2024 TECHNOLOGY TRANSFER AWARD WINNER

ADVANCED CONSIDERATION OF MAINTENANCE REQUIREMENTS REDUCES DESIGN REWORK AND HELPS ENSURE MAINTAINABILITY OF COMPACT PLANTS

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TECHNOLOGY TRANSFER AWARD

Rolls Royce Uses Advanced Consideration of Maintenance Requirements to Reduce Design Rework and Bolster Maintainability of Small Modular Reactors

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Designing first-generation small modular reactors (SMRs) requires careful thought into long-term plant maintenance. A comprehensive maintenance technical basis must be built for all systems and component groups to determine equipment layout, maintenance performance, access needs, and overall maintenance required. Rolls Royce SMR Ltd. leveraged robust industry data from EPRI's Preventive Maintenance Basis Database (PMBD), which is informed by decades of commercial light water plant operations, as the technical basis for 75% of its new reactor design's equipment.

Benefits

Accumulating the data required for the necessary maintenance technical basis is a large financial and labor-intensive endeavor. Rolls Royce has saved approximately 3,000 hours to date by using the data contained within EPRI's PMBD application.

The time savings are substantial, but the greater benefit is developing the Examination, Maintenance, Inspection, and Testing (EMIT) schedule early in the design phase. Typically, the data in the PMBD is only available after completing failure mode and effects analyses (FMEA), engaging suppliers for EMIT tasks, and reviewing supplier data for all the plant components. Having this data early reduces risks in the physical plant layout, ensuring it is optimized for component access frequency and extent of maintenance activities. This optimization is crucial for maintaining the Rolls Royce SMR, leading to high availability during the power station's design life.

This approach enhances data management by incorporating PMBD tasks and degradation mechanism assessments into maintenance technical basis for the components. Following a criticality assessment, system design teams use this data to achieve performance objectives. This information informs the plant's maintenance schedule, ensuring each task is traceable to its analysis and degradation detection/prevention goals. Accountability is upheld at all levels, supporting performance targets and distributing effort across the design organization. The generated tasks help early identification of support resource requirements (spares, tools, mechanical handling, etc.), giving valuable initial insights into supply chain and costing activities.

In addition to equipment layout design, condition monitoring sensors and parameters – sourced from the PMBD Sensors Module – are recorded alongside maintenance tasks.

All these benefits contribute to the data application's ultimate goal, which is building a safe, reliable, next-generation SMR, and increasing regulatory confidence during the design approval phase.

Application

If the maintenance schedule was unknown and insufficient space was reserved for maintenance activities, including the mechanical handling, radiation protection, and laydown areas, the result could be extensive rework later in the design at substantial additional cost. Instead, using the PMDB, Rolls Royce SMR was able to develop a detailed maintenance schedule much earlier in the design life cycle than typically is possible for a new plant. This has derisked the continuing design development of the Rolls Royce SMR, particularly the layout for a compact design.

The following EPRI guidance was used for this project:

- Preventive Maintenance Basis Database (PMBD) v 7.1, 3002029242

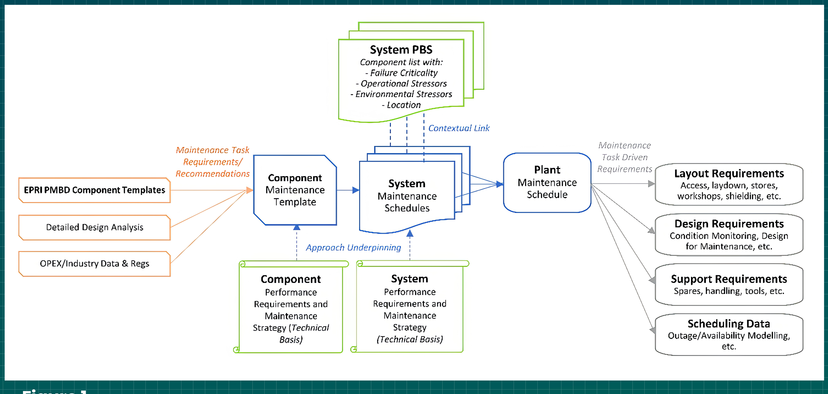

Figure 1
How the PMBD and supplementary data sets were used to guide the design process of the new Rolls Royce SMR power station

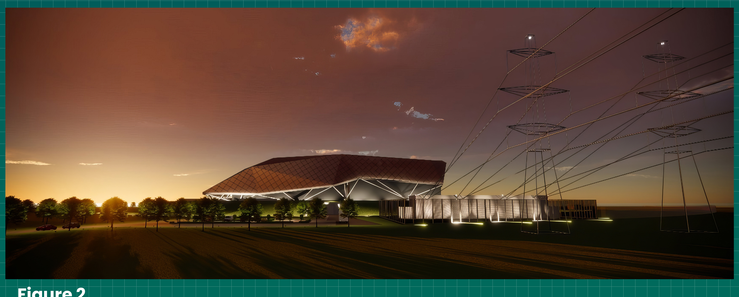

Figure 2
The conceptual design for the Rolls Royce SMR power station

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