NuScale Power

Western Focus Seminar

30th Annual CNS Conference

Dr. José N. Reyes

Chief Technical Officer

June 3, 2009

Overview

- NuScale is commercializing a 40 MWe system that can be scaled to meet customer requirements of virtually any size.
- NuScale's standard design is for a power plant with up to 12 modules generating 480 MWe.
- NuScale technology developed and tested by Oregon State University, Idaho National Lab and Nexant-Bechtel under DOE funded research. Company formed in 2007 with tech-transfer agreement from OSU.
- Design innovations simplify construction, strengthen safety, reduce costs and financial risks, and improve reliability.
- Reliance on existing commercial nuclear technology reduces regulatory risk and increases speed to market.

Management Team

Executive	Position	Experience / Accolades
Paul G. Lorenzini, PhD	Chief Executive Officer	President, Pacific Power & Light CEO, PowerCorp Australia VP/General Manager, Rockwell Hanford Operations
Jose N. Reyes, PhD	Chief Technical Officer	Internationally recognized for leadership in developing scalable test facilities for nuclear plants United Nations International Atomic Energy Agency (IAEA) technical expert on passive safety systems Department Chair, Nuclear Engineering, Oregon State University
Tom Marcille	Chief Operating Officer	Chief Engineer, Advanced Reactors, Los Alamos National Laboratory Twenty years as a contributing, managing and chief engineer in GE's advanced and terrestrial BWR business units
John "Jay" Surina	Chief Financial Officer	V.P. Financial Planning and Analysis, Boart Longyear Executive positions, Texas Genco, Centrica North America, Sithe Energies Co-founder and a managing partner of Cornerstone Energy Advisors MBA , Wharton School, University of Pennsylvania

NuScale Project Organization

Nuclear Vendor

NuScale Power

- Design & Engineering (NSSS)
- Licensing (Certification)
- Support services

Owner (typical utility)

- Site selection
- Licensing (ESP/COL)
- Operations

Suppliers

General Dynamics Electric Boat

Oregon Iron Works, Inc.

Curtiss Wright

- Fabricate Modules
- Steam Generator
- Forgings
- CRDM's

A/E Constructor

Kiewit

- Design & Engineering (BOP)
- Project Management
- Site Preparation & Construction

Strategic Partner - Kiewit Construction: NuScale / Kiewit MOU signed April 2008

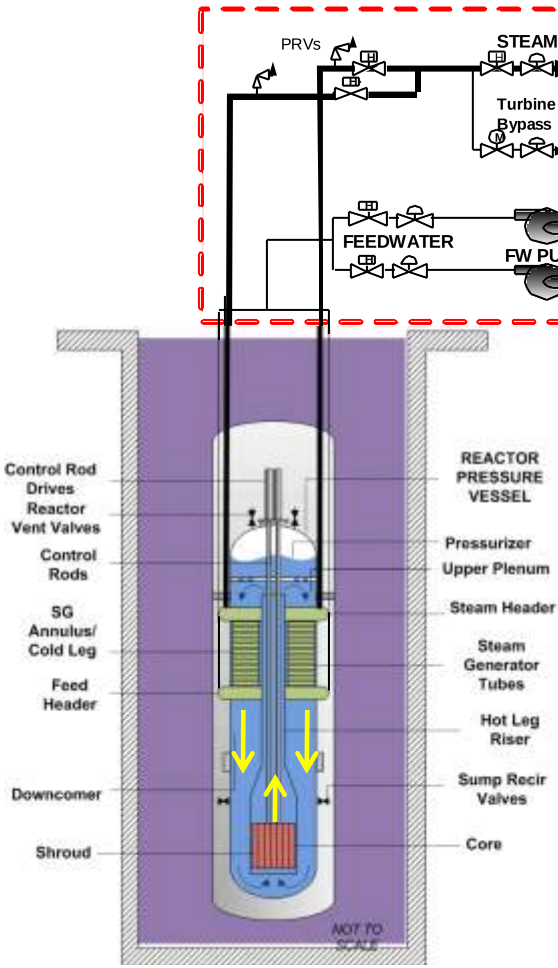
- Employee-owned company; $6 billion annual revenue with 120 year history and 16,600 Employees
- FORTUNE's most admired company in the engineering and construction industry in 2007
- Major power plant constructor
- Major commitment to new nuclear projects based on past nuclear construction experience

Kiewit Corporate Headquarters
Omaha, NE

NuScale Power

Key Industry Contractors and Partners

NuScale Power: Prefabricated, simple, safe …



- Construction Simplicity:
  - *Major components prefabricated and shipped by rail, truck or barge* - Entire nuclear system is 60' x 15' / 300 tons.
- Natural Circulation Cooling:
  - *Inherently safe* – Eliminates major accident secenarios
  - *Improves economics* - Eliminates pumps, pipes, auxiliary equipment
- Below Ground:
  - *Enhances security and safety* – Critical components - reactor, control room, fuel pool - located below ground

Prototype Confirms Design

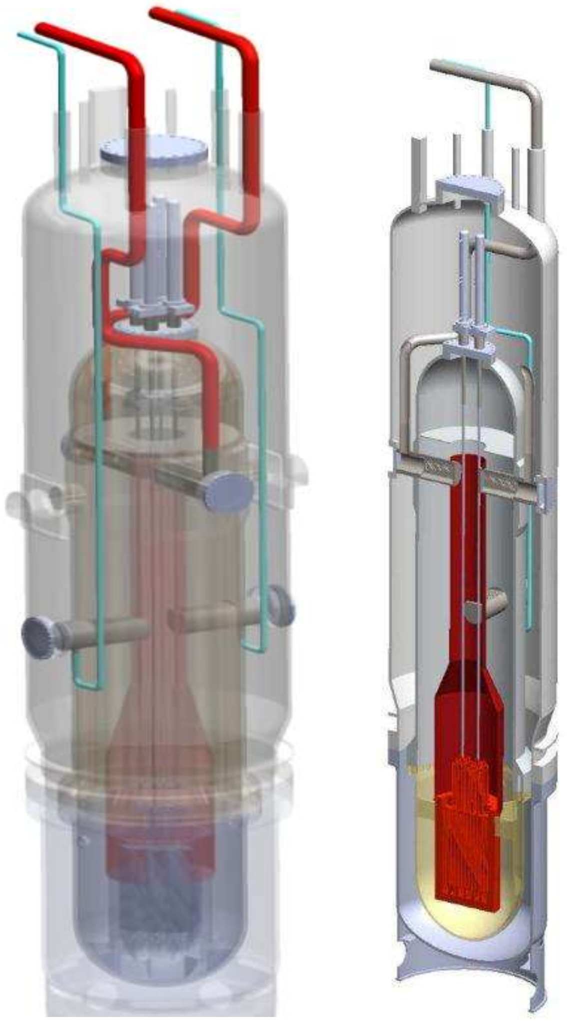
- One-third scale, electrically-heated prototype of NuScale plant confirms performance and safety.
- Plant design based on known commercial nuclear technology and operating experience offers confidence to regulators, owners and operators.

Engineered Safety Features

- High Pressure Containment Vessel
- Shutdown Accumulator System (SAS)
- Passive Safety Systems
  - Decay Heat Removal System (DHRS)
  - Containment Heat Removal System (CHRS)
- Severe Accident Mitigation and Prevention Design Features

High Pressure Containment

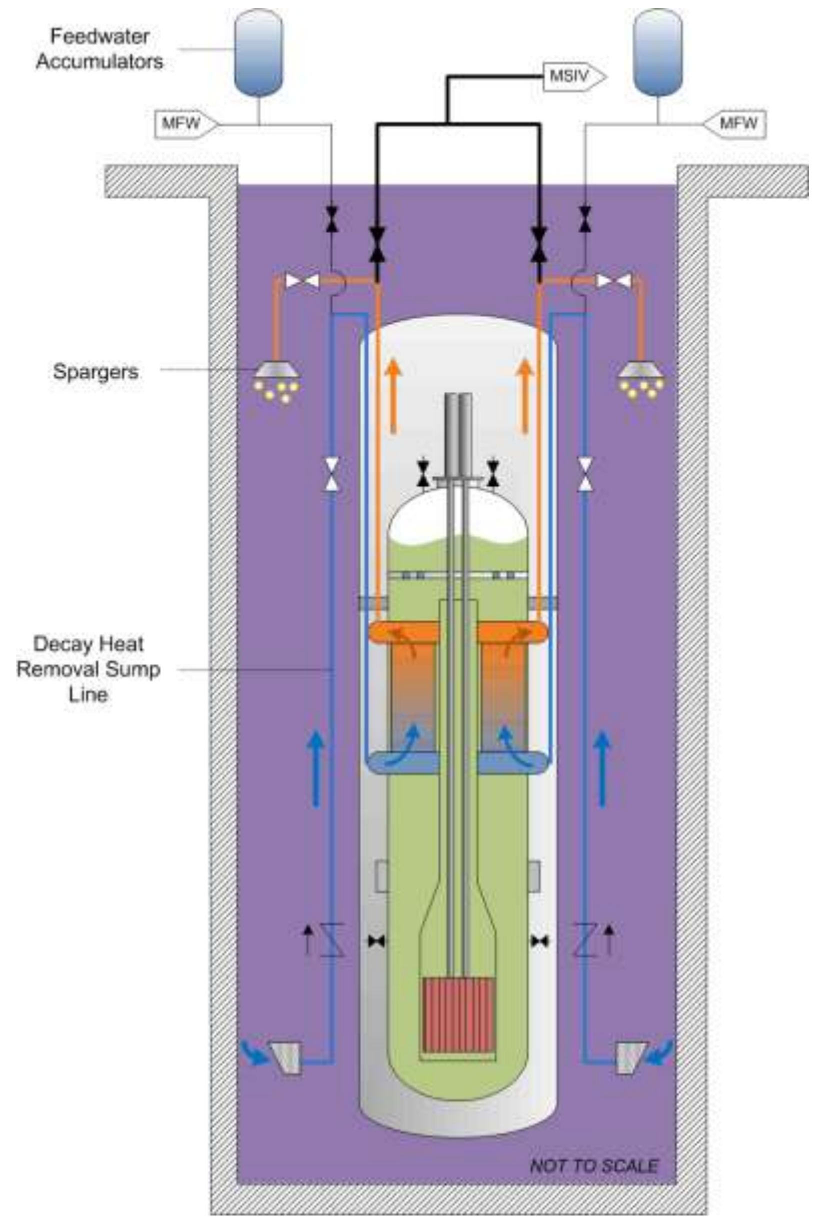
Enhanced Safety



- **Capable of 3.1 MPa (450 psia)**
  - 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.

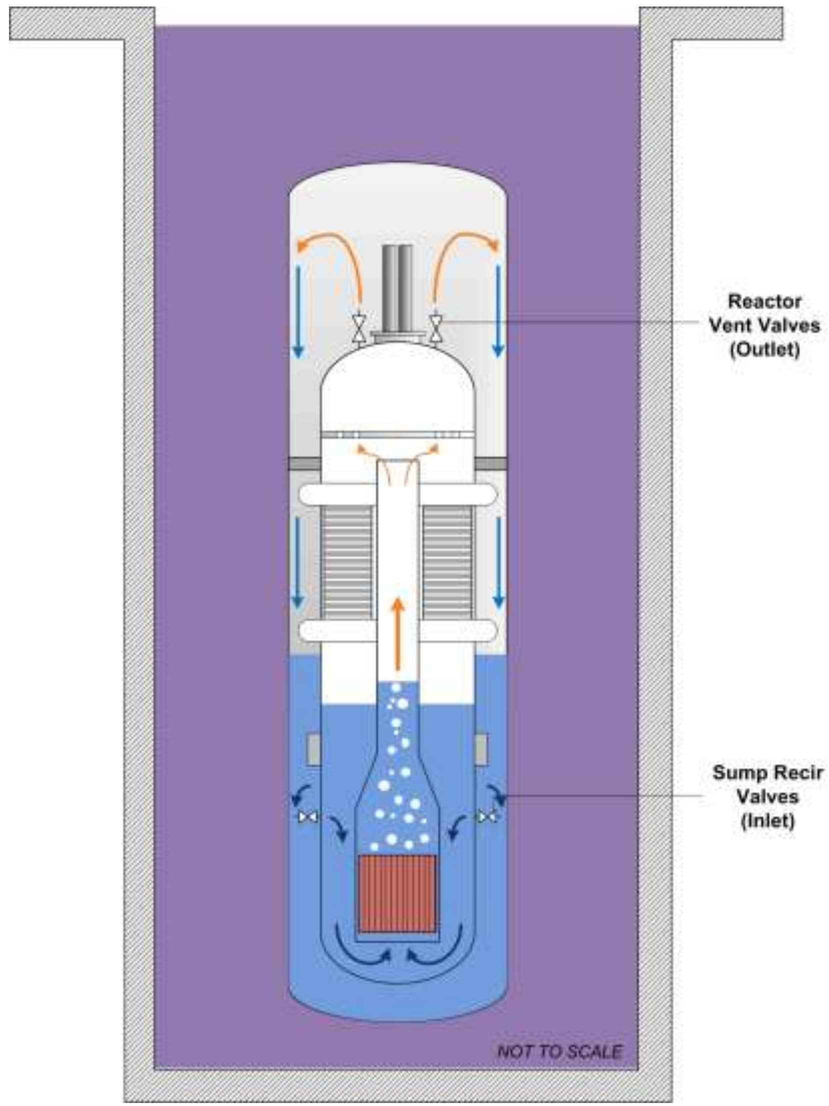
Decay Heat Removal System (DHRS)

- 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.

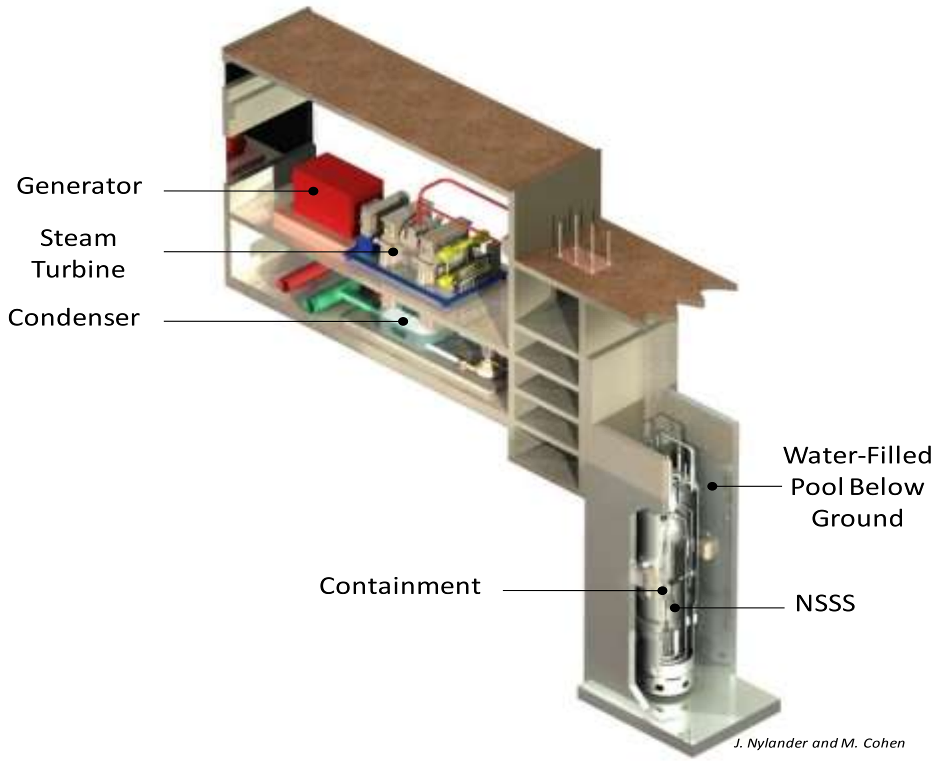


Containment Heat Removal System (CHRS)

- 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.



NuScale modules are scalable

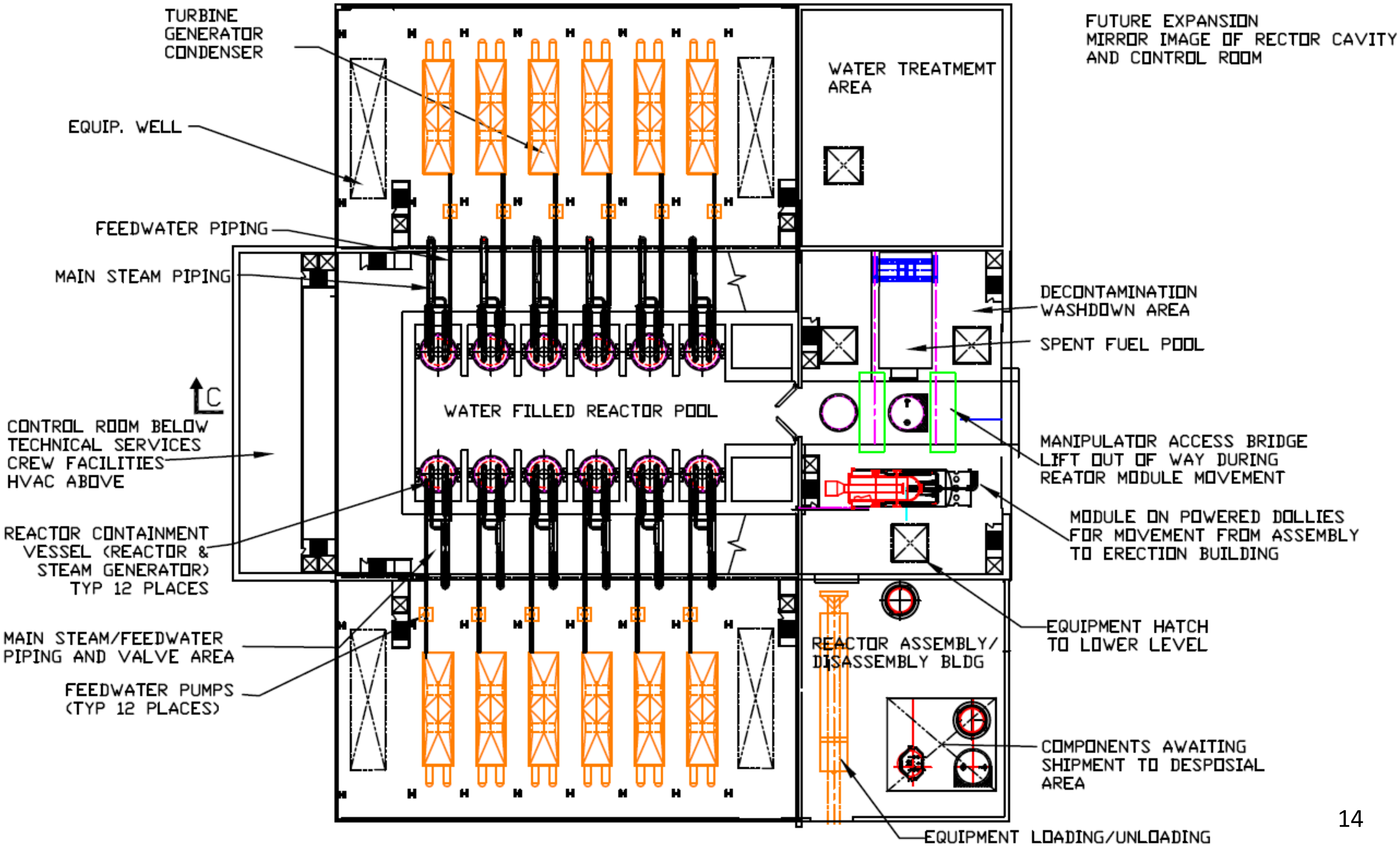


Each module has a dedicated Steam Turbine-Generator

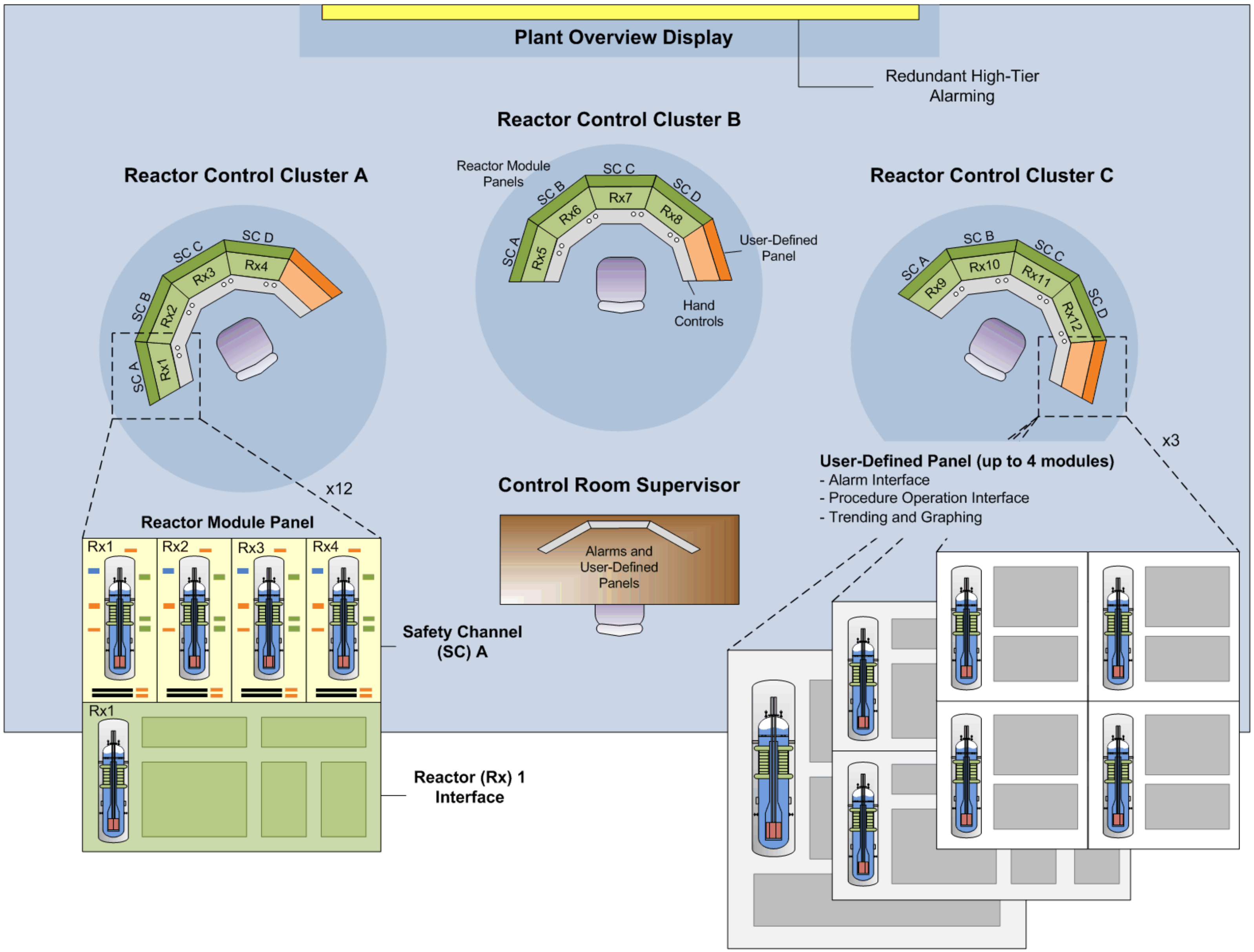
Modules can be “numbered-up” to achieve large generation capacities

Multiple-Module Complex – Flexible Capacity

(12 modules – 480 MWe)



Multi-Module Control Room



Advantages of modular scalable nuclear plants

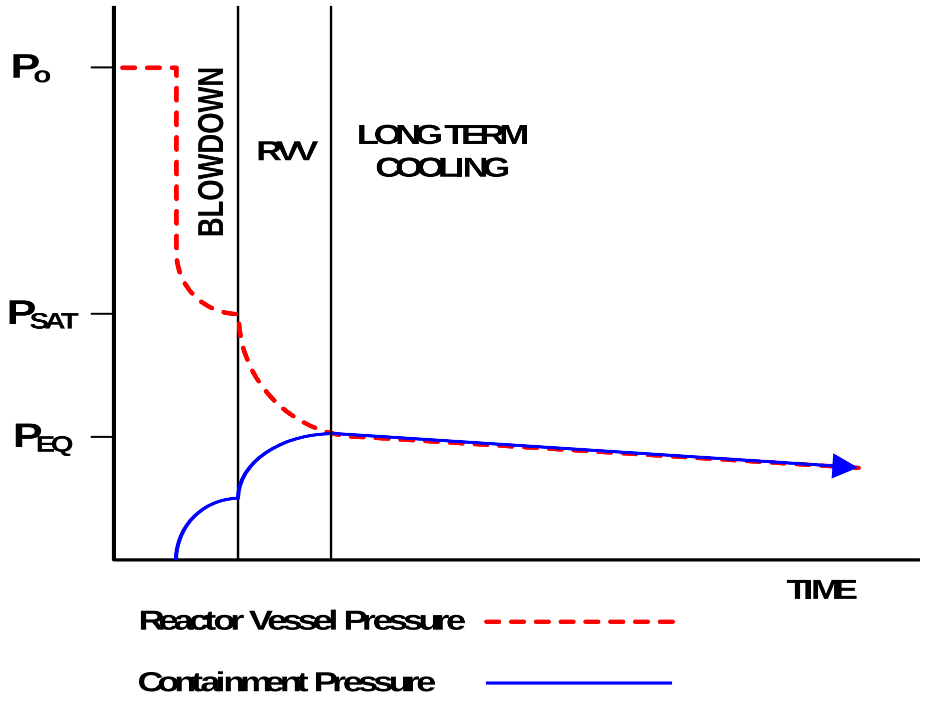
- Operational
  - Eliminates single shaft risk
  - On-line refueling
- Financial
  - Can sequentially add modules to match load growth
  - Smaller plant size minimize financial risks, complexity and uncertainty
  - Off-site manufacturing improves productivity and mitigates construction risks

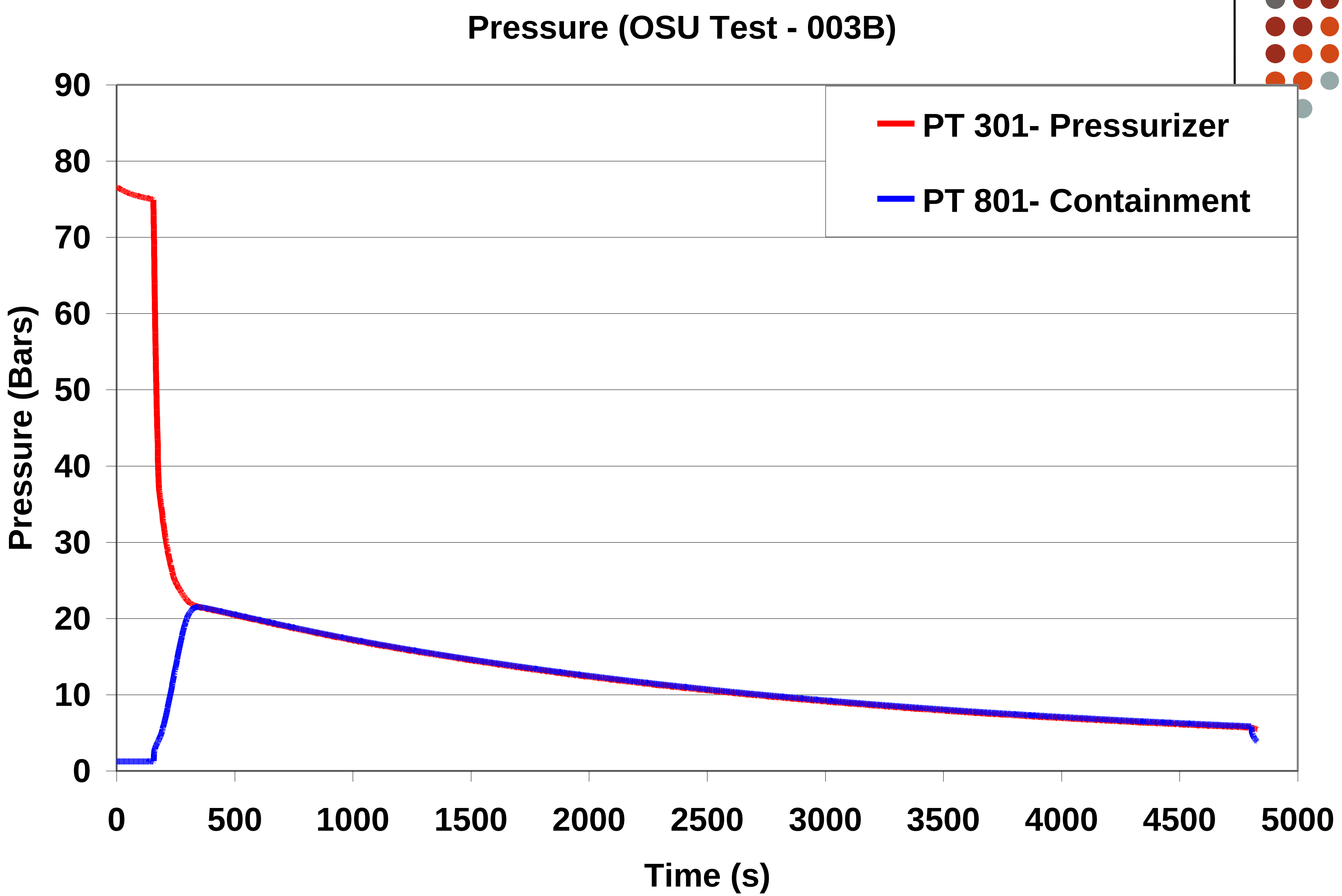
NuScale's modular plant offers significant safety enhancements

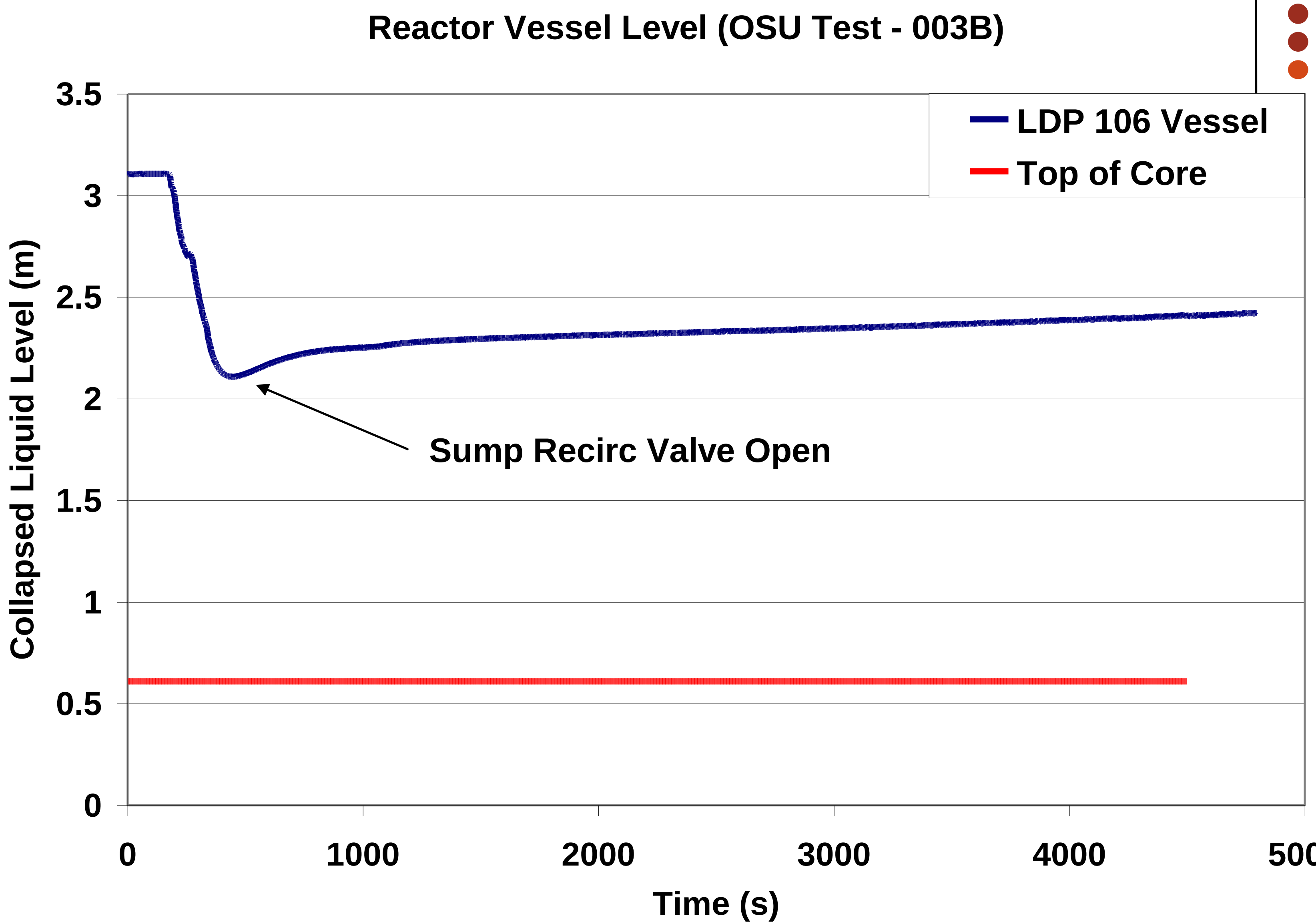
- June 2-3, 2008, a panel of experts convened to develop a Thermal-Hydraulics/Neutronics Phenomena Identification and Ranking Table (PIRT) for the NuScale module:
- February 24-26, 2009 Severe Accidents Analysis PIRT Panel
  - Large-break Loss of Cooling Accident (LOCA) <u>eliminated</u> by design
  - DBA Small break LOCA's will not uncover the core, thus do not challenge plant safety
  - Indicated that the PRA is overly conservative with regard to events that lead to core damage.
- Preliminary PRA already indicates that the overall Core Damage Frequency is extremely low

SBLOCA Transient Phases

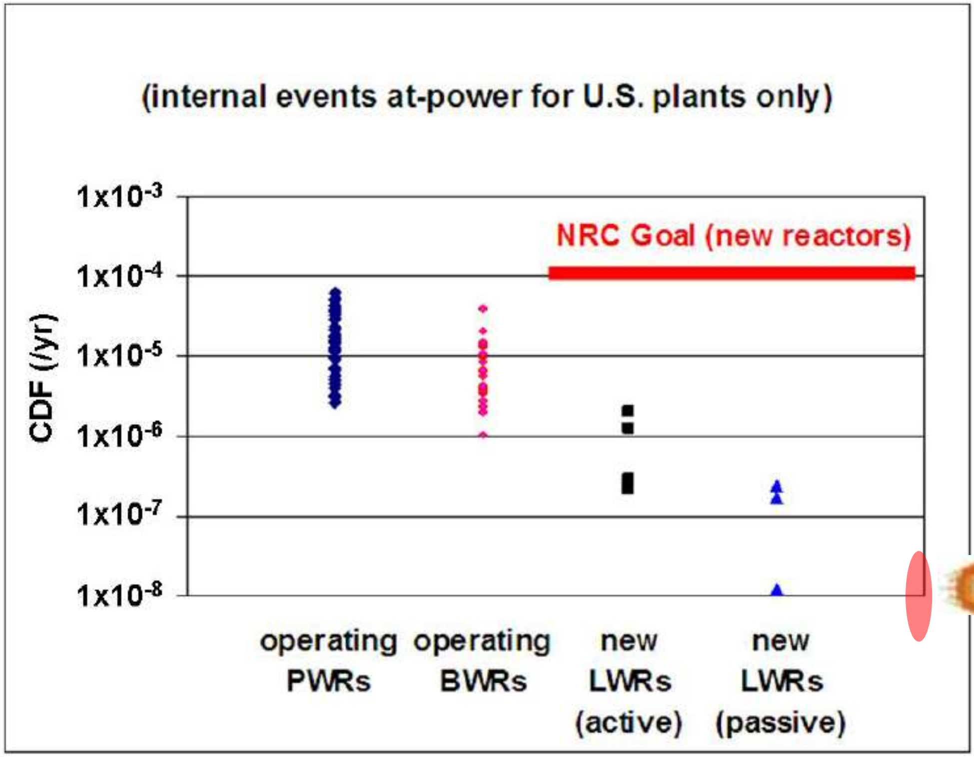
- Phase 1: Blowdown Phase
  - Begins with the opening of the break and ends with the reactor vent valve (RVV) initiation
- Phase 2: RVV Operation
  - Begins with the opening of the reactor vent valve and ends when the containment and reactor system pressures are equalized
- Phase 3 - Long Term Cooling
  - Begins with the equalization of the containment and reactor system pressures and ends when stable cooling is established via opening of the sump recirculation valves




Pressure (OSU Test - 003B)
PT 301- Pressurizer
PT 801- Containment
Pressure (Bars)
90
80
70
60
50
40
30
20
10
0
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
Time (s)

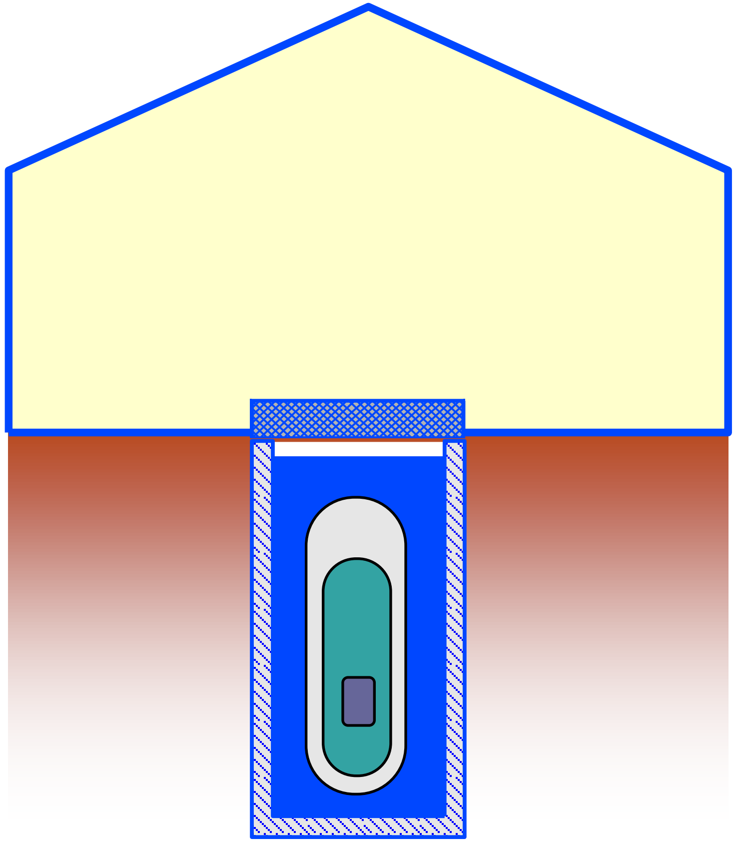

Reactor Vessel Level (OSU Test - 003B)
LDP 106 Vessel
Top of Core
Sump Recirc Valve Open
Collapsed Liquid Level (m)
Time (s)
3.5
3
2.5
2
1.5
1
0.5
0
0
1000
2000
3000
4000
5000

Core Damage Frequency by Plant Type



Source: NRC White Paper, D. Dube; Basis for discussion at 2/18/09 public meeting on implementation of risk matrices for new nuclear reactors

Additional Fission Product Barriers



NOT TO SCALE

- Fuel Pellet and Cladding
- Reactor Vessel
- Containment
- **Containment Cooling Pool Water**
- **Containment Pool Structure**
- **Biological Shield**
- **Reactor Building**

Reduced Emergency Planning Zone

"Generally, the plume exposure pathway EPZ for nuclear power plants shall consist of an area about 10 miles in radius … *The size of EPZs may also be determined on a case-by-case basis for … reactors with an authorized power level less than 250 MWt."*

10 CFR 50.47 (c) (2)

NuScale's Security Advantages

- Safety maintained without external power
- Below-ground
  - Power Module (NSSS and Containment)
  - Control Room
  - Spent Fuel Pool
- Low profile Buildings

Summary of NuScale Advantages

- Reduces financial risks
- Reduces operational risks
- Capacity added to match load growth
- Able to meet demand for smaller sized plants
- Robust supply chain strengthens manufacturing base
- Enhanced safety and security

Pre-Application Reviews Underway with NRC

	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				▼

201 NW 3RD STREET
CORVALLIS, OR 97330
541-207-3931

Dr. José N. Reyes, Jr.
Chief Technical Officer
JNR@NUSCALEPOWER.COM