www.holtec.com
www.smrllc.com

NRC Meeting:
SECY-94-084 Safe Shutdown Criteria

December 5, 2022

Meeting Agenda

- Introductions
- Purpose & Outcome
- Overview of SMR-160 PCCS
- PCCS Performance and Safe Shutdown Condition
- Questions provided to NRC
- Open Forum

Introductions

- NRC staff
- Holtec staff

Purpose & Outcome

- PURPOSE: To provide a description of Passive Core Cooling System (PCCS) for non-LOCA events and describe some unique challenges in meeting the safe shutdown guidance per SECY-94-084.

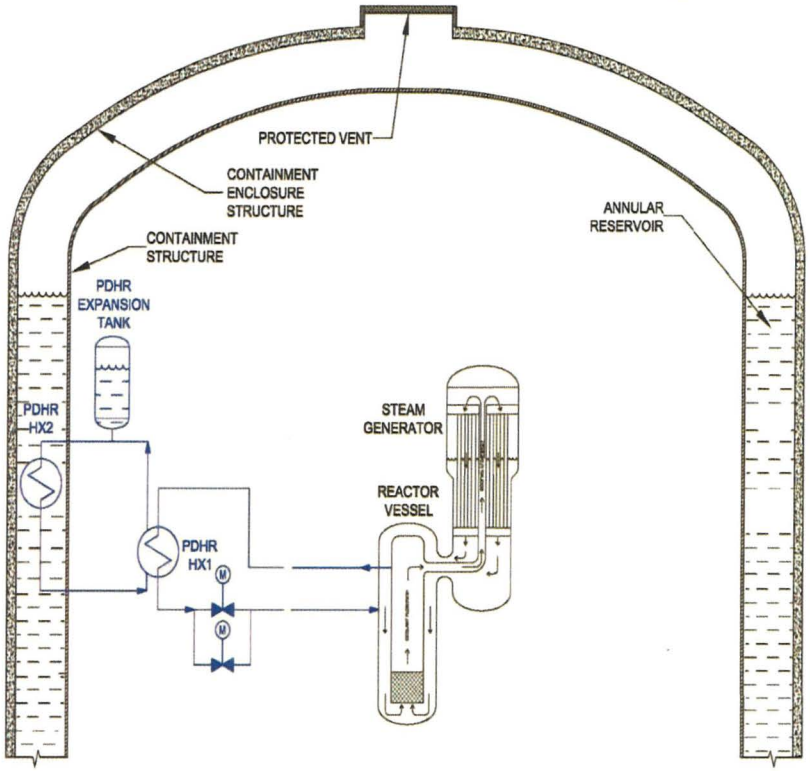
- OUTCOME: To obtain feedback from the NRC Staff on the safe shutdown guidance for SECY-94-084 and how it applies to SMR-160.

SMR-160 Passive Core Cooling

- PCCS is comprised of the following sub systems
  - Primary Decay Heat Removal (PDHR)
  - Secondary Decay Heat Removal (SDHR)
  - Automatic Depressurization System (ADS) – Only used for LOCA
  - Passive Core Makeup Water System (PCMWS) – Only used for LOCA

PDHR

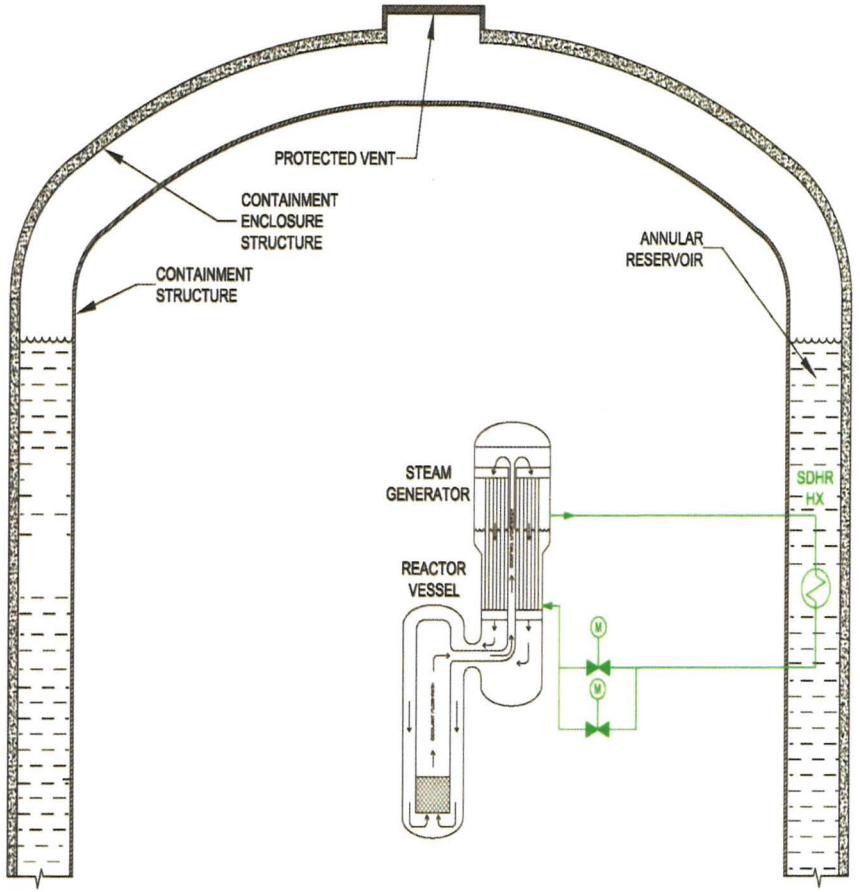
- Consists of two closed loops
  - Loop 1 pulls RCS coolant from the hot leg and returns cooler water to the SG lower head
  - Loop 2 rejects Loop 1 energy to annular reservoir
- Primary function is to remove decay heat during non-LOCA events
  - Capable of removing all decay heat without SDHR



Note this figure does accurately show elevations, scales, or PDHR-RCS connections

SDHR

- Consists of one closed loop
- Removes core decay heat using the SG and rejects it to AR
  - Steam from the SG enters the SDHR HX
  - Steam rejects heat to AR and condenses in SDHR HX tubes
  - Condensate returned to bottom of SG secondary side
- Primary function is to remove decay heat for non-LOCA or non-secondary side breaks
  - Capable of removing all decay heat without PDHR



SDHR Configuration

PCCS Performance and Safe Shutdown Condition

- Per SECY-94-084, safe shutdown conditions for a passive design is defined as bringing the reactor coolant temperature to 420 °F or below within 36 hours.
- Following a LOCA, the SMR-160 will satisfy the safe shutdown requirement since the RCS becomes a saturated system operating at a pressure below 60 psia (saturation temperature =293 °F).
- For the non-LOCAs (Main Steam Line Break (MSLB) or Feedwater Line Break (FWLB) excluded) the SMR-160 will satisfy the safe shutdown requirement using the PDHR and SDHR systems.

MSLB and FWLB Safe Shutdown Performance

- For MSLB and FWLB events the SDHR is inoperable as the SG secondary side empties due to the break.
- RCS coolant in the SG tubes is at an elevation above the RCS-PDHR nozzles.
- With an empty SG secondary and RCS-PDHR nozzles being below the SG tubes, the RCS coolant in the SG tubes does not significantly circulate or cool.
- Reactor core Specified Acceptable Fuel Design Limits (SAFDLs) are not challenged during MSLB or FWLB.

SECY-94-084 Safe Shutdown Questions

- Does 420 °F RCS temperature refer to RCS Average Temperature (Tavg)?
  - SMR-160 hot leg temperature is measured at bottom of the hot leg, thus the "RCS Average Temperature" will be below 420 °F within 36 hours for MSLB and FWLB events.
  - RCS coolant in the SG tubes would still be higher than the hot leg temperature (>550 °F). Would this violate the intent of the SECY-94-084 safe shutdown conditions, even if SAFDLs are met?

Open Forum