

Delivering the Nuclear Promise

Top Innovative Practice



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Gemini Reactor Vessel Closure Head Inspection System

2022 Top Innovative Practice Winner

Innovation

The Gemini system uses two independent articulating robotic arms to perform visual, ultrasonic, and eddy current inspection on two Reactor Vessel Closure Head (RVCH) penetrations in parallel. The Gemini system is also designed to be installed and removed through the personnel access opening in the head stand to alleviate the need to remove the RVCH for installation or demobilization of equipment. Previously, single end effector, stationary systems have been the standard equipment used for head inspections at Beaver Valley.

Safety

The compact footprint of the Gemini system removed interferences on the floor of the head stand that were caused by the track system used by the previous inspection system which improved industrial safety during the reactor head repair. Dose and contamination risk were reduced by implementing remote inspection of the head vent penetration rather using the manually delivered tool as was previously performed.

Similarly, decontamination of the Gemini robots was simplified by the ability to relocate the system during the repair and the overall decrease in inspection equipment located within the reactor head stand. While the BVPS-2 head inspection was not an emergent inspection, it should be noted that the design of the Gemini system allows for installation and removal while the RVCH is still in the stand which eliminates the need for an additional head lift to facilitate an emergent inspection if it becomes necessary during an outage.

Cost Savings

Due to the ability to inspect two penetrations in parallel, the overall duration of the inspection was reduced by approximately 36 hours. This saved approximately \$110,000 in service cost. This also saved approximately \$1.125 Million in outage baseline schedule reduction. The shortened service duration also improved the discovery window by approximately 36 hours and allowed for earlier planning and mobilization of resources to affect the repair.

Productivity/Efficiency

The Gemini system allowed for an improvement in outage baseline schedule of 36 hours. Up front inspection plan development maximized the impact of the dual inspection capability to achieve this schedule improvement. The simplified design of the system and ease of mobility also allowed for additional reductions

in setup, decontamination, and equipment demobilization time.

Transferability

The efficiencies noted at the Beaver Valley facility can be used as a benchmark for implementation of the Gemini system for RVCH inspections at all Westinghouse and CE PWRs. Inspection planning methodology has been captured to maximize the production efficiencies for all future services at both Beaver Valley units and throughout the U.S. operating fleet.

Team Members

- Brandon Padgett: Alloy 600 Program Manager (Energy Harbor)
- Mike Kienzle: Night Shift Program Manager (Energy Harbor)
- David Eargle: Principal Engineer (Westinghouse)
- Rick Seigh: Principal Engineer (Westinghouse)
- Scott Hodges: Principal Engineer (Westinghouse)



Figure 1



Figure 2



Figure 3