Duke Energy Enhances SPV Reliability with EPRI's PMBD API Integration, Saving $2.1M USD Annually

2025 TECHNOLOGY TRANSFER AWARD

Duke Energy's single point vulnerabilities (SPV) program previously relied on static data storage with no centralized platform for mitigation strategies. In 2022, the utility experienced 105.7 days of lost generation, 48.7 of which were linked to SPV failures. The need to reduce frequent SPV-related unplanned plant trips and forced outages led the company to leverage EPRI's Preventive Maintenance Basis Database (PMBD) API and develop a dynamic SPV application integrated into its Plant Health & Equipment Reliability Suite (PHERS) to automate SPV tracking and embed preventive maintenance strategies.

While not driven by a specific regulatory mandate, the initiative supported compliance with INPO IER 21-4 (Plant Reliability) by reducing consequential equipment failures. The team sought advantages such as improved reliability, reduced downtime, and more efficient SPV management through automation and integration of industry-leading preventive maintenance strategies.

Benefits

Automating SPV tracking and integrating PMBD data streamlined workflows, reduced manual effort, and created a structured, centralized approach to SPV management. With richer, more granular data on failure modes, maintenance tasks and frequencies, decision making became more consistent. As a result, Duke Energy reduced the risk of unplanned trips and consequential failures, improving nuclear safety margins.

With improved equipment reliability and fewer SPV-related failures, operational efficiency has been enhanced and downtime reduced. The utility estimates savings of $2.1 million USD per year from avoided trips, reduced lost-megawatt costs, and labor efficiency gains.

Application

Unlike traditional static tracking, the application automates updates and centralizes SPV mitigation strategies, enabling more proactive risk management and greater reliability. This first-of-its-kind application in the nuclear industry dynamically incorporates EPRI's PMBD data into a native utility platform for real-time SPV management. Duke Energy led the development and fleetwide implementation, while EPRI provided technical support, research data, and industry operating experience. The collaboration also refined API endpoints, improving usability for all EPRI members and laying the groundwork for future integrations.

The utility relied on the following EPRI reports for this project:

- Preventive Maintenance Basis Database (PMBD) API v1.0 Beta, 3002030308
- Preventive Maintenance Basis Database (PMBD) v7.1, 3002029242

■ User Input Data　　■ Station Engineering Database Data　　■ PMBD Data Selection　　■ Calculated Data
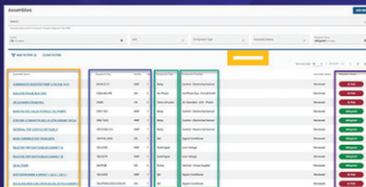

Figure 1
The tool enables fleetwide assembly search, at-a-glance mitigation status, and drill-down access to components, PMBD template recommendations, and critical Duke PMs. Assemblies are clearly identified as "At Risk" or fully "Mitigated."

Figure 2
Drill-down views display operating conditions, the EPRI template, assembly boundary, and mitigation strategies for a given component. EPRI inputs and plant data are integrated to support navigation across boundary components, mitigation strategies, component templates, and service environment.

Figure 3
Assembly views compare EPRI PMBD maintenance strategies with Duke implementation and highlight any discrepancies. The tool ties directly to plant data, enabling a quick view of tasks, scopes, and frequencies for managing SPVs, with a direct link to underlying plant data.
The example highlights EPRI-recommended tasks for an assembly with PM frequency discrepancies (red boxes), enabling engineering action for resolution or disposition.
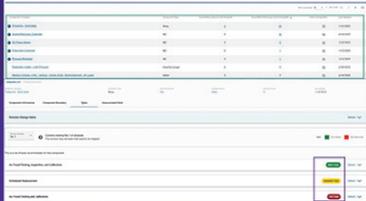

Figure 4
The tool monitors updates to PMBD templates and allows administrators to easily compare version changes and adjust mitigation strategies as needed.

EPRI