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SMR-300 Deterministic Safety Analysis Codes and Methods Overview

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Meeting Agenda

- Introductions
- Purpose and Outcomes
- Background
- Computer Codes
  - Basis
  - Validation Plans
- Methods
  - Event Identification and Classification
  - Acceptance Criteria
  - Single Failures
  - LOCA Methods
  - Non-LOCA Methods
- Summary and Next Steps

Introductions

- NRC Staff
- Holtec Staff

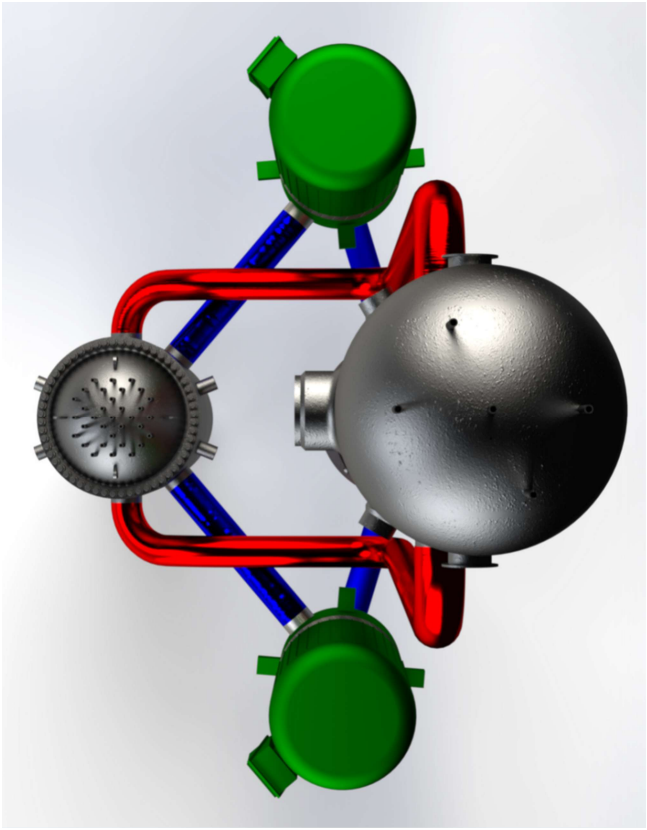
Purpose and Outcome

PURPOSE: To provide a high-level overview of the computer codes and methods used to perform transient and accident analyses.

OUTCOME: To obtain feedback from the NRC staff and identify specific topics that the NRC would like to discuss further in future meetings.

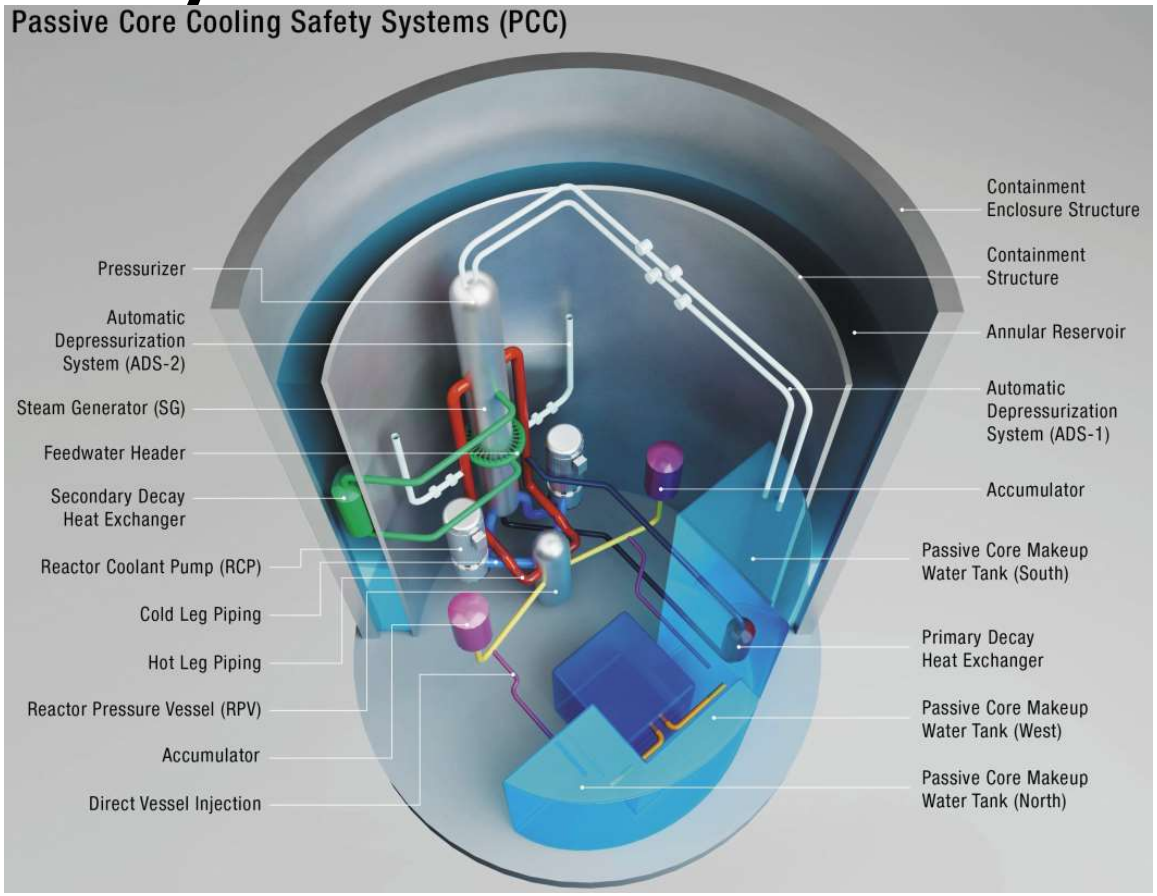
Background – Reactor Coolant System

- SMR-300 reactor coolant system (RCS) components:
  - Reactor pressure vessel (RPV)
  - Once-through steam generator (OTSG)
  - 2 cold legs (24” diameter)
  - 2 reactor coolant pumps
  - 2 hot legs (24” diameter)
  - Integral pressurizer to OTSG
  - 69 standard “17x17” fuel assemblies
- RCS operating conditions similar to existing PWRs
  - RCS Pressure – 2250 psia
  - RCS Tavg – 578 F
  - RCS Coolant Flow Rate 12,000 lb/s
  - 1050 MWth



Background – Engineered Safety Features

- All ESF systems are passive and do not require operator action
- All ESF systems are designed such that a single failure does not inhibit an ESF system from performing its intended function
- Plant Safety System (PSS)
  - Initiates reactor trip and actuates ESF systems
- Primary Decay Heat (PDH) removal system
  - Provides core cooling to RCS primary
- Secondary Decay Heat (SDH) removal system
  - Provides core cooling via the OTSG
- Automatic Depressurization System (ADS)
  - Enables passive safety injection during LOCA
- Passive Core Makeup (PCM) water system
  - Provides RCS makeup inventory during LOCA
- Passive Containment Heat (PCH) removal system
  - Ultimate heat sink for LOCA and non-LOCA events



Computer Codes Bases

- SMR-300 has materials, components, and operating conditions similar to licensed/operating PWR nuclear power plants, therefore computer codes used for analyses of these plants are generally applicable to the SMR-300.
- Neutronics
  - Studsvik's CMS5 Suite – CASMO5, SIMULATE5, SIMULATE-3K
  - [[ ]]
- Subchannel Analysis
  - Framatome's COBRA-FLX
- System Thermal Hydraulics
  - Idaho National Laboratory's (INL) RELAP5-3D
- Containment (Chapter 6.2)
  - Electric Power Research Institute's GOTHIC
- Radiological Consequences
  - Source Terms – SCALE
  - Dispersion Factors – ARCON96
  - Dose - RADTRAD

Generic Computer Code Validation Plan

- The Evaluation Model Development and Assessment Process (EMDAP) described in Regulatory Guide 1.203 will be followed for each computer code
- Holtec will leverage existing validation work where applicable

Studsvik CMS5 Validation Plan

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COBRA-FLX and CHF Validation Plans

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RELAP5-3D Validation Plan

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GOTHIC Validation Plan

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SMR-300 Experimental Facilities

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Methods – Event Identification & Classification

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Methods - Acceptance Criteria

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Methods - Single Failures

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Methods - LOCA

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NON-LOCA METHODS

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Summary

- Deterministic safety analysis codes and methods will adhere to regulations and follow guidance outlined by NRC
- An SMR-300 specific ISET program is being developed to support LOCA and non-LOCA EMDAP

Open Forum