ISSUE STATEMENT

Equipment failures can lead to lost generation and lost revenues and can distract plant personnel from more strategic tasks. Nuclear power plant operators have successfully implemented programs to foster and maintain high reliability as plants have aged and as some have entered extended operating periods. EPRI’s Preventive Maintenance Basis Database (PMBD) was developed in the late 1990s to assist in developing custom maintenance strategies for common power plant equipment. Over the years this tool has grown and is now available as a web-based tool available at pmbd.epri.com.

DRIVERS

- **Reliability and availability**: High reliability and availability are hallmarks of safe, reliable nuclear plant operation. Maintaining equipment to high performance standards is essential in achieving high reliability and availability levels.
- **Economic impacts**: Equipment failures can lead to unplanned downtime and emergent maintenance that result in lost electricity generation and the associated loss in revenues.

RESULTS IMPLEMENTATION

The results from projects related to PMBD will be implemented by providing:

- Major upgrades to the PMBD software:
  - Facilitate interactions with other information sources.
  - Define optimum replacement and refurbishment times.
  - Develop refurbishment/replacement considerations to effectively manage equipment obsolescence.
- Expanded interfaces with other software to facilitate more effective utilization of the PMBD software by continuing to expand the web-service platform.
- Technical reports, workshops, and meetings to share lessons learned using the PMBD.

PROJECT PLAN

Actions are necessary to address and improve plant and equipment reliability including better preventive maintenance to prevent failures before they occur. These actions include:

- Improved understanding of the degradations associated with component aging
- Impacts of new regulatory initiatives on component design and operation
- Development of strategies to address optimization of changing resources on maintenance strategies
- Development or revision of existing tools to address the stated issue

**Improved Knowledge of the Condition of Equipment**

EPRI’s PMBD has become a standard industry reference used by utility staff for determining or validating strategies for monitoring and maintenance of power plant equipment. Research is needed to improve knowledge of the condition of structures and components and to reflect the impact of degradation and aging in an advanced version of the PMBD. In 2013 PMBD became a web-based tool (Product ID 3002005428) and since then additional features and functionality are being added.

**Improved Component Monitoring Recommendations**

A review of current monitoring technologies and current reliability and health monitoring practices can provide opportunities for addressing gaps that exist in failure mode mitigation strategies. These gaps include a lack of monitoring technologies, ineffective monitoring tasks, ineffective maintenance practices, and outdated equipment designs. Technical gaps related to monitoring technologies will be identified and addressed, leading to new sensors with improved real-time component information collection.

**Defining the Optimum Preventive Maintenance**

The current version of the EPRI PMBD is based on the identification of likely degradation mechanisms, failure frequencies, and the appropriate mitigating tasks. The software continues to be upgraded to facilitate interactions with other information sources, define optimum replacement and refurbishment times, and develop refurbishment/replacement considerations to effectively manage equipment obsolescence.

**Development of Improved Effective User Interfaces**

The web service interface between the EPRI PMBD and third party software tools is being developed through work with industry vendors. This capability will allow for further adoption of the tool and easier viewing of PMBD data within native equipment reliability software platforms.
Onsite PMBD training activities have expanded the use of the PMBD and these activities will continue to be provided to raise awareness and use of the tool. The online help function within PMBD has recently been updated to include more information, screenshots, and training links.

**Development of Improved Effective User Interfaces**

The web service interface between the EPRI Preventive Maintenance Basis Database and third party software has been successfully demonstrated through use by one vendor. This capability continues to be expanded by upgrading the software to provide additional services through third party vendors. Onsite training activities have expanded the use of the PM Basis Database and these activities will continue to be provided to expand the user interface. The online help function will be expanded to provide multi-media training and user information.

**RISKS**

The primary risk to the industry if this roadmap is not implemented is that industry equipment reliability could degrade as plants age and knowledgeable personnel retire. Improved and easy-to-use equipment reliability data and analytical tools are required to offset these challenges.

**RECORD OF REVISION**

This record of revision will provide a high level summary of the major changes in the document and identify the Roadmap Owner.

<table>
<thead>
<tr>
<th>Revision</th>
<th>Description of Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Original Issue: August 2011 Roadmap Owner: Martin Bridges</td>
</tr>
<tr>
<td>1</td>
<td>Revision Issued: August 2012 Roadmap Owner: Martin Bridges Changes: This revision incorporates more detailed information relating to the projects included in this roadmap. The information was a result of the Technical Advisory Committee meetings for the projects held after the beginning of 2012. These changes have been reflected on the flowchart swim lanes for these projects.</td>
</tr>
<tr>
<td>2</td>
<td>Revision Issued: August 2013 Roadmap Owner: Martin Bridges Changes: Status updated to reflect the release of Version 3.0 of the PM Basis Database and to add the Virtual Sensor Project to the roadmap.</td>
</tr>
<tr>
<td>4</td>
<td>Revision Issued: August 2014 Roadmap Owner: Martin Bridges Changes: The extension of each of the project boxes is a result of the completion of the initial phases of the various projects. As a result of the completion of these phases, follow-on activities have been identified that are necessary to support completion of the projects.</td>
</tr>
<tr>
<td>5</td>
<td>Revision Issued: December 2014 Roadmap Owner: Martin Bridges Changes: Added completion dates for Version 3.1. Added Version 3.1.1 Cost Evaluation Module to the PM Basis Project. Activities to support this added scope have been added.</td>
</tr>
<tr>
<td>6</td>
<td>Revision Issued: August 2015 Roadmap Owner: Martin Bridges Changes: Added completion dates for Version 3.1 and updated planned revisions.</td>
</tr>
<tr>
<td>7</td>
<td>Revision Issued: December 2015 Roadmap Owner: Martin Bridges Changes: Reviewed with only minor modifications to wording.</td>
</tr>
<tr>
<td>8</td>
<td>Revision Issued: December 2016 Roadmap Owner: Jeff Greene Changes: Overhaul to document and associated roadmap to adjust timeline out to 2020. Changed name to Preventive Maintenance Basis Activities.</td>
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