NuScale Integral System Test Facility

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U.S. Nuclear Regulatory Commission
Pre-Application Meeting
Rockville, MD

NuScale Power

Outline

- Introduction
- Proposed Certification Testing
- Overview of Test Facility
- Schedule

Introduction

- NuScale will conduct a series of integral system tests in support of its safety analysis code assessment process
- A 1/3 scale integral system test facility has been constructed at Oregon State University
- Testing will be conducted under an Appendix B Quality Assurance program

Proposed Certification Testing

- Objective is to obtain qualified data to evaluate the integral performance of safety analysis codes for important thermal hydraulic transients
- NuScale Integral System tests will include characterization tests, a spectrum of design-basis, small-break LOCAs, and Non-LOCAs such as:
  - Natural circulation assessment
  - Decay Heat Removal System operation
  - Containment Heat Removal System operation
  - Inadvertent opening of a reactor vent valve or reactor recirculation valve
  - Main steam line break
  - Feedwater line break
- NuScale will seek NRC input regarding test matrix development

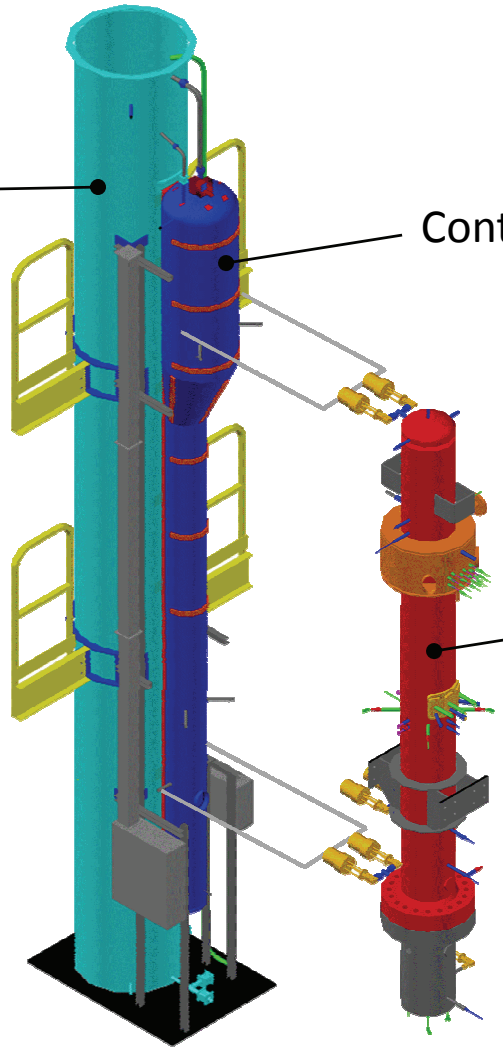
Integral System Test Facility

- A scaling analysis was used to guide the design, construction, and operation of a 1/3-scale integral system test facility for the original MASLWR design
- NuScale is modifying the facility to incorporate design improvements
- OSU has significant testing capability
  - Performed DOE and NRC certification tests for the AP600 and AP1000 designs
  - 10 CFR 50 Appendix B, NQA-1, 10 CFR 21

Scaling Ratios

Pressure Ratio	1:1
Temperature Ratio	1:1
Length Ratio	1:3.1
Time Ratio	1:1
Velocity Ratio	1:3.1
Cross-sectional Area Ratio	1:82
Volume Ratio	1:254.7
Power Ratio	1:254.7
Active Heat Transfer Area Ratio	1:254.7
Active Heat Transfer Wall Thickness Ratio	1:1

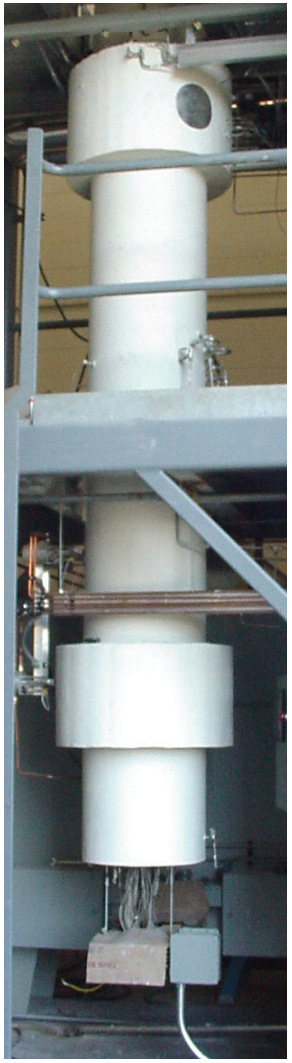
NuScale Integral System Test Facility Schematic

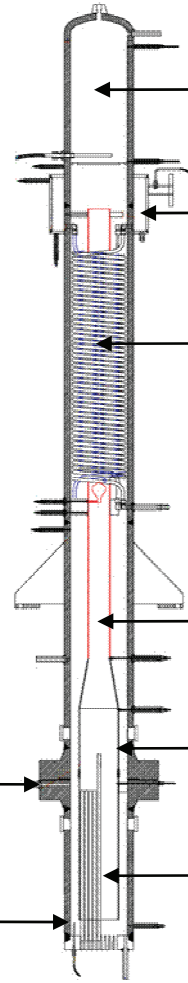


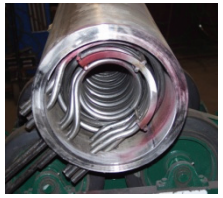
NuScale Integral SystemTest Facility

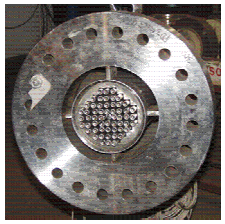
- **Stainless steel integral system test facility operating at full system pressure and temperature**
  - Reactor vessel
  - Electrically heated rod bundle
  - Core shroud with riser
  - Pressurizer
  - Sump recirculation valves
  - Helical coil steam generator
  - Variable-speed feedwater pump
  - Containment vessel
  - Containment cooling pool
  - Instrumentation

Integrated Reactor Test Vessel









Containment and Cooling Pool

Containment Cooling Pool

Trace Heated High-pressure Containment

Containment Heat Transfer Plate

Instrumentation and BOP

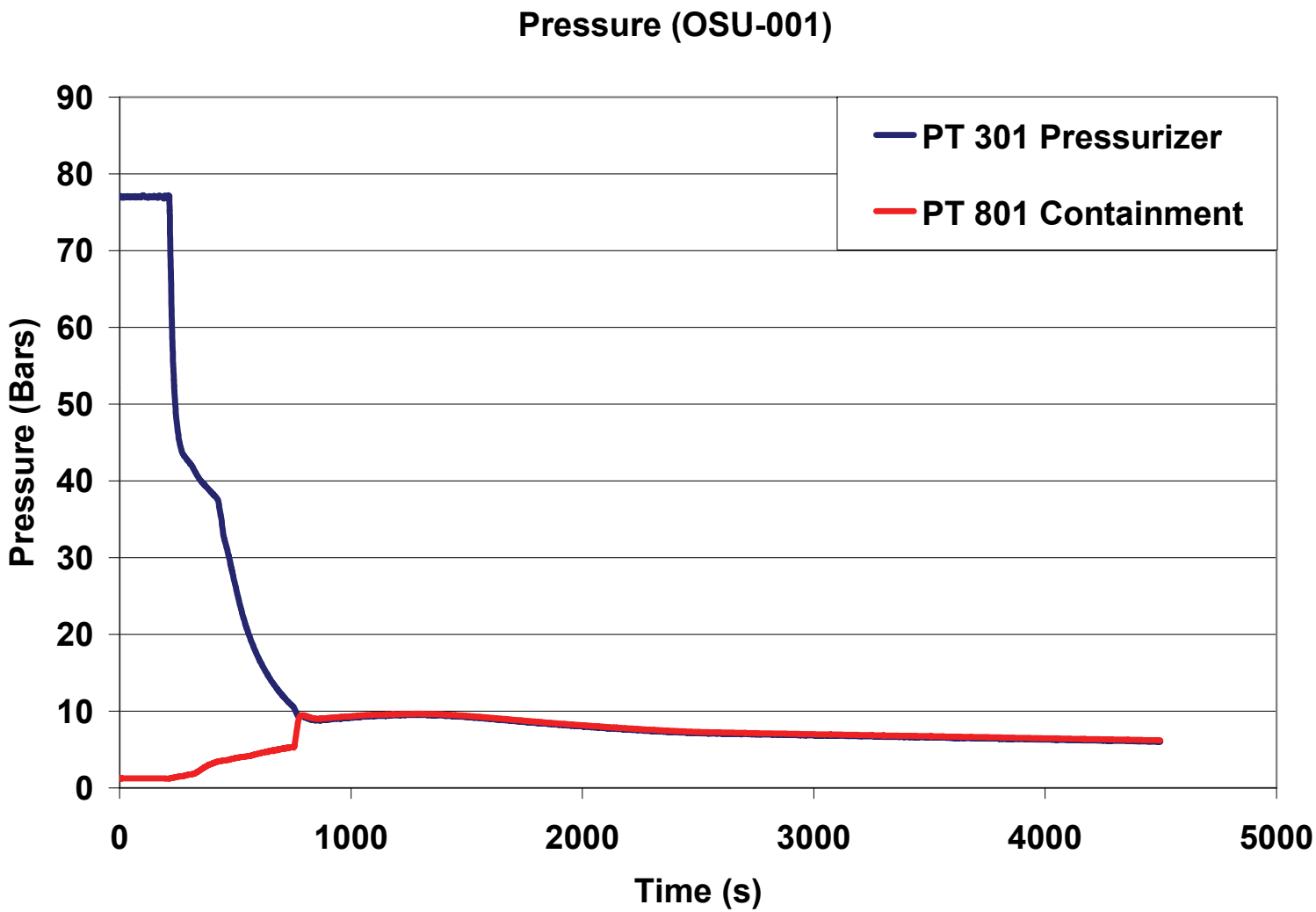
- 3 Power measurements
- 32 Fluid thermocouples
- 1 Vortex flow meter
- 3 Coriolis flowmeters
- 1 Magnetic flowmeter
- 1 Mass vortex flowmeter
- 1 DP flowmeter
- 5-Gauge pressure meters
- 6 Differential pressure meters
- 2 Level DP meters
- Complete Data Acquisition System and programmable logic controls
- Balance of plant; water supply, chemical treatment, air supply, power supply

DOE NERI Tests

Test # OSU-MASLWR	Simulation	Low ADS #1 (%)	Low ADS #2 (%)	RVV #1 (%)	RVV #2 (%)	SRV #1	SRV #2
001	Inadvertent Actuation of 1 submerged ADS valve	*Failed Shut	100	100	100	100	100
002	Natural Circulation Parametric Study to 210 kW	N/A	N/A	N/A	N/A	N/A	N/A
003A	Natural Circulation Parametric Study to 210 kW	*Failed Shut	N/A	N/A	N/A	N/A	N/A
003B	Inadvertent Actuation of Single RVV	*Failed Shut	100	*Failed Shut	100	100	100

*Assumed Multiple Failures and no DHRS

Pressure Trends for OSU-001



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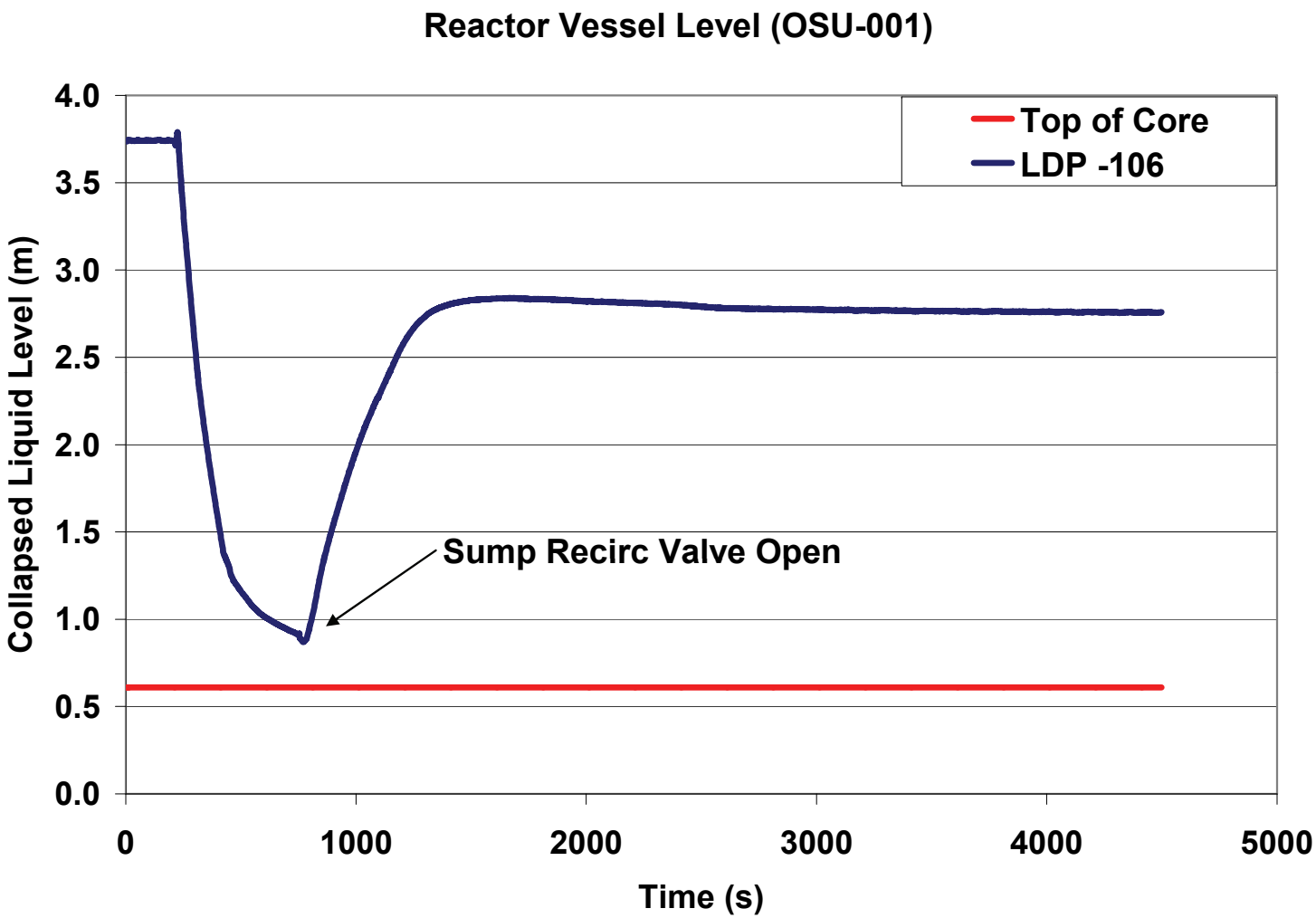
Reactor Vessel Level (OSU-001)



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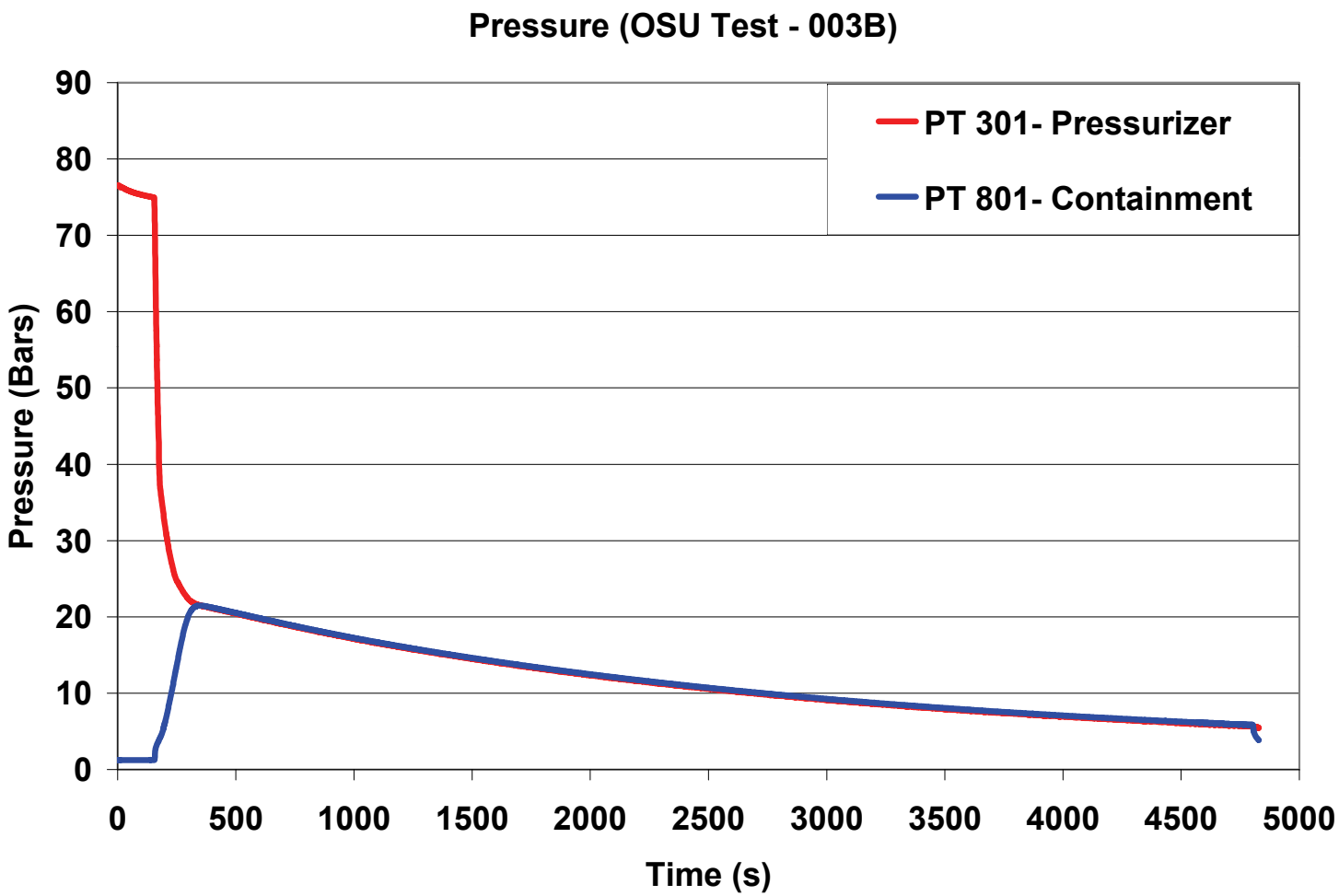
Pressure Trends for OSU-003B



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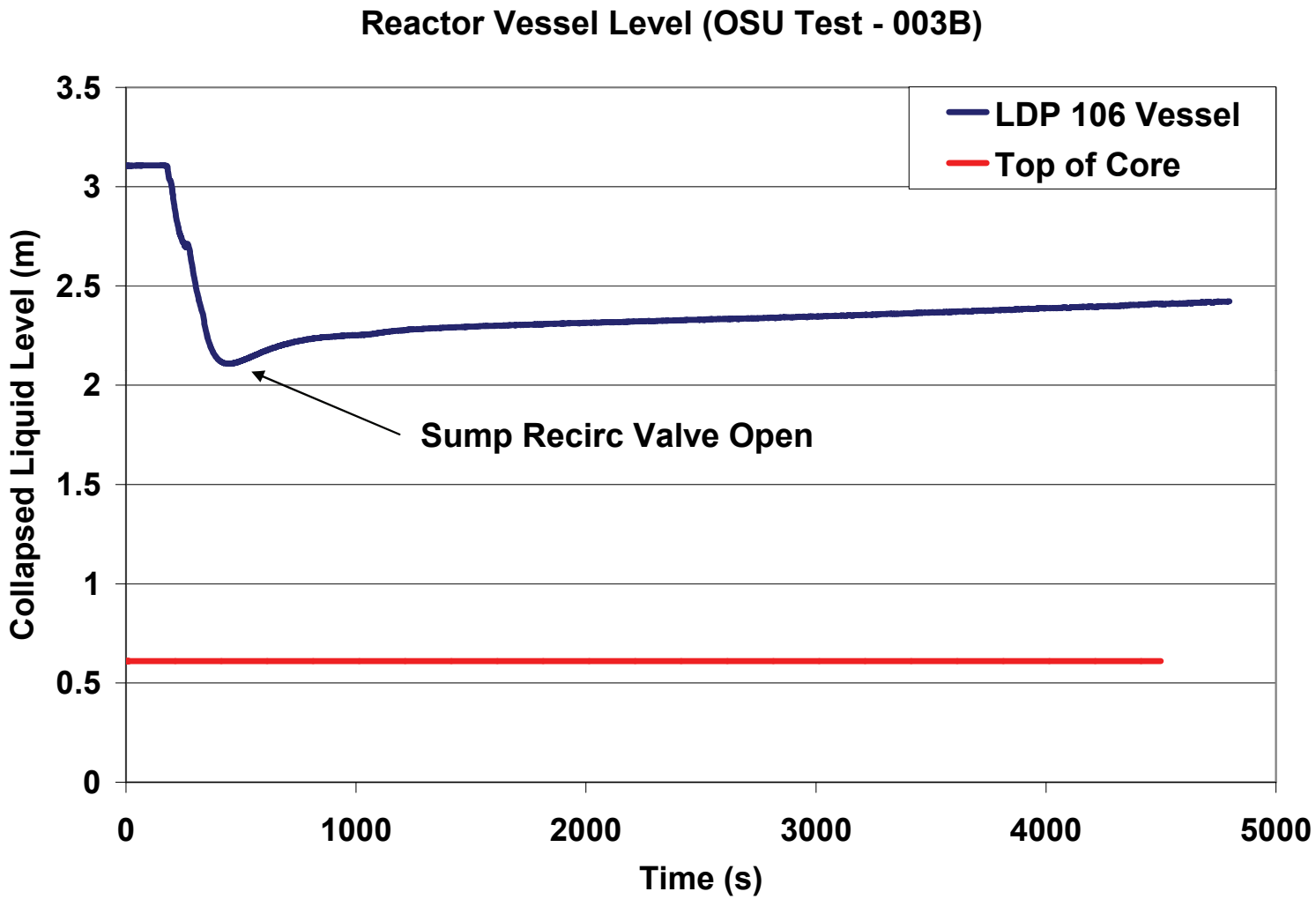
Reactor Vessel Level (OSU-003B)



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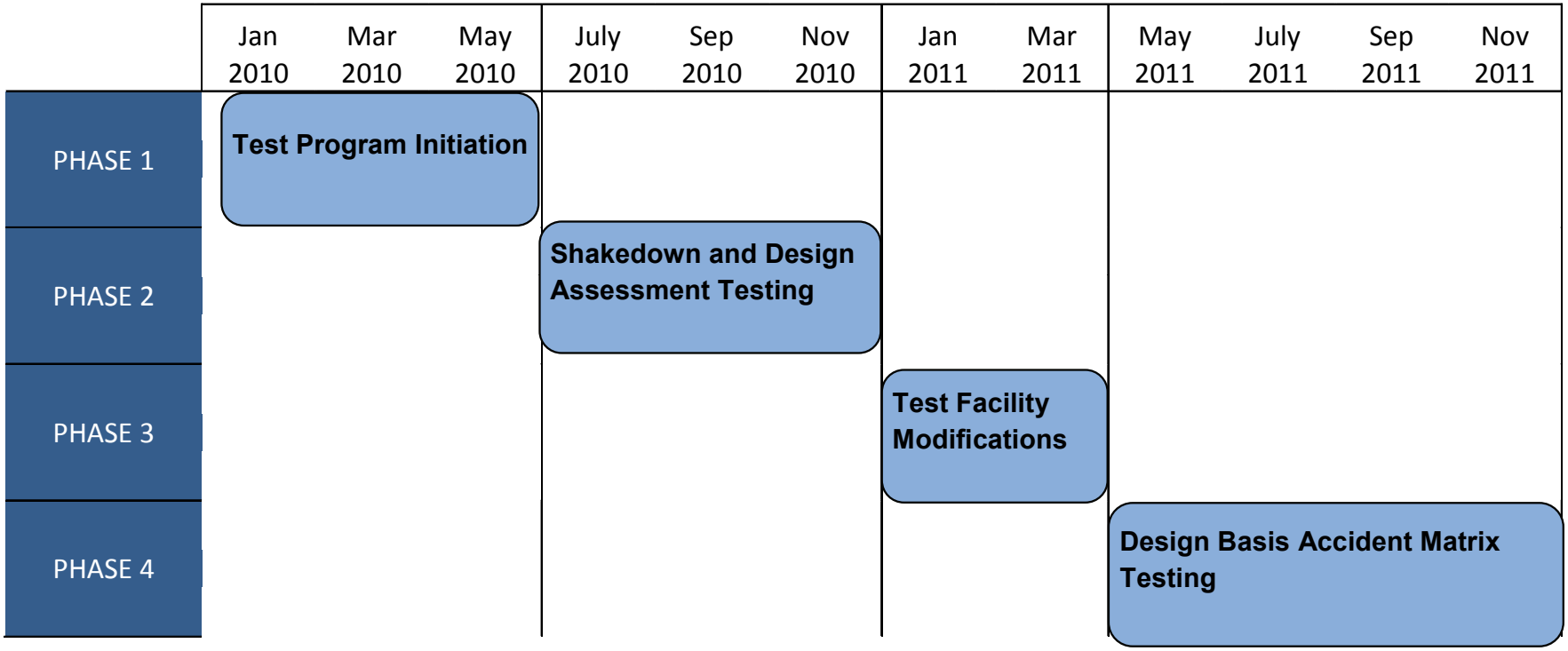
Schedule



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