

U.S. NUCLEAR REGULATORY COMMISSION SUMMARY OF THE SEPTEMBER 27, 2023,
OBSERVATION PREAPPLICATION PUBLIC MEETING
WITH SMR, LLC (A HOLTEC INTERNATIONAL COMPANY)
TO DISCUSS THE SMR-160
NEW AND SPENT FUEL MANAGEMENT PROGRAM

Meeting Summary

The U.S. Nuclear Regulatory Commission (NRC) held an observation public meeting on September 27, 2023, with SMR, LLC (SMR), a Holtec International Company (Holtec), to discuss the SMR-160 new and spent fuel management program.¹ SMR (Holtec) provided presentation slides to support the discussion during the public meeting with accompanying affidavit pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 2.390.^{2,3,4} This meeting summary satisfies the SMR (Holtec) request for review and feedback on its preapplication meeting materials.

This virtual observation preapplication meeting had attendees from SMR (Holtec), NRC staff, and members of the public. During the closed session of the meeting, SMR (Holtec) and NRC staff discussed proprietary information.

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.

The following summarizes the discussion during the open session of the meeting:

The open session started at 1:30 PM.

- Following the NRC staff's opening remarks and introductions, SMR (Holtec) opened its presentation with the meeting agenda, purpose, and desired outcome of the meeting. The purpose was to familiarize NRC staff with the SMR-160 fuel management program for both new and spent fuel assemblies, and the desired outcome was to obtain feedback from the NRC staff on licensing assumptions made in the fuel management program.

¹ Letter from A. Brenner, "Submittal of SMR, LLC, Preapplication Meeting Materials for September 27, 2023," September 19, 2023, Agencywide Documents and Access Management System (ADAMS) Accession No. (ML23262B223), part of (ML23262B222).

² SMR, LLC, Enclosure 1: "SMR, LLC Meeting Presentation Materials for September 27, 2023 (P), New and Spent Fuel Management Program" September 27, 2023, (ML23262B224) - Proprietary, part of (ML23262B222).

³ SMR, LLC, Enclosure 2: "Enclosure 2: SMR, LLC Meeting Presentation Materials for September 27, 2023 (NP)," September 27, 2023, (ML23262B225), part of (ML23262B222).

⁴ SMR, LLC, Enclosure 3: "Enclosure 3: Affidavit Pursuant to 10 CFR 2.390 to Withhold Information from Public Disclosure (NP)," September 19, 2023, (ML23262B226), part of (ML23262B222).

- The NRC staff noted that the fuel multipurpose containers (MPCs) are licensed under 10 CFR Part 72 to transport and store spent fuel assemblies for long term storage, and added that the MPCs would likely need to also be licensed under 10 CFR Part 50 for handling new fuel.^{5,6} The NRC staff added that the intended use and the potential proximity of two reactor cores inside containment (the power generating reactor and the MPC storage reactor) should be taken into consideration when selecting the exact version or model for MPC-37 considering aspects such as burnup credit or soluble credit. The NRC staff advised SMR (Holtec) to look at relevant studies conducted by Argonne National Laboratory on the proximity of two reactor cores for system response and code benchmarking.
- SMR (Holtec) stated that the maximum fuel enrichment would be less than 5% and that fuel specifics are still being designed. The NRC staff advised SMR (Holtec) to look at the maintenance of subcriticality.
- SMR (Holtec) clarified that the current plan is to have a central new fuel vault shared by multiple reactor units.
- The NRC staff pointed out that there is currently no specific regulation that covers using MPCs for new fuel storage. The NRC staff added that the SMR (Holtec) fuel management proposal is similar to the wet canister transfer process between reactor units employed by the Indian Point Energy Center (IPEC) and the subject of a 2009 License Amendment Request.⁷ The NRC staff postulated that a similar review and regulatory perspective would likely take place, and SMR (Holtec) would have to address similar considerations. The NRC staff acknowledged that there are notable differences such as the IPEC process being used for transfer of fuel between reactor units, whereas the SMR (Holtec) process is for transfer within a reactor. Normally MPCs licensed under 10 CFR Part 72 for loading spent fuel for disposal are not repeatedly used and are welded shut. For new fuel transport, repeated use of the MPC will occasionally occur as a dry ask campaign will not occur during every refueling. This repeated use of the MPC and other “first of a kind” or unique aspects of the SMR (Holtec) process will need to be addressed. For the repeated use of an MPC, the effects of induced cyclic fatigue and loading on the MPC, support structures, and fuel lifting and handling equipment would need to be analyzed and considered in the final design.
- SMR (Holtec) pointed out that for moving spent fuel out of the reactor, a lid over the MPC is required for shielding and prevention of foreign material exclusion (FME). The NRC staff pointed out that there is no specific regulation regarding the MPCs handling new fuel and therefore, no regulation on MPC lid requirements. At a minimum, the requirements of 10 CFR 50.68 must be met when handling new fuel.⁸ The NRC staff estimated that providing an MPC lid would be a good idea for FME and to not splash

⁵ 10 CFR Part 72, “Licensing Requirements for the Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste, and Reactor-Related Greater Than Class C Waste.”

⁶ 10 CFR Part 50, “Domestic Licensing of Production and Utilization Facilities.”

⁷ Letter from Entergy to U.S. NRC, “Indian Point, Units 2 & 3 - Response to Request for Additional Information re Inter-Unit Spent Fuel Transfer License Amendment Request, October 5, 2010, (ML102910511).

⁸ 10 CFR 50.68, “Criticality Accident Requirements.”

water out of the MPC when lifting off the low profile train and moving fuel over the spent fuel pool (SFP).

- In terms of cooling, SMR (Holtec) clarified that the SFP cooling system, the residual heat removal system, and the safety-related cooling water level makeup systems will be in continuous operation or available during the fuel movement process, similar to system operations when the plant is shut down.
- SMR (Holtec) noted that the MPCs have dedicated attachment components and landing points within the SFP that will be seismically evaluated to prevent unintentional movement. Currently these components and points are being evaluated and are subject to modifications before their design is finalized.
- The NRC staff recommended that SMR (Holtec) consider fuel transfer safe load paths in terms of navigating around other equipment, access to laydown areas, fuel and MPC movement components, heavier loads handled by lifting and laydown components, and confirmation of operations within range of fuel lifting and handling equipment. SMR (Holtec) acknowledged and indicated that early analysis on safe load paths was done, and modeling is currently being done with their fuel handling vendors.
- The NRC staff confirmed that the MPC is essentially a fuel containment unit that is temporarily loaded on SFP storage racks, and pointed out that the MPC contained fuel would experience less mixing and cooling flow within the SFP. SMR (Holtec) explained that the fuel loading process would be the same as any loading operation involving a fuel loading in a flooded SFP and natural circulation cooling in pool is credited. The NRC staff brought up the concern that depending on the soluble Boron content, Boron liquid stratification may occur in the MPC if fuel is left in the MPC for an extended period of time. SMR (Holtec) acknowledged the concern and indicated it would review comparable industry practices and take the concern into consideration.
- NRC staff noted that computing spent fuel decay heat is not based on an American National Standards Institute standard baseline, but rather specific computations of decay heat per fuel assembly, assuming a burn up of 60 GW days, summing up the decay heat for total assemblies, and factoring in decay time.
- The proposed SMR (Holtec) fuel management process results in a mix of spent fuel and new fuel in the MPC. The NRC staff pointed out that until all the new fuel is transferred to the SFP rack, and out of the MPC, the criticality requirements of 10 CFR 50.68 would have to be met. There is an unspecified demarcation line in the process where 10 CFR Part 50 licensing (for new fuel) would switch to 10 CFR Part 72 (for spent fuel ready to go to dry cast storage). The mix of fresh and spent fuel is unique situation that will need further consideration.

The open session ended at 2:55 PM.

The closed session started at 2:58 PM.

The following summarizes the closed session discussion:

- The closed session discussed similar topics as the open session, going into proprietary details on the fuel management process, MPC, SFP, containment, fuel movement equipment, and decay heat analysis.
- SMR (Holtec) clarified details on the new fuel storage rack design and pointed out that, in contrast to typical pressurized water reactors designs, the spent fuel rack is embedded in the ground with a concrete wall around it. The spent fuel rack anchoring mechanism was discussed, and the NRC staff advised that SMR (Holtec) analyze and consider seismic requirements and cracking of support and concrete components.
- Moving new fuel directly into the reactor core vice temporarily placing it in SFP racks was discussed. Benefits in the direct option included minimizing fuel movements, and benefits of the temporary option included being able to perform the spent fuel dry cask storage process sooner and saving days on the overall refueling outage. SMR (Holtec) indicated that various options in the fuel management process were still under review.
- The NRC staff pointed out that the initial fuel loading would likely need to be a separate safety analysis from the steady state refueling fuel management operation, and that typically initial fuel loading is a dry process. SMR (Holtec) acknowledged and indicated that best industry practices would be reviewed and considered in their final process.
- The NRC staff pointed out that dosage rates related to spent fuel removal and the minimum water levels for various fuel movements (refueling, normal operations, in transient fuel, etc.) to provide necessary cooling, to minimize dosage to workers, and to prevent inadvertent drain down should be considered in the final process and design. SMR (Holtec) acknowledged these considerations and noted that the proposed refueling cavity is much deeper than a typical pressurized-water reactor.

The meeting was adjourned at 3:28 PM.