

Innovative Use of Robotics to Find Condenser Leaks

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Background

- ✓ In December 2008 Clinton purchased a Caliber robot for multipurpose use in the Radiological Control Areas of the Plant.
- ✓ The concept of the Clinton robot was to reduce worker radiation exposure through remote inspections and surveillances.
- ✓ The robot was successfully deployed for the first time in May of 2009,
- ✓ Used for locating steam leaks inside the Turbine Building Heater Bay.
- ✓ As a result of the demonstrated capabilities of the robot, the Clinton team realized there was substantial dose saving potential for other activities in the plant.

Background (cont.)

- ✓ During review of an ALARA Suggestion at a Station ALARA Committee meeting, a potential use for Helium leak testing was identified.
- ✓ Upon recommendation by the Site Vice President, the ALARA team met with Engineering and Mechanical Maintenance to evaluate using the robot for Helium leak testing inside the TB Locked High Radiation Areas (LHRA).
- ✓ The team identified the barriers that would preclude the use of the robot and assigned actions to the appropriate owners.

- ✓ The mechanical team challenge was fabricating the delivery system for the robot.
- ✓ Mechanical Maintenance, Engineering, and Radiation Protection (RP) worked together to design, fabricate, install, and test the Helium delivery system for the robot.
- ✓ Engineering and RP worked together on the test plan based on probability and accessibility of the Helium target test points in the TB Bioshield.
- ✓ Over 400 test points were identified in the Helium leak test procedure with the majority located within the TB Bioshield (LHRA). The team used plant drawings, survey maps, and the Clinton photo library to identify the accessibility of target areas.

Application - Heater Bay

- ✓ After several days the team had the modified Helium delivery system installed on the robot. (See attachment 1)
- ✓ Robot operation was tested with the modification in place.
- ✓ The robot vendor had been consulted throughout the process and acknowledged the Clinton modification to the robot would not adversely affect robot operations. The robot vendor is interested in making the Clinton design a standard feature for their Caliber Robot.
- ✓ On 7/15/2009 the first entry in TB 762' Heater Bay was made with the modified Caliber Robot.



Application for Risk Reduction

- ✓ The use of the robot is reducing both radiological and personnel safety risks.
- ✓ It eliminates the requirement for individuals to enter high temperature work areas inside the Turbine Building Bioshield.
- ✓ Requirements for stay times and heat stress monitoring have been eliminated along with the risk of physical body burns.
- ✓ For the identification of the last significant condenser air leak, radiation dose for TB Heater Bay Helium leak testing was reduced to a minimal due to the remote operational capability of the robot.
- ✓ The Helium leak testing dose saved at least 500 – 2500 mrem of exposure for the 2009 Helium leak investigation campaign

Results- Dose Savings

- ✓ In 2010 it saved 3 REM at CPS.
- ✓ it was also used at Quad Cities for tank leak identification and repair as well as at Grand Gulf for off gas leak testing.
- ✓ Additionally, because the RP Robot has a video camera, visual inspection of these high probability areas was possible. The benefit of this was that some of the high probability areas could be tested and inspected for little or no dose expenditure.
- ✓ This also reduced the number of high probability areas so that consideration of human entry into the other high probability areas could be considered, without significant impact to overall station dose.

Application- Helium Sprays

- ✓ One other use of the RP robot was to perform area He sprays.
- ✓ This technique is used to narrow in on the leakage location.
- ✓ Again this can be done with little or no dose expenditure. This allows the station to be proactive in leakage identification without adversely impacting overall station dose.
- ✓ Areas that show potential can then be evaluated for high probability targets, and if those areas are accessible to the RP robot, they can be tested by the robot. If not, they can be evaluated for human testing.

Results- Helium Sprays

- ✓ The primary savings for use of the Caliber Robot for Helium leak testing is exposure reduction at Clinton.
- ✓ However, additional savings can be accounted for in productivity and efficiency.
- ✓ The dose savings must still be considered as cost savings as each mRem is equivalent to \$13,500.00 (Exelon Innovative Ideas Website).
- ✓ The information below compares the use of robotics versus use of personnel for Helium leak testing at Clinton.

Results- Helium Sprays

- ✓ Clinton Power Station received over 20 Rem of exposure ($\$13,500.00 \times 20 \text{ mRem} = \$270,500.00$) in the past searching for Off Gas in Leakage in 2009.
- ✓ The unique idea was to modify the robot to meet the need of the specific problem and adapt it to that issue successfully.
- ✓ Clinton ALARA has been contacted by the robot vendor for permission to develop the Clinton modification as an enhancement to the Caliber Robot.

Results- Productivity Increased

- ✓ Productivity is increased when using robotics because fewer individuals are required when compared to manual inspections.
- ✓ The robots test team requires one engineer and one RP technician at the robot control station.
- ✓ The manual test method requires multiple engineers due to time limitations from exposure and a minimum of two RP technicians and one RP management person for LHRA job coverage.
- ✓ The use of robotics cost-savings impact for the station is additional resources are available for normal planned activities or emergent activities for the site.

Results- Productivity Increased

- ✓ Efficiency is increased when using robotics because there are fewer opportunities for retest.
- ✓ When using the robot for inspection it allows for a more thorough evaluation of a target area.
- ✓ When testing a target area manually the engineer will not have the luxury of time due to high dose fields at the test locations. Additionally, the engineer will not have the same accessibility to test targets in the overhead areas.
- ✓ The robotic test method allows for testing in overhead areas so the test gas can be delivered directly to the test target. In some cases manual tests will have to be performed again because the test gas was released too far from the test target.

Results- Productivity Increase

- ✓ The efficiencies gained are a collective product of the robots ability and the use of sound engineering judgment in winnowing the wheat.
- ✓ To quote my Plant Manager, the difference between the 20 Rem before the robot and 5 Rem afterwards was the difference between

**“Aim Once, Shoot Many Times
Vs.
Aim Many Times, Shoot Once”**