

SPECIAL HANDLING WASTE AT THE ENVIRONMENTAL RESTORATION AND DISPOSAL FACILITY

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ABSTRACT

The Environmental Restoration and Disposal Facility (ERDF) is a large radioactive and mixed waste landfill located on the Hanford Site, near Richland, Washington. The landfill is optimized to receive large amounts of low level solid waste in the form of contaminated soil and associated debris. The addition of new waste streams from demolition and decontamination (D&D) work at Hanford required the ERDF staff to develop special handling techniques for non-soil waste. The key to cost-effective solutions to difficult disposal problems and safe special handling processes was to improve communications between waste generators and the ERDF staff. In so doing a team approach was developed between all parties.

INTRODUCTION

The ERDF is located in the 600 Area, between the 200 East and 200 West Areas of the Hanford Site, which is located near Richland, Washington. Figure 1 shows the ERDF relative to the Hanford Site, the 200 East Area, 200 West Area, and the 100 Area remediation sites. Operations at ERDF began in July 1996. Design requirements for ERDF were derived under the regulatory authority of the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA), as administered under the *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) (Ecology et al. 1994).

The ERDF serves as the disposal site for radioactive, hazardous/dangerous, and mixed waste that is excavated during waste site remediation located in the 100, 200, and 300 Areas on the Hanford Site. Remediation of the waste management sites is expected to generate up to 4,590,000 m³ (6,000,000 yd³) of active waste for disposal to the ERDF. The ERDF will initially provide burial capacity for the first four years of expected remediation activities in the 100 and 300 Areas.

Although the majority of the waste placed in the ERDF comes from soil remediation sites, a significant amount of waste is derived from decontamination and decommission (D&D) projects and must be specially handled. Developing cost effective special handling solutions for the ERDF requires ingenuity, teamwork, and communications. This paper will describe the operational drivers, the development of the teaming approach, and specific examples of special handling at the ERDF.

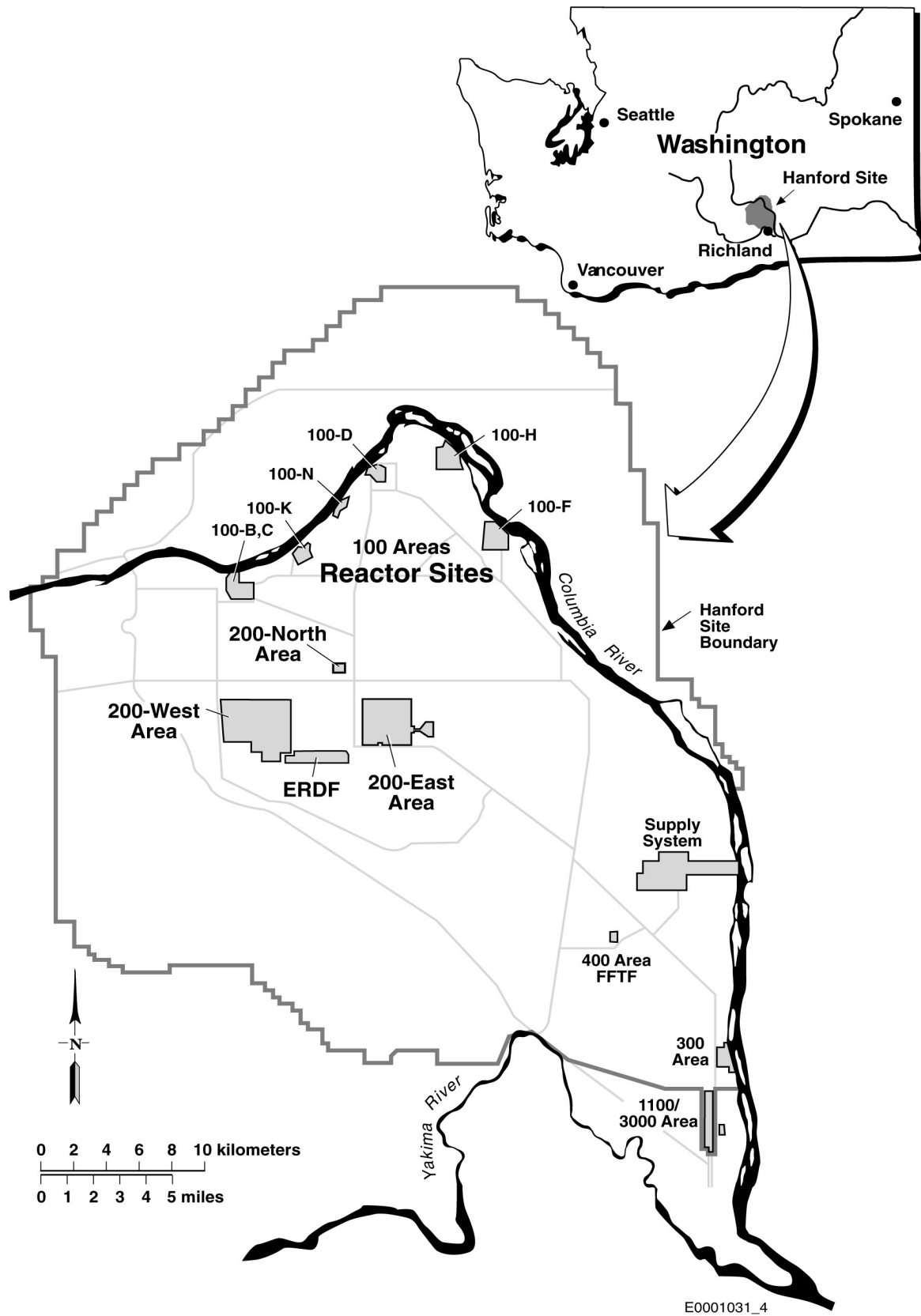


Figure 1 ERDF Location

Facility Description

The ERDF is a large-scale, *Resource Conservation and Recovery Act of 1976* (RCRA) compliant trench with a double liner and leachate collection system. (Figure 2). The initial trench was composed of two 152 m x 152 m (500 ft x 500 ft) waste cells that were 21m (70 ft) deep. The trench is designed so that it can be expanded in two-cell increments while operations are ongoing. The first such expansion was completed in the third quarter of 1999 giving the trench a total of four cells. ERDF has two 681,000 L (180,000gal) wastewater / leachate-collection tanks. These tanks provide redundant storage for effluent resulting from the hypothetical 25-year/24-hour design storm. The leachate collection system is designed to prevent liquid from collecting in the bottom of the trench at levels greater than one foot. Most waste is transported to the ERDF on semi-trailer roll-on/roll-off trucks. A container transfer pad is located near the trench to serve as a short term container stockpile and to facilitate the transfer of containers from tractor trailer trucks that travel between remediation sites and the ERDF to a fleet of shuttle trucks. The shuttle trucks operate exclusively within the confines of the ERDF. Other ERDF features of include: A 44 L/s (700 gpm) raw water system; a 32 L/s (500 gpm) potable-water system; high- and low-voltage distribution systems, a sewer system, roadways, and the necessary utilities for pre-manufactured (trailer-type) facilities.



Figure 2: Aerial Photograph of the ERDF

Normal ERDF Disposal Operations

Approximately 93% of the wastes disposed in the ERDF are soil and concrete rubble from soil remediation sites. These materials are placed in the trench at an average rate of 2,722 t per day with peak rates exceeding 3,630 t per day. Disposal processes have been established to optimize the handling of this kind of waste. Filled roll-on containers are hauled to ERDF and off-loaded onto the container transfer pad. Shuttle trucks pick up the containers and transport them to a dump face in the trench. The dump faces are located on top of, and at the forward edge of the currently active layer of waste. Each layer is 10 m (33 ft) thick and topped with 0.6 m (2 ft) of clean soil called daily operational cover (DOC). Shuttle trucks back up to the dump face where the tailgate latches are released and the load is dumped. A bulldozer spreads and compacts the waste in thin layers. Moisture is applied during dumping and compacting operations to eliminate

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dust generation. A soil fixative is sprayed on the active areas of the trench at the end of every working day to prevent the spread of contamination from the trench in off-hours. The top surface of the upper lift is sloped to shed rainfall and to set the grade for a permanent cover that will be installed at the end of the project's life.

Special Handling At The ERDF

The decision to specially handle some wastes is driven by two fundamental concerns: structural integrity of the fill and radiation control (radcon) considerations. The parameters that define normal waste handling are enumerated in a document titled Supplementary Waste Acceptance Criteria (SWAC) for Bulk Shipments to ERDF. The SWAC also presents a path forward for developing special handling methods for waste that falls outside the bounds of the SWAC. The path forward calls for a teaming approach that involves both ERDF personnel and those from the waste generating organization. This methodology has allowed the ERDF to safely dispose of a wide variety of wastes ranging from high dose rate hardware and large highly contaminated structures to contaminated sludges and portions of a reactor's fuel transfer basin.

SPECIAL HANDLING DRIVERS

As stated above, special handling is driven by two main operational concerns: 1) The need to place the waste in a structurally sound configuration that will support the final cover with a high degree of integrity and, 2) The need to control the spread of contamination within the trench and to maintain low dose rates for those working in the trench. Other considerations such as the handling of large, awkward objects or hazardous materials like asbestos and lead also drive special handling.

Structural Integrity

The ERDF was designed and is operated to completely isolate the emplaced waste materials from the surrounding environment. The RCRA Subtitle C double liner system in the floor and walls of the trench form the primary barrier to the environment. A modified RCRA Subtitle C compliant cover will complete the encapsulation of the waste. The cover, as currently conceived, will incorporate a clay and plastic composite liner, an intrusion barrier of rock or rubble, and a thick soil layer. The key to maintaining the integrity of the cover is the elimination of differential settlement within the waste. The cover will be able to withstand uniform settlement of the waste underneath. However, differential settlement may carry through from the waste into the cover, disrupting one or more of its layers.

The soil and rubble are compacted to 90% of Modified Proctor (ASTM D1557) to control general settlement in the waste. Eliminating void spaces that may collapse at some future date controls differential settlements. When a void collapses the cone of soil above the void will be displaced downward into the void. When the void is large enough, or near the surface of the landfill the displacement could extend into the cover itself. Therefore, one of the major concerns for special handling is eliminating voids and maintaining the structural integrity of the future cover.

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The primary method of eliminating voids in the waste is to crush objects with the bulldozer and incorporate them into the soil matrix. When this is not possible voids are filled with either free-running sand or a low density fill (LDF) type of grout. These operations will be described later in this paper.

Radcon

The personnel working in the trench do not routinely wear anti-contamination clothing. This is made possible by performing all operations (except bulldozing) on top of the clean DOC, carefully controlling dust generation while dumping and spreading waste, and by special handling waste that has the potential to cause a loss of contamination control. Items that come from airborne contamination areas or that have the potential to generate airborne contamination are not “dumped and dozed”. Instead they are packaged and handled in a manner that eliminates the potential for the spread of contamination. This criterion also applies to non-radioactive materials that have the potential to generate harmful dust, such as asbestos.

Waste is also packaged and handled to minimize the dose received by those working in the trench. The principles of as low as reasonable achievable (ALARA) are implemented with all waste handling. Disposal methodology is carefully worked out in advance for objects that have the potential to impart a significant dose to employees. Careful attention to radcon procedures and close communication between the waste generator and the ERDF is essential to maintaining low cumulative dose rates for those handling the waste.

The drivers mentioned above, structural integrity and radcon, are embodied in the supplemental waste acceptance criteria which is described below.

SUPPLEMENTARY WASTE ACCEPTANCE CRITERIA

The supplementary waste acceptance criteria (SWAC) document was developed after the ERDF had been in operation for 10 months. Prior to that time the waste acceptance criteria (WAC) was thought to be sufficient. However, increasing amounts of D&D waste challenged that assumption, resulting in creation of the SWAC.

Development

The WAC was established to define responsibilities, identify the waste acceptance process and to provide the primary acceptance criteria and regulatory citations to guide ERDF users. Waste packaging was only addressed where regulations specifically stipulated the packaging, e.g. asbestos. Contaminated soil was the only waste stream received during the early operations of the ERDF. Because ERDF facilities and operations were geared towards accepting large amounts of contaminated soil the WAC was sufficient. However, starting in November 1996, the Hanford N-Basin cleanup project identified the ERDF as a cost effective disposal alternative for the waste generated by the cleanup.

Initial waste shipment volumes from N-Basin were low and were coordinated on an informal basis. However, as cleanup activities accelerated the need for a protocol to control the packaging

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and disposal of disparate waste forms became obvious. Management quickly brought design engineering, N-Basin operations, and ERDF personnel together to establish the means for coordinating packaging, transportation, and disposal of cleanup waste. The resulting agreement called for joint development of disposal solutions for waste items or streams that could not be disposed at the ERDF in bulk (non-packaged) form. The disposal solutions were to be formalized in waste shipping and receiving plans (WSRPs). A WSRP would be created for each individual waste stream or unique waste item that fell outside the bounds of the SWAC. It would contain a description of the waste and the means of packaging, shipping, and disposal required for it. Four signatures are required for approval: The project engineers for the generator and for the ERDF, and the radiological engineer for each operation. The WSRP protocol was combined with bulk dumping limits for radiological contamination levels, dose rates, and rubble size limits to form the SWAC.

Creation of the SWAC was only the first step in developing a comprehensive solution to special waste handling problems. Waste scheduling meetings between ERDF and N-Basin personnel began immediately. Each group became acquainted, through facility tours, with each other's physical operating conditions and constraints. Waste generation and disposal schedules were coordinated on a weekly basis. The enhanced communication and mutual education bore fruit right away. Customized solutions for a number of different waste streams were developed in a short period of time.

Implementation

In practice, each WSRP was the product of teamwork taking place at a low organizational level. Field engineers, production personnel, and radcon supervision would develop the plan and obtain their project and radiological engineer's approval. The waste shipper initiated the document by supplying a description of the waste object(s) including physical dimensions and composition as well as the radiological condition. Photographs or original design drawings of some of the waste items were provided when available. The ERDF field engineer coordinated with ERDF production and radcon personnel and with the generator's field engineers to develop appropriate packaging, transportation, and disposal plans. The draft WSRP was to be reviewed by all parties and their comments were incorporated. Quite often, solutions to specific problems were developed during the waste scheduling meetings held at N-Basins in brain storming sessions. When agreement was reached at the field level the WSRP was presented to the project engineers for review and approval. Once signed off, the WSRP number was entered on the disposal schedule for the particular waste item and a shipment date was set. The status of WSRPs in development was tracked during ERDF scheduling meetings and priorities were adjusted to meet the waste generator's needs.

SPECIAL HANDLING EXAMPLES

Following is a brief description of some of the specially handled waste that has been disposed in the ERDF.

High Dose Rate Hardware

The first example of special handled waste actually came to the ERDF before the SWAC was developed. High dose rate hardware included debris from the N-Basin pool that had fields of up to 11 Sv/hr. The N-Basin Cleanup project had already decided to package these items inside a steel-encased grout monolith. The hot items were placed, while underwater, into baskets suspended inside the steel case. When a monolith's waste capacity was reached the shell was filled with grout and allowed to set. As it was extracted from the pool the exterior was sprayed with a high pressure water jet to remove loose contamination. As a further precaution it was sprayed with a fixative. Because of the residual contamination and dose rate levels, the monoliths were shipped to the ERDF inside a shipping cask.

At the ERDF a crane was positioned in the trench with a special hoisting hook attached. Once the transport truck was backed into position, the cask lid was removed and the hook engaged trunnions on the top of the monolith liner. The monolith was then lifted out of the cask and swung to its final disposal position. As soon as the transport truck and crane left the area a dozer began compacting waste soil around and over the monolith. This process was safely repeated many times over the life of the N-Basin Cleanup Project.

Large Low Dose Debris

The first WSRP was issued for disposal of large low dose debris. This was a broad category of items that had two common characteristics: they resided in the N-Basin pool and were therefore very contaminated, and they were often large bulky objects. These included large, structural steel tables, tools, carts – similar to small mining cars, and large steel doors that formed part of the basin itself. This waste stream proved the effectiveness of the newly defined WSRP process. N-Basin personnel originally planned to remove large items and wrap them in plastic sheeting. This would have created a massive void space problem for the ERDF because the potential airborne problem that would be created when soil was pushed through the plastic wrap would preclude dozing soil into the package. Also, compaction of soil within the structures would be problematical. ERDF personnel preferred to have the items cut up or disassembled before they left the N-Basin air borne area. This would have resulted in unacceptable exposure levels for N-Basin workers so a better alternative was sought.

The solution was development of the "conex method". Large objects were placed into a shipping container, transported to the ERDF and grouted with a low-density fill (LDF) to eliminate voids after being placed in the ERDF. Open-top conex boxes, otherwise known as Sea/Land containers, were placed next to the basins. Large items were lifted out of the basins, spray painted, and placed in the container. When filled to capacity a specially fabricated plywood lid was secured to the box and sealed. The box was radiologically surveyed, released and transported to the ERDF where a crane placed the box onto the floor of the ERDF trench (Figure 3). The plywood lid included two valved ports equipped with cam-lock connectors. These two ports were used for grouting the container. One port was the grout inlet, the second was for a filtered vent to release air displaced by the grout. A conventional concrete pump injected LDF into the conex box. After the grout had time to set waste soil was compacted around and over the conex box. The N-Basin Cleanup project purchased a number of used, open top conex

boxes, reinforced their floors, and sealed them before taking them into the basin area. This low cost solution satisfied the ERDF's void space concerns and resulted in fewer doses to N-Basin workers than their original preferred alternative.



Figure 3: Conex Box Being Placed in the ERDF

Aluminum Spiders

Another difficult waste item from N-Basins was the aluminum cubicle corner spacers commonly known as spiders. These were used in the basin to blind the corners of underwater cubicles used to hold irradiated fuel elements. The spiders four long legs approximately 1.5 m (5 ft) in length attached to a flat plate that straddled the top of the cubicle walls. The spiders looked like long, spindly, four legged stools. Due to their long residence in the pools, the spiders were highly contaminated. Grouting was not an option because of concerns that the aluminum would react with grout and produce hydrogen gas. Again, ERDF and N-Basin personnel applied a teaming approach and devised a mutually agreeable disposal solution. The spiders were placed in 1.2 m x 1.2 m x 2.4 m (4 ft x 4 ft x 8 ft) wooden boxes and surrounded with free-flowing sand while still located at the N Basins. The sealed boxes were transported to and fork-lifted onto the floor of the ERDF trench where waste soil was compacted around and over them.

Asbestos And Asbestos Wrapped Piping

The SWAC stipulates that asbestos be double bagged, wetted, and weigh less than 18 kg (40 lbs). It also states that asbestos shall be removed from pipes prior to shipment to the ERDF. Another D&D project, the 105C Reactor D&D project had large quantities of radioactive asbestos covered pipes. D&D personnel wanted to avoid the cost and potential hazard of stripping asbestos lagging from the pipes. ERDF personnel were requested to jointly develop the means to dispose of the pipes with the lagging intact. The resulting process was documented by WSRP. Lagging was removed from the ends of pipe sections so that they could be cut away from the pipelines in the reactor building. The remaining lagging was left on the pipe section, wetted, and double wrapped. Each pipe section was taped at the ends with duct tape and the pipes were strapped onto pallets. At the ERDF the pallets were placed on the floor of the trench and a berm of clean soil was built up around the pipes to form a grout pit. The pipe ends were pierced to

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allow grout entry and LDF grout was poured into grout pit. This methodology proved to be both cost effective and ALARA.

Fuel Basin Sediments

One of the most demanding disposal projects in terms of the planning and coordination required were two 58 t concrete blocks from the 105C Reactor D&D project. Sediments in the 105C reactor basin had been collected in the two fuel transfer basins situated at one end of the reactor's fuel basin. The sediments were quite radioactive and, having been allowed to dry for a number of years, constituted a potential airborne problem. The 105C Reactor D&D project originally planned to vacuum the sediments out of the basin and place them into drums. The difficulty of this approach was emphasized by the high levels of airborne contamination discovered when a worker removed the plywood lid over the basin in order to sample the sediment. The D&D project decided instead to investigate encapsulating the sediments by capping them with grout and sawing the transfer basins away from the main basin. ERDF personnel were consulted to confirm the feasibility of disposing the resulting monoliths in the trench. Actual creation and disposal of the monoliths did not occur for over a year due to the D&D project's scheduling priorities. As the D&D project approached its completion the transfer basin subproject began to take shape. The basins were filled with grout, which was allowed to set. Each fuel transfer basin was cut away from the main portion of the 105C basin using a diamond wire saw so that it could be lifted onto a lowboy trailer for transport to ERDF.

The original disposal plan was to lift the 58 t monoliths off of the lowboy trailer and place them on the top of the lower level of waste in the trench. The plan was abandoned due to the high rental fees for a crane with sufficient capacity. Also, schedule uncertainties had the potential to keep the crane on standby for a week or more, increasing the disposal cost. An alternative plan that utilized existing ERDF was accepted instead.

The D-8 dozer would be used to drag the monolith off of the trailer and onto a specially prepared pad. It was not known how much force would be required to move each massive block. This was dependent on the friction factor between the monolith and the transport trailer and the special disposal pad. A table of friction factors from an engineering textbook indicated that the force required to slide the concrete block off of the trailer's deck might be too high. The roughness of the bottom of the concrete monolith was not known in advance so the friction factor could not be reliably determined. Friction factors for steel on steel were available and were lower than concrete on steel. D&D personnel fabricated two steel plates and placed them under each monolith as it lifted onto the transport trailer. Two wide strips of steel plate were placed on the wooden deck of the trailer to protect it and to provide the required steel on steel contact. The steel deck plating was lubricated with non-hazardous gear lube to further reduce the friction factor. This portion of the disposal plan required close coordination between ERDF personnel and the 105C project.

At the ERDF a pad was prepared to receive the 58 t blocks as they were pulled off of the lowboy. Waste soil was compacted and built up to the height of the lowboy deck. Surplus railroad rail and ties from the Hanford site were laid on the top of the pad so that the steel on steel friction factor could be maintained as the block slid onto the pad. Finally, the rails were also greased.

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Calculations showed that given adequate footing, the ERDF's D-8 bulldozer should develop sufficient tractive effort to move the block. However, the D-6 dozer was put on standby in case the D-8 could not make the pull. It should be noted that the D-8's operator did not think he would be able to budge the massive block of concrete.

The lowboy with the first monolith aboard was pulled alongside the pad. After the trailer was blocked to protect it from the torsional effects of dragging the block off of it, the D-8 was tied to the block's base plate with heavy cables. Slack in the cables was taken up and the operator gradually increased the throttle until the monolith began to move. The block slid steadily and silently onto the pad with the dozer engine barely above an idle (Figure 4). The second monolith was placed in the ERDF the following week.



Figure 4: 105C Transfer Pit Monolith Drag Off

The success of the entire operation was made possible by the early and open communications and cooperation between D&D project and ERDF staff.

CONCLUSION

Difficult waste disposal problems are made easier by fostering effective communications between the generator and the disposal facility. Enhanced communications lead to greater understanding of the difficulties and priorities of each. Development of the supplemental waste acceptance criteria for the ERDF and establishing the waste shipping and receiving plan protocol provided a framework for improving communications. These communication tools and the willingness to use them by waste generator and waste disposal personnel saved time and money for all parties concerned.