION
AUDIT PLAN FOR THE REGULATORY AUDIT OF
HOLTEC SMR TOPICAL REPORT
HI-2201064, “ELIMINATION OF THE LARGE BREAK LOSS OF COOLANT ACCIDENT
(LOCA) AND ESTABLISHMENT OF LOCA ACCEPTANCE CRITERIA,” REVISION 2**

Docket No. 99902049

APPLICANT: SMR, LLC. A Holtec International Company

APPLICANT CONTACT: Tammy Morin

DATE: October 4, 2021 – January 28, 2022

LOCATION: U.S. Nuclear Regulatory Commission (NRC) Headquarters/
Teleconferencing (via Holtec International, LLC Electronic
Reading Room (eRR))

AUDIT TEAM: Antonio Barrett, Office of Nuclear Reactor Regulation (NRR)
Greg Cranston (NRR)
John Honcharik (NRR)
Renee Li (NRR)
Ryan Nolan (NRR)
Thomas Scarbrough (NRR)
Rosemary Sugrue (NRR)
Zach Sweeney (NRR)
John Tsao (NRR)

I. Background

By letter dated December 21, 2020, (Agencywide Documents Access and Management System (ADAMS) Accession No. ML20356A018), SMR, LLC (Holtec), requested U.S. Nuclear Regulatory Commission (NRC) review and approval of Topical Report (TR) HI-2201064, “Elimination of the Large Break Loss of Coolant Accident (LOCA) and Establishment of LOCA Acceptance Criteria.” Holtec, submitted a revision to the TR, HI-2201064R2 (ADAMS Accession No. ML21064A037) on March 5, 2021, to provide additional information and criteria needed to describe the methodology regarding the regulatory basis to eliminate the need to analyze a large break LOCA for the SMR-160 reactor coolant system (RCS). This TR seeks to describe the requirements and regulatory basis to eliminate the need to analyze a large break LOCA for the SMR-160 RCS. This TR also provides a description of the passive core cooling system and the passive containment heat removal system. Additionally, the TR seeks to establish LOCA acceptance criteria and the basis for how these criteria are more restrictive than the requirements in Title 10 of the *Code of Federal Regulations* 50.46, “Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors.” The purpose of the audit is to better understand the details and bases for the information provided in the TR used to justify Holtec’s approach to eliminate the need to analyze for large break LOCAs and associated regulatory implications.

Enclosure

Additionally, the technical content of the TR was discussed in a public meeting on June 16, 2021 (ADAMS Accession No ML21180A465). During this meeting, several items for follow-up on the discussions were identified with respect to Holtec's response (ADAMS Accession No. ML21147A529) to the staff's request for additional information (RAI) RAI-9832 (ADAMS Accession No. ML21123A187). Portions of this audit may address those follow-up discussion items identified in the public meeting.

II. Regulatory Audit Bases

This regulatory audit is based on TR HI-2201064, "Elimination of the Large Break Loss of Coolant Accident (LOCA) and Establishment of LOCA Acceptance Criteria," Revision 2 (ADAMS Accession No. ML21064A038).

III. Regulatory Audit Scope or Methodology

The audit team will review supporting design documents, design drawings, calculations, methodology, and other related information. The audit team will also meet with subject matter experts to discuss details of the information supporting HI-2201064.

IV. Information and other Material Necessary for Audit

The NRC staff requests that the following material and information be made available for audit, to the extent that such documentation is available at this stage of the design. This will better inform the staff's review of the proposed design criteria specified in the TR that could be applied during a future licensing action once final design details are available. In our experience these types of documents, to the extent that they are available, can be helpful in providing valuable insights or resolving technical issues similar to those presented by the TR:

1. Documents and related information, such as drawings, that describe design features or provide design details that would mitigate a potential loss of coolant through the steam generator (SG) riser or reactor pressure vessel (RPV)/SG connection.
2. Documents and related information with respect to defense-in-depth, possible operator actions or other operational considerations which may exist to mitigate a potential loss of coolant through the SG riser or RPV/SG connection. This information can provide insights about the capability for actions that are available for an operator or initiate automatically, such as isolation of the RPV/SG or available refill/inventory makeup methods.
3. Documents or related information, such as preliminary sensitivity analyses, that provide potential plant responses for the types and sizes of breaks that may occur for the subject locations including drawings of the potential areas.
4. Documents or drawings that provide specifications regarding the types of welds to be implemented at various locations such as the cross duct or planar inter vessel forging (PIF)-to-SG and SG riser locations. Relevant specifications or drawings include geometric configuration, weld fabrication details, weld joint details, and stress state including operational stresses as available.

5. Documents that convey procedures as to how field welding of the cross duct PIF to the SG will be performed and how such welding will affect residual stresses in the subject weld.
6. Documents and related information for the PIF and SG riser geometries with respect to ensure accessibility as well as inspect-ability. Documents and drawings that provide information that confirms that the welds will achieve 100 percent examination coverage when performing inspection using ultrasonic testing, magnetic particle testing, and penetrant testing in accordance with the American Society of Mechanical Engineers Code, Section XI.
7. Documents that clearly define various parameters of the welds within the SG riser such as the number of welds and materials, how the welds will be installed at the riser with respect to the support plates in the SG, and associated properties, to be used.
8. Documents that provide information regarding the proposed thermal sleeve/liner and its role in preventing corrosion in the reactor coolant pressure boundary (RCPB) and other information about the role of the thermal liner with respect to the reliability of the reactor coolant boundary.
9. Documents that provide information regarding the location and design analysis of SG riser welds with respect to expected pressure differential, temperature, and environmental conditions and expected performance of the RCPB for those conditions.
10. Documents that provide a basis of comparison of the proposed excluded welds (i.e., the welds associated with PIF and SG) to those of current operating reactor vessels by virtue of both similarities and differences.
11. Documents and related information with respect to the methodology of the fracture mechanics analysis to be performed and the associated acceptance criteria. Documents that specify both deterministic as well as probabilistic fracture mechanics analysis that will be used to demonstrate the extremely low probability of failure of the PIF and SG riser.
12. Documents that address whether PIF will be susceptible to thermal (aging) and/or hydrogen embrittlement.
13. Documents that provide details about a local leakage detection system that will be employed to detect leakage from welds in RPV/SG connection and SG riser.
14. Documents that provide the plan that Holtec intends to employ for comprehensive vibration assessment program.
15. Documents that provide information related to welds and/or forgings of the Combined Vessel with respect to being susceptible to water and/or steam hammer loads.

V. Audit Team Assignments

The audit team includes:

- Antonio Barrett, NRR (Technical Reviewer)
- Greg Cranston, NRR (Project Manager and Audit Lead)
- John Honcharik, NRR (Technical Reviewer)
- Renee Li, NRR (Technical Reviewer)
- Ryan Nolan, NRR (Technical Reviewer)
- Thomas Scarbrough, NRR (Technical Reviewer)
- Rosemary Sugrue, NRR (Technical Reviewer)
- Zach Sweeney, NRR (Technical Reviewer)
- John Tsao, NRR (Technical Reviewer)

VI. Logistics

Date: October 4, 2021 – January 28, 2022

Location: U.S. Nuclear Regulatory Commission (NRC) Headquarters
(via Holtec International; SMR, LLC Electronic Reading Room (eRR))

VII. Special Requests

The NRC staff requests that Holtec provide subject matter experts, if necessary, to discuss the details of the audit material requested in Section IV of this audit plan.

VIII. Deliverables

An audit report will be prepared and issued in accordance with NRR LIC-111, "Regulatory Audits," within 90 days following the completion of the audit.