Rocky Flats Closure Legacy

Waste Disposition

Achieving a consistent rate of TRU waste shipments (top) was essential to the success of the program. As the project progressed, traffic safety became increasingly complex and important to proactively manage.

INTRODUCTION

During a Rocky Flats public meeting in September 1997, the Assistant Secretary for Environmental Management, Al Alm, committed to no onsite disposal of waste.[97] Although there were no mature plans for onsite disposal of waste at that time, storage scenarios and implementation of a Resource Conservation and Recovery Act (RCRA) Corrective Action Management Unit (CAMU) were on the table as project risk management options. Forecasted waste volumes were based upon incomplete building and soil characterization data, and receiver sites were not lined up for receipt of the myriad Rocky Flats waste forms.

The actual quantities of waste generated were relatively low during the production period and early 1990s and the waste management infrastructure was designed to handle those smaller quantities. There had been extended periods where no waste was shipped to disposal sites, and as a result, the Site had a substantial and growing backlog of "legacy" waste that was poorly characterized. Much of this legacy waste had been scheduled for processing to recover its plutonium during the Site's production mission and contained a much higher plutonium concentration than could be shipped. Inadequate waste storage capacity was a chronic Site issue – early performance incentives in 1996 included measures to remove waste drums that were clogging hallways in the former production facilities. As the closure project became defined in the late 1990's waste generation forecasts exceeded shipping capacity, and waste storage volumes increased even though record amounts of waste were being shipped offsite.

Meeting these challenges was well beyond the capacity of Rocky Flats to solve on its own. Waste (and materials) disposition required a DOE corporate commitment, including the support and advocacy of DOE and contractor personnel at DOE HQ, and at treatment and disposal facilities across the complex. Figure 9-1 depicts the breadth of the project in terms of support provided from other sites.

Ultimately these challenges were met and the Site achieved an unprecedented goal and mission which was given a low probability of success in the late 1990's and early 2000's. All waste was removed from the Site by October 2005, fourteen months ahead of target schedule. Waste forecasting, onsite characterization, storage and transportation, and coordination with offsite treatment and disposal facilities were essential to ensure the timely removal of all wastes. Key innovations enabled process efficiencies and cost savings. Despite the overall success the waste program also struggled with inefficiencies and problem areas throughout the closure project. The experience and lessons, positive and negative, are presented in this section. The waste disposition discussion is organized by waste form since transuranic waste (TRU), low-level waste (LLW), and sanitary waste each posed unique characterization, packaging, transportation and regulatory challenges.

Figure 9-1, Location of Principal Rocky Flats Material Disposition Sites

TRANSURANIC WASTE DISCUSSION

Rocky Flats was one of the first sites to ship waste to the Waste Isolation Pilot Plant (WIPP), and therefore did not benefit from lessons learned from other sites. Early baselines repeatedly showed TRU waste disposal as near critical path due to characterization and transportation bottlenecks, and with little capacity for acceleration either at Rocky Flats or WIPP. The TRU waste program was heavily regulated and proceduralized. Consequently, the certification process, as well as the onsite logistical issues, received senior management attention from the outset.

Whether or not WIPP would be the disposal site for TRU waste was in question prior to May 1999. The TRU waste “storage footprint” became of increasing interest since there was limited capacity for storage of TRU waste, particularly TRU-mixed waste that needed to be stored in RCRA-permitted facilities. Competing pressures included the schedule for demolition of buildings, which required further consolidation of TRU, and the generation of additional TRU from cleanup activities. WIPP was ready to receive TRU waste in May of 1999, and Rocky Flats commenced shipping TRU waste on June 15, 1999.

Generation

Decontamination of gloveboxes reduced safety hazards and TRU waste volume, and improved operational efficiency. At the beginning of the decommissioning process, gloveboxes, tanks, and other equipment had to be size-reduced in order to fit into a Standard Waste Box, a relatively small container specified by WIPP for transportation. Workers had to wear Supplied Breathing Air suits to cut the gloveboxes in a controlled environment. This was a cumbersome, slow, and potentially hazardous operation. The desire to avoid hazards that resulted from size-reduction led to the development of a revised decontamination and characterization method, which allowed most equipment to be shipped as Surface Contaminated Object (SCO) in large LLW containers.

Glovebox decontamination using cerium nitrate and application of the surface contaminated object process allowed equipment to be shipped in large low-level waste containers, obviating size reduction activities, improving worker safety and lowering project costs.

Several decontamination agents were tested. Cerium nitrate, a water-soluble acid, was selected as the preferred decontamination solution. It was liberally applied to the interior tank and glovebox surfaces in a process that transferred removable contamination to wipes, which were disposed of as TRU waste in a much smaller volume. Following neutralization and surveys, the process was repeated as necessary, and if decontamination was successful, surfaces were fixed and the component was disposed as LLW. The “SCO process” reduced the TRU waste volume to be disposed of at WIPP, and consequently increased the volume and cost of the low-level mixed waste (LLMW) disposal. The net result was that the SCO process reduced total project cost, and improved efficiency and worker safety.

Characterization

Before TRU waste could be shipped, it was essential to create and maintain an effective Quality Assurance and Self-Assessment program and to demonstrate the program’s proficiency to the Carlsbad Field Office (CBFO), the Environmental Protection Agency, and the State of New Mexico Environmental Division (NMED). During the period from July 1997 through April 2005, thirty five (35) audits and surveillances were conducted by CBFO, EPA, and NMED at Rocky Flats. An additional four comprehensive audits were conducted by the Office of the Inspector General and the General Accounting Office during the same period. Characterization and record-keeping requirements were extensive.

Some characterization equipment was inadequate to sustain a high rate of TRU waste shipping, and assay of TRU waste was a logistical concern from the beginning of the project. Also, TRU characterization equipment was located in various buildings across the industrial area, resulting in multiple inter-building drum movements during the characterization process. TRU waste containers were moved out of the high-security Protected Area for real-time radiography, then transported back inside the Protected Area to be assayed, repacked, or gas sampled, then back outside to the shipping facility for final characterization prior to being shipped to WIPP.

Load management remained a challenge through the entire shipping campaign including issues of weight, wattage, and waste profile.

One substantial improvement in the characterization process was the use of Visual Verification (V2) to verify TRU container contents instead of Real Time Radiography. The V2 was only suitable for newly-generated TRU and required substantial training, certification, and discipline at the point of generation to implement. However, its use avoided substantial container movement and the scheduling, handling, and quality assurance associated with Real Time Radiography.

The Site created a TRU waste management complex, placing characterization, staging and shipping facilities within the same authorization basis and administrative boundaries, and outside of the Protected Area. This consolidated characterization equipment at the waste storage and shipping location and reduced the number of onsite drum movements. Waste characterization was prioritized and managed to support closure objectives. Readily characterized wastes were given priority. Waste characterization activities were systematically planned to ensure that an inventory of shipment-ready containers was always available to support the maximum utilization of transportation resources. Other wastes were given priority if stored in facilities slated for early closure.

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<u>Shipping</u>

The shipping capability was initially insufficient to meet project needs. Building 664 was the only shipping facility available and could sustain no more than seven shipments per week. Building 664 also experienced frequent down time due to equipment failure. TRU waste would end up on the project critical path if the bottleneck was not addressed. In 2001 a high bay was added to Building 440, adding two TRUPACT II container loading facilities, and enabling the number of weekly shipments to increase substantially. This new capital construction was controversial for a site undergoing accelerated closure. However, this investment paid off since it supported a sustained shipping rate of 15 shipments per week, and the TRU waste shipping campaign was completed in the spring of 2005, seven months prior to physical completion of the cleanup.

The limited availability of characterized waste meeting WIPP waste acceptance criteria was a second limiting factor to achieving the necessary shipping rate. Consolidation of characterization processes into one central area assisted with this problem, but load management remained a challenge through the entire shipping campaign, including issues of weight, wattage, and waste profile.

The TRU waste program is built for consistency, not for speed, and consequently it is important to meet project shipping goals, and difficult to make up for shipments once they are missed.

A third issue affecting the shipping campaign was the availability of a sufficient number of TRUPACT IIs. The DOE did not plan for having all generator sites ship to WIPP at the same time and WIPP planning forecasts continually showed a shortage of TRUPACT II shipping containers to meet the total EM complex need. Fortunately, the inability of other sites to meet their shipping projections made additional shipping resources available. Ensuring that there was sufficient characterized, shipment-ready inventory allowed the Site to take advantage of this availability when it occurred. For several years Rocky Flats consumed most of DOE's available TRUPACT II shipping resources to meet its GFS&I requirements under the closure contract.

Year	Shipments
1999	23
2000	53
2001	205
2002	497
2003	462
2004	638
2005	167

Figure 9-2, Transuranic Waste Shipments

Note: A total of 15,137 cubic meters of TRU waste was disposed at WIPP when the project was completed.

TRANSURANIC WASTE KEY LEARNING POINTS

1. The TRU waste program is built for consistency, not for speed, and consequently it is important to meet project shipping goals and difficult to make up for shipments once they are missed.

2. A systems approach – generation, characterization, packaging, and transportation – must be established up front to ensure maximum efficiencies are achieved.

3. Record keeping and robust quality assurance is vital for the TRU program, and requires extensive planning and active management.

4. Under the best of circumstances TRU waste disposal is extremely expensive for EM. Aggressive decontamination and packaging approaches such as SCO should be pursued to reduce the amount of TRU for disposal.

5. Closure contracts that commit corporate DOE resources should consider how to ensure the availability of those resources. Without the excess capacity that materialized when other sites were not ready to ship, DOE would have fallen short of its GFS&I commitments and likely delayed the project completion.

LOW LEVEL, MIXED, AND ORPHAN WASTE DISCUSSION

<u>Generation</u>

The original baseline LLW forecast volume was 184,475; the revised baseline was 413,000 cubic meters and the actual volume was 594,000 cubic meters. Several factors contributed to the low baseline estimate. Initial plans were for generators to provide extensive decontamination of building structures. This turned out to be inefficient and impractical, as well as a safety concern, especially for some of the older buildings. Consequently, large volumes of waste were generated later in the project from buildings that were originally expected to be decontaminated, but underwent contaminated demolition instead. In fact, about 50 percent of the total project LLW was generated and shipped in the final year.

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Another factor contributing to increased LLW volumes was bulk packaging inefficiency. The Kaiser-Hill Material Stewardship project, which managed all project-generated waste, maintained a separate budget for all disposal and treatment activities. Generators had no direct incentive to provide efficient packaging, as there were no cost ramifications to the generating project. When generated waste volumes exceeded estimated and budgeted volumes, shippable accumulations were carried over to the next fiscal year. This delayed the Site's ability to tackle certain critical path activities, such as the disposition of legacy wastes in storage areas, until late in the project.

On-site generators had no direct incentive to provide efficient packaging, as there were no cost ramifications to the generating project.

During early decommissioning projects waste was packaged into crates and drums with some of the inefficiencies described above. To address the inefficiencies the decommissioning projects began disposing of almost all of their LLW in larger containers –initially cargo containers and intermodal containers and ultimately railroad gondolas. The larger packages reduced worker risk by limiting size-reduction operations and reducing container handling and manual container movement. It also increased waste management efficiency due to fewer of packages generated, inspected, certified, marked, labeled, and shipped; and reduced waste package commodity procurement, inspection, and storage.

The use of larger packages required the successful implementation of Low Specific Activity (LSA) and SCO characterization programs (see the Technology Development section). Bulk packages would likely exceed DOT A2 limits, necessitating the need to take LSA/SCO package exceptions under DOT regulations. Implementation of LSA/SCO programs promoted waste characterization prior to packaging, placing greater emphasis on the generator's responsibility for characterizing waste.

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There were some disadvantages. Since the cost of waste disposal is usually based on the volume of the waste, the more material (i.e., weight) that can be packed in a container (i.e., volume), the lower the cost of disposal. The volume per unit weight increased about 25% as the Site used cargo containers instead of 4'X4'X8' waste boxes, resulting in greater disposal volume and cost. However, this increased cost was only when waste management was viewed separately. The man-hour savings from size reduction tasks that were completely avoided more than made up for the increased waste cost, so the total project cost and schedule were reduced. There was also a greater industrial safety risk due to heavy lift equipment, heavier suspended loads and a potential for injury during loading. However, the safety record for these heavy lifts was very good, and repetitive motion injuries and punctures from size reduction were avoided.

<u>Characterization</u>

The development of the SCO process and development of an SCO database as a waste characterization method resulted in huge characterization efficiencies. This was due to the ability to eliminate total item assay as the required method for radiological characterization. This allowed the use of larger packages, as well as a more efficient means for providing a radiological determination.

<u>Rail Shipment</u>

For most of the project, shipping of LLW was conducted by truck transport. This was preferable in the early phases of the decommissioning, when waste volumes were small and flexibility was important. As the project progressed to larger quantities, mainly due to the demolition of contaminated facilities and ER activities, it became clear that truck shipments involving reusable containers (e.g., intermodals) would not be efficient. Demolition of the larger facilities provided an opportunity for point-of-generation shipping that justified the expense of expanding onsite rail lines. Rail spurs were constructed beginning in 2004, extending existing lines to areas adjacent to Building 776 and Building 371. Other precursors to rail shipment were the development of Authorization Bases (ABs) that would allow open air work with bulk contaminated materials and regulatory approval (achieved through the implementation of selected RSOP).

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Rail shipment removed approximately 5,000 trucks from the highway and saved about $27 million over the later phases of the Closure Project. Each railcar can hold as much as 100 tons of waste, the equivalent to seven trucks. Also, larger containers allowed workers to spend less time size-reducing large pieces of equipment, building structural elements, and rubble with significantly less exposure to safety hazards[100].

Treatment and Disposal Sites

Rocky Flats principally used two waste disposal sites for its LLW – DOE's Nevada Test Site disposal facility (NTS) and the Envirocare of Utah (Envirocare, now called Energy Solutions) commercial disposal facility. Initial planning favored NTS for LLW disposal since it could accept wastes with activity levels greater than 10 nCi/gm (and less than 100 nCi/gm) which were above the levels acceptable under Envirocare's Waste Acceptance Criteria (WAC). Also, the disposal cost per volume was nominally less at NTS than at Envirocare.

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Over time, the commercial treatment and disposal site's greater flexibility and responsiveness overcame the initial cost differential between them and the DOE-owned and DOE-operated facilities. Rocky Flats continued to use NTS for disposal of its LLW that was packaged and greater than 10 nCi/gm. However, particularly for its lower-activity bulk waste, Envirocare's lower disposal fees for mixes of different waste materials (e.g., soil and debris), its willingness to negotiate lower fees in exchange for quantity guarantees, and its lower transportation cost (particularly by rail) resulted in a lower actual disposal cost. Additionally NTS required a rigorous set of programmatic controls to ensure waste was acceptable for disposal. Envirocare depended upon specific characterization of waste to provide evidence that WAC was met. Consequently, administrative errors caused delays in shipments to NTS, whereas this was seldom the case for Envirocare.

As the project progressed Rocky Flats also learned that NTS was less flexible in adapting their operations to accommodate Site efforts to improve disposal efficiency. For example, Rocky Flats wanted to dispose of several very large pieces of equipment without size reduction. NTS was unable to accommodate this request. NTS was also unable to accept large volume shipments of intermodal containers and rail cars. Envirocare was much more flexible and was able to accommodate both requests, saving the project substantial effort and cost.

The WAC at the TSCA Incinerator in Tennessee was very restrictive and the process for gaining acceptance of waste at TSCAI was very cumbersome, often requiring senior management intervention. The lead time for gaining TSCAI acceptance for shipment of waste was six to twelve months, partially as a result of aggressive oversight by the State of Tennessee. In contrast most commercial sites required lead time of about one month.

These orphan issues were some of the most problematic issues from a closure project perspective because they existed at the confluence of technical, regulatory, political, and administrative processes.

Orphan Wastes

In the mid- to late-1990s the Site identified certain mixed waste forms that had no approved treatment and/or disposal pathway. The predominant population in this category was the >10nCi/g LLMW. Neither DOE's Hanford nor NTS were able to provide a disposal path (except for about 500 55-gallon drums disposed at Hanford in the few weeks it was available). Others, predominantly the organic and mercury contaminated radioactive wastes, were "treatment orphans." Facilities permitted to treat the organic component of these wastes were not licensed to handle radioactive waste.

Early in the project, orphan wastes existed in the shadow of more pressing special nuclear material (SNM) packaging and disposition issues. But as these SNM issues were resolved, orphan waste treatment and disposal gained visibility as a critical issue. Orphan waste issues were some of the most complex from a closure project perspective, because they required the negotiation of technical, regulatory, political, and administrative processes. All orphan wastes were placed on a tracking system, regardless of the volume or number of containers. The status of treatment and disposal options was reported routinely at the DOE headquarters level to provide visibility. Because of the myriad factors affecting the disposition of orphan wastes, it was essential that actions and responsible parties be clearly identified. DOE shared responsibility with K-H for the availability of disposal sites as a Government Furnished Service/Item.

Prior to the Closure Project, nearly all LLMW waste was treated or planned to be treated with onsite facilities and processes. As the project progressed, the philosophy shifted to using offsite commercial treatment facilities to provide LLMW waste treatment. This resulted in significant cost savings as the commercial vendors enjoyed an economy of scale by treating waste from multiple DOE sites. Commercial sites also had greater flexibility to accept waste, as most have comprehensive permits and a greater ability to adapt and adjust.

As the project progressed, the philosophy shifted to using offsite commercial treatment facilities to provide LLMW waste treatment.

DOE and K-H developed several strategies to treat and dispose of the orphan waste stream consisting of >10 nCi/g radioactive mixed wastes. The Site developed an agreement with NRC-licensed Envirocare that spelled out essential and applicable requirements consistent with an anticipated revision to the NRC Branch Technical Position on Concentration Averaging[101]. DOE did not prohibit mixing greater than NRC Class A waste with NRC Class C waste. And the NRC issued a guidance interpretation that allowed mixing wastes from different classes (i.e., mixing Class A with Class C) for purposes of meeting a TSDF WAC for sites undergoing closure. As such, Envirocare could offer bulk consolidation, co-processing, and disposal of Class A and Class C LLMW. Such consolidations were arranged so that limitations of the Branch Technical Position and Envirocare's SNM exemption criteria were satisfied. This resulted in the disposal of over 1,500 m^3 of LLMW that would otherwise have become orphaned due to activity at levels greater than permitted under the WACs of Envirocare or other LLMW disposal sites.

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One particular issue that caused ongoing problems was the identification, collection, and disposal of excess chemicals. There were numerous instances of legacy chemicals, many with hazardous, oxidizer, or even explosive characteristics that continued to be discovered as Site demolition proceeded, despite a comprehensive excess chemical disposal program that began in the mid-1990s. Chemicals that were radioactive or retrieved from radiologically controlled areas, while small in volume, were extremely expensive to dispose of, one of the most extreme examples being one truckload costing over one million dollars. Two final types of material, lab returns and sources became a problem in 2005, not because they were inherently difficult to dispose of but because the waste management infrastructure was being reduced and disposal of these materials had not been properly anticipated and planned.

Internal requirements

The rigorous AB and Site Safety Analysis Report (SAR)[62] requirements that were established for all LLW and LLMW waste management activities conducted on the Site often led to difficulties in managing the LLW and LLMW waste population. These requirements were not consistent with the very low level of risk associated with the extremely small quantities of packaged nuclear material contained in LLW. Waste Facility ABs were not well matched to the needs of the storage and shipping operations. For example, some facilities allowed filter changes or recognized the potential for encountering a pressurized container, while others did not. These inconsistencies resulted in additional container movements to transfer wastes to facilities where these functions could be performed.

The Justification for Continuing Operation (JCO)[99] process required to remediate a single potentially pressurized container was slow and failed to deliver timely risk reduction. For example, in one case the hazard posed by a single suspect pressurized container was not remediated for three months due to the JCO process. It was fortunate that only one pressurized drum was discovered.

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Adopting the requirement that onsite shipments must conform to DOT requirements placed unnecessary restrictions on certain onsite movements, with minimal benefit to safety. This requirement was a carryover from the production era when pits and special nuclear material benefited from the additional rigor of the DOT requirements. However, for LLW the efficiency of moving packages through the process of preparation for shipment was usually hindered rather than helped by the DOT requirement.

Finally the Site criticality safety program required that items containing more than 15 grams of enriched uranium (>0.72% U-235) be managed under a criticality safety program (compared to 250 grams of plutonium). This required criticality safety operating limits, infrastructure, alarms, and procedures that were inconsistent with the risk posed by the materials.

Legacy Waste Disposal

At the start of the Closure Project the Site had approximately 12,000 containers of "Legacy Waste" that required disposition. This waste had been generated prior to the cleanup mission and characterized and packaged using a variety of criteria. The NTS requirements for the Site to demonstrate that a waste meets all of the rigorous NTS programmatic requirements when generated could not be met using the available data. The Site originally planned to repackage the entire population of legacy waste to ensure that every package fully conformed to the NTS programmatic requirements. As it evaluated alternatives the Site realized that the flexibility of the Envirocare WAC could allow a reduction in the repackaging of legacy wastes, since Envirocare placed greater emphasis on waste measurements and characterization rather than on production records. Although NTS waste disposal costs were nominally less, the extensive efficiency and safety improvements that resulted from the reduction in repackaging significantly streamlined and accelerated the disposition process and justified the decision to ship legacy waste to Envirocare.

LOW LEVEL, MIXED, AND ORPHAN WASTE KEY LEARNING POINTS

1. Criticality control programs need to set limits on accumulations of enriched uranium for decommissioning that are generally consistent with the DOT fissile exception requirements.

2. Hazard control criteria based on specific activities greater than 100nCi/g do reduce risks since specific activity does not contribute to risk. Controls should be based on Material at Risk mass values, consistent with DOE STD 1027.

3. Adopting DOT regulations for intra-site movement of waste packages should be closely examined for cost vs. benefit when such movement does not introduce the waste into public commerce.

4. ABs that address the progressive reduction in risk as facilities transition down in Hazard Classification 2 (non-reactor) to 3 etc., should be developed in advance.

5. Operational Readiness requirements should formally relax as facilities transition to lower Hazard Classification. As with AB documents, the life cycle of Operational Readiness Review requirements and rigor can be developed in advance.

6. Better estimate tools for predicting waste volumes are needed. In nearly every case, waste volumes produced exceeded previously estimated quantities, sometimes displaying multi-fold increase.

7. Load management techniques should be adopted in a timely manner to facilitate using WIPP for certain problematic LLMW waste types (e.g., 801s wastes). This adds a tool that increases flexibility and potentially lowers cost and risk.

8. Commercial treatment and disposal facilities were generally easier to work with, especially for innovative treatment or disposal approaches. When administrative delays and other factors were included in the cost comparison, commercial facilities could also be less expensive.

9. Larger waste packages that allow the disposal of bigger pieces of equipment and reduce size reduction can increase waste disposal volumes and costs, but can significantly decrease overall project cost and schedule, and improve safety.

SANITARY WASTE DISCUSSION

Sanitary waste disposal (which includes uncontaminated demolition debris) became a larger element of the closure project than originally anticipated. During the original waste estimating process the identification of sanitary waste quantities was an afterthought due to its relatively lower disposal cost and infrastructure (compared to radioactive waste). There was no systematic definition of exactly what materials would become waste, the ultimate scope of the effort was unclear, and much of the material was assumed to be available to recycle. Since items such as steam piping, roads, parking lots, etc. were never assigned a facility number there was no inventory from which to work. The 2000 Closure Project Baseline forecasted 66,000 tons of sanitary waste.

Sanitary waste disposal was larger than originally anticipated... sanitary waste quantities were an afterthought... There was no systematic definition of exactly what materials would become waste... there was no inventory from which to estimate.

Approximately 575,000 tons was actually disposed, nearly a factor of ten greater than the estimate. Truck shipments were increased from 5-10 per day in 2000 to an average of 130 per day in 2005, with peak days of over 300 shipments. The Site increased staff to mobilize operations, developed procedures, disposal contracts, a communication awareness program, and a tracking database.

<u>Subcontracting</u>

Initial offsite disposal was with a single landfill operator, which limited competition and was a single point failure for any landfill shutdowns.
Due to the increased volumes of sanitary waste, contracts were initiated with a second landfill, and later with a third. This resulted in a lowered disposal unit rate and a 24/7 disposal capability, which benefited some project operations. A local friable asbestos disposal capability was obtained, resulting in approximately one million dollars in savings. The third landfill was located within five miles of the Site, which cut in-half the transportation cost to the more distant landfills and also halved the daily number of trucks required. Contracts with asphalt recyclers avoided approximately two million dollars in asphalt disposal fees. Adding hauling contractors and renegotiating with existing contractors lowered sanitary waste transportation unit costs by approximately 40 percent. Using multiple contractors also improved the ability to obtain the trucks required each day.

Disposal

K-H negotiated with the landfills (and regulators) for disposal of PCB bulk product waste to include fluorescent light ballasts to greatly facilitate and make building demolition safer by avoiding manually removing light fixtures and ballasts.

A local friable asbestos disposal capability was obtained, resulting in approximately one million dollars in savings.

Onsite Requirements

The availability of an installed stationary scale was a great benefit to sanitary waste operations. The system was augmented to include an active radiological scanner and RFID system with electronically completed shipping papers for each shipment. Peak shipments of more than 300 per day would not have been possible without the automated system.

Project Management

From the start, using Conduct of Operations type controls and program management helped ensure clear communications and safe operations. A Plan-of-The-Day (POD) format was used for scheduled sanitary waste shipping work. An effective communication and employee awareness program was important early in the program as waste management changes and offsite disposal was implemented. This helped resulted in fewer incidents of unauthorized waste drop-off and incorrect waste loading. Finally, the identification of waste piles for appropriate management and disposal became more difficult as the sanitary waste loading and disposal activities increased and the Site landmarks disappeared. A GPS system "pile identification" system was implemented to assure that an appropriate level of control was provided for the effort.

SANITARY WASTE KEY LEARNING POINTS

1. As with the other waste forms, sanitary waste needs better quantity estimating tools. Sanitary waste was particularly challenging because some infrastructure sources of waste (roads, parking lots, etc) were not catalogued.

2. Continuous effort to negotiate with new haulers and disposal vendors can lower costs, expand disposal options, and improve operational flexibility.

3. Onsite supervision by trucking contractors ensures activities are completed and is useful for dealing with truck and driver issues.

4. Truck and container damage should be expected. A higher incidence of container damage was experienced in the first years of the project as loading operators were becoming familiar with the equipment.

5. For tracking onsite work (such as Davis-Bacon), establish a driver tracking matrix linked to the waste disposal database along with the shipment software (ATMS or Smart BOL). Automated systems add substantial efficiency that justifies the initial investment.

6. In the latter stages of the project, waste piles approved for disposal became difficult to identify due to loss of landmarks. A more robust tracking or identification system was warranted.

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