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Valve Design Discussions

November 27th, 2012

(Redacted Version)

This is a pre-application document and includes preliminary B&W mPower Reactor design or design supporting information and is subject to further internal review, revision, or verification.

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Agenda

- Objectives
- Background
- Brief reactor coolant system (RCS) overview
- [ ] Valve (IIV) Benefits
- Emergency Core Cooling (ECC) LOCA response
- IIV concept and lower vessel flange design
  - Conceptual design and analysis
  - IIV testing
  - IIV inspection/monitoring
  - Operating experience
  - IIV maintenance
  - IIV qualification
- Conclusions
- Discussion

[CCI per Affidavit 4(a)-(d)]

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Objectives

- Describe IIV conceptual design, locations, and functions
- Discuss benefits for IIV use in mPower design
- Solicit feedback on approach for IIV

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Background

Current PWR's

- Large quantities of Class 1 piping, fittings and welds
- Two reactor coolant pressure boundary (RCPB) isolation valves

mPower™ Reactor

- [

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mPower Benefits

- Proven technology - typical Class 1 RCPB components
- Eliminates potential failure of RCPB piping, fittings, welds
- Drastically improves safety margins and overall reliability
- [

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mPower Innovative Approach to Safety

[CCI per Affidavit 4(a)-(d)]

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RCS Overview

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Benefits of IIVs

- Provide [ ] of reactor coolant pressure boundary
- Eliminate RCS inventory loss through [ ]
- Eliminate concerns [ ]
- Enable up to [ ]

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Emergency Core Cooling (ECC) LOCA Response

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[ ] LOCA Response Without IIVs

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High Break LOCA Response <u>With</u> IIVs

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Conceptual Design and Analysis
(Letdown POVs)

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Letdown IIV

[

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Cross Section View- Letdown IIV

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[CCI per Affidavit 4(a)-(d)]

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Conceptual Design – IIV

- [ ]
- Materials

  [ ]

- Flange Design

[ ]

[CCI per Affidavit 4(a)-(d)]

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Pressure, Seismic, & Preload Stresses

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Pressure, Seismic, & Preload Stresses

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Lower Vessel Flange Design

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Lower Vessel Flange Design

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IIV Testing and Inspection

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IIV Testing

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Consistent with current practice

[CCI per Affidavit 4(a)-(d)]

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Inspection / Monitoring

[

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Consistent with current practice

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Operating Experience

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OE and Lessons Learned

- Motor operated valves (MOV)
  - Industry experience and regulatory guidance shall be incorporated into MOV Program (e.g.)
    - JOG Program will be incorporated
      - Report MPR-2425-A used as a starting point for Class D valves
      - Periodic verification based on safety significance classification and functional margin
      - Extensive qualification testing will be employed to quantify degradation issues
- Other power operated valves (AOV, SOV and HOV)
  - RIS 2000-03, program attributes will incorporate MOV lessons learned
  - Performance data information from NUREG/CR-6644
- Check Valves
  - NUREG/CR-5944 – Characterization of degradation and failures (e.g.)
  - Nuclear Industry Check Valve Group (NIC)

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OE and Lessons Learned (cont.)

- Flanges and Bolts
  - Flange leakage observed; caused by deterioration of bolt or bolt preload after several operation cycles
    - GSI-29
  - Industry recommendations and guidelines incorporated in bolting integrity program
    - Material selection and testing
    - Bolting preload control
    - In-service inspection
    - Plant operation and maintenance
    - Evaluation of structural integrity of bolted joints

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Maintenance and Qualification

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IIV Maintenance

- Typical MOV/POV Periodic Maintenance
  - Packing replacement/adjustment
  - Seal inspection/replacement
  - Valve stem inspection
  - Lubrication locations
  - Bolt torque for bonnet to body joints
  - Proper lifting and handling procedure
  - Actuator maintenance

In kind Replaceable

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IIV Qualification

- Comply with
  - QME-1 (2007): End of life test, design basis event, production testing
  - IEEE-323: Class 1E equipment (MOV, SOV, Switches) purchase qualified components
  - IEEE-382: Actuator qualification done by Actuator vendor
  - IEEE-344: Seismic test/analysis methods (shake table testing, analytical methods)
- Create report per QV-7461.1 (qualified valve)
- Reports for production valve per QV-7463.1

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Conclusions

- IIV design is an innovative application of proven valve technology with performance within Code limits
- IIV Application in the mPower design [ ] concerns and improves safety with enhanced post LOCA response for the plant

[CCI per Affidavit 4(a)-(d)]

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Discussion