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NRC Meeting:
SFP Makeup

October 18, 2022

Meeting Agenda

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- Introductions
- Purpose & Outcome
- Overview of SMR-160 SFP and Makeup Systems
- Regulations and Guidance
- Recent Designs
- Questions provided to NRC
- Open Forum

Introductions

- NRC staff
- Holtec staff

Purpose & Outcome

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PURPOSE: to give a high-level overview of Holtec's design of the SMR-160 Spent Fuel Pool (SFP), safety-related makeup methods, and the associated regulatory requirements.

OUTCOME: To obtain feedback from the NRC staff on SFP makeup regulations and understand how they apply to the SMR-160 design.

Overview of SMR-160 SFP

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- The SMR-160 SFP is uniquely located inside containment thereby increasing overall safety to the public.
- SFP has a minimum of approximately 80,500 gallons of water during normal operations and 232,900 gallons of water during refueling operations.
- All penetrations are safety related and all but two (PCMWT balance line) are at least 10 ft above the top of the fuel storage racks.
- The SFP cooling system is not safety related.

Overview of SMR-160 SFP Makeup Systems

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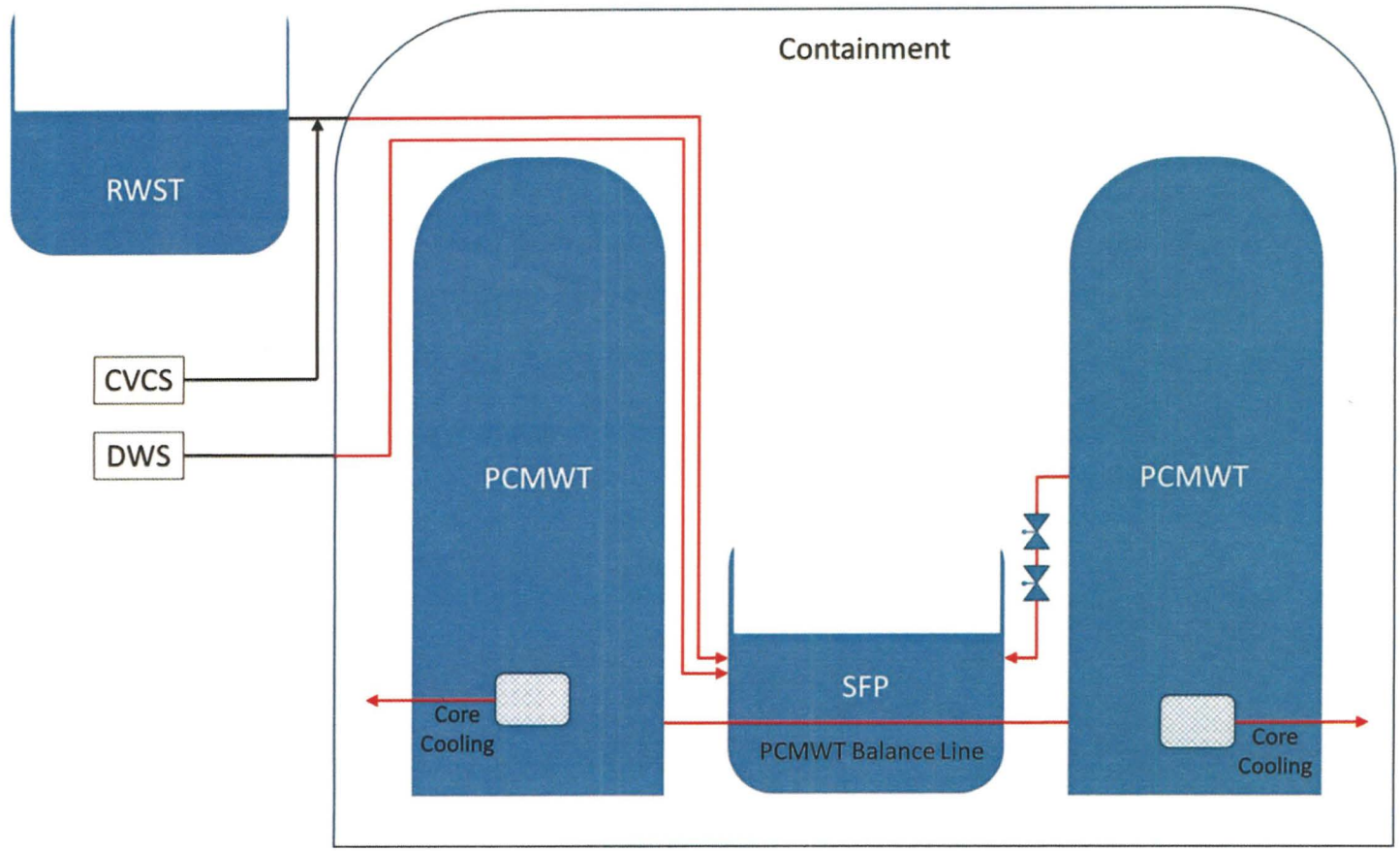
- The SFP normal makeup sources are the DWS (unborated makeup) and the CVCS (borated makeup).
- The refueling water storage tank supplies borated water to flood up the SFP during refueling.
- A permanently installed connection to a Passive Core Makeup Water Tank supplies safety related makeup water.
- Preliminary SFP boiloff calculations show makeup is not needed for at least 72 hours following bounding emergency core offload conditions and sufficient makeup is available for at least 7 days.

Overview of SMR-160 SFP Makeup Systems



Overview of SMR-160 SFP Makeup Systems

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Regulations and Guidance

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- GDC 61, *Fuel storage and handling and radioactivity control*, states:
  - The fuel storage and handling, radioactive waste, and other systems which may contain radioactivity shall be designed to assure adequate safety under normal and postulated accident conditions. These systems shall be designed (1) with a capability to permit appropriate periodic inspection and testing of components important to safety, (2) with suitable shielding for radiation protection, (3) with appropriate containment, confinement, and filtering systems, (4) with a residual heat removal capability having reliability and testability that reflects the importance to safety of decay heat and other residual heat removal, and (5) to prevent significant reduction in fuel storage coolant inventory under accident conditions.

Regulations and Guidance

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- SRP 9.1.3, *Spent Fuel Pool Cooling System*, Review Procedures 1.F states:
  - A seismic Category I, Quality Group C makeup system and an appropriate backup method to add coolant to the spent fuel pool are provided. If the forced-circulation cooling system is designed to seismic Category I, Quality Group C standards, the backup system need not be a permanently installed system, or Category I, but should take water from a seismic Category I source. Otherwise, the backup system should also be permanently installed, physically separate and independent from the primary makeup system, and designed to seismic Category I, Quality Group C standards. The minimum makeup capacity for each system exceeds the larger of the pool leakage rate assuming spent fuel pool liner perforation resulting from a dropped fuel assembly or the evaporation rate necessary to remove 0.3 percent of the reactor rated thermal power. The design permits initiation of makeup water flow through either system from locations remote from the operating floor surrounding the pool surface. Engineering judgment and comparison with plants of similar design are used to determine that the time necessary to align systems and connect makeup systems not permanently installed is consistent with heatup times or expected leakage from structural damage.

Regulations and Guidance

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- RG 1.13, *Spent Fuel Storage Facility Design Basis*, Regulatory Position C.8 Makeup Water states:
  - A Quality Group C, Seismic Category I makeup system should be provided to add coolant to the pool. Appropriate redundancy or a backup system for filling the pool from a reliable source, such as a lake, river, or onsite Seismic Category I water-storage facility, should be provided. If the spent fuel pool cooling system is designed to the requirements of Quality Group C, Seismic Category I, the backup to the makeup system need not be permanently installed or designed to Seismic Category I requirements; however, the backup system should still take water from a Seismic Category I source. The makeup system and its backup should have redundant flowpaths for providing water to the storage pool. The capacity of the makeup systems should exceed the larger of (1) the pool leakage rate, assuming spent fuel pool liner perforation resulting from a dropped fuel assembly, or (2) the evaporation rate necessary to remove 0.3 percent of the rated reactor thermal power.

NuScale

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- Primary safety-related makeup source – flow from UHS over maximum weir gate height. Sufficient for an estimated 30 days.
- Backup safety-related makeup source – a permanently installed pipe from the UHS to the SFP.
- UHS is only source of safety-related makeup.

AP1000 (Westinghouse)

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- Primary safety-related makeup source – flow from cask washdown pit and cask loading pit – sufficient for at least 72 hours.
- Backup safety-related makeup source – Passive Containment Cooling Water Storage Tank* – will provide makeup between 72 hours and 7 days.
- *Certain emergency core offload conditions could require PCCWST for containment cooling, would then rely on the nonsafety-related auxiliary tank PCCAWST to provide SFP makeup between 72 hours and 7 days.

Questions

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- Can compliance with GDC 61 be demonstrated without meeting SRP 9.1.3 and RG 1.13?

- Context: SMR-160 is currently designed with one safety-related makeup source to the SFP but is inherently safer than other plant designs given the SFP is located inside containment and a portion of the water that boils off after a loss of SFP cooling will condense on containment walls and return to the SFP.

Questions

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- What does the NRC mean by "physically separate and independent" in SRP 9.1.3:
  - *"Otherwise, the backup system should also be permanently installed, physically separate and independent from the primary makeup system, and designed to seismic Category I, Quality Group C standards."*
  - Context: Can the primary and backup makeup systems take water from normally connected sources and still be considered physically separate and independent?

Questions

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- What does the NRC mean by the makeup system and its backup should have redundant flowpaths in RG 1.13?
  - *"The makeup system and its backup should have redundant flowpaths for providing water to the storage pool."*
  - Context: Does this refer to redundant flowpaths for the makeup system, and redundant flowpaths for the backup? Or does the backup system flowpath being redundant to the makeup system flowpath satisfy this requirement?

Open Forum