Enclosure 4
ACRS Presentation - Key Design Features
(REDACTED)

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ACRS Presentation – Key Design Features (Continued)

April 10, 2014

(Redacted Version)

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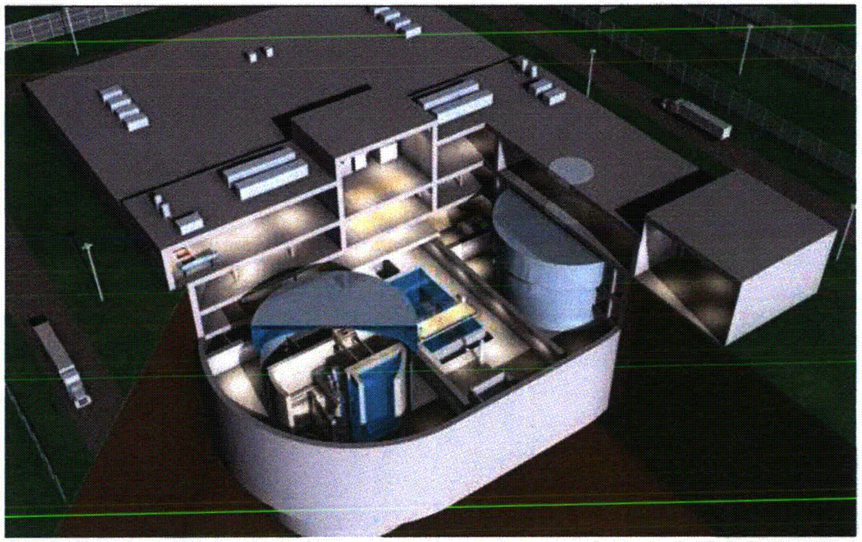
Key Design Features - Agenda

- Simple and Robust Architecture
  - mPower Nuclear Island Design Features
- Integral Design
  - B&W mPower Reactor
- Safety Strategy:
  - Prevention and Mitigation
  - RCS Key Safety Improvements
  - Defense-in-Depth Strategies
  - ECC Video
- Probabilistic Risk Assessment
- Test Program Overview

Simple and Robust Architecture

mPower Nuclear Island Features



- Fully underground
  - Protected from external threats
  - Enables security-informed architecture
  - More efficient seismic design
  - Robust containment, with space for O&M
- "Passive safety" design
  - No safety-related emergency AC power
  - Passive containment heat removal
  - 72-hour safety-related control/monitoring battery
  - No shared active safety systems between units
  - >7-day "coping time" under station blackout
  - No post-LOCA long term cooling recirculation
- Enhanced spent fuel pool configuration
  - Underground, inside reactor building
  - Large heat sink with 30-day "coping time"

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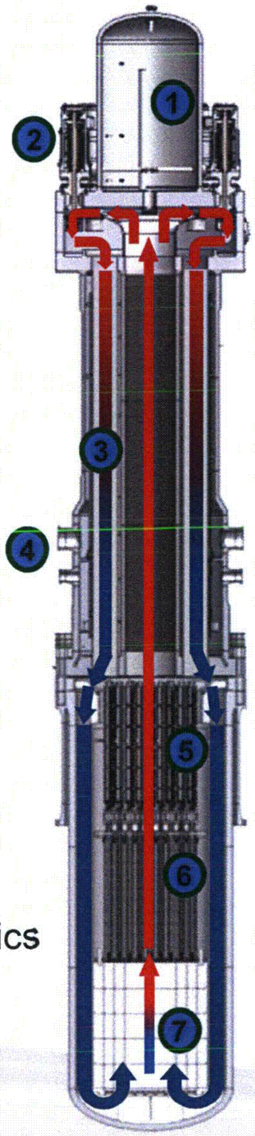
Integral Design

B&W mPower™ Reactor

- Integral 530 MWt NSSS module
  - Internal CRDMs, SG, Pressurizer and Coolant Pumps
  - Lowest penetration 23 feet above top of active fuel
  - 50-degree superheat in Secondary Loop
  - 60-year design life, rail shippable
- Next generation passive safety design philosophy
  - Core remains covered during all postulated accidents
  - Long term coping without off-site support
  - Non-safety "defense-in-depth" systems used first
- PRA informed design
  - Multiple defense-in-depth layers: Goal of ~10^{-8}/yr CDF
- Testing confirmation of analytic models
- 4-Year fuel cycle with "standard" 17x17 PWR fuel
  - 69 fuel assemblies with <5% ^{235}U enrichment
  - ~40 GWD/T core avg burn-up & no shuffling delivers economics
  - Burnable poisons, no chemical boron shim in coolant
  - Full reactivity control using 69 control rod assemblies and/or moderator temperature coefficient reactivity feedback



1. Pressurizer
2. Reactor Coolant Pumps
3. Once-Through Steam Generator (OTSG)
4. Feedwater Inlet / Steam Outlet
5. Electro- Hydraulic CRDMs
6. Upper Internals
7. Reactor Core

Primary Conditions

2060 psia
606°F Core outlet
31 Mlbm/hr

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Safety Strategy

Goal: Minimize Radiological Consequences Through Prevention and Mitigation

- Prevention
  - Large class of Loss of Coolant Accidents (LOCAs) excluded by design
  - Spectrum of rod ejection accidents precluded by internal CRDMs
  - RCP shaft seal LOCA excluded by canned RCP design
  - Boron dilution event excluded by not using boron for reactivity shim
- Mitigation
  - Defense-in-Depth: non-safety systems are used for transient mitigation; safety systems for accident mitigation
  - Large Safety Margins: Relying only on safety systems, core damage is prevented for all design basis events
  - Core remains covered with water preventing significant cladding heat up and maintaining first fission product barrier intact for all credible scenarios
- Traditional analysis models used – RELAP, GOTHIC, and MAAP

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Safety Strategy

RCS Key Safety Improvements

- Provide double isolation of reactor coolant system
- Eliminate RCS inventory loss through a low break
- Eliminate concerns of debris transport through break (GSI-191)
- > 7 days of cooling from ECC

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Defense-in-Depth Strategies

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[Proprietary per Affidavit 5(a)-(f)]

ECC Video

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[Proprietary per Affidavit 5(a)-(f)]

Probabilistic Risk Assessment (PRA)

- Use of PRA
  - Measure of health and safety Risk to the population and surroundings
  - Informs plant design
  - Optimizes design
- mPower and PRA   *PRA* ⟷ *Design*
  - ADV diversity – Improved CDF an order of magnitude
  - Flooding insights
  - Low Power and Shutdown – auto-isolation to reduce overdrain events

B&W mPower Test Program Overview