

U.S. NUCLEAR REGULATORY COMMISSION SUMMARY OF THE AUGUST 30, 2023,
OBSERVATION PREAPPLICATION PUBLIC MEETING
WITH SMR, LLC (A HOLTEC INTERNATIONAL COMPANY)
TO DISCUSS THE SMR-160 REACTOR PRESSURE VESSEL EMBRITTLMENT

Meeting Summary

The U.S. Nuclear Regulatory Commission (NRC) held an observation public meeting on August 30, 2023, with SMR, LLC (SMR), a Holtec International Company (Holtec), to discuss preapplication information related to the SMR-160 reactor pressure vessel embrittlement.¹ Specifically, SMR (Holtec) requested the meeting to discuss and receive NRC staff feedback on the potential application of various embrittlement trend curves to the SMR-160 design. SMR (Holtec) provided presentation slides for the public meeting.²³ This meeting summary satisfies the SMR (Holtec) request for review and feedback on its preapplication meeting materials.

Preapplication engagements, including this meeting, provide an opportunity for the NRC staff to engage in early discussions with a prospective applicant to offer licensing guidance and to identify potential licensing issues early in the licensing process. No decisions or commitments were made during the preapplication meeting.

This virtual observation preapplication meeting had attendees from SMR (Holtec), PEAI Consulting, and NRC staff. There were no members of the public observing the meeting. The NRC staff and SMR (Holtec) discussed proprietary information during the closed session.

After opening remarks and introductions, SMR (Holtec) started the presentation with the objective of the meeting to provide SMR's plans to use a unique methodology to predict neutron embrittlement, to justify the use of that methodology and to execute a surveillance plan.

To support a more efficient meeting, and because no members of the public were observing the meeting, the NRC staff and the prospective applicant moved into the closed portion of the meeting to discuss proprietary information.

¹ Letter from A. Brenner, "SMR, LLC Preapplication Meeting Materials for August 30, 2023 (Project No. 99902049)," dated August 17, 2023, Agencywide Documents and Access Management System (ADAMS) Accession No. ML23229A592, part of ML23229A591.

² SMR, LLC, "Enclosure 2: SMR, LLC Meeting Presentation Materials for August 30, 2023," dated August 17, 2023, ML23229A594 – Public, part of ML23229A591.

³ SMR, LLC, "Enclosure 1: SMR, LLC Meeting Presentation Materials for August 30, 2023 (P)," dated August 17, 2023, ML23229A593 – Proprietary, part of ML23229A591.

The following summarizes the discussion during the meeting:

- As an introduction to the meeting, SMR(Holtec) provided a summary of the February 22, 2023, public meeting to discuss SMR-160 reactor pressure embrittlement.⁴ This introduction included brief discussions on the use of the American Society of Mechanical Engineers (ASME) SA-508 Grade 3, Class 2 base material, cold leg/irradiation temperature, and maximum estimated neutron fluence.
- SMR (Holtec) discussed the applicability of Regulatory Guide 1.99, “Radiation Embrittlement of Reactor Vessel Materials,” Revision 2, May 1988 (ML003740284), for temperatures equal to or greater than 525F (which is not applicable to SMR-160 since they operate at a lower temperature). SMR (Holtec) stated they would be using alternate industry standards. These are American Society for Testing and Materials (ASTM) E900, “Standard Guide for Predicting Radiation-Induced Transition Temperature Shift in Reactor Vessel Materials,” which includes applicable temperature dependent terms and Electric Power Research Institute (EPRI) Material Reliability Program (MRP) document EPRI MRP-462, “Methods to Address the Effects of Irradiation Embrittlement in Section XI of the ASME Code (MRP-462) Estimation of an Irradiated Reference Temperature using either Traditional Charpy Approaches or Master Curve Data.”

The NRC staff stated that EPRI MRP-462, Revision 0, November 2021, is currently under revision and that there is a Code Case N-914 under review by the code committee related to the EPRI document. The staff also noted that the Revision 1 to the EPRI document could be published by the end of the year but there is no forecast date. NRC will, at a later date, vote on the code case action which is derived from Revision 0 of the EPRI Report. SMR (Holtec) stated that the approach they will be using for predicting reference temperature shift due to irradiation is unchanged in the new revision and that the code case implements the ASTM-E900 equation for determining ΔT_{41J} term discussed in the presentation. Therefore, SMR (Holtec) expects their approach to remain sound.

- SMR(Holtec) acknowledged that operating at lower temperatures plays a significant role in the extent of neutron embrittlement. SMR(Holtec) stated that the two main types of damage are generally copper (Cu) clusters and matrix damage and, therefore, they will be specifying very low Cu content and reviewing a wide range of industry metallurgical data to determine the best metallurgy to be used for the specified alloy that will be used for the RPV base metal. SMR(Holtec) stated that they will be modifying the ASTM-E900 fit (EPRI MRP-462 correlation) to account for low temperature data. This modification is not related to the code case.
- SMR (Holtec) discussed the SMR-160 surveillance program which will generally follow Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Appendix H, “Reactor Vessel Material Surveillance Program Requirements.” Appendix H references the ASTM Standard E185-82, “Standard Practice for Design of Surveillance Programs for Light-Water Moderated Nuclear Power Reactor Vessels,” which is not all ideal for SMR-160. For example, SMR (Holtec) is considering

⁴ Meeting Summary of Public Meeting with SMR, LLC, a Holtec International Company, to Discuss SMR-160 Reactor Pressure Vessel Embrittlement ML23045A015, part of ML23045A010).

replacing weld metal specimens with additional base metal. The NRC staff indicated that not monitoring welds could be a concern and that SMR (Holtec) would need appropriate justification in their exemption request regarding exceptions from Appendix H. SMR (Holtec) provided information that there are no welds at the peak fluence location in the RPV beltline. The fluence at the welds above and below the RPV beltline forging is predicted to be <25% of the peak fluence but is high enough that they will consider irradiation damage in their analysis.

- The NRC staff asked for information on whether the surveillance data for embrittlement would be used to meet the requirements in 10 CFR Part 50, Appendix H and whether the surveillance program would be consistent with the guidance in ASTM Standard E185. In response to the NRC staff's question, SMR (Holtec) described its plans to meet the requirements in 10 CFR Part 50, Appendix H and in Appendix G, "Fracture Toughness Requirements," and to use the surveillance data to validate its calculations.
- SMR (Holtec) stated they do not plan to obtain fracture toughness (K_{Ic}) data from three heats of material before construction as required by ASME Section XI, "Rules for Inservice Inspection of Nuclear Power Plants Components," Appendix G, because the 2021 version of the ASME code provides an exemption from this requirement. NRC staff stated that the 2021 version of the ASME code has not yet been approved by the NRC and further discussions in this issue will be required.

The meeting was adjourned.