

July 10, 2013

10 CFR 52

U.S. Nuclear Regulatory Commission (NRC) ATTN: Document Control Desk 11555 Rockville Pike Rockville, MD 20852-2738

Subject: Project No. PROJ0776 Generation mPower LLC (GmP) Submittal of GSI-191 Technical Report Overview and Integrated System Test Program Update Presentation Slides Ltr. No. LTR-13-0040

A meeting is scheduled to be conducted between GmP and NRC staff in Rockville, MD on July 30, 2013. Two sessions will be held on the topics noted in the above subject line. Participants will include technical staff from GmP, B&W mPower, and NRC. GmP has requested these sessions be closed to the public because of the proprietary nature of the design information to be discussed.

Two sets of the slides to be presented during the meeting are enclosed with this letter. A portion of the information provided in the slides is considered proprietary Information. GmP requests that the proprietary information within these slides be withheld from public disclosure in accordance with the requirements of 10 CFR 2.390. Enclosure 1 is a signed affidavit that provides the justification for withholding the proprietary information enclosed within brackets in Enclosures 2 and 3. Enclosures 4 and 5 are non-proprietary (redacted) versions of the slides for public release.

If you have any questions or need any additional information, please contact me at your convenience at (980) 365-2071 or at <u>pshastings@generationmpower.com</u>.

Peter S. Hastings Director of Licensing Generation mPower LLC

Enclosures: 1. Affidavit

- 2. GSI- 191 Technical Report Overview and Discussions Slides (Proprietary)
- 3. Integrated System Test Program Update Slides (Proprietary)
- 4. GSI- 191 Technical Report Overview and Discussions Slides (REDACTED)
- 5. Integrated System Test Program Update Slides (REDACTED)

cc: J. L. Starefos, NRC, TWFN 9-F-27 S. L. Magruder, Jr, NRC, TWFN 9-F-27

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Enclosure 1 AFFIDAVIT of Peter S. Hastings

#### **AFFIDAVIT OF PETER S. HASTINGS**

State of North Carolina

County of Mecklenburg

I, Peter S. Hastings, being duly sworn, do hereby depose and say:

1. I am the Director of Licensing for Generation mPower LLC (GmP). I have been delegated the responsibility for reviewing information sought to be withheld from public disclosure in connection with information being submitted to U.S. Nuclear Regulatory Commission (NRC) related to the proposed mPower Plant design certification application and I am authorized to apply for its withholding from public disclosure on behalf of GmP.

2. I am making this affidavit in conformance with the provisions of 10 CFR 2.390 of the regulations of the NRC and in conjunction with GmP's application for withholding which accompanies this affidavit.

3. I have knowledge of the criteria used by GmP in designating information as sensitive, proprietary, or confidential. I am familiar with the information contained in presentation slides entitled "GSI-191 Technical Report Overview and Discussions" and "Integrated System Test Program Update," and information contained in these documents has been classified by GmP as sensitive, proprietary, or confidential in accordance with GmP procedures.

4. Pursuant to the provision of paragraph (a)(4) of 10 CFR 2.390, the following is furnished for consideration by the NRC in determining whether the information sought to be withheld from public disclosure should be withheld.

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a. The information sought to be withheld from public disclosure is owned by or licensed to GmP and has been held in confidence by GmP, Babcock & Wilcox mPower, Inc.
(B&W mPower), and their consultants.

b. The information sought to be protected is not publicly available to the best of our knowledge and belief.

c. The information is of the type that would customarily be held in confidence by GmP. This information includes GmP's and B&W mPower's conceptual and technical approaches regarding details of the design of the B&W mPower<sup>™</sup> reactor systems, structures, and components and associated analysis, and classifications, disclosure of which could adversely affect our competitive position by informing competitors of the degree of maturity and viability of the program, thereby motivating them to increase efforts to develop competing technologies. All or parts of the approach described in the withheld material is patentable.

d. Release of the subject information will harm GmP because GmP will be put at a competitive disadvantage if its competitors in the small modular reactor market become aware of its proprietary information. In addition, GmP has contractual relationships with B&W mPower regarding proprietary information, and GmP is contractually obligated to seek confidential and proprietary treatment of such information.

e. The proprietary information sought to be withheld from public disclosure is identified and is marked as proprietary as it appears in the materials.

f. The information was transmitted to the NRC in confidence and under the provisions of 10 CFR 2.390; it is to be received in confidence by the NRC.

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I declare under penalty of perjury under the laws of the United States of America that the

foregoing is a true and correct statement of facts.

Peter S. Hastings

Subscribed and sworn to before me this  $10^{4}$  day of July, 2013. J .DET=301 Notary Public

My commission expires: April 10, 2017

Enclosure 4 GSI- 191 Technical Report Overview and Discussions Slides (REDACTED)

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## **MPOMER** GSI-191 Technical Report Overview & Discussions

July 30, 2013 (Redacted Version)

This material is based upon work supported by the Department of Energy under Award Number DE-NE0000583.

This report was prepared as an account of work sponsored by an agency of the United States Government.

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### **Meeting Topics and Objectives**

#### Discuss B&W mPower GSI-191 Technical Report

- Background and purpose
- Contents key design and evaluation information
- Conclusions

#### Address NRC comments, questions, and concerns

#### **Identify future actions**

pre-application and application

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### **Report Background**

- Design evolution lead to elimination of low breaks and sump recirculation
  - [ ] Isolation Valve [ ] overview

### Submittal of B&W mPower GSI-191 Position Paper

• MPWR-EPP-005009

### **Recent Interaction with NRC staff at design meetings**

11/27/12 meeting – NRC feedback

[Proprietary per Affidavit 4(a)-(f)]



### **GSI-191 Technical Report Contents**

#### Introduction

#### Background

History of GSI-191

#### **B&W mPower Design Overview**

- Design Features
- Emergency Core Cooling System (ECC) Operation

### Regulatory Guide (RG) 1.82 Conformance

**Conclusions/Recommendations** 

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### **B&W mPower Design Overview**

#### **Reactor Design**

- Modular advanced light water reactor
- Integral arrangement of reactor core, steam generator, pressurizer
- Eliminates large primary coolant loop piping
- Reduces inventory discharge rate in a LOCA
- Reduces insulation and post-LOCA debris sources



### **B&W mPower Design Overview**

### **ECC Design**

- Provides passive, long-term, core decay heat removal with the RWST and ADVs
- Two identical, redundant trains



### **B&W mPower Design Overview**

#### **RWST Design and Water Quality**







### **ECC Operation**

#### **RWST** provides long-term core cooling for DBAs

Time Frame	Objective	Core Cooling Source
72 hours	Supply passive core-cooling for 72 hours without operator action or AC power	RWST inventory
72 hours- 7 days	Supply core-cooling for at least 7 days with onsite sources	RWST inventory
Indefinite (30 days)	Continue to provide cooling	Means provided to add inventory to RWST

[Proprietary per Affidavit 4(a)-(f)]





### **RG 1.82 Conformance**

## RG 1.82 employs evaluation guidance for long-term recirculation cooling following a LOCA

- Section C. Staff Regulatory Guidance—includes regulatory positions on design criteria, performance standards, and analysis methods that relate to reactor types
- Identifies information and methods that NRC staff considers acceptable for use in evaluating analytical techniques and implementing regulations related to water sources for long-term cooling of (...) reactor systems.

### **Report discusses RG guidance items**

- Includes conformance discussions for applicable items
- Identifies items not applicable

### **Design conforms to RG 1.82 guidance.**



### Conclusions

#### **B&W mPower design features [**

Design conforms to RG 1.82 guidance





Enclosure 5 Integrated System Test Program Update Slides (REDACTED)

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### Integrated System Test Program Update

July 30, 2013 (Redacted Version)

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generation m**Power** Contents

- IST Program
  - Design
  - Operations
  - Quality
- Scaling Update
- Testing
  - Steam Generator Performance
  - [
  - 2013 Plan
- Operational Experience
- Summary



### Integrated System Test Program

### generation *mPower* IST Objectives

- Integrated system performance
- Steam generator and component performance
- Evaluation model development support
- Licensing support
- Insights
  - Control and protection systems development
  - Design enhancements
  - Simulator development
  - Operating procedures and training development
- Demonstration to potential customers



A broad spectrum of objectives identified





### *mPower* IST – *mPower* Design Comparison

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[Proprietary per Affidavit 4(a)-(f)]

### generation *m***Power** Systems Included in the IST





[Proprietary per Affidavit 4(a)-(f)]

### generation *mPower* IST Systems Diagram



generation *mPower HP/LP ADV* 

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### generation *mPower* IST Organizational Chart

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### generation *mPower* IST Programs

Program	Governing Procedure
Conduct of Testing	
Conduct of Operations	
Conduct of Engineering	
Conduct of Training	
Conduct of Maintenance	]

[Proprietary per Affidavit 4(a)-(f)]
# **IST Quality Assurance Program**

- IST Quality Assurance Program Plan (QAPP):
  - Represents the top-level IST quality document
  - Defines the QA criteria that are implemented at the IST
    - 18 implemented (through specific commitments / exceptions) by the B&W mPower Quality Assurance Program Description (QAPD)
    - 6 of the above not implemented at the IST
      - Design Control(3), Identification and Control of Materials, Parts, and Components (8), and Control of Special Processes (9)
      - Inspection (10), Handling, Storage and Shipping (13), and Inspection, Test, and Operating Status (14)
  - Documents IST commitments / exceptions for the implemented QA criteria, as addressed by Part III, Section 1 (Non-Safety-Related SSCs - Significant Contributors to Plant Safety) of the B&W mPower QAPD.
  - Defines the set of controls that collectively establish the IST augmented-quality (IST-AQ) designation for selected IST testing and test data.

# **Quality Designations of IST Programs**

- IST Non-Quality Programs:
  - Conduct of Operations
  - Conduct of Engineering (including IST configuration control)
  - Conduct of Maintenance
- IST Quality-Related Programs:
  - Conduct of Training Program governs processes that qualify IST test engineers to perform IST-AQ testing.
  - Conduct of Testing Program governs processes that control IST-AQ testing and the production of IST-AQ test data, as well as measuring and test equipment (M&TE) that support such activities.

# IST Conduct of Training Program

- Establishes an IST-AQ designation for the following processes:
  - Definition of test-engineer training matrices
  - Initial qualification of test engineers against the above training matrices
  - Requalification of test engineers against the above training matrices
- Defines the IST-AQ documents that govern the above processes:
  - Qualification records for test engineers
- Governs the nonquality-related training and qualification of IST
  Operators

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# **IST Conduct of Testing Program**

- Establishes an IST-AQ designation for the following processes:
  - Configuration control of the computer hardware / firmware / software that comprises the IST traceable data stream (i.e., the pathway for acquired test data from analog signal input through digital data storage)
  - Calibration and control of M&TE (including IST instruments)
  - Development, execution and documentation of testing, whose specifications are developed by the B&W mPower design organization
  - Establishment of archive coordinates (i.e., instrument tags and start / stop times) that allow digitally-stored test data to be retrieved and subsequently qualified by the B&W mPower design organization
- Defines the IST-AQ documents that govern the above processes:
  - XAQT / XACR test control test package and completion record
  - XATR test report and production of the electronic data set
  - XADS approved electronic data set (MS Excel spreadsheet)
  - Each completed document is maintained as a quality record.

## generation *mPower* IST Electronic Test Data

• Data acquisition system [

[Proprietary per Affidavit 4(a)-(f)]



## Integrated System Test Scaling Update

## generation m**Power** Previously Scaled Tests

- OTSG Design and Verification Tests
- MIST Test Facility (BAW-2021, NUREG/CR-5395)
  - Lowered Loop OTSG
  - Test Objectives
    - SBLOCA
    - PORV-HPI
    - ATOG
  - Scaling
- OTIS Tests (BAW-1905, NUREG/CR-4567)
  - Raised Loop OTSG
  - SBLOCA
  - ATOG
- GERDA
  - → IEOTSG
  - SBLOCA

## generation m**Power** IST Phenomena / Scaling

 Ishii & Kataoka Report, "Scaling Criteria for LWRs Under Single-Phase and Two-Phase Natural Circulation, CONF-820962-04, September 1982"

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[Proprietary per Affidavit 4(a)-(f)]



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IST Phenomena / Scaling (cont.)

[Proprietary per Affidavit 4(a)-(f)]



[Proprietary per Affidavit 4(a)-(f)]



### generation *mPower* EM Development

- IST is a component of the Evaluation Model (EM) Adequacy Assessment (RG 1.203)
- The mPower EM is developed using:
  - Expert judgment and elicitation (PIRT)
  - Additional assessments to expand and complete data base
  - Uncertainty, scaling, and importance analysis
  - Methodology guidelines

Establishes the basic principles important for the development, assessment, and review of safety analysis methods



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## Safety Analysis & Methods and IST Interface

Process for Obtaining IST Data for the EM Assessment

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# The IST Conduct of Testing (CoTST) Program

- Develops / controls / performs / documents IST experimental testing
- Supports mPower design / performance / licensing efforts
- Defines test descriptions and objectives

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- Produces unambiguous test procedures with acceptance criteria
- Acquires and archives data with traceability and uncertainty
- Resolves discrepancies between data and expected performance

[Proprietary per Affidavit 4(a)-(f)]



# **IST Steam Generator Testing**

• Define the forced circulation thermal/hydraulic performance of the B&W mPower once-through steam generator.

Test Objectives created by SG analysts, executed by IST Test Engineering

[Proprietary per Affidavit 4(a)-(f)]

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## **IST Steam Generator Testing**

Nominal	Low SG Pressure	High SG Pressure	Low FW Temp	High FW Temp	RCS Average Temp	Constant Minimum Super - heat	Low Power

] Test Packages defined to create a thorough understanding of SG performance.

[Proprietary per Affidavit 4(a)-(f)]



## Startup and Power Range Temperature Trends

SG operational experience input to mPower

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[Proprietary per Affidavit 4(a)-(f)] 36



# **Isokinetic Steam Sampling**

Proven ASME method of steam sampling

[Proprietary per Affidavit 4(a)-(f)]



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## **Steam Generator Performance**

[Proprietary per Affidavit 4(a)-(f)]

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## Steam Generator- RELAP Comparison

[Proprietary per Affidavit 4(a)-(f)]



[Proprietary per Affidavit 4(a)-(f)]



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[Proprietary per Affidavit 4(a)-(f)]





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[Proprietary per Affidavit 4(a)-{f}]



## **IST Operational Experience**

### generation *mPower* IST Operational Experience

• IST Declared "Operable" March 16, 2012; Commenced Startup / Heat-up

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Achieved full operating temperature and pressure on July 12, 2012

[Proprietary per Affidavit 4(a)-(f)]

### generation *mPower* IST Operation

The IST has operated well from initial start-up

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[Proprietary per Affidavit 4(a)-(f)]
## generation *mPower* IST Program Summary

- IST fully operational and testing is well underway
- Quality program operative
- Completed steam generator performance [
  ] tests

[Proprietary per Affidavit 4(a)-(f)]

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