Attachment 3

mPower Reactor Fuel/Core Design and Analysis Slides (Non-Proprietary)

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Fuel/Core Design and Analysis Update (Redacted Version)

June 22, 2011

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AGENDA

- Introduction
- B&W mPower™ Reactor Fuel Mechanical Design Update
- Reactor Physics Design and Analysis Update
- Conclusions

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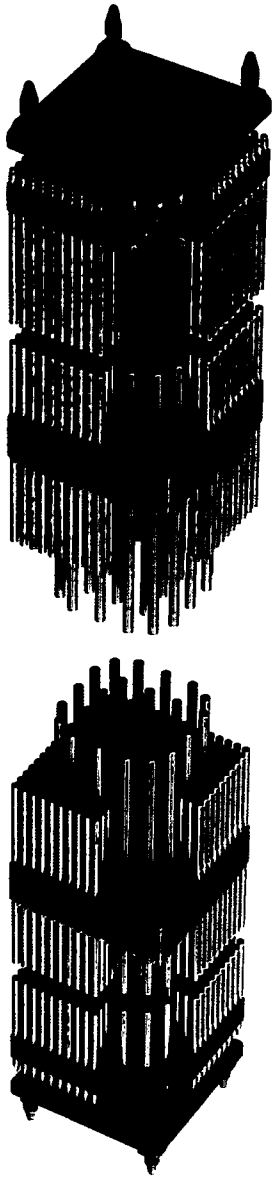

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Fuel Mechanical Design Update

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General Fuel Mechanical Design Objectives

- **Ensure that Fuel Rods, Burnable Poison Rods, Fuel Assemblies and In-Core Control Components are Designed -**
  - ★ **To Remain Leaktight for Anticipated Operational Occurrences (AOOs) and Postulated Accidents (PAs)**
    - **Designs Shall Account for the Effects of Temperature, Pressure, Irradiation, Fission Products, Static and Dynamic Loads, and Changes in the Chemical Characteristics of the Constituent Materials**
  - ★ **To Provide a Means for their Structural Integrity and Safe Handling During Transport, Storage, Installation, and Refueling Operations**

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General Fuel Mechanical Design Objectives (cont.)

- **Ensure that the Fuel System is Designed -**
  - ★ **To Maintain Structural Integrity Under all AOOs and PAs**
  - ★ **To be Compatible Under the Effects of Irradiation, and Chemical and Physical Processes**
  - ★ **To Minimize any Potential Obstruction to Coolant Flow**

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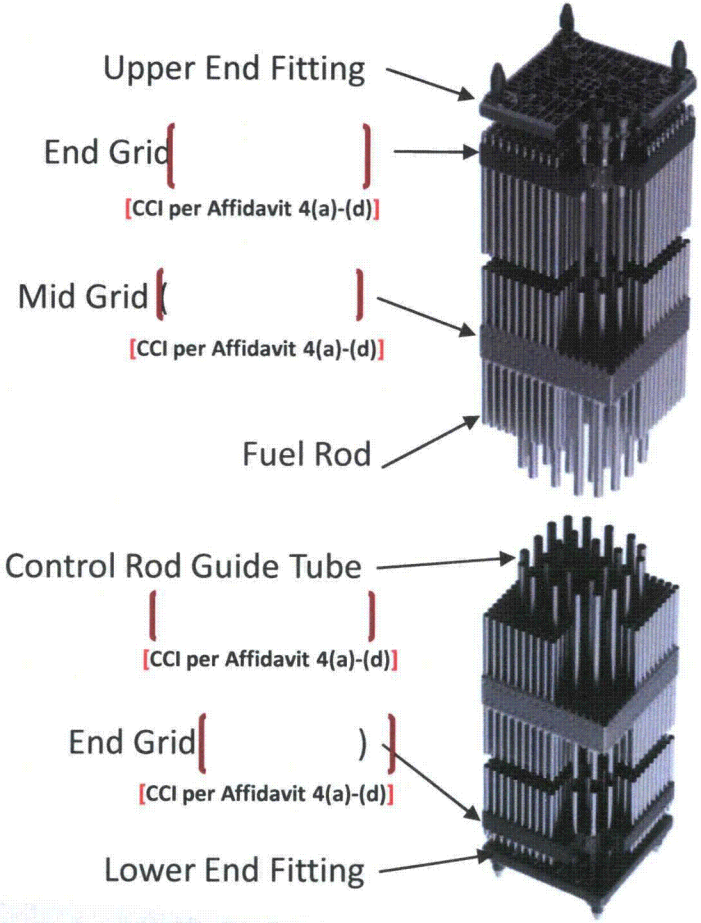
Fuel Assembly Design



Fuel Assembly Attributes

- 17 x 17 Fuel Rod Array

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

Shortened and Simplified Conventional Fuel Assembly Design

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Fuel Rod Design

Fuel Rod Attributes

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

- Low Power Density
- Large Plenum Volume (Low End of Life Pressure)

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

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

Conventional Fuel Rod Design

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Upper End Fitting

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

Simplified Upper End Fitting Design

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

Robust, Low Pressure Drop End Grids

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

Robust, Low Pressure Drop Mid Grids

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Guide Tube Assemblies

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

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Lower End Fitting

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

Simplified Lower End Fitting Design

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Lower End Fitting

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

Simplified Lower End Fitting Design

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Threaded Joints & Connections

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

Reliable Joint Design

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

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Reference Design Control Rod Configuration

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

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Mechanical Design Analysis Methodology

- **Development And Validation of Design Analysis Methodology And Computer Codes**
  - **Fuel Rod Design Analyses**
  - **Fuel Assembly Design Analyses**
- **Fuel Rod Design Analysis Methodology And Codes**

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

Developing Suite of Design Analysis Codes

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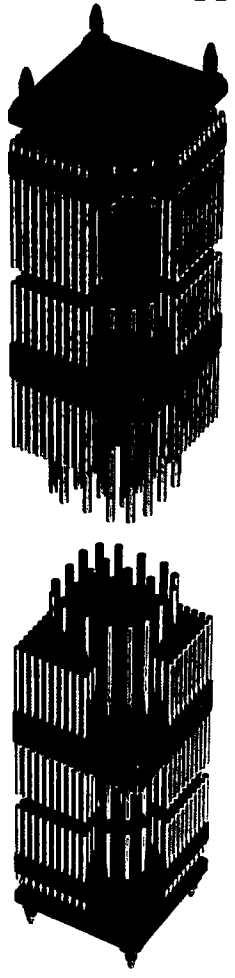
Mechanical And Hydraulic Tests



- **Extensive Mechanical And Hydraulic Testing Planned To Support Fuel Assembly Development And Qualify Design**

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

Comprehensive Fuel System Testing Program

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Mechanical And Hydraulic Tests

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

Extensive Component Mechanical Testing

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Mechanical And Hydraulic Tests

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

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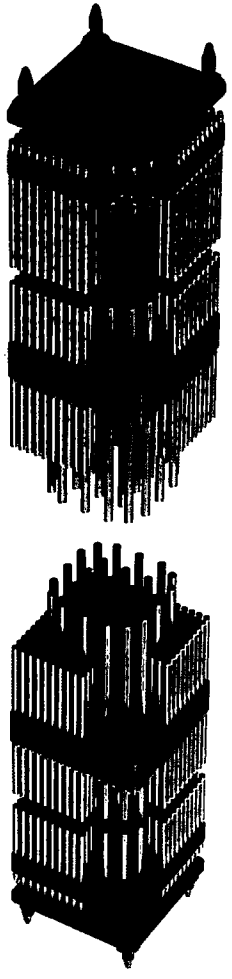
Mechanical And Hydraulic Tests



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

Static and Dynamic Fuel Assembly Tests

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Mechanical And Hydraulic Tests

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

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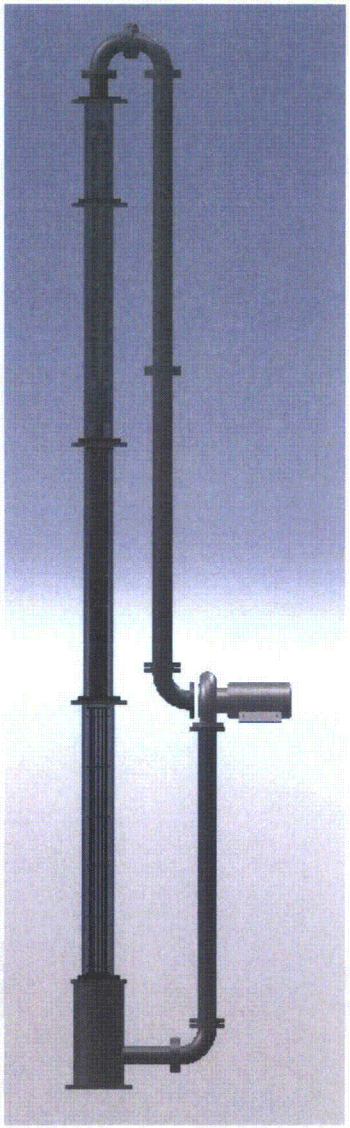
Mechanical And Hydraulic Tests



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

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Mechanical And Hydraulic Tests

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

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

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Prototype Fuel Assembly Fabrication

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

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Prototype Fuel Assembly Fabrication

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

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Prototype Fuel Assembly Fabrication

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

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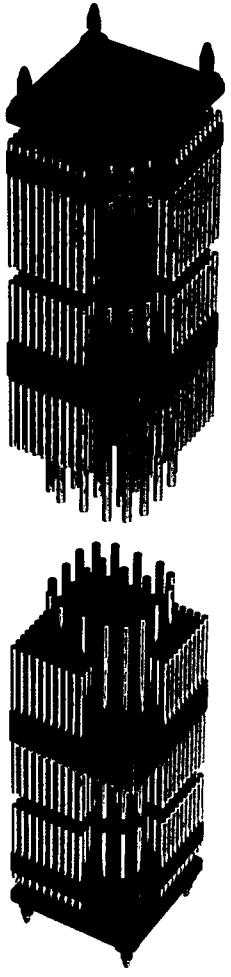
Mechanical Design Summary



- Reliable Design Based On Conventional 17x17 Array

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

Unique, Simple Fuel Assembly Design

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B&W mPower™ Reactor Physics Design Update

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

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Primary Core Design Objectives

- **Load Enough Fuel Inventory To Ensure That**
  - The Core Excess Reactivity Is Sufficient To Operate At A Steady-State Power Level For 4 Years At A Capacity Factor > 95% Without Refueling

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

- **Ensure Core Shutdown Margin (SDM) Of > 1% $\Delta k_{eff}/k_{eff}$ Under Cold Conditions At The Most Reactive Time In Core Life With The Highest Worth Rod Cluster Stuck Out**

Extended Core Life With Large Thermal Margins

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Fuel Design Characteristics

Conventional Fuel and Control Materials

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

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Core Design Developments

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

Simplified Assembly Design Variations

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Control Cluster Configuration and Worths

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

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Core Axial Power Distribution

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

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Axial, Radial, and Nodal Peaking

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

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MCNPX Lattice Physics Benchmarks

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

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Lattice Benchmark k_∞ Preliminary Results

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

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MCNPX Lattice Reflector Benchmarks

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

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Lattice Benchmark Reflector Preliminary Results

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

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Lattice Benchmark Reflector Preliminary Results

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

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Core Thermal-Hydraulic Subchannel Analysis

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

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

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

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

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B&W Nuclear Energy CHF Correlation

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

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Reactor Physics Design Status

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

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Conclusions