

The Environmental Restoration Disposal Facility: Hanford's Onsite Disposal Solution for Cleanup Wastes – 10342

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ABSTRACT

Nearly 50 years of defense production at Hanford left thousands of contaminated buildings, waste sites and burial grounds to clean up. Cleanup began in earnest in 1989 with the signing of the Tri-Party Agreement[1] between the U.S. Department of Energy (DOE), the U.S. Environmental Protection Agency and the Washington State Department of Ecology. The agreement provided for onsite disposal of Hanford cleanup wastes governed by the *Comprehensive Environmental Response, Compensation, and Liability Act*. The Environmental Restoration Disposal Facility (ERDF) began receiving waste on July 1, 1996. Designed to be expanded as needed, work has just begun in August 2009 on the fourth and largest expansion of the facility. When the new disposal cells are completed in the fall of 2011, the facility will have a capacity of more than 16 million tons. Nearly 9 million tons have been disposed to date. For most of ERDF's operation, the only cleanup wastes disposed at the facility were from Hanford's six reactor areas, located along the banks of the Columbia River. The wastes consisted mainly of soil contaminated by the effluent of Hanford's nine plutonium production reactors, which operated from 1943-1987. Wastes from what is called the River Corridor primarily consisted of soil contaminated with fission and activation products. Disposal operations averaged 150 waste containers a day. With the effluent sites remediated, what remains in the River Corridor includes waste sites, burial grounds and buildings contaminated with radionuclides, as well as hazardous materials, such as mercury, asbestos, beryllium, chromium and lead. Today, disposal operations average 250-350 containers a day, with a portion of the waste requiring treatment to meet facility Waste Acceptance Criteria. With DOE's Tank Waste and Plateau Remediation contracts now in place, and with cleanup work across the Hanford Site being accelerated due to funding from the American Recovery and Investment Act, disposal at ERDF is expected to increase substantially. This paper will focus on what Washington Closure Hanford is doing to ensure ERDF continues to safely and compliantly meet the challenges of unprecedented waste volume, balancing generator needs with facility capacity, treating a wide range of contaminants before disposal and providing lessons-learned to the wider DOE complex.

INTRODUCTION

Washington Closure Hanford is responsible for protecting the Columbia River by cleaning up 370 waste sites and burial grounds, demolishing 486 unused facilities, and placing in interim storage three surplus plutonium production facilities. This is part of the \$2.4 billion River Corridor Closure Project which Washington Closure manages for the Richland Operations Office of the U.S. Department of Energy (DOE).

At the hub of the cleanup project is the Environmental Restoration Disposal Facility (ERDF). Most of Hanford's low-level and mixed cleanup wastes go to ERDF. Even with nearly 900 waste containers, ERDF's "surge capacity" is only little more than a day – meaning work at waste sites would have to start shutting down if ERDF were closed for any length of time.

ERDF is a lined disposal facility built in 1996 and expanded as necessary to accept low-level and mixed wastes generated during the cleanup of the 218-square-mile River Corridor, which is part of the 586-square-mile Hanford Site in southeastern Washington state. In the early 1990s, the government estimated Hanford's River Corridor contained about 10 million tons of contaminated material from waste sites, burial grounds and planned building demolitions. Designed to be expanded as needed, the first two disposal areas, or cells, came online in 1996. Additional pairs of cells were added in 1999, 2004 and 2009. In addition, since the facility was conceived and designed nearly 20 years ago, significant effort has been expended over the last two years to upgrade processes and systems.



Figure 1. Construction of super cells 9 and 10, which is underway at the U.S. Department of Energy's Environmental Restoration Disposal Facility, will expand capacity by 50 percent. The \$55 million expansion and another \$45 million in upgrades are funded by the American Recovery and Reinvestment Act.

Even though disposal cells seven and eight came online in mid-2009, a predicted increase in planned waste disposal volumes and the American Recovery and Reinvestment Act (ARRA) combined to allow the expansion of the facility by 50 percent with the construction of two "super cells," which are the equivalent of four existing cells. Construction of super cell nine began in 2009. Construction of and super cell ten will begin in 2010.

Recovery Act funding also is supporting facility upgrades to meet an expected waste disposal volume of nearly 500 waste containers per day. The increase is the result of accelerated cleanup efforts by Washington Closure and other Hanford contractors (OHC), primarily the Plateau Remediation Contractor (PRC), and accelerated cleanup work made possible by ARRA.

FACILITY BACKGROUND

ERDF is regulated by the U.S. Environmental Protection Agency. The facility accepts cleanup waste from the River Corridor Closure Project and other Hanford operations, but does not accept non-Hanford or offsite wastes. It is a *Resource Conservation and Recovery Act*[2] (RCRA)-compliant *Comprehensive Environmental Response, Compensation and Liability Act*[3] (CERCLA) facility. The ERDF Waste Acceptance Criteria governs what wastes may be disposed directly or with treatment.

DOE sited ERDF in Hanford's 200 Area for two major reasons: it was centrally located to Hanford's cleanup efforts and it was 300 feet above the water table. The facility consists of a series of waste disposal areas or cells. The first eight cells were constructed two at a time. Each pair of cells is 70 feet deep and 500 feet by 1,000 feet at the base – large enough to hold about 2.8 million tons of material. The cells are constructed with a bottom liner consisting of multiple layers of impermeable clay and plastic and a leachate collection system to collect and remove liquids as they drain through the waste materials. The existing eight cells have a total capacity of 11 million tons. ERDF currently contains nearly nine million tons of waste material.

For the first decade of operation, most of the cleanup wastes disposed at ERDF came from the River Corridor. It mostly comprised soil contaminated by leaky effluent pipelines exiting Hanford's nine surplus plutonium production reactors. The balance contained waste from burial grounds and demolition debris from several of the old reactors. Although a minimal amount of material came from other portions of the Hanford site, the pace of disposal from other DOE cleanup activities is expected to pick up substantially in 2010 and beyond as soil remediation and building cleanup accelerates in Hanford's Central Plateau.

Many of the recent upgrades at ERDF were driven by the desire to become more efficient in handling the expected increase in waste volumes from Washington Closure and other contractors working at Hanford. Each day, waste operations staff at ERDF dispose of 250-350 containers of waste, each with a 25-ton capacity. With upgrades completed in early spring 2008 and the Recovery Act upgrades underway, the facility will have the capacity to dispose of 500 containers per day.

As each pair of waste disposal cells reach capacity, an interim cover is installed to prevent the infiltration of water. It consists of a 30-mil sheet of plastic covered with one foot of soil. A permanent cap will be placed over the facility when Hanford cleanup is completed, as required by the ERDF Record of Decision[4]. The permanent cap will not be designed until the facility is closed. That way it can be designed to the regulations of the day, using contemporary materials, as opposed to having a patchwork-cover designed to different regulations and using differing materials.

ERDF was sited in an area that had remained untouched for decades by development or brush fires. It provided valuable habitat for desert flora and fauna, and contained, as does the surrounding area, threatened species of sage grouse and burrowing owls, as well as hundred-year-old sage brush. DOE developed a plan to mitigate loss of habitat caused by initial construction of ERDF as well as any future expansions[5].

SAFETY

Safety is paramount to the overall success of the project. In the fall of 2007, Washington Closure received its Integrated Safety Management System Phase II verification. Earlier this year, the company received its Voluntary Protection Program Star Status from DOE. Both awards validated the existence of a strong safety culture across the project. Workers at ERDF are doing their part to maintain and enhance the safety culture by engaging their Local Safety Improvement Team (LSIT) in addressing the strengths and weaknesses identified during a recent survey of the River Corridor Closure Project's safety culture. The LSIT and ERDF management are working together to ensure project personnel are working safely on a daily basis by involving employees in a strong safety program that includes safety celebrations, gate greetings, on-the-spot safety awards, safety performance incentives, and activities designed to focus worker attention on safety.

To date, the project has certified more than 50 employees as Safety Trained Supervisors. Waste transport drivers have logged nearly 15 million miles with only one at-fault accident in 14 years of operation. Employees on the waste disposal subcontract have worked the life of the subcontract with no lost-time injuries. The Waste Operations team of the River Corridor Closure Project has a very proactive, engaged employee-driven safety program that is the basis for the success of the project.

IMPROVEMENTS

Over the last two years, the Waste Operations team has upgraded processes, equipment and the facility itself to receive larger volumes of waste and improve safety. Some of the upgrades were long overdue. Others were scheduled in future years, but were accelerated because of the availability of ARRA funds. The total package of improvements includes:

- New compaction methods and equipment
- Leachate system upgrades
- Requirements and commitments databases
- New trucks, containers and scales
- Cells seven and eight construction
- Super cells nine and ten construction
- Traffic safety upgrades
- Habitat mitigation

New compaction method approved

In April 2008, DOE and the U.S. Environmental Protection Agency, which provides regulatory oversight of ERDF, granted the most significant change in operations when they approved the revised Waste and Material Management Plan[6]. The two most significant changes approved in the plan were the use of GPS-equipped landfill compactors to compact waste and allowing a 1-to-1 soil-to-debris ratio in place of the previous 3-to-1 ratio for void fill and compaction requirements.

The change in soil-to-debris ratio was significant. Past operations required three containers of soil for each container of building debris. That wasn't typically a problem since most of the disposed waste consisted of contaminated soil. However, that started becoming an issue as work at the major contaminated soil sites decreased and building demolition and burial ground debris increased. If a 3-to-1 ratio of contaminated soil wasn't available, clean soil had to be used to achieve the mandated compaction ratio.

To gain approval for a change to the 1-to-1 soil-to-debris ratio, Washington Closure constructed two test pads. Workers placed waste at a 1-to-1 ratio of soil to debris and a 2-to-1 ratio of soil to debris and compacted it at various lift thicknesses. Subsidence of each lift within the test pad was monitored. Once the test was completed, results were documented. The favorable test results were the basis for updating the Waste and Material Management Plan that DOE and EPA approved to allow use of the 1-to-1 soil-to-debris ratio. This significant milestone will allow disposal of waste to continue for years to come.

In early 2007, Washington Closure began investigating the use of GPS-equipped compactors to perform compaction and to verify and document appropriate compaction of waste materials. The previous compaction method required the operator of a bulldozer to make several passes over waste material at a maximum lift of 16 inches deep. Verifying compaction required a person dressed in protective clothing to walk out onto contaminated material and measure compaction using a nuclear densometer instrument. The verification process was labor intensive and required manual data entry.

The new method uses Caterpillar 836H Landfill Compactors to make several passes over waste placed 30 inches deep. Each compactor contains a GPS receiver tied to a proprietary Computer-Aided Earth-moving System developed by Caterpillar. Equipment operators, along with engineering staff, monitor compaction as the machine passes over the waste via on-screen displays inside the compactors and remote computer monitors. System operators use the output to verify that waste is sufficiently compacted or if additional compaction is required.

Leachate system upgraded

ERDF is a lined facility with a multi-barrier system. Each cell is constructed with a bottom liner consisting of multiple layers of impermeable clay and plastic and a system to collect and remove liquid, or leachate, as it drains through the waste materials. Liquids may not be disposed in the facility; however, water from dust suppression and rain and snow will eventually seep through the buried waste and make its way to the leachate collection system.

About 100,000 gallons of leachate are pumped into holding tanks each month before being sent via underground piping to the Hanford Effluent Treatment Facility. There, it is treated and released into a permitted drain field. The filter media and removed contaminants are returned to ERDF for disposal.

In early 2007, Washington Closure discovered that part of the leachate collection system was not working properly. As a result, the entire leachate collection system was revamped. New programmable logic controllers were installed, along with monitoring systems for the sumps and holding tanks. The new system also contains an automatic feature to notify managers via text messaging when alarms are activated, power is lost or any number of pre-set conditions are exceeded. The new computerized system allows operators to view the status of the leachate collection system in real time and collect data in sufficient detail to provide an auditable record.

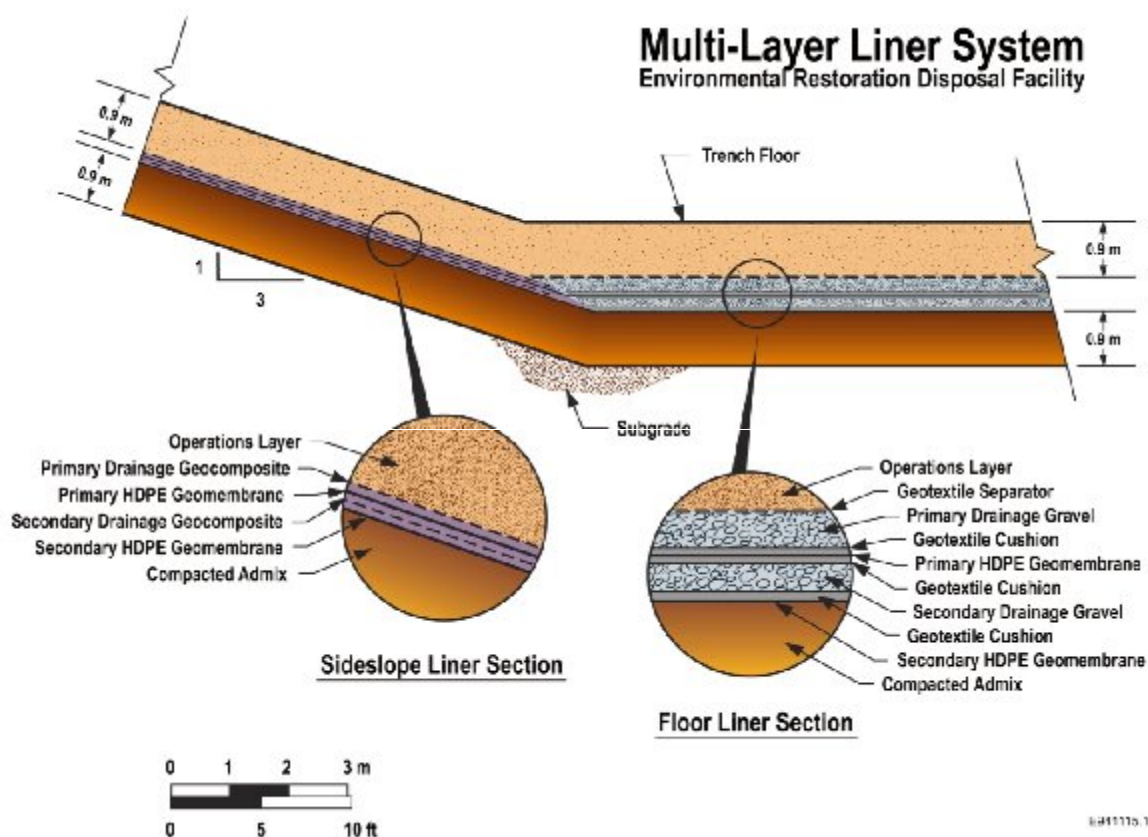


Figure 2. The U.S. Environmental Protection Agency provides oversight of ERDF, a RCRA-compliant CERCLA facility. The facility accepts radioactive and mixed wastes generated during Hanford cleanup.

Requirements and commitment database developed

Washington Closure identified more than 500 regulatory requirements that governed ERDF operations. To help track action items, the team compiled all requirements into a comprehensive database that provides the specific regulatory requirement, the approved plan with the

requirement identified, the implementing procedures and routine action-item tracking to ensure commitments are implemented.

Truck, container and scale improvements

The project purchased two additional long-haul trucks in 2008 and 20 additional trucks in 2009, bringing the total fleet size to 48 shuttle and long-haul trucks. The company also purchased an additional 150 roll-off containers in 2008 and 150 in 2009, bringing the total to about 900 in-service containers at the end of 2009. The 2009 purchases were made possible with ARRA funding, and will allow the safe increase in production across two shifts of long-haul truck drivers.

In addition, two fully automated scales were placed in service – one in 2008 and another in 2009, the latter funded by ARRA. One scale augments an older scale. The other scale is for use by other Hanford contractors, who provide transport of their own waste containers to ERDF. At one time, the driver of each truck had to exit the cab and manually enter pertinent details on paper forms. Now, all trucks and containers are equipped with RFID tags, which are read as the truck enters the scale, allowing the driver to remain in the truck. The data for each truck and container is matched with the shipping manifest and weight of the container contents to generate real-time data regarding the amount and type of waste entering the facility. Using the old system, it took about five minutes to weigh a truck and complete the paperwork. The new system is able to collect all the needed data in about 30 seconds.

Super cells nine and ten construction

In mid-2009, construction of super cell nine[7] began with excavation of an overlying stockpile from previous excavations, as well as excavation of the underlying soil. In all, a total of 1.8 million cubic yards of soil was removed. Excavation of super cell nine began soon after cells seven and eight were completed in May 2009[8]. In fact, the subcontractor, DelHur Industries, was still onsite. In order to ensure ERDF could continue to receive waste uninterrupted, design and construction of additional capacity would normally have begun in 2010. However, with the availability of ARRA funds, design and construction was accelerated by about half a year, and construction of super cell 10 was added to the scope of work. In order to get recovery dollars into the economy as soon as possible, Washington Closure added the cell nine excavation task to DelHur's existing subcontract for cells seven and eight. A request for proposals to excavate super cell 10 and constructing the liner and leachate collection system for super cells nine and ten was issued in November 2009, and an award is expected in February 2010. Construction of ERDF super cells nine and ten will allow Hanford cleanup work to continue uninterrupted for the next several years. The two new super cells will add about 5.6 million tons of waste disposal capacity to ERDF, bringing the total capacity of the facility to about 16.6 million tons. Based on current waste projections, the new cells will provide about 4-5 years of cleanup capacity.

The redesign of the leachate collection system, included in the 2009 amendment to the ERDF Record of Decision[4], allowed engineers to double the size of a cell from 500 feet by 500 feet to 500 feet by 1,000 feet. This allows all the leachate that would have been generated in two separate leachate collection systems to be collected in one. The one system saves money by

cutting in half the number of pumps, motors, control systems, and instruments needed to handle the same amount of leachate. In addition, the labor to install these systems is reduced significantly. Another proposed modification to the leachate collection system will allow a drainage medium other than gravel to be used.

Multi-modal transport upgrades

As planning began for remediation of waste sites located in different areas of Hanford, it became apparent that it would be more efficient and cost effective to consider alternative waste containers in addition to the existing 25-ton roll-off containers.

A subcontractor was procured to provide 20 heavy dump truck and trailer combinations, or trucks and pups, to handle non-regulated wastes from Hanford's D and H areas for disposal at ERDF. Although the material was not contaminated enough to require any special treatment or handling, regulations required its removal.



Figure 3. In the summer of 2009, disposal operations at ERDF averaged about 250 containers of waste per day. Upgrades underway will accommodate waste volumes more than twice the previous quantity.

Traffic safety upgrades

With disposal traffic doubling from 250 containers per day to up to 500 per day, construction traffic averaging about 300 trucks per day, and the normal operations and small-vehicle traffic, personnel/vehicle interactions was identified as the number one safety concern at the facility.

To accommodate the increased risk, a new access road to the facility was built. Roads for specific types of vehicles, such as the trucks and pups were built and container transfer areas were reconfigured to handle rerouted traffic. The changes served to reduce traffic by 50 percent in areas where heavy equipment traffic merged with high pedestrian traffic.

Habitat Mitigation

Preserving and restoring the environment is as much a part of the River Corridor cleanup mission as cleaning up waste sites and tearing down contaminated buildings. Initial actions to mitigate the construction of ERDF began during project planning in the mid-1990s. The initial design for ERDF was modified from multiple standard sized trenches to a single large trench. This served to reduce the total area reserved for current and future cell construction from 6 mi² to 1.6 mi², minimizing habitat disturbances. The facility also was moved north of its originally planned location. The current location falls within the area designated by the *Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement*[9] for waste management operations.

From initial construction through subsequent expansions, mitigation of disturbed areas was accomplished by restoring habitat in other areas[5]. Replacement ratios ranged from 3:1 for mature sagebrush habitat to 1:1 for areas that lacked mature shrubs but maintained a native plant community. To date, about 225,000 sagebrush tubelings have been planted on over 700 acres. The effort also included installation of 10 artificial burrowing owl nest boxes and seeding of 160 acres with native grasses.

SUMMARY OF ARRA-FUNDED UPGRADES

The most significant upgrades to occur at ERDF were made possible with Recovery Act Funding. DOE's criteria for Recovery Act money at Hanford was that it had to 1) create or save jobs, 2) reduce the footprint of active cleanup, and 3) reduce the overall cost of Hanford cleanup. Some activities, such as construction of new ERDF disposal cells, were already under way, making them "shovel-ready." Other projects, such as reconfiguring traffic flow to allow for safely doubling heavy equipment traffic at the facility, were initiated. They helped stimulate the economy by getting Recovery Act dollars into the community in a timely fashion – a federal criterion for ARRA dollars.

DOE has allocated about \$100 million for construction and upgrades at ERDF. Roughly \$55 million will go to construction of the new disposal cells, and \$45 million will go toward facility upgrades and improvements. Specifically, the work includes:

- Construction of super cells 9 and 10
- Adding a container transfer area for other Hanford contractor (OHC) containers
- Constructing a new entry to road into ERDF
- Paving the east entrance road into ERDF
- Installing a third scale to accommodate OHC waste
- Expanding the existing container transfer area
- Installing a refueling station

- Upgrading the septic system
- Purchasing 20 waste haul trucks
- Purchasing 150 waste containers
- Purchasing four GPS-equipped bulldozers
- Purchasing two water trucks
- Rerouting traffic through the facility
- Constructing a road for use by the trucks and pups



Figure 4. ARRA-funded work at ERDF is being completed in several phases. The facility upgrades and expansions are designed to accommodate significantly increased waste volumes over the next several years, as identified by waste generators.

TEAMWORK CRITICAL

DOE and EPA have been an integral part of the upgrades since the beginning. They share the desire to have the safest, most efficient and productive disposal facility in the DOE complex. Each has played a key role in helping to identify new upgrades and removing barriers to implementing them.

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