

**EXPEDITING THE PATH TO CLOSURE
THE CHEMICAL WASTE LANDFILL,
SANDIA NATIONAL LABORATORIES, NEW MEXICO**

S. G. Young and D. P. Schofield
Sandia National Laboratories
P.O. Box 5800, Albuquerque, New Mexico 87125-1088

M. J. Davis
Science Applications International Corporation
2109 Air Park Road, SE, Albuquerque, NM 87106

R. Methvin and M. Mitchell
Gram, Inc.
8500 Menaul Blvd. NE, Suite B-335, Albuquerque, NM 87112

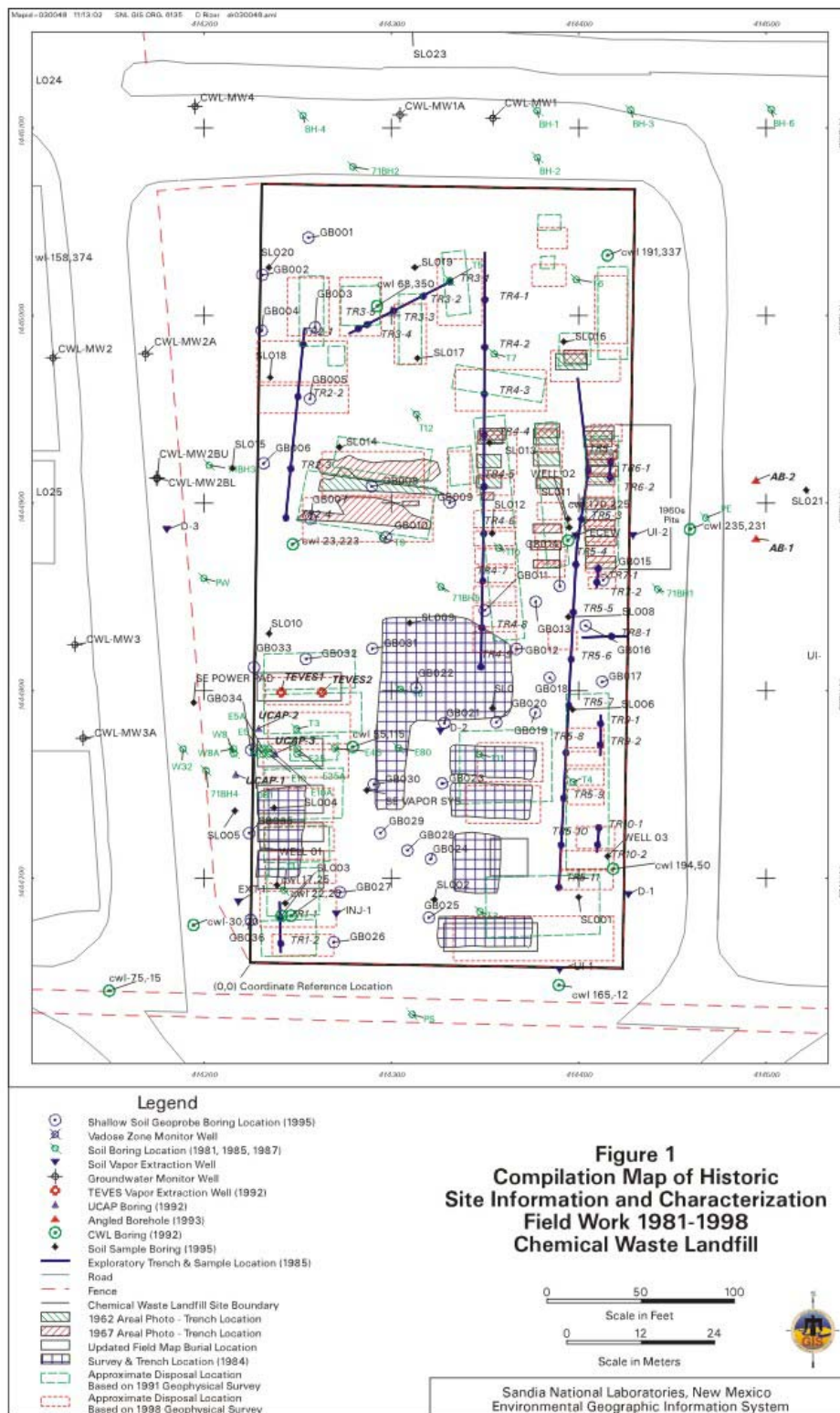
ABSTRACT

The Chemical Waste Landfill (CWL) at Sandia National Laboratories, New Mexico (SNL/NM) is undergoing closure subject to the requirements of Subtitle C of RCRA. This paper identifies regulatory mechanisms that have and continue to expedite and simplify the closure of the CWL. These include 1) the Environmental Restoration (ER) Programmatic effort to achieve progress quickly with respect to the standard regulatory processes, which resulted in the performance of voluntary corrective measures at the CWL years in advance of the standard process schedule, 2) the management and disposal of CWL remediation wastes and materials according to the risks posed, and 3) the combination of multiple regulatory requirements into a single submittal.

INTRODUCTION

The Chemical Waste Landfill (CWL) at Sandia National Laboratories/New Mexico (SNL/NM) is a 7689 square meter landfill used from 1962 until 1985 for the disposal of chemical and solid waste generated by SNL/NM research activities. In 1981 all liquid waste disposal was discontinued and solid waste disposal continued until 1985. The landfill was operated as a hazardous waste drum storage facility from 1981 to 1989, after which, all CWL disposal and storage operations were discontinued. Closure proceeded under the Resource Conservation and Recovery Act (RCRA) interim status according to the requirements in Title 40 Code of Federal Regulation (CFR) 265.

As part of the closure requirements, the Department of Energy (DOE), SNL/NM and the New Mexico Environment Department (NMED) began negotiations of a closure plan in May 1988. In 1991 groundwater monitoring results detected the presence of trichloroethene (TCE) in the groundwater approximately 152 meters (m) below the site at concentrations just over the drinking water maximum contaminant limit (MCL) of 5 parts per billion (ppb). In February 1993 the closure plan for the CWL was conditionally approved by the NMED. Extensive characterization efforts were conducted to identify and locate contaminant migration from the landfill (Figure 1).



VOLUNTARY CORRECTIVE ACTIONS

Based on an SNL/NM programmatic effort to streamline the ER Project, in 1995 submission of a draft corrective measures study plan was deferred in lieu of performing voluntary corrective actions (VCMs) that would accelerate risk reduction through source removal and mitigate groundwater impacts through active vapor extraction.

After a two year planning, field testing and vapor extraction well installation effort, the vapor extraction VCM was performed from May 1997 to July 1998 to prevent further degradation of the groundwater by partially removing, and gaining control, of the volatile organic compound (VOC) vapor plume in the vadose zone. The extraction wells were fitted with passive vapor extraction devices that operate as check valves powered by changes in barometric pressure. Subsequent monitoring has shown that TCE levels in groundwater have been reduced to levels below the MCL for the 3 years since completion of the vapor extraction VCM.

Landfill excavation immediately followed the vapor extraction effort, beginning in September 1998. The largely unknown nature of the wastes that had been disposed in the CWL created uncertainty as to whether the buried wastes constituted a continuing source of groundwater contamination. A statement of work was developed based on the previous characterization work, which had been focussed on identifying mobile contaminants with the potential to migrate from the site and/or contaminate groundwater, such as solvents and chromium.

Once planning of the excavation was underway, disposal records were examined in more detail. These disposal records were only available for the last 10 years of the 23-year disposal history, and were consistent with Sandia's work history in that a wide variety of small volumes of chemical compounds were itemized. However, the records tended to be vague and incomplete, including entries such as "unknown fume hood chemicals". Additionally, the existing records included entries identifying disposals of radioactive wastes, pyrophoric materials, munitions components, and compressed gas cylinders. Although these items have a low probability of vadose zone or groundwater impacts, their presence significantly altered the operational approach to excavation.

Health and safety measures and emergency planning efforts for the excavation were extensive. The proximity of workers at a neighboring office facility greatly increased the complexity and rigor of operational procedures during the excavation and forced the initial phases of excavation to be performed in a very cautious manner to minimize the breakage of buried containers.

After approximately 20% of the landfill had been excavated, the nature of the buried waste was much better understood and the excavation process could be re-engineered to accelerate the project. Re-engineering also targeted increasing site worker safety by mechanizing the debris segregation process using a diesel powered screen plant and a conveyor system. This excavation process yielded approximately 39,757 cubic meters of excavated soil, over 2,000 intact chemical containers with unknown contents, hundreds of thermal and chemical batteries, approximately 350 intact corroded compressed gas cylinders, and a couple of hundred cubic meters of bulk debris including wood, metal, paper products and plastics.

By the end of 2002, the landfill contents had been completely excavated, partially backfilled, and most of the excavated soils had been treated and/or placed directly into the adjacent Corrective Action Management Unit (CAMU) containment cell. All excavated compressed gas cylinders had been evacuated, contents assayed, and treated. Excavated wastes that exhibited the highest levels of hazard, such as elemental sodium and sodium-potassium alloys, partially expended munitions components, and water-reactive chemicals had been treated on-site, picked-up by the Kirtland Air Force Explosives Ordnance Disposal team, or sent directly to an off-site treatment, storage and disposal facility.

RISK-BASED WASTE MANAGEMENT

The accomplishments summarized above were due to the approval of 3 regulatory strategies that allowed remediation wastes to be managed according to the risks posed, rather than being managed more conservatively. These three approvals were:

- 1) a risk-based approach to excavating and backfilling the CWL,
- 2) a risk-based approach under the Toxic Substances Control Act (TSCA), and
- 3) a delisting petition for excavated and project-generated debris.

Risk-Based Approach Under RCRA

NMED approval of a RCRA risk-based approach at the CWL allowed for excavated rocks and minimally contaminated soils to be replaced into the excavation as backfill material. This resulted in the replacement of all of the excavated rocks totaling approximately 955 cubic yards, followed by the replacement of approximately 10% of the excavated soils that were below negotiated risk-based levels.

This approval also allowed excavation to cease when risk-based levels of residual contaminants were encountered, rather than continuing excavation until background concentrations were reached, to a maximum of 6.1 meters below ground surface (mbgs). This approach reduced the number of necessary iterations of sampling, followed by deeper excavation, followed by more sampling, in each area of contamination. It also limited the volume of soil that was removed at depth. Excavation in most areas of the landfill achieved risk-based levels at a depth of 3.7 mbgs, rather than 6.1 mbgs.

Risk-Based Approach Under TSCA

Excavation deeper than 6.1 mbgs was required to comply with TSCA regulations in specific areas. The excavation had begun under the self-implementing approach described in title 40 CFR 761.61(a). It soon became apparent that these procedures were too restrictive to allow cost-effective remediation of the landfill. For example, storage of excavated soils with PCBs greater than 50 parts per million (ppm) was limited to 6 months and specified decontamination requirements for equipment were designed to remove pure PCB products, instead of the routine removal of dust and soil adhering to CWL equipment. Excavation was originally required to proceed until 1 ppm total PCBs was achieved. Final verification sampling requirements were extremely detailed in terms of exact dimensions of sample sleeves and dictated a sample location spacing that was more applicable to smaller areas of remediation.

In addition to these constraints, a larger volume of PCB-containing soils than expected were excavated and over half of these soils also were contaminated with tritium above background activities. This discovery, combined with the previously described TSCA restrictions, prompted the CWL and CAMU to apply to the Environmental Protection Agency (EPA) under the risk-based TSCA clean-up standards, title 40 CFR 761.61(c) and to change the CAMU permit to allow the acceptance of low levels of tritium. This risk-based TSCA approval included the following key operational changes:

- 1) PCB-contaminated soils could now be accepted at the CAMU,
- 2) PCB-containing soils could be stored on-site and at the CAMU until the end of excavation when the CAMU treatment units began operation,
- 3) Equipment decontamination could be performed in the same manner as for RCRA constituents,
- 4) Verification sampling of the final extent of excavation was changed to coincide with the verification sampling grid established for RCRA constituents,
- 5) Using a system of graded long-term controls, excavation could cease at a maximum value of 100 ppm total PCBs, rather than a clean-up level of 1 ppm with no allowance for institutional or engineering controls.

Contained-In Determination

Once all of the impediments to completing the excavation were removed, the next area that could lead to quicker and more simplified closure was the management of excavated and project-generated wastes that remained in the site operational boundary, impeding closure. All of these wastes are categorized under RCRA as listed wastes. Project-generated wastes constitute approximately 91.75 cubic meters of a wide variety of used materials items including spill pallets, plastic sheeting, drums and buckets, personal protective equipment, wooden pallets, temporary fencing, and many other items. Excavated debris included approximately 344 cubic meters of wood, corroded metals, and compactible debris such as cardboard, paper products, and plastics.

A petition to delist these wastes was submitted to NMED in August 2001, and approved in January 2002. This lengthy approval process was due to the precedent-setting nature of the request; the NMED had never received a request under the contained-in regulations before. An expedited disposal process incorporating these contained-in determinations is under way. The approval allowed for excavated and project-generated remediation wastes to be determined to no longer contain hazardous waste according to two methods:

- 1) a visual inspection of the waste items by NMED, and
- 2) comparison of analytical results to the total waste standards or waste extracted standards tables in Title 40 CFR 268.40.

Based upon method 1 of this approval, an inspection was performed by the NMED in March 2002 to identify wastes that qualified for a contained-in determination under RCRA (Figure 2).



Figure 2. NMED Inspection of Hazardous Waste for a Contained-In Determination

This inspection resulted in the delisting of approximately 69 cubic meters of project-generated waste. To dispose of the project-generated waste as non-hazardous waste, based on the NMED's inspection, resulted in a cost savings of approximately \$9,000 in waste disposal costs based solely on this visual inspection.

The contained-in approval has also established *de minimus* levels of hazardous constituents if the NMED determines that data is required prior to making a contained in determination for specific waste. The constituent list for the contained-in determinations includes only the listed solvents and heavy metals that have been identified as contaminants of concern based on soil analytical results. If measured concentrations of these compounds are present below the concentrations given in 40 CFR 268.40, the waste is no longer a hazardous waste and can be managed according to a lower level of rigor.

An estimated 7 cy of excavated waste presently identified as mixed waste may be recharacterized as radioactive waste, based on this contained-in determination, using either of the two approved methods. This could result in a cost saving of up to \$67,000 in disposal costs. The consequential reduction of schedule and elimination of characterization, handling and management requirements for these waste streams can realize additional savings of approximately \$50,000.

REGULATORY CLOSURE REQUIREMENTS

A report documenting the excavation VCM has been drafted and provides the final data set for the post-excavation surface and near-surface characterization that will lay the groundwork for the next step in the closure process. A risk assessment representing the landfill condition when it is backfilled level with surrounding grade will be included in this Landfill Excavation VCM Report. Although closure is subject to 40 CFR 265 Subpart G regulations, which only require the submission of a post-closure care plan, the closure plan and NMED require a corrective measures study (CMS) report and a remedial action proposal (RAP) will also be submitted.

To address these requirements for multiple and partially redundant documents, a single regulatory submittal is currently being drafted that incorporates regulatory requirements for these multiple reports, including the CMS Report, RAP, Post-Closure Care Plan and Permit Application, and several modifications to existing closure plan appendices to make them consistent with the post-closure care plan. This single submittal will address all requirements, result in only one permit modification, and pave the road to final closure.

This single document submittal will contain all necessary elements of the closure strategy including regulatory and technical uncertainties, recommend a final corrective action(s) and presenting a long term monitoring strategy that will address many long-term stewardship issues at the CWL. Specifically, the CMS Report will summarize existing data and reiterate the conceptual model of the site from older reports, many of which were not regulatory deliverables and as such were never approved by NMED. This report will also address technical uncertainty associated with residual contamination that exists in the floor of the excavation and in the vadose zone, followed by the evaluation of remedial action alternatives such as construction of an engineered cover. The Remedial Action Report will take the resulting recommendations of the CMS Report and provide conceptual engineering design details for approval. The Post-Closure Care Plan and Permit Application will detail maintenance and groundwater monitoring. A contingency plan for conducting further actions based on monitoring criteria will also be included in this plan and permit application.

After approval of the combined documents described above, several additional regulatory requirements must be met. These include:

1. Notification to start closure required under 40 CFR 265.112,
2. Corrective Measure Implementation (CMI) Plan (if any corrective measures are necessary),
3. Certification of closure/completion of final remedies (if any) under 40 CFR 265.115,
4. Submission of a survey plat according to requirements in 40 CFR 265.116
5. Notice to the county zoning authority indicating that a notation to the deed has been issued (as appropriate) under 40 CFR 265.119,
6. A final report required by the CWL closure plan and EPA under the TSCA risk-based approach approval, 40 CFR 761.61(c),
7. Certification of post-closure care under 40 CFR 265.120.

Construction and implementation of the final remedy, assumed to be an alternative RCRA landfill cover designed for arid to semi-arid climates will begin after the notification to start closure has been submitted to the NMED. Implementation of the post-closure period will begin after the submission of the final report and will involve groundwater monitoring and cover maintenance at the CWL for a period of up to 30 years. This monitoring and maintenance activity will be proposed as a graded approach such that decision points as to the efficacy of and the continuing need to conduct these activities are scheduled at much shorter intervals than the entire 30 years presently required under RCRA. In addition, stipulations regarding actions that will be taken if specified critical events occur, such as conducting another active vapor extraction operation if sustained solvent detection in the groundwater above MCLs should occur, will be included in the post-closure care plan.

CONCLUSION

Acceleration of the closure schedule and project cost reduction has been achieved by continuous process improvements and a close working relationship with the NMED to implement on-going improvements. The approval and implementation of contained-in determinations has resulted in the acceleration of the waste disposal effort by several months and cost avoidance savings related to sampling, analysis and disposal of up to \$130,000. In addition, the submission of a single class 3 closure plan modification that combines the requirements for 3 or 4 separate documents will further reduce schedule and costs associated with landfill closure by an estimated one and a half to two years over submission of these documents sequentially.