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U.S. Nuclear Regulatory Commission  
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Babcock & Wilcox mPower, Inc.  
Docket Number-PROJ0776  
Project Number-776

Subject: Voluntary Response to NRC Regulatory Issue Summary (RIS) 2012-12, "Licensing Submittal Information and Design Development Activities for Small Modular Reactor Designs," dated December 28, 2012

Attached please find the Babcock & Wilcox mPower, Inc. (B&W mPower) response to the subject RIS. This response updates information previously provided to the NRC from B&W Nuclear Energy, Inc. (B&W NE), on February 9, 2012. As noted in previous correspondence, the Babcock and Wilcox Company reorganized in 2012, removed the mPower design activities from B&W NE, and established a separate business unit named B&W mPower, Inc.

B&W mPower continues to advance the B&W mPower™ Reactor design with Bechtel Power Corporation's support under Generation mPower, LLC. Based on our current project schedule, a Design Certification Application (DCA) for the B&W mPower Reactor design is planned for submittal to the NRC in the third quarter of calendar year (CY) 2014.

Generation mPower, LLC, is also continuing to support the Tennessee Valley Authority's (TVA's) plans to submit a Construction Permit Application (CPA) for mPower Reactor modules at the Clinch River site in Roane County, Tennessee. Further information regarding this project will be provided separately by TVA in response to the subject RIS.

Questions concerning this submittal may be directed to Jeff Halfinger at 434-316-7507 (email: [jahalfinger@babcock.com](mailto:jahalfinger@babcock.com)) or Peter Hastings at 980-365-2071 (email: [pshastings@generationmpower.com](mailto:pshastings@generationmpower.com)).



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Attachments: 1: B&W mPower Response to NRC RIS 2012-12  
2: Planned Pre-Application Technical/Topical Report Submittals to NRC

cc: Glenn M. Tracy, NRC  
Michael Mayfield, NRC  
Stewart L. Magruder, Jr., NRC  
Joelle L. Starefos, NRC  
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# Attachment 1

## B&W mPower RESPONSE TO NRC RIS 2012-12

### *Design and Licensing Submittal Information*

- **When (month and year) are applications planned for design-related applications and what NRC action will be requested (i.e., DC, DA, ML, or COL that does not reference a DC or DA)?**

B&W mPower expects to transition the role of design certification applicant to Generation mPower, LLC (GmP) in the second quarter of calendar year (CY) 2013.<sup>1</sup> The Design Certification Application (DCA) for the mPower™ Reactor design is expected to be submitted to the NRC in the third quarter of CY 2014. This date is later than previously communicated in part as a result of the timing of the November 2012 DOE award and associated funding for small modular reactors to the mPower team.

- **Will the applicants be organized into DCWGs? If known, what is the membership of the DCWG and which party is the primary point-of-contact designated for each DCWG?**

A number of electric utility companies continue to participate with B&W mPower and Generation mPower in the review of design development and design certification preparation activities, both in a broad Industry Advisory Council, and in a more focused mPower Consortium. The mPower Consortium includes TVA, First Energy Corporation, and 12 regional generation and transmission companies, represented by the Oglethorpe Power Corporation. TVA's Construction Permit Application (CPA) is expected to be the lead site-specific license application for the standard Generation mPower design. TVA and Generation mPower are working closely together to integrate the CPA, DCA and Operating License Application (OLA) activities. The mPower consortium is expected to evolve into an mPower Reactor DCWG, and protocols are being developed to ensure that coordinated responses will be provided for RAIs with generic applicability to the design center in the future and to maintain configuration management among the applications.

- **Have protocols been developed to provide coordinated responses for RAIs with generic applicability to a design center?**

As noted above, protocols are being developed to provide coordinated responses to RAIs.

- **Which applicant that references the design will be designated as the reference COL applicant or, alternatively, how will various applications (e.g., CP, DC, COL) be coordinated to achieve the desired design-centered licensing review approach?**

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<sup>1</sup> B&W mPower and GmP will discuss the details of this transition with the NRC staff; those discussions, along with B&W mPower's continued essential role in GmP, will ensure a smooth transition and preclude disruption to ongoing pre-application interactions. At the appropriate time, this RIS response will be amended accordingly to reflect the transition.

TVA has communicated to the NRC that it plans, as the lead site-specific applicant for the mPower Reactor design, to submit a CPA for mPower modules to be built at the Clinch River site in Roane County, Tennessee. TVA remains committed to standardization and expects that a future operating licensing stage Final Safety Analysis Report could serve as a template for a reference mPower COL applicant in the future. In addition, TVA's use of the Regulatory Framework Documents (RFDs), already shared with the NRC, assures alignment with the NRC on the scope and content of the Clinch River CPA as well as the additional level of detail to be provided in the DCA and OLA. Alignment between the CP, DCA, and OLA assures the required coordination to achieve the desired design-centered licensing review approach. B&W mPower also shares that commitment to standardization for future applications referencing the mPower design under 10 CFR Part 52.

- **When (month and year) will CP, COL, or ESP applications be submitted for review? In addition, what are the design, site location, and number of units at each site?**

TVA is expected separately to update that information in its response to this RIS.

- **Are vendors or consultants assisting in the preparation of the application(s)? If so, please describe roles and responsibilities for the design and licensing activities.**

The following companies are supporting the design and licensing activities associated with the mPower Reactor Design:

**Bechtel Power Corporation** - Balance of Plant Design in accordance with the Generation mPower LLC alliance (note that Bechtel is also supporting the TVA CPA effort);

**Northrop Grumman** - Instrumentation & Control design integration, software quality assurance;

**Stern Laboratories, Inc** - Critical Heat Flux Testing;

**Maracor Software & Engineering Inc.** - Probabilistic Risk Assessment Activities;

**Erin Engineering and Research, Inc.** – Aircraft Impact Assessment;

**ClydeUnion Pumps, an SPX Brand** – Design of reactor coolant pumps;

**Zachry Nuclear Engineering, Nuclear Applications Division** – Safety Analysis support.

### ***Design, Testing, and Application Preparation***

- **What is the current status of the development of the plant design (i.e., conceptual, preliminary, or finalizing)? Has the applicant established a schedule for completing the design? If so, please describe the schedule.**

The conceptual design for the B&W mPower design is complete. Preliminary design development is continuing in parallel with development of the DCA and appropriate design information will be developed to support both the DCA and the TVA CPA for the Clinch River site. The schedule for completing the design is currently being revised. These revisions are necessary to reflect the timing of the DOE funding award and contract.

- **What is the applicant's current status (i.e., planning, in progress, or complete) for the qualification of fuel and other major systems and components? Has the applicant established a schedule for completing the qualification testing? If so, please describe the schedule.**

The following are the planned testing programs to support the DCA:

Control Rod Drive Mechanism Testing;  
Critical Heat Flux Correlation Testing;  
Fuel Mechanical Design Separate Effects Testing;  
Integrated CRDM/Fuel Testing;  
Integrated Systems Testing;  
Reactor Coolant Pump Testing.

Several of these test programs have begun and have been described in earlier B&W mPower technical report submittals to the NRC. In addition, planned testing programs have been discussed in detail in several meetings with NRC staff. Testing is underway for all of the programs identified above. Additional qualification test program information and schedule updates will be shared with NRC staff in future meetings and in subsequent communications.

- **What is the applicant's status (i.e., planning, in progress, or complete) in developing computer codes and models to perform design and licensing analyses? Has the applicant defined principal design criteria, licensing-basis events, and other fundamental design/licensing relationships? Has the applicant established a schedule for completing the design and licensing analyses? If so, please describe the schedule.**

B&W mPower plans to utilize computer codes such as CASMO/Simulate and FRAPCON for the reactor and fuel analyses. In addition, industry standard computer codes such as GOTHIC and RELAP will be used, as appropriate. Principal design criteria, licensing basis events, and (as appropriate) other fundamental design/licensing relationships are being identified during the ongoing design work and preparation of the DCA. Additional details regarding our planned safety analysis were included in our technical report submittal dated November, 2011, entitled, "Safety Analysis Evaluation Methodology Requirements for the B&W mPower™ Reactor." Preliminary computer models and analysis results were presented to the NRC in a meeting held on January 29, 2013 and will be refined as preparation of the DCA continues. In addition, the development of accident analysis methods using the Regulatory Guide 1.203 framework, and data from the B&W mPower Integrated Systems Test facility, will continue throughout 2013 and result in a topical report submittal according to the attached schedule. The schedule for completing the design and licensing analyses is being incorporated in the project master schedule revision.

- **What is the applicant's status in designing, constructing, and using thermal-fluidic testing facilities and in using such tests to validate computer models? Has the applicant established a schedule for the construction of testing facilities? If so, please describe the schedule. Has the applicant established a schedule for completing the thermal-fluidic testing? If so, please describe the schedule.**

An integrated systems test (IST) facility has been constructed near Lynchburg, Virginia, and is operational. An existing vendor testing facility (Stern Laboratories, Inc., located in Ontario, Canada) is being utilized for critical heat flux (CHF) testing. The CHF testing began in 2011 and is providing the data upon which the fuel DNBR correlation will be based. The IST facility is providing data that characterizes the performance of the integral reactor and associated systems including the steam generator and will provide transient system performance data to assess the adequacy of the evaluation model.

- **What is the applicant's status in defining system and component suppliers (including fuel), manufacturing processes, and other major factors that could influence design decisions? Has the applicant established a schedule for identifying suppliers and key contractors? If so, please describe the schedule.**

Major primary system components (e.g., integral reactor vessel, steam generator, reactor internals including control rods and drives) will be provided from within the B&W family of companies. The reactor coolant pumps will be supplied by ClydeUnion. Also, it is anticipated the turbine-generator and an integrated instrumentation and control (I&C) system will be supplied by external entities. Additional information about suppliers and contractors will be provided at a later date.

- **What is the applicant's status in the development and implementation of a quality assurance program?**

The B&W NE Quality Assurance Program Topical Report (08-00000320-000-A, Rev. 2, "Quality Assurance Program for the Design Certification of the B&W mPower Reactor") dated January 31, 2011, has been approved by the NRC. With the separation and creation of B&W mPower from B&W NE, a B&W mPower Quality Assurance Program Description was issued and is being used for design and testing activities being conducted by B&W mPower. The B&W mPower Quality Assurance Program Description has been fully evaluated to assure it does not reduce the commitments made in the approved topical report.

- **What is the applicant's status in the development of probabilistic risk assessment models needed to support applications (e.g., needed for Chapter 19 of safety analysis reports or needed to support risk-informed licensing approaches)? Does the applicant plan to use PRA for risk-informed applications (i.e., risk-informed technical specifications, risk-informed inservice inspection, risk-informed categorization and treatment, risk-informed inservice testing, etc.). What are the applicants' plans for using the PRA models in the development of the design? At what level will the PRA be prepared and when will it be submitted in the application process?**

B&W mPower is preparing a Level 1, and Level 2, and a limited scope Level 3 PRA for the mPower Reactor design. B&W mPower is informing the design by using it to identify significant contributors to risk in the mPower Reactor design and instituting design changes to minimize or eliminate those contributions. The PRA is also being used to identify and subsequently minimize defense in depth vulnerabilities. This was recently discussed at the January 29, 2013 meeting with NRC technical staff.

- **What is the applicant's status in the development, construction, and use of a control room simulator?**

B&W mPower is executing the design and construction of a main control room (MCR) prototype for the mPower Reactor. The prototype is currently being integrated with a simulation model to facilitate dynamic assessment of user interface design concepts. The prototype will be used to validate staffing assumptions, concept-of-operation, navigation, alarm presentation and proceduralized automations. The user interface concept development strategy and its integration into the HFE design process is consistent with the six HFE Technical Reports submitted to the NRC in 2012.

- **What are the applicant's current staffing levels (e.g., full-time equivalent staff) for the design and testing of the reactor design? Does the applicant have plans to increase staffing? If so, please describe future staffing plans.**

Currently the total staffing level for Generation mPower, B&W mPower and Bechtel is over 300 full time equivalents (FTEs).

- **What are the applicant's plans on the submittal of white papers or technical/topical reports related to the features of their design or the resolution of policy or technical issues?**

Please refer to Attachment 2.

- **Has the applicant established a schedule for submitting such reports? If so, please describe the schedule.**

Please refer to Attachment 2.

- **Will ESP applicants seek approval of either "proposed major features of the emergency plans" in accordance with 10 CFR 52.17(b)(2)(i) or "proposed complete and integrated emergency plans" in accordance with 10 CFR 52.17(b)(2)(ii)?**

Not Applicable

- **Describe the possible interest in the use of the provisions of Subpart F, "Manufacturing Licenses," of 10 CFR Part 52 instead of, or in combination with, other licensing approaches (e.g. DC or DA).**

B&W mPower does not plan to pursue a manufacturing license for the mPower Reactor at this time.

- **Describe the desired scope of a possible ML and what design or licensing process would address the remainder of the proposed nuclear power plant. For example, would the ML address an essentially complete plant or would it be limited to the primary coolant system that basically comprises the integral reactor vessel and internals?**

Not Applicable

- **Describe the expected combination of manufacturing, fabrication, and site construction that results in a completed operational nuclear power plant. For example, what systems, structures, and components are being fabricated and delivered? Which of these are being assembled on site? Which of these are being constructed on site?**

Details on the information related to this question will be provided at a later date.



## Attachment 2

### PLANNED PRE-APPLICATION TECHNICAL/TOPICAL REPORT SUBMITTALS TO THE NRC February 2013

TOPIC	Planned SUBMITTAL DATE	CATEGORY
Source Term Methodology	Q 2 2013	Topical
GSI-191 Discussion Paper	Q 2 2013	Technical
RVT Methodology Report	Q 2 2013	Topical
Security Staffing Methodology	Q 2 2013	Topical
VIPRE Qualification	Q 3 2013	Topical
Fuel System Mechanical Design Criteria R-1	Q 3 2013	Technical
T-H/DNB Methodology	Q 4 2013	Topical
Operating Experience Review Plan (Rev 1)	Q 4 2013	Technical
HFE Program Management Plan (Rev 1)	Q 4 2013	Technical
Functional Requirements Analysis and Function Allocation (Rev 1)	Q 4 2013	Technical
HFE Integration of HRA (Rev 1)	Q 4 2013	Technical
Task Analysis (Rev 1)	Q 4 2013	Technical
Human Factor Engineering Verification and Validation Plan (Rev 1)	Q 4 2013	Technical
I&C Software Quality Assurance and Program Plan (Digital Safety Systems)	Q 1 2014	Topical
LOCA Accident Analysis Methodology	Q 1 2014	Topical
Human System Interface Design Program	Q 1 2014	Technical
Procedure Development Guidelines Implementation Plan	Q 1 2014	Technical
Training Program Development Guidelines	Q 1 2014	Technical
HFE Design Implementation Program Plan	Q 1 2014	Technical

<b>TOPIC</b>	<b>Planned SUBMITTAL DATE</b>	<b>CATEGORY</b>
<b>HFE Lifecycle Management Program Plan</b>	<b>Q 1 2014</b>	<b>Technical</b>
<b>Fuel Seismic Code and Analysis Methodology</b>	<b>Q 1 2014</b>	<b>Topical</b>
<b>Fuel Rod Performance Code and Analysis Methodology</b>	<b>Q 2 2014</b>	<b>Topical</b>
<b>Critical Heat Flux Test and Correlation (Results)</b>	<b>Q 2 2014</b>	<b>Topical</b>
<b>Integrated System Test Report (Phase 1)</b>	<b>Q 2 2014</b>	<b>Technical</b>
<b>I&amp;C System Defense-in-Depth and Diversity</b>	<b>Q 2 2014</b>	<b>Topical</b>
<b>FOAK Testing Proposals for mPower Reactor</b>	<b>Q 2 2014</b>	<b>Technical</b>
<b>Severe Accident Methodology</b>	<b>Q 2 2014</b>	<b>Topical</b>
<b>Pressure-Temperature Limits Methodology</b>	<b>Q 2 2014</b>	<b>Topical</b>
<b>Operational Concepts of mPower Design</b>	<b>Q 3 2014</b>	<b>Technical</b>
<b>Fuel System Design Evaluation Report</b>	<b>Q 3 2014</b>	<b>Topical</b>
<b>Integrated System Test Report (Phase 2)</b>	<b>Q 4 2015</b>	<b>Technical</b>