MORE WEIGHT ON THE JOB

New methods and heavier equipment are expected to hasten the nuclear-waste transfer at the Hanford Site's tank farms. By Harry Hutchinson, Executive Editor

The Department of Energy wants the aging tank farms at Hanford cleared of radioactive waste in 30 years. At the current rate of progress, though, the job will take about a century and a half.

So the contractor is trying something new to pick up speed and finish on time.

The Hanford Site, which produced plutonium for the U.S. nuclear arsenal beginning in the days of the Manhattan Project, occupies 586 square miles in southeastern Washington. Today the site includes old processing plants, groundwater that exceeds safe levels of radioactivity, and high-level radioactive waste held in 149 aging tanks—some more than 60 years old—that lie underground just ten miles from the Columbia River.

There are numerous cleanup tasks in progress at the Hanford Site, but dealing with the 149 tanks has proven to be a slow and stubborn one.

The objective is to remove the highly radioactive waste from the old tanks, which have a single-shell construction, and transfer it to 28 newer, more-secure double-shell tanks nearby, where the waste will safely reside until it can be treated in facilities now under construction.

The tank transfer program is funded by the U.S.

Department of Energy's Office of River Protection and is currently overseen by its prime contractor, Washington River Protection Solutions, a joint venture between URS Corp. and Energy Solutions, with Areva as the primary subcontractor.

Most of the waste by volume is liquid, which was pumped from the old to the new containers years ago to prevent leaks. So the old tanks have been stabilized, but the job is far from complete. What remains are solids that have settled out of the liquid over the years. Some of the material is loose. Most is a thick sludge-like material with the consistency of peanut butter, but a significant portion has caked firmly to the bottom of the giant tanks. Removing the solids, especially the caked form known as hard heel, has been slow and, in some cases, very difficult.

142 MORE TO GO

Under an agreement among the U.S. Department of Energy, the State of Washington's Department of Ecology, and the U.S. Environmental Protection Agency, the contractor must remove at least 99 percent of the radioactive waste from each tank. After more than a decade, six of the old tanks have been cleared to the target level and a seventh is awaiting confirmation by the Washington State Department of Ecology. That leaves 142 to go.

The tanks are arranged into groups called farms. They are of different ages and designs, and were built over a few decades, from the 1940s into the 1980s. They have steel sides and floors, and reinforced concrete roofs. The interiors are accessible through risers, and this is the complication of the job: many of the older tanks have risers only about a foot wide.

Over the years, the various contractors at the site have developed specialized machinery that will fit through the risers and clean out solids, including the hard heel.

The scissor-like Salt Mantis and the reconfiguring Foldtrack are two such devices that have been described in this magazine in recent years. They are remotely controlled machines that can fit through the narrow riser and then open or reconfigure their parts. They use high-pressure water jets to break up stubborn matter and flush it to pumps for removal from the tanks. The sheer mass they can bring to the job is limited by the need to fit down a 12-inch-wide pipe, and that is one of the reasons that progress has been slow.

Now Washington River Protection Solutions is planning a more aggressive approach, not limited by the legacy of the risers. The company plans to deploy a much larger device, called the Mobile Arm Retrieval System, or MARS. It has a telescoping robotic arm with a pump attached to a central mast. High-pressure water nozzles at the end of the arm can break up hard heel and flush it to the pump.

MARS was designed for Washington River Protection Solutions by Columbia Energy and Environmental Services of Richland, Wash., and fabricated by Highline Engineering Co. in a facility at the Richland airport.

The device is in tests now using materials that simulate the solid radioactive waste in the tanks—gravel, sludge, and the concrete-like hard heel.

Scott Saunders, technology and single-shell tank retrieval manager for Washington River Protection Solutions, expects significant gains in efficiency from the new machine. MARS is much larger than its predecessors and will be able to handle more material in less time.

The MARS arm can apply water at 100 psi at a rate of 100 gallons a minute to push bulk waste to the pump. It can spray 5,000 psi water jets at 20 to 30 gallons a minute to break up hard heel waste. The arm can reach all quadrants of a tank. It has an elbow joint for greater flexibility of control and has a multi-axle wrist movement to work around obstacles.

The remote operator will have three camera views of the interior of the tank and will control the device by a combination of joysticks, pushbuttons, and switches.

According to Saunders, who is an ASME member, loose bulk retrieval will proceed at the current rate. The gain will be in treating the hard heel, which could take less than a month to remove. So far, that part of the job has taken several months.

Another advantage is that, once MARS is in place, one machine will be able to complete the entire job of removing solid waste from a tank.

Traditionally, operations have used sluicing to remove loose bulk solids, and then one of the specialized pieces of hardware was introduced to remove the caked solids.

The C Farm (left), one of several groups of holding tanks at Hanford, is where a new means of waste removal will get its first workout. Cleanup begins with removal and wrapping of equipment abandoned in the tanks (below).

The changeover by itself often takes months, Saunders said, including the time that operators need to adapt to the change in equipment.

The major change in policy is the refusal to be limited by the diameter of the risers in the tanks. Many tanks already have risers with the 42-inch diameter that MARS

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MARS is being tested on material simulating the sludge and caked radioactive waste still contained in 142 holding tanks at the Hanford Site. Hard heel, much like the simulated material at right, has been a particularly stubborn challenge.

needs. A scenario is being worked out to safely open the other tanks, the ones with risers too small for MARS, and to create access for the larger equipment.

PREPARING A WAY

Each tank lies under several feet of earth. So the first step is to excavate soil from the top of the tank. Next, a team will lay a form on the tank roof and pour a layer of concrete to create a level platform several feet across.

A remotely controlled water jet will cut a 54-inch diameter hole through the concrete platform and the reinforced concrete roof of the tank. The cutting area will be secured to a crane beforehand to prevent the plug from falling into the tank.

A.K. Services of Boston has been contracted to test the cutting method on a reinforced concrete dome, similar to the roof of one of the tanks.

A ventilation system, using another riser, will draw air from the interior through a filter to maintain negative pressure inside the tank. A positive velocity of air entering the tank through the new cutting will prevent a release of contaminants.

The cutting will make room for a new riser, which can be sealed in place with a gasket and grout. The top of the riser will be enclosed in a covered pit.

Another concrete pad, this on the ground surface above the tank, will support the weight of MARS. No load will be placed directly on the tank dome or on the floor of the tank.

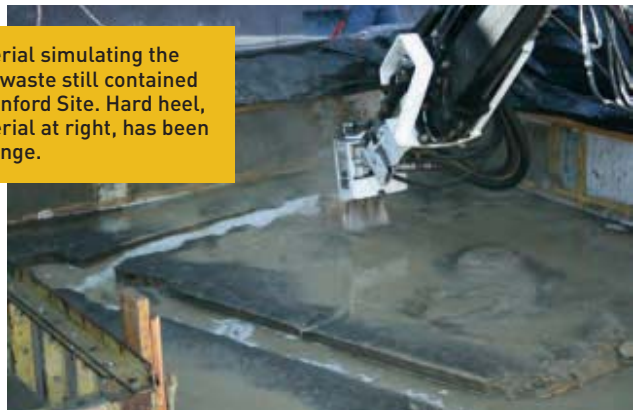
Operations will be remotely controlled because people must be kept at a distance. Operators will be protected by steel shielding.

Before any of this can begin, other prep work is necessary. In some cases, there is no electricity available to a tank farm, so power sources will have to be set up. Operators will need remote TV cameras and lighting in the tank, and that can be accommodated by the old risers.

Those risers are frequently blocked by abandoned equipment, including pumps, which must be removed first. There is a procedure for that.

As old equipment comes out of a riser, it passes through a ring sprayer that washes it. At the same time, a sleeve, placed on the crane cable above the hook, is drawn down over the object as it emerges to contain any remaining residual contamination.

Once the planning and testing are completed, MARS will be used to remove radioactive waste from tank C-107, which has a height from roof dome to floor of about 31 feet. Completing the job will require a reach



inside of 37.5 feet. Getting MARS into C-107 will require putting in a new riser.

The company is developing a second MARS design combining water jets with a vacuum system on the arm.

This variation, intended for tanks known to be leakers, will minimize the use of water. It will apply 10 to 20 gallons a minute with immediate vacuum retrieval. The vacuum system will deposit waste in a collection vessel placed in the tank. A pump will empty the collection vessel.

There are approximately 53,000,000 gallons of nuclear and chemical waste stored in the tanks at the Hanford Site. Bechtel National Inc., another of the prime contractors for Office of River Protection, is building a treatment plant that will process the wastes being stored in the underground tanks into a stable glass form for permanent disposal in a federal geological repository. ■

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