Laser system 'mapping' waste in Hanford tank

Geoff Tyree, CHG

Working for the DOE Office of River Protection, CH2M HILL Hanford Group officials are preparing to use a laser imaging system to monitor cleanup of Hanford's aging single-shell tanks. Called the Topographical Mapping System, the imaging tool will provide a clearer picture of how new cleanup systems are performing and a more precise measurement of how much waste is being retrieved for treatment in a planned vitrification facility.

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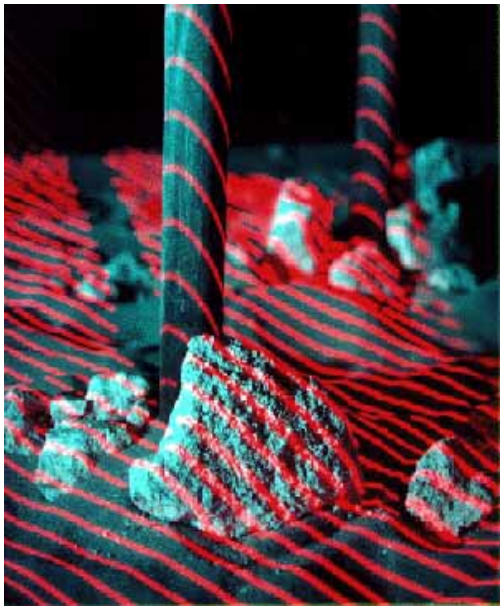
PNNL's Jake Tucker (right) operates a laser imaging system during acceptance testing while CHG's Dan Baide looks on. The system is attached to an assembly in the center of the photo, along with its support scaffold. When lowered into a tank, the Topographical Mapping System will provide an image of the waste surface and calculate the volume of waste retrieved during demonstrations.

Current methods of calculating the volume of tank waste being removed are based on measuring the change in the height of waste in a tank. Another method measures the amount of waste flowing through transfer pumps or pipes during retrieval.

"These methods have been fine for the cleanup work we've been doing," said Rick Raymond, CH2M HILL Hanford Group vice president of projects. "But as we move into demonstrating waste retrieval using new technologies, we need a clearer picture of how much waste is being removed and which retrieval methods work best."

While much of the liquid waste has been removed from Hanford's single-shell tanks, a major effort is under way to demonstrate technologies to remove the remaining solid waste. A regulatory milestone calls for the Office of River Protection to remove enough waste with dilution water to fill at least 2 million gallons of double-shell tank space before October 2006.



A time-lapse photo of the Topographical Mapping System shows the laser stripes that are generated during three-dimensional scans of simulated tank waste.

At 3.5 inches in diameter, the laser assembly is small enough to fit through a 4-inch opening, or riser, in a tank. CHG project manager Dan Baide estimates it will take about four hours to scan the typical 75-foot-wide Hanford tank. Allan Pardini, PNNL's lead engineer responsible for getting the mapping system ready to deploy, explains that the laser makes an image of the waste and displays it on a computer screen for an operator. Computer software calculates the volume change of waste in the tank based on the "before" and "after" images during the retrieval process.

Test successful

During acceptance testing in June, the assembly was mounted on a tall scaffold in a Pacific Northwest National Laboratory facility in Richland. Operators scanned a box of known dimensions and compared the results of the laser scan with the physical measurements.

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The acceptance test was successful. The laser assembly will be installed in single-shell Tank U-107, along with a prototype waste retrieval system, to gather information for use in other Hanford tank waste retrieval projects.

After pumping a layer of liquid waste, the effort to remove about 10 percent of the underlying saltcake in Tank U-107 will begin. Saltcake waste, with the consistency of wet beach sand, was created when tank liquids were processed in evaporation facilities over the decades. Methods to retrieve saltcake waste will involve dissolving the waste with a liquid so it can be pumped out of the tank.

The key is to use as little liquid as possible to minimize the risk of a future tank leak. Sixty-seven of Hanford’s 149 aging single-shell tanks have leaked approximately a million gallons of radioactive and hazardous waste to the soil in the past, with evidence the contamination has affected the groundwater.

“We need to protect the Columbia River by avoiding more tank leaks,” said Raymond. “At the same time, we need to move forward with getting the waste out of the older tanks and into glass, so we can close the tanks for good.”

Finding safest way

During the demonstration in Tank U-107, PNNL operators will make an initial scan of the waste surface. By alternating gentle sprays of small amounts of water with pumping, CHG will find the best and safest way to dissolve the waste. Over a three-month period, approximately 37,000 gallons of solid waste will be removed from the tank.

Repeated laser scans of the waste surface during the cleanup will tell operators how much waste is being removed, how much water is needed, and which type of sprinkler or configuration of sprinklers works best.

While the Topographical Mapping System is new to the tank farms, it has already proven its success in cleaning up waste sites similar to Hanford’s. A series of underground tanks known as the Gunite tanks at DOE’s Oak Ridge National Laboratory site were cleaned up with the aid of the Topographical Mapping System.

Oak Ridge National Laboratory, PNNL and Mechanical Technology, Inc. developed the mapping system in the early 1990s. The system was developed using funds provided by the Tanks Focus Area Program of the Department of Energy Office of Science and Technology. ✦