

Diablo Canyon Power Plant (DCPP) Unit 1 Steam Generator Replacement

The project consisted of all activities required to replace four steam generators—each 70 feet long and 350 tons—at Unit 1. The team had successfully replaced the four Unit 2 steam generators in 2008. The installation of all eight generators was the largest project in the history of the DCPP since its construction.

Innovation/Why it is innovative World-class performance requires tenacity for schedule certainty and innovative approaches to project execution including:

Photogrammetry and computer modeling enabled the team to set the replacement steam generators to within 1/16" of design, an accomplishment recognized industry-wide. Precise setting tolerances reduced the weld out time of the reactor coolant system piping, allowing earlier system turnover to plant operations.

A Performance Improvement Oversight Group identified high consequence failure scenarios, implemented mitigation strategies, and took actions to prevent future occurrence throughout the outage period.

Focus Groups implemented ways to improve performance in critical areas—such as safety, steam generator supports, structural, instrumentation, rigging and handling, document turnover, and work package closure. This group also provided a forum to resolve key issues. For example, the Instrumentation Focus Group implemented improvements including enhanced and early as-found condition analysis, extensive pre-outage work supported by detailed engineering, detailed work coordination with competing work in the same areas, smaller work packages, etc. Mockups used during the pre-outage and coordination with other work groups enhanced performance; work scope was completed ahead of schedule without becoming critical path. The Rigging/Handling Focus Group developed an enhanced training program—with classroom instruction and detailed performance demonstration sections—for equipment operators and rigging personnel.

Due to the difficulties of installing steam generator support keyway shims on uneven surfaces, the team investigated innovative alternatives to maintain the required and restrictive gap criteria. The chosen methodology used custom-designed machines to machine the keyways to a flat surface prior to installing the replacement steam generators resulting in successful keyway shim installation in reduced time.

The Team overcame complications encountered during support bolt removal on an earlier unit and developed an innovative contingency plan to thread studs to install the down-ending device if the steam generator support bolts became stuck. While not required in the Unit I outage, the plan reduced the previous outage performance from 16 hours per steam generator to an estimated 6-hour duration.

Robust dropped object prevention strategy was enhanced with a formalized, comprehensive Red Hat program. Red Hat personnel monitored containment to report and monitor housekeeping deficiencies and to assist in the mitigation and prevention of dropped objects.

Radiological exposure was minimized through innovative ideas including additional shielding and work sequencing.

What it changed/replaced: The team built on the successful Unit 2 steam generator replacement project and further improved performance: 58-day breaker-to-breaker duration in the Unit 1 outage vs. 68-day, 23 hour performance for Unit 2; safety event reduction of 55 percent compared to Unit 2 outage performance; and a total steam generator replacement "window" reduction from 50 days for Unit 2 to just over 40 days in the Unit 1 outage.

Significant advancements and a proven success: Replacing the steam generators helps ensure that DCPP will continue to run safely and cost-effectively.

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Above and below: the Team worked nearly flawlessly to complete the meticulous welding on the large components.

