

Plan for an On-Site Audit of the mPower Probabilistic Risk Assessment

I. Purpose

Babcock & Wilcox Nuclear Energy (B&W) is developing the mPower integrated pressurized water reactor and intends to apply to the Nuclear Regulatory Commission (NRC) for certification of the design in the fourth quarter of 2013. The staff will conduct an on-site audit for the purpose of gathering pre-application information on the reactor's probabilistic risk assessment (PRA).

The staff has two objectives:

1. to assess the extent to which the PRA is aligned with the NRC staff's guidance and expectations for a PRA that supports design certification
2. to identify risk insights for the mPower design that the NRC staff may use to allocate resources in its review

In addition, the staff will discuss interim staff guidance and topics related to PRA in order to facilitate the submittal of an acceptable application for design certification by B&W.

II. Background and Audit Bases

By letter dated April 28, 2009, B&W informed the NRC of its intent to apply for certification of the mPower design, its 160 MWe integrated pressurized-water reactor (iPWR). The NRC staff began pre-application interactions with B&W (and Generation mPower, a consortium of companies with an interest in the B&W design) to gain familiarity with the conceptual design. In addition, the staff has engaged B&W in more detailed discussion of key technical considerations and the appropriate regulatory framework for reviewing the proposed design. Conducting a pre-application audit of the mPower PRA is consistent with the NRC staff's commitment to review developments at the earliest opportunity and provide timely feedback.

The NRC staff reviews PRA results and insights for iPWR license applications in accordance with NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants, LWR Edition" (SRP), specifically, SRP Chapter 19, "Severe Accidents." By applying risk insights during their reviews, the NRC staff can focus its attention and resources upon aspects of the design that contribute most to plant safety. Such a review is characterized as "risk-informed."

Although it is no longer required, an applicant for design certification may choose to submit the associated PRA report (including results and key "risk insights") along with the application for its certification. All others have included the results and risk insights as part of the generic design control document (DCD). These risk insights reflect features and characteristics of the design that significantly affect risk. The NRC staff has reviewed these insights for each new reactor design certification application and used them to develop risk-informed guidance for its technical reviewers. In some cases this was done prior to receiving the application. Such an approach allows the NRC staff to use risk insights to tailor its review.

During the pre-application audit at B&W, the staff will discuss its experience in performing reviews of PRA for design certification. This should help B&W to develop an acceptable application for design certification. Specifically, the staff will discuss applicable interim staff guidance that has been published since the SRP was last updated. Other lessons learned from design certification reviews will be described, as well.

III. Objectives

In this on-site audit, the staff has three objectives:

1. Explain and discuss NRC staff guidance and expectations for a PRA that is suitable for supporting design certification as well as related programs (e.g., reliability assurance program [RAP] and regulatory treatment of non-safety-related systems [RTNSS]).
2. Assess the quality and completeness of the current mPower PRA as well as the process for maintaining it.
3. Extract risk insights relevant to the mPower design.

In addition, some members of the audit team plan to tour the mPower Test Facility

IV. Scope

The NRC staff will review up-to-date mPower design information:

- structures, systems, and components (SSCs) relied upon for
 - prevention
 - mitigation
 - defense in depth
 with respect to core damage
- decay heat removal systems
- refueling systems
- other available information that the mPower staff thinks may be useful to the NRC

The NRC staff will audit the mPower Level 1 PRA for internal events:

- initiating events
- systems analysis, including failure modes and effects
- accident sequence analysis
- human reliability
- data
- model integration and quality control

The NRC staff will audit the mPower Level 2 PRA to the extent that it has been developed.

The NRC staff will review risk insights that the mPower staff have developed for the mPower design.

V. Audit Activities

The audit will be conducted by a team of NRC staff members who are knowledgeable in various aspects of PRA. Based on the identified scope, it is expected that the team will spend two consecutive days at the mPower offices to conduct the audit. The NRC staff resource expenditure (exclusive of travel-related expenses) is estimated to be less than 200 person-hours including preparation and documentation.

The team will perform the audit at a location that facilitates access to the prospective applicant's PRA model, documentation of the PRA, and its PRA practitioners. The team members will be assigned to review specific areas of interest. They will review documentation and discuss questions with the applicant's PRA practitioners and design engineers. They may request that certain parts of the PRA model (e.g., event trees, fault trees) be demonstrated by a member of the mPower staff who is proficient with the software used to model the mPower design. They will examine design descriptions and review risk assessment results (e.g., importance measures, sensitivity studies, focused PRA) with emphasis on risk insights that have been developed and are being applied in the design process. The process for assessment of design changes for potential impact on the PRA is of particular interest. The audit findings will be based largely on samples of the documentation and modeling within the audit scope.

The team will meet for approximately 30 minutes at the end of each day to share key findings and insights. The audit team leader will advise B&W of any issues that may be of interest to the mPower staff and communicate specific support requests (e.g., documents to be reviewed or interviews to be scheduled).

A report documenting the activities of the audit team will be published in the Agencywide Document Access and Management System (ADAMS). Each team member is responsible for timely input to the audit report in their assigned areas.

VI. Audit Team

These are the members of the audit team:

Name	Title and Organization	Primary Review Responsibility
Donald Dube	Senior Technical Advisor for Risk-Informed Initiatives Division Of Safety Systems and Risk Assessment	PRA procedures, tracking and validation of assumptions
Lynn Mrowca	Chief, PRA And Severe Accidents Branch (SPRA) Division Of Safety Systems and Risk Assessment	
Joelle Starefos	Senior Project Manager Division of Advanced Reactors and Rulemaking	
Ross Moore	Project Manager Division of Advanced Reactors and Rulemaking	
Todd Hilsmeier	Audit Team Leader Reliability and Risk Analyst, SPRA	Level 1 PRA: initiating events, documentation and model
Mark Caruso	Senior Reliability and Risk Analyst, SPRA	Level 2 PRA
Malcolm Patterson	Reliability and Risk Analyst, SPRA	Process for assessment of design changes
Jeffery Wood	Reliability and Risk Analyst Division of Risk Analysis, PRA Branch	Determination of success criteria

VII. Schedule

The audit will take place at the Generation mPower offices of B&W in Lynchburg, Virginia. The audit is currently scheduled to begin on July 16, 2012 and end on July 17, 2012, with the potential to extend an additional day if necessary. This is a proposed agenda:

Day 1 (AM)

- Tour of the mPower Test Facility

Day 1 (PM)

- Entrance meeting
- Fukushima, Interim Staff Guidance, and Lessons Learned from New Reactor Reviews (NRC)
 - post-Fukushima insights
 - design-specific review standards
 - PRA technical adequacy
 - RTNSS
 - development of RAP list & RAP ISG
 - D-RAP ITAAC
 - treatment of external events
 - Lynn Mrowca
 - Joelle Starefos
 - Mark Caruso
 - Mark Caruso
 - Todd Hilsmeier
 - Malcolm Patterson
 - Malcolm Patterson
- Update on mPower design (mPower)
- Description of the preliminary PRA and its results (mPower)
- Overview of materials available; interview schedule
- Audit team meeting

Day 2

- Audit team members review PRA model and documentation
- Audit team members interview mPower staff
- Audit team members meeting (NRC)
- Exit meeting (NRC/mPower)

Day 3 (if needed)

- Audit team members conduct additional reviews and discussions with mPower staff

VIII. Support Material

In addition to access to the current PRA model, the staff will want to review supporting documentation:

- system notebooks
- human reliability methodology
- descriptions of the SSCs that have been modeled in the PRA
- descriptions of refueling techniques and shutdown heat removal systems
- documentation of risk insights developed to date
- documentation of assumptions
- documentation of decisions about what to exclude from the PRA
- success criteria developed for accident sequences and related thermal-hydraulic analyses
- quality assurance procedures for PRA
- PRA peer review or self assessment results, if available
- data and documentation of the sources of data
 - initiating event frequencies
 - component failure rates
 - availability

VII. References

DC/COL-ISG-3, "PRA Information to Support Design Certification and Combined License Applications"

DC/COL-ISG-18, "Interim Staff Guidance on Standard Review Plan, Section 17.4, Reliability Assurance Program"