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Technology helps map waste plume

For the first time, a fully three-dimensional view may be possible of a plume of radioactive and chemical contaminants in the soil near an area of the Hanford Site known as C Farm. The so-called “farm” is home to more than a dozen underground storage tanks containing radioactive and chemical waste. Surface Geophysical Exploration (SGE) probes were installed on the surface around a diversion box, while four SGE sensors were placed deep in the soil.

SGE uses electricity to measure differences in soil resistance caused by changes in moisture and chemical content. Steel probes are connected to a computerized system that directs electrical impulses between them and measures differences in soil resistance. These differences are then used to provide a “map” of the plume of contaminants.

The diversion box was used to direct liquid waste from the processing plants to the tanks within the farm. In October 1969, a pipe broke, allowing about 36,000 gallons of liquid to leak into the surrounding soil. A vital element of the Hanford cleanup programs is to identify such leaks in and near tank farms and map their spread so decisions can be made about the best way to clean them up to protect the public and the environment.

A total of 336 surface electrodes have been installed around the diversion box, plus two more at a depth of 50 feet and two more at a depth of 100 feet. SGE technology has been used to map plumes in and around several Hanford tank farms, but this is the most challenging application of the technology due to the large number of buried pipes as well as other infrastructure around the diversion box that create interference in the electrical signals coming back to the computer. The use of deep buried probes should help overcome that problem by allowing electrical signals to travel under the other pipes and infrastructure.

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Tank C-110 next in line for retrieval

Washington River Protection Solutions is preparing to resume waste retrieval from tank C-110 in early 2009. The 530,000-gallon tank was built in 1946 and currently holds approximately 126,000 gallons of sludge and other radioactive and chemical waste materials.

Waste retrieval activities were stopped in September 2008 to allow modifications to a nearby double-shell tank that will be receiving the C-110 waste. Through innovation WRPS has developed a new approach (see insert) that will reduce costs and allow retrieval to begin several months sooner than previously planned.

Innovative approach

The waste from C-110 is being transferred to nearby double-shell tank AN-106. But accumulated solids from other waste transfers are nearing levels that would block the intake of the pump in AN-106 that recirculates the double-shell tank liquid used for sluicing in C-110.

To avoid the delay and expense of purchasing a new pump on a shorter intake pipe, engineers devised, fabricated and installed a collar that will lift the existing pump assembly vertically and move the pump intake well above the layer of solid material at the bottom of AN-106, eliminating the need to design and build a new pump.

Evaporator upgrades set stage for waste reduction

The 242-A Evaporator is undergoing major upgrades in preparation for liquid waste volume reduction campaigns beginning in spring 2009. Workers have finished upgrading the ventilation and monitoring and control systems and rebuilding one of two main pumps and have removed nearly all of the radioactive contamination in the condenser room.

The condenser room is the operating heart of the evaporator, containing most of the operating instrumentation and transmitters. As the last operating nuclear facility at Hanford, the 242-A Evaporator is critical to the cleanup mission. The evaporator creates storage space in double-shell tanks by removing water and concentrating the liquid waste, making it possible to empty the waste from Hanford’s aging single-shell tanks.

Independent panel to review single-shell tank integrity

With the support and direction of DOE’s Office of River Protection, Washington River Protection Solutions is convening an independent panel of experts to review all pertinent information and programs regarding construction and operation of the single-shell tanks.

The panel will recommend enhancements to the existing program of monitoring the integrity of the tanks and propose methods to better inspect and assess them. The panel is made up of nationally recognized experts in numerous engineering and scientific disciplines associated with single-shell tank integrity.

A similar expert panel process was used several years ago for Hanford’s 28 double-shell tanks, resulting in a very effective integrity assessment program. Hanford’s 149 single-shell tanks, many of which date back to the early days of the Manhattan Project during World War II, have passed their original design life, and their integrity is critical as they will need to continue to hold solids and sludges until the waste can be removed and prepared for disposal in the nearby Waste Treatment Plant which is still under construction. All pumpable liquids were removed from these tanks several years ago.

New generation of robotic arm in tank cleanout future

Design work has started on an innovative robotic arm that offers the potential to increase the efficiency of waste removal from Hanford’s single-shell tanks. The arm, referred to as the Mobile Arm Retrieval System (MARS), will be capable of a wide range of motion and include telescoping capabilities to enable it to reach the tank extremities. Interchangeable tools on the end of the arm will be used to break up the waste, move it to a pump and remove it from the tank.

The use of robotic arms for waste retrieval has been studied at Hanford since the beginning of the cleanup program, but the state of the technology and deployment strategies limited their usefulness. Incorporating lessons learned from other DOE sites and the corporate parents of WRPS with new technology innovations such as use of lightweight and high-strength composite materials have increased the options for effective tank waste retrieval.

Part of the design challenge will be to make a large portion of the system transportable so it can be moved from one tank to another and make use of existing tank farm utilities, such as electrical and water systems, thus saving time and money. Design work is expected to be completed before the end of 2009, with installation expected in 2010.

Development of new and innovative technologies to speed the retrieval of tank waste and make retrieval operations more efficient and cost-effective is a goal of Washington River Protection Solutions.

Integration with the Waste Treatment Plant key element of WRPS activities

WRPS tests key Waste Treatment Plant process at 222-S Laboratory

Washington River Protection Solutions is testing a prototype of a key Waste Treatment Plant component at 222-S Laboratory. The testing is conducted on double-shell tank waste in hot cells -- compartments heavily shielded to protect operators from radiation while they remotely handle samples and equipment.

Laser ablation will be a primary analytical tool in the Waste Treatment Plant’s Analytical Laboratory. It will be used to analyze the solid waste feed to the High Level Waste Vitrification Facility and the waste glass produced by both the High-Level Waste and Low Activity Waste Vitrification Facilities.

The laser ablation process uses a high-powered laser to vaporize a small bit of solid waste to form an aerosol. The aerosol is transferred into plasma where the emitted light is analyzed in a spectrograph to determine its chemical composition.

WRPS is proving the technique works on actual tank waste and writing the operating procedures.

Focus continues on waste retrieval from single-shell tanks

WRPS has developed a new approach (see insert) that will reduce costs and allow retrieval to begin several months sooner than previously planned.

Pump collar mockup

Ultrasonic testing of a double-shell tank mockup

Early conceptual approach for robotic arm

222-S hot cell

Image 847x55 to 1188x322

Image 869x442 to 1188x730

Image 323x281 to 595x435

Image 396x594 to 595x714
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