

Preventing Structural Breach of Radiation Waste Storage Tanks

Safe, remotely operated ultrasonic and visual inspection solution to identify cracks and thinning of tank walls, through annulus spaces as small as five inches

The Challenge

Cold War remnant nuclear weapon production facilities in the U.S. maintain one-million gallon (3.9 million liter) capacity high-level storage tanks containing radioactive waste, buried underground. It is critical that the structural integrity of these tanks is maintained to prevent the contents from leaking and posing a severe public health threat to local communities and the environment. Some of these tanks have been in service nearly 50 years.

The Customer, one of the oldest nuclear material manufacturing facilities in the United States, performed periodic visual and ultrasonic nondestructive examinations on the tanks to monitor the effects of service. These inspections revealed that several older, non-stress-relieved tanks had developed cracks. A more aggressive inspection and monitoring solution was needed.

A new in-service inspection program was defined by the Department of Energy, with oversight by the Defense Nuclear Facilities Safety Board. To detect and characterize any cracking, thinning or pitting of the steel sidewalls of the waste tanks, the program required both ultrasonic and visual examination of the regions of the tanks that would be most susceptible to corrosion attack.

There were several difficulties with implementing this new inspection regimen. First, all inspections had to be conducted completely remotely, due to high radiation risk for any individuals coming in close proximity to the tanks. Second, the tanks were located underground and built with a double-wall construction; inspections had to be made of the interior wall, which enclosed the actual waste material. The space between this primary steel wall and the secondary concrete wall that surrounded the tank (the annular space) was just 30 inches wide. To add one final challenge, access to the annular space was through vertical riser pipes that were just 12 to 15



Industry: Government / Nuclear

Technology: Ultrasound

Products & Services: P-Scan / Robotic crawler-mounted scanner and camera for remote weld inspection, corrosion mapping and visual inspection of underground storage tanks

Customer Profile: One of the United States' oldest nuclear material manufacturing facilities

Business Challenge: Aging double shell steel storage tanks can develop cracks or wall thinning, creating a threat of leaks of the highly dangerous radiation waste inside. The tanks are difficult to access, and inspection by humans carries the risk of lethal radiation exposure

Solution: Design and fabrication of a remote-controlled robotic crawler that carries a small imaging system for visual and ultrasonic inspection and can operate in very confined spaces

Benefits:

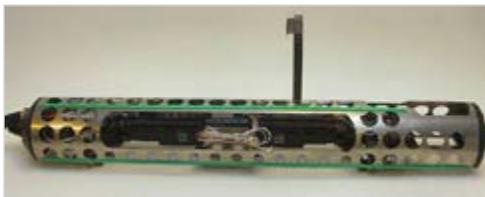
- Allows micro-inspection of tanks from a safe distance, through an annulus just five inches in diameter
- Provides critical inspection capabilities that enable the Customer to maintain the structural integrity of the tanks and take preventive action to avoid leaks
- Protects employees from radiation exposure on the job
- Protects the health and safety of the public from dangerous radiation leaks and environmental contamination

Robotic crawler capturing images between the two walls of the underground storage tank

inches wide, and up to 14 feet long. This set of challenges called for a highly specialized test solution.

The Adaptive Energy Solution

The Customer selected the P-Scan ultrasonic system and rugged remote scanners for their ability to deliver customized, integrated solutions for unique testing problems. Adaptive Energy teamed with FORCE Technology, a Danish technology product research institute that had developed P-Scan, as a partner in the design and fabrication of a remote inspection system that could overcome these challenges.



The scanner unit, designed to fit through an access opening as small as 5" in diameter

The solution combines multiple technology components with a robotic mechanical structure. It uses the P-Scan System 4, a compact, battery-powered ultrasonic imaging unit, along with a remotely-operated magnetic wheel crawler, the P-Scan AMS-1T. The crawler can be inserted through a five-inch carbon steel riser.

The unit is capable of scanning with up to four transducers to create ultrasonic images, and can be outfitted with a small remote-controlled video camera and light to capture visual inspection images as well. It can be deployed through an access pipe with a minimum internal diameter of just five inches. The video camera and an angle sensor are connected to a controller system for easy remote operation of the unit. Additionally, it has a pneumatic operated arm and integrated pneumatic operated release system for enhanced mechanical control.

Results

The remote crawler unit is used to perform thickness mapping and crack detection simultaneously. These examinations are performed in several vertical strips in sequence to cover the entire accessible height of the tank wall and to cover all of the current and historic interfaces (joins and welds). To inspect the weld points, four shear wave probes are used simultaneously.

These examinations are designed to detect and characterize flaws and demonstrate whether the tanks meet acceptable structural status to protect against potential leakage and instability. Results of the examinations are also used to validate the current degradation models used to help predict future risks.

By using the crawler unit, the facility is able to perform critical inspection of its waste storage tanks, while protecting its workers by allowing them to conduct these inspections remotely from a safe distance. As a result, the tanks can now be monitored appropriately to protect the health and safety of the public by preventing potential leaks of radioactive material.

About Adaptive Energy

Adaptive Energy creates customized, non-destructive material evaluation solutions to address mission-critical, time-sensitive testing needs. By combining the latest digital radiography, computed tomography, and ultrasonic imaging technologies with innovative mechanical and robotic assemblies, Adaptive Energy's integrated systems offer rapid deployment, are easy to learn and maintain, and perform reliably under pressure.

Working collaboratively with organizations in the aerospace, automotive, energy, petro-chemical, defense, infrastructure, and materials industries, our experts develop optimized solutions for flaw and crack detection, composite delamination, weld inspection, hardness testing, custom radiation enclosures and overhead gantry systems, and more.

Adaptive Energy is also the exclusive distributor in the U.S. and Canada of FORCE Technology's P-Scan ultrasonic scanners, including the P-Scan Stack with Phased Array, a next generation automated inspection system.



+1.253.284.0825

Email info@adaptiveenergy.com

Mailing address

Adaptive Energy
1640 Marine View Drive, Suite B
Tacoma, WA 98422

www.adaptiveenergy.com

CONTACT