Cleanup

Cold spray

Tank refurbishment system

Orano has been supporting the Hanford tank waste mission for over a decade and continues to do so with the cold spray tank refurbishment system.

Double-shell tanks (DSTs) are a critical part of the Hanford tank waste mission as they offer the only environmentally compliant storage space for waste. The tanks will be required to remain in operation for several decades, well beyond their original designed operating life.

Project objective

Support the development of a cold spray refurbishment system applicable to the Hanford site that will:

- Build back material thickness at locations thinned by corrosion degradation
- Utilize cold spray process parameters, characterizations, and surface preparations parameters using commercially available equipment

> "Our **successful cold spray demonstration** is the outcome of several years of research and **strong partnerships** with industry leaders such as VRC Metals, Robotic Technologies of Tennessee, and **Orano**."
>
> Alex Pappas
> Chief Technology Scientist
> WRPS

Phase I

In 2021 Orano received a contract from Washington River Protection Solutions (WRPS) to support the development of a cold spray application repair system for the underground waste storage tanks at the Hanford site. Ensuring the integrity of these tanks is a top priority for WRPS, DOE, and Washington State Department of Ecology for the safety of the Hanford site workforce, the public, and the environment.

WRPS has a tank integrity program that includes researching, testing and implementation of new technology to refurbish aging tanks. Areas of thinning walls in DSTs are a concern identified by WRPS. The cold spray refurbishment method is a technology that has the potential to address this concern.

Cold spray is a coating process where metal powders are deposited on a surface at supersonic speed and adhere to the surface. Cold spray has the ability to perform metal-to-metal solutions for increasing the thickness of a DST wall. Commercial

The Orano team performing a cold spray demonstration at Hanford's Cold Test Facility

applications of cold spray technology allow the use of mild steel, stainless steel, or other metal blends for surface refurbishment.

Orano led a team comprised of VRC Metal Systems and Robotic Technologies of Tennessee (RTT) to demonstrate the cold spray technology at the Hanford Cold Test Facility (CTF). Testing by the team included mild-steel powder performance relative to adhesion, sealing, and corrosion resistance on a mockup tank at the Hanford site.

With completion of the field demonstration test, the cold spray team identified additional testing and optimization opportunities, as well as lessons learned, that need to be completed prior to deployment in a DST. Results from these demonstrations will be used to make decisions on the path forward for tank refurbishment.

Cold spray robot with pre-demo test coupon

Phase II

The Cold Spray Phase II project is ongoing through fiscal year 2023. During Phase II, the Orano team integrates regularly with WRPS. Continuing development from the first phase of this project, the team has a two-step process to reach the overall goal of developing, demonstrating and deploying this technology for tank refurbishment.

Step 1

The first step is to optimize each component of the cold spray system, including the development of a tank access strategy for the robotic crawler and evaluation of the cold spray coating properties using various material combinations. Additional attributes being evaluated in this early step include:

- Robotic system performance optimization
- Additional tool attachments to the robotic platform
- Optimization of cold spray deposition characteristics
- Process cost optimization
- Coating equipment modification for tank access

Step 2

Once each component has been optimized, the systems will be combined and evaluated in mockup environments. This step will utilize actual equipment that would be deployed for full-scale demonstration at the customer's facility in the future.

The process will involve:

- Combining miniaturized cold spray equipment and robotic system and testing functionality
- Mockup evaluation at VRC headquarters for cold spray robot validation
- Mockup evaluation at RTT headquarters for robotic system evaluation on a simulated tank annulus section mockup

Orano consults with WRPS to establish physical specifications to ensure the mockup trials are as relevant as possible. Four tank deployment demonstrations at the Hanford CTF in 2022 and 2023 were conducted, incorporating lessons learned from each into the cold spray system design. These deployments to a simulated tank annulus environment informed upgrades to the crawler deployment hardware, magnets, umbilical management, wheel design, and cold spray equipment. In the next phase of this project, the CTF will be utilized for operator training, followed by delivery of the equipment and deployment in an actual Hanford tank annulus in 2024.

Contact: oranousacomm@orano.group

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