NuScale Power

Meeting Introduction and Overview of NuScale Design

Dr. José N. Reyes, Jr.
Chief Technical Officer
NuScale Power Inc.

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Pre-Application Meeting
Rockville, MD

NP-DEM-PM-0000-004

Outline

- Overview of Pre-Application Schedule
  - Request for Second Phase of Pre-application Meetings
- Design Overview
  - Single Power Module
  - Multi-Module Plant
  - Engineered Safety Features

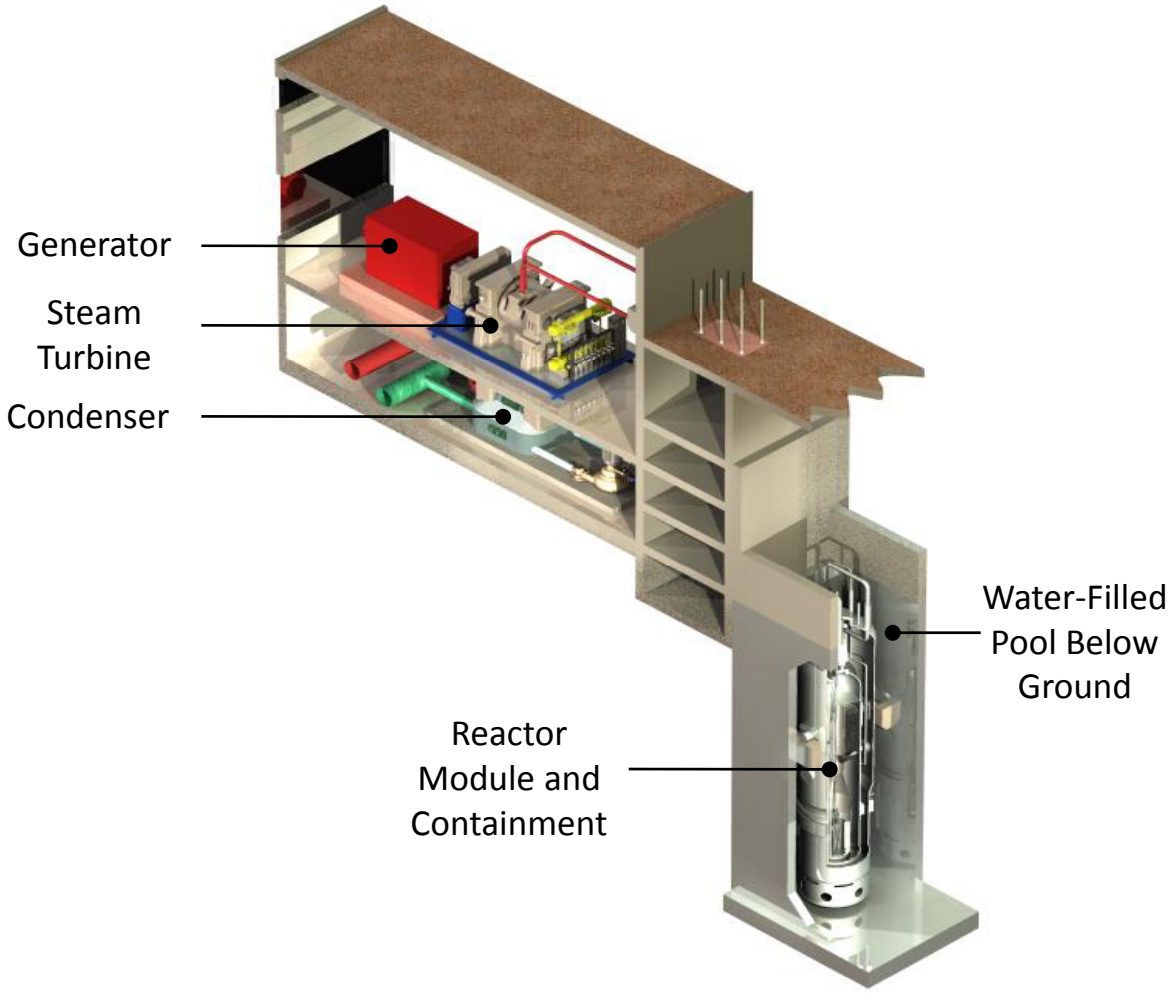
Pre-Application Schedule

	FY2008	FY2009		
	4Q	1Q	2Q	3Q
1st Meeting • NuScale and Design Introduction	▼			
Submit Design Description Report		▼		
2nd Meeting • Codes and Methods Topical Report		▼		
3rd Meeting • Online Refueling Topical Report • Multi-Module I&C and Operations Staffing Topical Report			▼	
4th Meeting • Multi-Module PRA Topical Report • Severe Accidents Topical Report • Dose Calculations and Emergency Planning Topical Report				▼

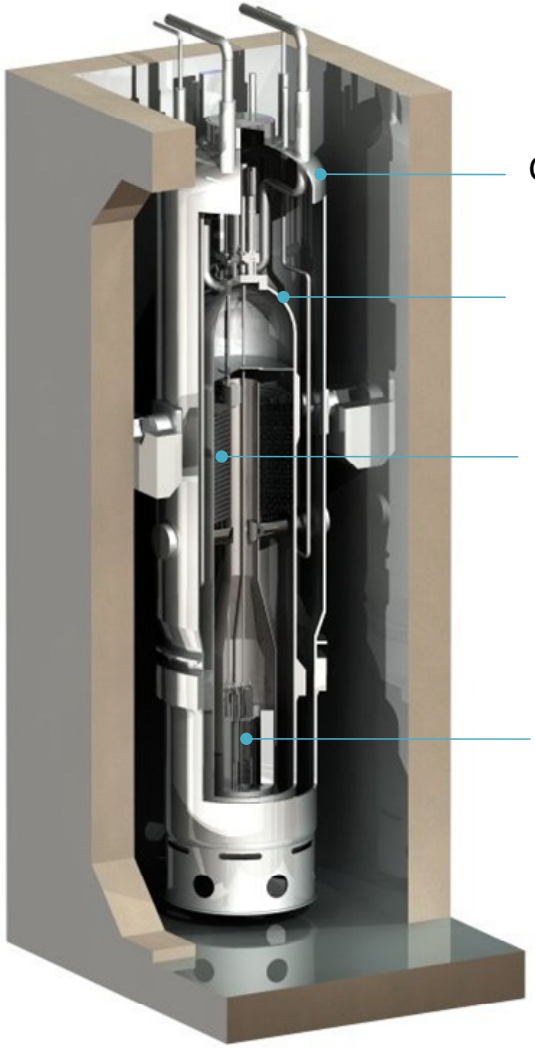
Today's Meeting

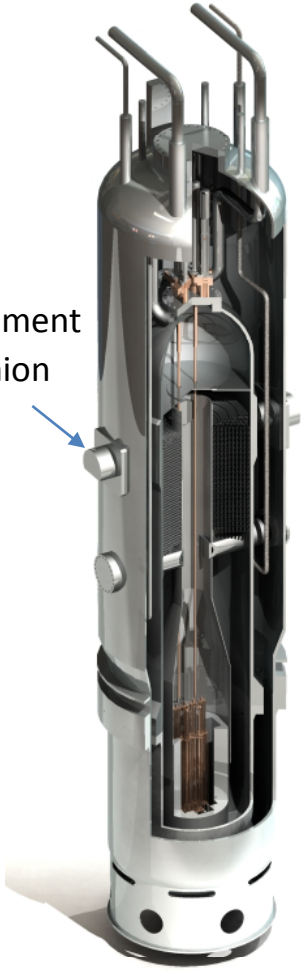
- Focusing on topics unique to NuScale Refueling and Plant Control
  - Moving containment and reactor vessel to a dedicated refueling location while remaining modules remain at power
  - Controlling multiple reactors from a single control room

Design Overview



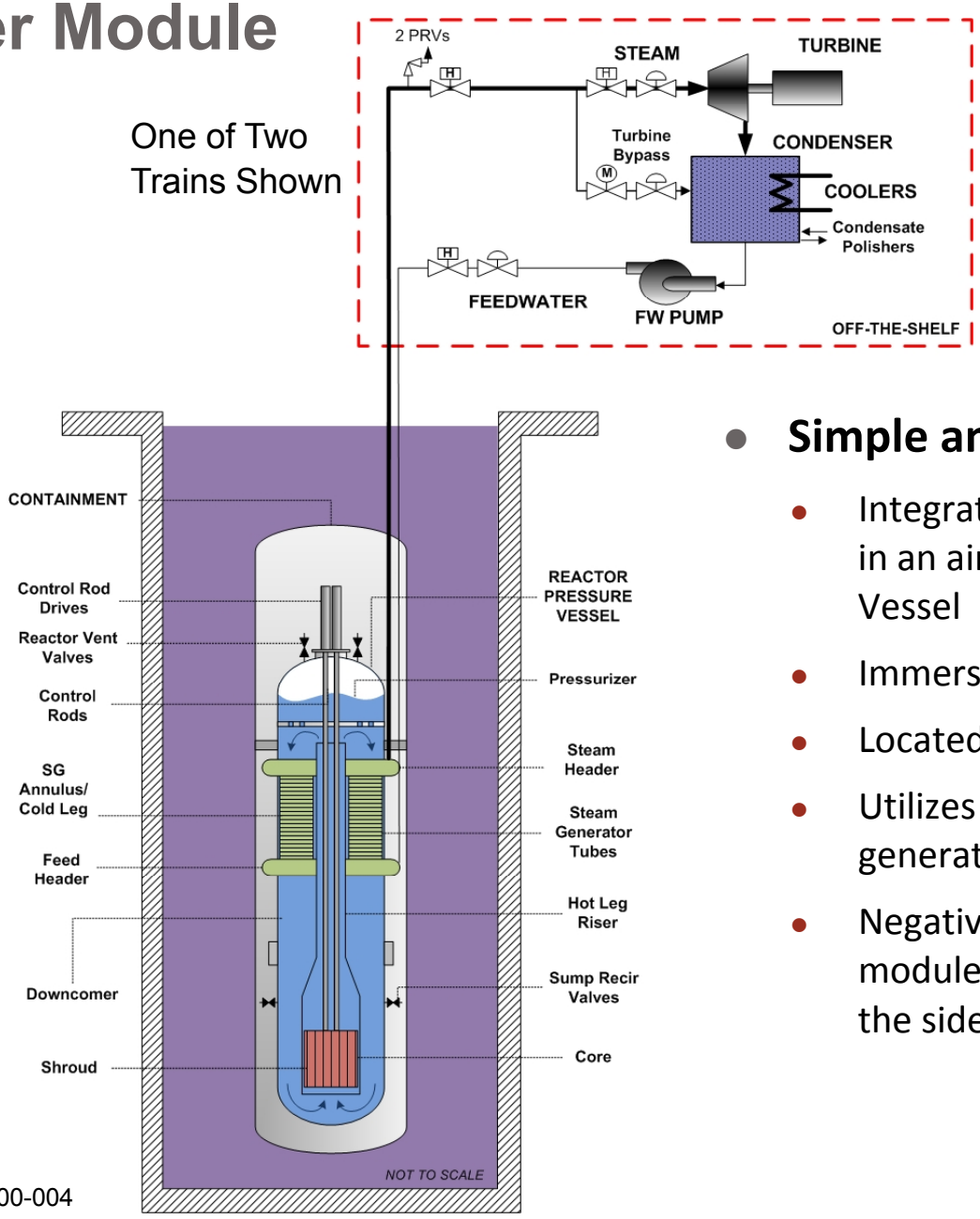
NSSS and Containment





Power Module

One of Two Trains Shown



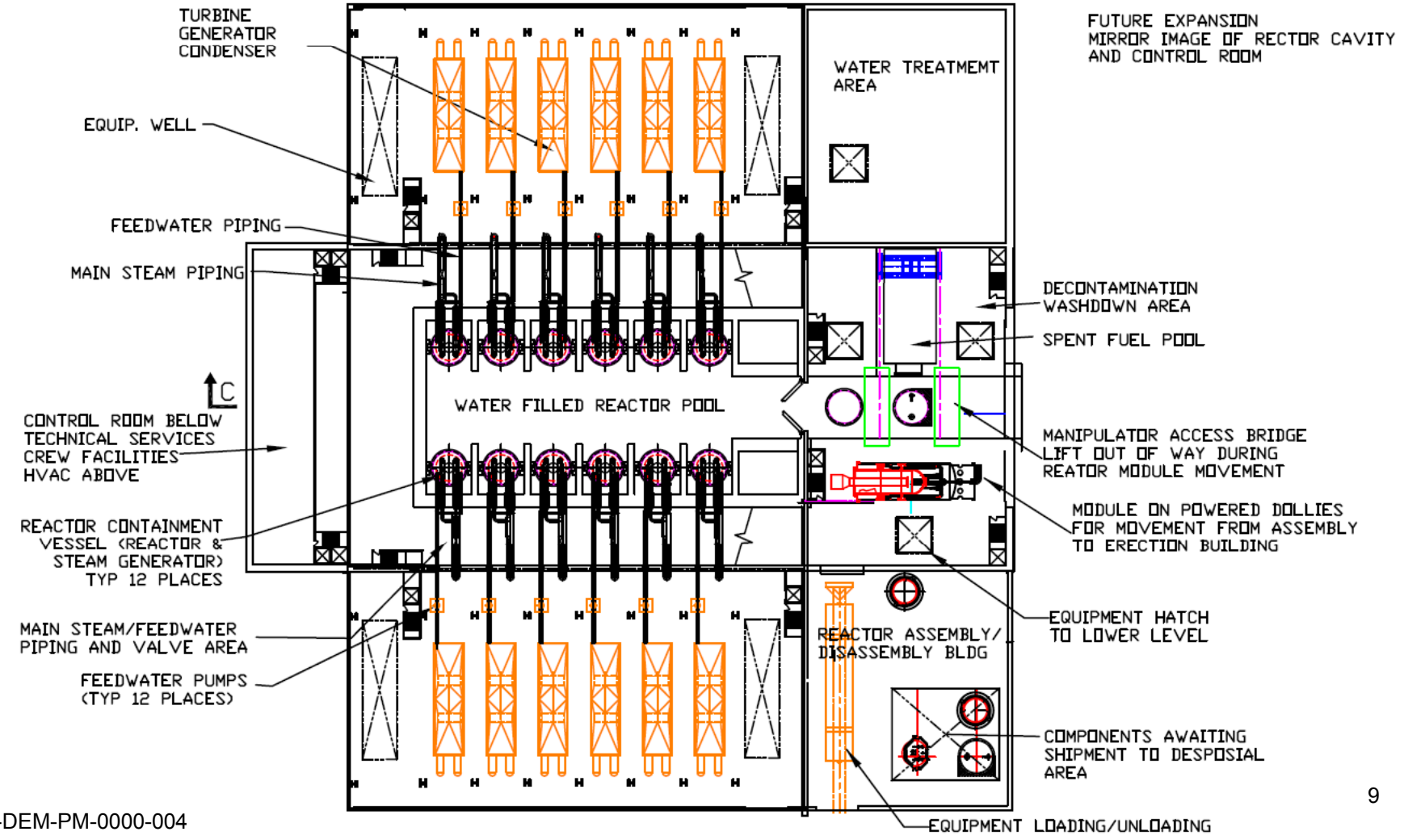
- **Simple and Robust Design**
  - Integrated Reactor Vessel enclosed in an air evacuated Containment Vessel
  - Immersed in a large pool of water
  - Located below grade
  - Utilizes off-the-shelf turbine-generator set
  - Negatively buoyant (slightly) module with seismic supports on the side (not shown)

Preliminary Plant Parameters

Overall Plant	
• Net Electrical Output	480 MW(e) nominal
• Net Station Efficiency	27%
• Number of Power Generation Units	12
• Nominal Plant Capacity Factor	> 90%
Power Generation Unit	
• Number of Reactors	One
• Net Electrical Output	40 MW(e) nominal
• Steam Generator Number	Two independent tube bundles
• Steam Generator Type	Vertical helical tube
• Steam Generator Average Tube Length	30.1 m (98.8 ft)
• Steam Generator Heat Transfer Area	1624.2 m^2 (17,482.8 ft^2)
• Steam Cycle	Slightly superheated
• Turbine Type	3600 rpm, single pressure
• Turbine Throttle Conditions	3.1 MPa (450 psia)
Module	
• Thermal Power Rating	150 MWt
• Operating Pressure	9.4 MPa (1350 psig)
Reactor Core	
▪ Fuel	UO_2 (< 4.95% enrichment)
▪ Refueling Intervals	24 months

Multiple-Module Complex – Example Layout

12 modules ~ 480 MW(e) Nominal

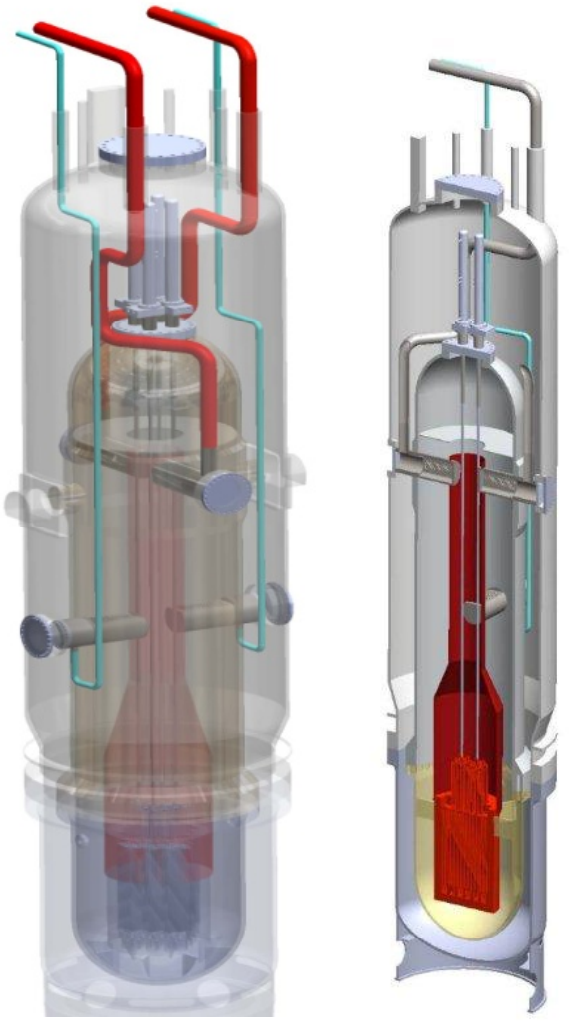


Engineered Safety Features

ESF	Primary Function(s)
High Pressure Containment Vessel	Prevents release of fission products to environment and provides core decay heat removal.
Decay Heat Removal System (DHRS)	Provides core decay heat removal and emergency feedwater cooling via natural circulation through two independent helical coil steam generator tube bundles.
Containment Heat Removal System (CHRS)	Provides a means to rapidly reduce containment pressure and temperature during any LOCA and maintain them at acceptably low levels for extended periods of time.
Emergency Core Cooling System (ECCS) • Reactor Vent Valves • Reactor Recirculation Valves • CHRS	Provides core decay and containment heat removal by steam condensation, natural circulation and sump recirculation. Includes two RVV on the reactor vessel head to vent steam, two SRV at the reactor vessel midsection to provide coolant recirculation, and the containment cooling pool to serve as the emergency heat sink.

High Pressure Containment

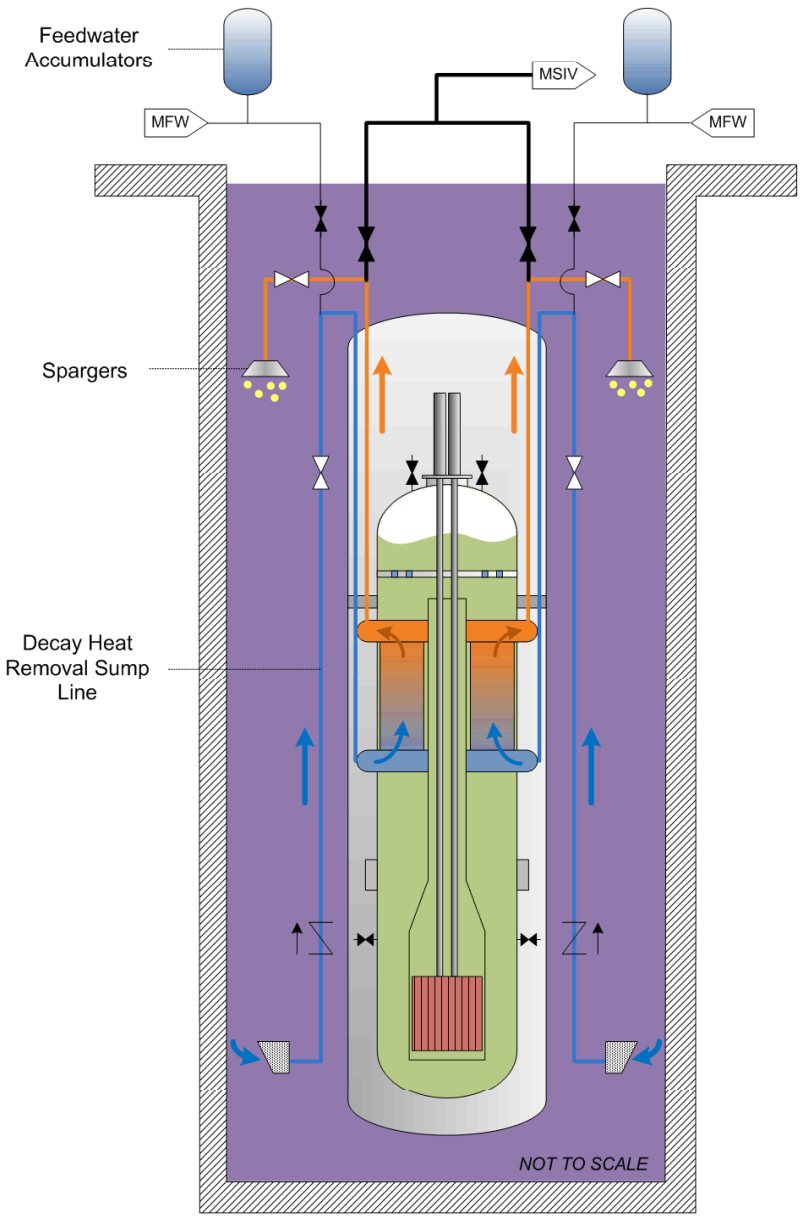
Enhanced Safety



- **High Pressure Capability**
  - Equilibrium pressure between reactor and containment following any LOCA is always below containment design pressure.
- **Insulating Vacuum**
  - Significantly reduces convection heat transfer during normal operation.
  - No insulation on reactor vessel. ELIMINATES SUMP SCREEN BLOCKAGE ISSUE (GSI-191).
  - Improves steam condensation rates during a LOCA by eliminating air.
  - Prevents combustible hydrogen mixture in the unlikely event of a severe accident (i.e., no oxygen).
  - Eliminates corrosion and humidity problems inside containment.

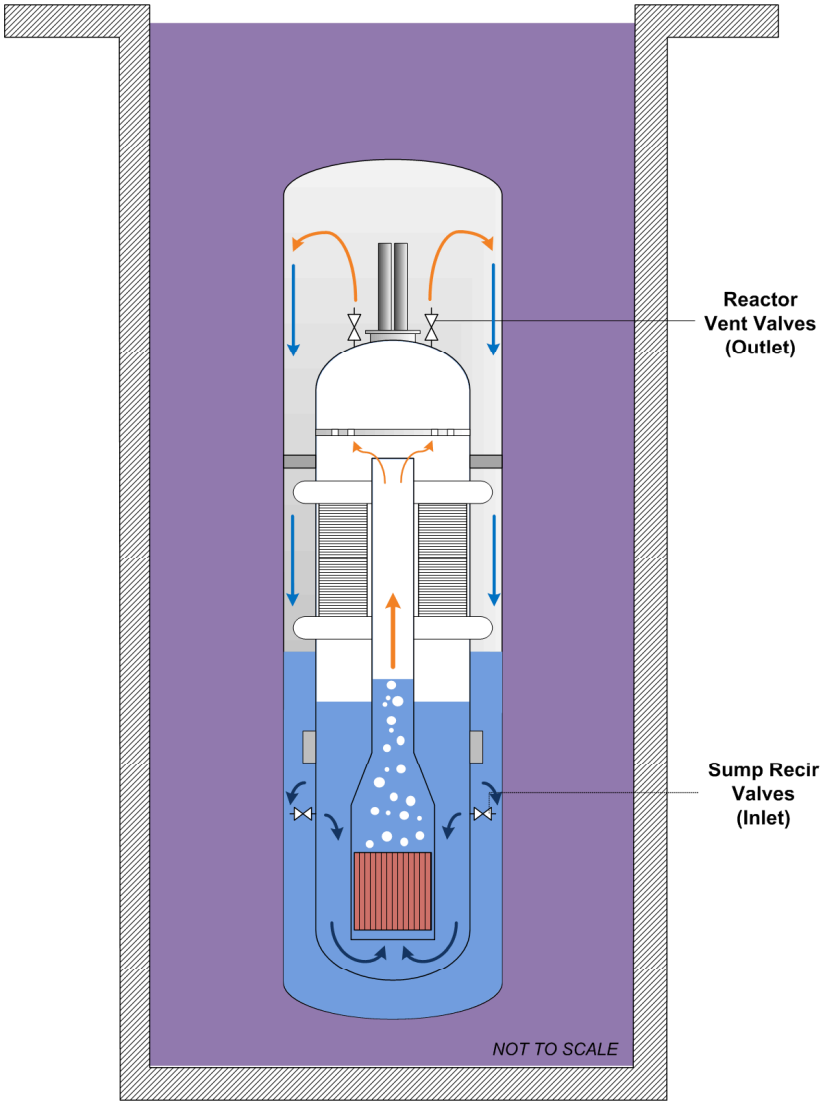
Decay Heat Removal System (DHRS)

- Two independent trains of emergency feedwater to the steam generator tube bundles
- Water is drawn from the containment cooling pool through a sump screen
- Steam is vented through spargers and condensed in the pool
- Feedwater Accumulators provide initial feed flow while DHRS transitions to natural circulation flow
- Pool provides a 3 day cooling supply for decay heat removal



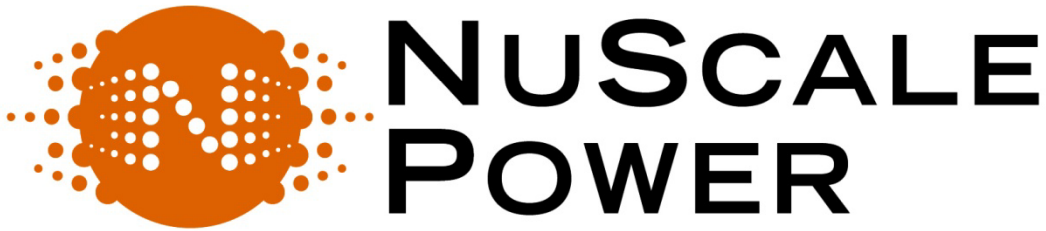
Containment Heat Removal System (CHRS)

- Provides a means of removing core decay heat and limits containment pressure by:
  - Steam Condensation
  - Convective Heat Transfer
  - Heat Conduction
  - Sump Recirculation
- Reactor Vessel steam is vented through the reactor vent valves (flow limiter)
- Steam condenses on containment
- Condensate collects in lower containment region (sump)
- Sump valves open to provide recirculation path through the core



Meeting Materials

- Report Transmitted to NRC
  - *Refueling Operations for the NuScale Power Module*, NuScale Power Inc., NP-DEM-RP-RFOP-002 (Proprietary) and NP-DEM-RP-RFOP-002-NP (Non-Proprietary)
- *Description of NuScale Refueling Process*, presented by Ross Snuggerud, NuScale Power, NP-DEM-PM-RFOP-003 (Proprietary) and NP-DEM-PM-RFOP-003-NP (Non-Proprietary)
- *Human Factors in Advanced I&C Design*, presented by Ken Harris, NuScale Power, NP-OMM-PM-HFIC-001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