

**U.S. NUCLEAR REGULATORY COMMISSION SUMMARY OF THE MAY 25, 2023,**  
**OBSERVATION PREAPPLICATION PUBLIC MEETING**  
**WITH SMR, LLC (A HOLTEC INTERNATIONAL COMPANY)**  
**TO DISCUSS PROPRIETARY INFORMATION REGARDING**  
**THE SMR-160 LOSS-OF-COOLANT ACCIDENT ANALYSIS**

**Meeting Summary**

The U.S. Nuclear Regulatory Commission (NRC) held an observation public meeting on May 25, 2023, with SMR, LLC (SMR), a Holtec International Company (Holtec), to discuss preapplication information related to the SMR-160 loss-of-coolant accident (LOCA) analysis.<sup>1</sup> Specifically, SMR (Holtec) requested the meeting to discuss proprietary information related to its LOCA analysis and to receive NRC staff feedback on its questions related to this topic in its presentation materials and its White Paper.<sup>2, 3</sup> SMR (Holtec) submitted a revised letter requesting a written assessment of its White Paper.<sup>4</sup>

This virtual closed meeting had attendees from SMR, LLC, Holtec, and NRC staff. The NRC staff and SMR (Holtec) discussed proprietary information during this meeting.

Preapplication engagements, including this meeting, provide an opportunity for the NRC staff to conduct early discussions with a prospective applicant to offer licensing guidance and to identify potential issues early in the licensing process. The NRC staff did not make any decisions or commitments during the meeting.

The following provides a high-level summary of the proprietary discussion during the meeting:

- After introductions, SMR (Holtec) described the purpose of the meeting to discuss the details of a potential regulatory exemption request related to the SMR-160 planar inter-vessel forging (PIF) and steam generator (SGE) riser, including acceptance criteria to justify the potential exemption.

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<sup>1</sup> Letter from J. Hawkins, "SMR, LLC Preapplication Meeting Materials for May 25, 2023," dated May 16, 2023, Agencywide Documents and Access Management System (ADAMS) Accession No. ML23142A005, part of ML23142A004.

<sup>2</sup> SMR, LLC, "Enclosure 1 - SMR, LLC Meeting Presentation Materials for May 25, 2023," dated May 25, 2023, ML23142A006 – Proprietary, part of ML23142A004.

<sup>3</sup> SMR, LLC, "Enclosure 2 - HI-2230397 Rev. 0, SMR-160 LOCA Exemption Request Language and Acceptance Criteria White Paper for May 25, 2023," dated May 25, 2023, ML23142A007 – Proprietary, part of ML23142A004.

<sup>4</sup> SMR, LLC, "Revision 1 to the Letter Dated May 17, 2023, Regarding SMR, LLC, Preapplication Meeting Materials for May 25, 2023," dated May 23, 2023, ML23143A199.

- SMR (Holtec) provided details on the assumptions in its proposal including crack initiation, leakage, break size(s), and failure probabilities.
- The NRC staff observed that SMR (Holtec) should consider the proposal with respect to other analyses and regulatory requirements and pointed to Draft Regulatory Guide (DG)-1322<sup>5</sup> for insights into risk-informing the transition break size.
- The NRC staff commented that the hypothetical accident referred to in 10 CFR 50.46(c)(1) is not tied to a frequency of occurrence and that the postulated LOCAs in 10 CFR Part 50, Appendix A, applies more broadly to breaks in the reactor coolant system including piping.<sup>6, 7</sup>
- The NRC staff noted that an applicant applying a risk-informed approach would still need to perform a deterministic analysis to meet the regulations but with flexibilities to support any special circumstances in its design and address aspects of defense-in-depth, safety margins, and performance monitoring. The NRC staff referred to its previous feedback summarized in an SMR (Holtec) White Paper and supplemented with information in a meeting summary.<sup>8, 9</sup>
- The NRC staff commented that including more design-specific information in the proposal for the SMR-160 could support a more efficient review. The NRC staff also noted that it would need to further consider the cascading effect of the proposal on other requirements such as 10 CFR Part 50, Appendix A, General Design Criterion 35.<sup>10</sup>
- The NRC staff noted that a reference to a draft guide on Slide #12 has been issued as final in RG 1.233.<sup>11</sup>
- In response to an SMR (Holtec) question, the NRC staff referenced RG 1.174 which contains guidance on addressing the principles of risk-informed decision-making, including the interpretation and implementation of the defense-in-depth philosophy, safety margins, and performance monitoring.<sup>12</sup>

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<sup>5</sup> U.S. NRC, Draft Regulatory Guide DG-1322, “Risk-Informed Approach for Addressing the Effects of Debris on Post-Accident Long-Term Core Cooling,” Proposed Revision 0.

<sup>6</sup> Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.46, “Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors.”

<sup>7</sup> 10 CFR Part 50, Appendix A, “General Design Criteria for Nuclear Power Plants.”

<sup>8</sup> SMR (Holtec), “SMR, LLC Basis for Future LOCA Exemption Request,” dated October 3, 2022.

<sup>9</sup> U.S. NRC, “10-19-22 Meeting Summary with SMR, LLC, a Holtec International Company, to Discuss Loss-of-Coolant Accident Analysis,” dated January 30, 2023.

<sup>10</sup> 10 CFR Part 50, Appendix A, General Design Criterion 35, “Emergency Core Cooling.”

<sup>11</sup> RG 1.233, “Guidance for a Technology-Inclusive, Risk-Informed, and Performance-Based Methodology to Inform the Licensing Basis and Content of Applications for Licenses, Certifications, and Approvals for Non-Light Water Reactors,” Revision 0, June 2020.

<sup>12</sup> U.S. NRC, Regulatory Guide 1.174, “An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis,” Revision 3, January 2018.

- SMR (Holtec) confirmed that the results from the probabilistic fracture mechanics (PFM) codes used in its analyses will be benchmarked to other PFM codes and results for vessels and pipes. The NRC staff emphasized that the information previously discussed during the October 19, 2022, public meeting would still apply and needs to be addressed. In response to an SMR (Holtec) question, the NRC staff confirmed that acceptance criteria would be needed for each materials analysis previously discussed to demonstrate that the PIF weld joint is robust with a low probability of failure and that the PIF weld joint is accessible for preservice and inservice inspections.
- The NRC staff noted that understanding the loadings seen by the component is important for the PFM analysis. The PFM analysis should consider the loading for the life of the component, e.g., loading experienced as part of fabrication, and operational loadings from pressure, vibration, and transients. The NRC staff referenced RG 1.245 for the PFM analysis.<sup>13</sup>
- The NRC staff requested clarification concerning how uncertainty associated with the PFM analysis would be taken into account. SMR (Holtec) indicated that further information on that topic could be provided at a future date.
- The NRC staff identified the need to address uncertainty in the probabilistic risk assessment and referenced NUREG-1855 and the discussion in the *Federal Register* notice issuing RG 1.174.<sup>14, 15</sup>

The meeting was adjourned at 11:50 AM.

After the meeting, the NRC staff provided the following clarification to what was discussed during the meeting:

In the Final Policy Statement on the use of probabilistic risk assessment methods in nuclear regulatory activities ([60 FR 42622, August 16, 1995](https://www.federalregister.gov/documents/1995/08/16/60-fr-42622)), the Commission noted that it was not its intent to replace traditional defense-in-depth concepts with probabilistic risk assessment (PRA) but to exploit the use of PRA insights to further understand the risk and improve risk-effective safety decision-making in regulatory matters. Therefore, the probabilistic approach to regulation is considered an extension and enhancement of traditional regulations by considering risk in a more coherent and complete manner. PRA plays a complementary role to focus the traditional deterministic-based regulations and support the defense-in-depth philosophy. The policy statement sets an expectation on the expanded use of PRA and data in a manner that complements the NRC's deterministic approach and supports the defense-in-depth philosophy.

In applying a risk-informed approach, the NRC looks at the probability of an event and its possible consequences to understand its importance (risk). The NRC staff asks

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<sup>13</sup> U.S. NRC, Regulatory Guide 1.245, "Preparing Probabilistic Fracture Mechanics (PFM) Submittals," Revision 0, January 2022. <https://www.nrc.gov/docs/ML2133/ML21334A158.pdf>

<sup>14</sup> U.S. NRC, NUREG-1855, "Guidance on the Treatment of Uncertainties Associated with PRAs in Risk-Informed Decisionmaking," Final Report, July 2016. <https://www.nrc.gov/reading-rm/doc-collections/nureqs/staff/sr1855/>

<sup>15</sup> *Federal Register* notice, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," (83 FR 4520, January 31, 2018). <https://www.govinfo.gov/content/pkg/FR-2018-01-31/pdf/2018-01901.pdf>

questions of what can go wrong, how likely it is, and what are the consequences. The answers guide the approach for those issues that are most important to the health and safety of the public and the environment. The risk-informed approach is guided by five key principles: current regulations met, defense-in-depth consistency, maintenance of safety margins, risk-informed analysis, and performance monitoring. The risk-informed integrated decisionmaking process characterizes how risk information is used and, more specifically, clarifies that such information is one element of the decision-making process. That is, decisions are expected to be reached in an integrated fashion, considering traditional engineering and risk information, and may be informed by qualitative and quantitative risk insights.

The NRC staff referenced RG 1.174 as a guide to clarify what is meant by “risk-informed,” and was not indented as a prescriptive resolution for this issue. The NRC staff expects an applicant to perform thermal-hydraulic analyses to demonstrate adequate LOCA mitigation capabilities and acceptable consequences beyond containment integrity. Additional details are provided below.

The NRC staff expects events such as the breaks of the SMR-160 PIF and hot leg riser to be evaluated as part of the LOCA Evaluation Model with modification, as appropriate. The NRC staff notes that the mitigation analysis for the beyond-design-basis (BDB) break sizes could be performed in a realistic or best-estimate manner. SMR (Holtec) could consider the model discussed in SECY-10-0161:<sup>16</sup>

... the emergency core cooling system design requirements for pipe breaks larger than the transition break size (TBS) may be analyzed using fewer conservative assumptions based on their lower likelihood. Although LOCAs for break sizes larger than the transition break would become beyond-design-basis accidents, these breaks will still be subject to regulatory control... licensees maintain the ability to mitigate all LOCAs, up to and including the Double-ended Guillotine Break of the largest reactor coolant system pipe. However, mitigation analyses for LOCAs larger than the TBS need not assume the loss-of-offsite power or the occurrence of a single failure.

The NRC staff previously provided feedback to consider at least a nominal best-estimate analysis for the breaks in question for the reasons noted above and potential similar frequency to other BDB events that are analyzed in a similar way, such as ATWS. It should be noted that the rulemaking described in SECY-10-0161 has been discontinued ([81 FR 69446, October 6, 2016](https://www.federalregister.gov/doc/81/69/2016/10/06/2016-20446)).

During the October 19, 2022, public meeting, SMR (Holtec) provided a White Paper that summarized the NRC staff feedback on the SMR (Holtec) previously submitted topical report.<sup>8</sup> The NRC staff understood that the White Paper will be used as a basis for its future exemption request related to the LOCA regulation.<sup>6</sup> The White Paper identified deterministic analyses for fracture mechanics analyses and design-basis LOCA. The NRC confirmed that the information in the White Paper was consistent with its feedback and provided additional information for consideration during the public meeting and in

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<sup>16</sup> U.S. NRC, SECY-10-0161, “Final Rule: Risk-Informed Changes to Loss-of-Coolant Accident Technical Requirements (10 CFR 50.46(a)) (RIN 3150-AH29),” dated December 10, 2010. <https://www.nrc.gov/docs/ML1022/ML102210460.pdf>

Enclosure 4 to the public meeting.<sup>9, 17</sup> The NRC staff anticipated that subsequent LOCA exemption update discussions would build upon the information discussed during the October 19, 2022, meeting.

However, during the May 25, 2023, LOCA exemption update public meeting, SMR (Holtec) proposed an exemption to the definition of LOCA described in its proprietary report, HI-2230397 Revision 0.<sup>3</sup> An exemption to the LOCA definition was first discussed during this meeting. The NRC staff is not clear how the LOCA definition exemption fits in with the information discussed during the October 19, 2022, meeting, and whether SMR (Holtec) still plans to address the NRC feedback discussed during the October 19, 2022, public meeting. The NRC staff plans to issue an assessment of the SMR (Holtec) proposed exemption to the definition of LOCA described in HI-2230397 Revision 0.

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<sup>17</sup> U.S. NRC, “Enclosure 4 - Staff Observations on Materials for 10-19-22 Meeting with SMR, LLC, a Holtec International Company, to Discuss Loss-of-Coolant Accident Analysis,” dated January 30, 2023. <https://www.nrc.gov/docs/ML2230/ML22304A002.pdf>