

CASE STUDY OF TREATMENT OF MIXED WASTES UTILIZING THE OAK RIDGE BROAD SPECTRUM CONTRACTS

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ABSTRACT

To meet the requirements of the State of Tennessee's Department of Environment and Conservation Commissioner's Order for treatment of mixed low level wastes, Oak Ridge has utilized commercial treatment companies to treat and dispose mixed waste. Over the past year and a half, Oak Ridge has shipped mixed waste soils, sludges, and debris for treatment to meet milestones under the Site Treatment Plan. Oak Ridge has established contracts with commercial treatment companies accessible by all DOE sites for treatment of a wide range of mixed wastes. The paper will describe and summarize the activities involved in utilizing a contract and the treatment and disposal activities required.

This paper will describe the case history of treatment of several typical mixed wastes from the Oak Ridge Reservation requiring treatment prior to disposal. The paper will include a contract overview, waste category information, implementation activities, and contract access. The paper will discuss the specifics of the mixed waste treatment including waste characteristics, treatment utilized, and treatment results. Additional information will be provided on task order development, waste characterization and profiling, staging and delivery of waste to vendors, treatment pricing, and the disposal process.

BACKGROUND

The Federal Facility Compliance Act requires that all DOE facilities identify treatment for Mixed Low Level Waste (MLLW). In most cases this requires construction of new facilities or establishing new contracts with private sector firms having the capability to treat MLLW. However, volumes of MLLW at many DOE facilities are small, making the economies of many small treatment efforts unfavorable.

To take advantage of economies of scale, Bechtel Jacobs Company, the Oak Ridge management and integrating contractor for waste management and environmental restoration, initiated procurements for treatment of a wide variety of MLLW. This contracting action makes MLLW treatment available to all DOE facilities. The contracts have recently been modified to incorporate terms and conditions approved by the DOE Integrated Procurement Contracting Team which make the contracts more easily accessible throughout the DOE complex. There are roughly 80 separate waste streams or approximately 14 million pounds of MLLW stored on the Oak Ridge Reservation that are included in this action. Many other DOE sites have similar waste streams in storage and some sites continue to generate MLLW.

This results in a potential to treat 40 million pounds of MLLW. To demonstrate the capabilities provided by the contracts, this paper follows the progress of two waste streams that were treated under the Broad Spectrum contracts.

The procurements allowed competitive bids for six different categories of waste that reflect the spectrum of legacy mixed wastes in DOE; and are available to all sites under a Basic Order Agreement. Six categories were chosen to maximize the competition between qualified firms and result in multiple contract awards. DOE treatment schedules are expected to be shortened as a result of greater DOE access to commercial mixed waste treatment capacity through the contracts. For those wastes where there is a lack of existing treatment capability at DOE sites, the contracts eliminate the need to construct new treatment facilities at DOE sites.

WASTE CATEGORIES

The waste categories were developed based on waste type, treatment technologies, and regulatory requirements and are described below. In all cases, the radionuclides in the raw waste will be below licensing levels at the disposal facility, such as Envirocare of Utah, Inc. which is currently under DOE contract, and consist of elements that are accepted for disposal at the disposal facility.

Treatment Category A: The waste offered for treatment is generally expected to consist of non-combustible, low-level, contact-handled soils, sludges, and other solids material meeting the Environmental Protection Agency (EPA) definition of debris, all of which is contaminated with organic constituents alone, or organic constituents and RCRA metals, including mercury. The predominant waste codes in this category will be D004 through D011 and F001 through F007. Additional codes that are expected include D018 through D043 and those list codes that may need similar treatment technology. Polychlorinated Biphenyls (PCBs), at levels requiring regulation under TSCA are not present in this waste.

Treatment Category B: This category is generally expected to consist of non-combustible, low-level, contact-handled soils, sludges, and other solids material meeting the EPA definition of debris, all of which is contaminated with PCBs above levels requiring regulation under TSCA. The waste will also contain organic constituents alone, or organic constituents and RCRA metals, including mercury. The predominant waste codes in this category will be D004 through D011 and F001 through F007. Additional codes that are expected include D018 through D043 and those list codes that may need similar treatment technology.

Treatment Category C: This category is generally expected to consist of non-combustible, low-level, contact-handled, non-combustible soils, sludges, and other solids material meeting the EPA definition of debris, all of which is contaminated with RCRA metals. The predominant waste codes in this category will be D004 through D011, F006, and F007 and

those list codes that may need similar treatment technology. Mercury levels will be below 260 ppm.

Treatment Category D: This category consists of low-level, contact-handled, combustible and non-combustible material including soils, sludges, and may contain some material meeting the EPA definition of debris. All of this waste is contaminated with PCBs above levels requiring regulation under TSCA. The waste will also contain RCRA constituents that require incineration and may contain other RCRA constituents that may be treated by incineration or stabilization.

Treatment Category E: This category consists of low-level, contact-handled, combustible and non-combustible soils, sludges, electrical equipment and debris contaminated with PCBs above levels requiring regulation under TSCA and needing thermal treatment or permitted alternative. RCRA regulated materials are not present.

Treatment Category L: This category consists of low-level, contact-handled, liquid aqueous and organic RCRA non-wastewaters all of which are contaminated with organic constituents alone, or organic constituents and RCRA metals. The category also includes elemental mercury. The predominant waste codes in this category are D001 through D011 and F001 through F009. Additional codes that are expected include D018 through D043 and those listed codes that may need similar treatment technology. The wastes are expected to contain primarily listed hazardous wastes and/or characteristically hazardous wastes. In addition, some of the wastes have come in contact with PCBs at a concentration greater than 50 parts per million (ppm) and therefore are regulated under Toxic Substances Control Act (TSCA). Cyanide levels in the raw waste may exceed 30 mg/L (amenable) and 590 mg/L (total).

CONTRACT STATUS

Five Broad Spectrum contracts were signed in June 1998 with two vendors. East Tennessee Materials and Energy Corporation (M&EC) of Oak Ridge, Tennessee was awarded contracts for treatment of Categories A, B, and D. Waste Control Specialists (WCS) of Andrews, Texas was awarded contracts for Categories C and E. An additional contract to treat Category L liquids was signed in August 1999 with Allied Technology Group (ATG) in Richland, Washington. The contract is to treat liquid aqueous and organic RCRA non-wastewaters and elemental mercury. Recently the terms and conditions of the contracts have been modified to conform to the DOE Integrated Contracting Procurement Team terms and conditions. This is part of an effort by DOE to consolidate procurements and eliminate redundant procurements.

In the spring of 2001, Perma-Fix Environmental Services, Inc. completed acquisition of M&EC. Perma-Fix has brought needed capital and resources to the development of the treatment processing and handling facilities. M&EC completed a First Article Test for the stabilization under Category A using their Perma-Fix I unit in November 2001.

Bechtel Jacobs Company approved the First Article Test for stabilization in December 2001. M&EC has completed a First Article Test for Category A for its low-temperature thermal desorption unit in December 2001. The First Article Test will be approved by Bechtel Jacobs Company after the disposal profile is approved for the treatment residue. In addition, waste treatment is available under the Category A contract at the Perma-Fix Environmental Services facility at Gainesville, Florida under a subcontract to M&EC. A separate First Article Test for that facility was completed in May 2001. The Gainesville facility has installed a smaller scale low-temperature thermal desorption system that is similar to the M&EC facility.

WCS has obtained all RCRA permits and has installed stabilization equipment to treat Category C waste. WCS successfully completed the First Article Test for Category C in July 1999. PCB authorization for treatment and process equipment for Category E waste is being obtained by WCS. A First Article Test for Category E is planned for March 2002. To date, numerous waste streams have been shipped to WCS for stabilization treatment under Category C. Three small waste streams associated with facility clean up from the Mound Site have been treated and are planned for disposal at the Nevada Test Site. Three wastestreams from the Paducah Gaseous Diffusion Plant was shipped in the fall of 1999 and in 2000 and 2001 for stabilization. Fifteen Oak Ridge waste streams, primarily debris, labpacks, contaminated soils, and waste water treatment sludges, totaling approximately 550,000 kgs were shipped for stabilization from November 1998 through October 2001. Treatment of these wastes is significant in that compliance milestones exist for each waste stream. Also, in December 1999, three Naval Shipyard facilities made shipments totaling 3,800 kgs to WCS for treatment utilizing the Broad Spectrum contracts through a memorandum of understanding with DOE.

An additional contract was signed in August 1999 with Allied Technology Group (ATG) in Richland, Washington. ATG filed for Chapter 11 bankruptcy in December 2001. ATG is in the process of developing a stabilization budget to restart the processes at the Richland facility. The contract is to treat liquid aqueous and organic RCRA non-wastewaters and elemental mercury. ATG has obtained RCRA permits and is in the process of completing its treatment demonstration under the permit. A gas vitrification treatment unit is being constructed and is planned to be operational in the summer of 2002. A First Article Test will be completed prior to receipt of production quantities. Elemental mercury will also be treated through amalgamation.

Audits of all Broad Spectrum contract facilities have been performed. Bechtel Jacobs Company and the Department of Energy Oak Ridge Operations Office conducted an audit of WCS in November 2001. The audit reviewed the storage, treatment, and analytical laboratory facilities at WCS. The findings indicated that WCS had corrected some deficiencies from previous audits and were working to correct other findings. Based on the recent audit, Bechtel Jacobs Company approved the use of WCS for storage and treatment of MLLW. The Department of Energy Oak Ridge Operations Office completed an audit at the Perma-Fix Gainesville facility in late November 2001. Based on the audit, Bechtel Jacobs

Company continues to approve the facility for treatment of mixed waste. In November 2001, DOE and Bechtel Jacobs performed a readiness assessment for the new M&EC facility in Oak Ridge. It is expected that an audit will be conducted for M&EC in early February 2002 and in May 2002 for ATG.

In September 1998, Bechtel Jacobs Company established a website for the Broad Spectrum contracts. The address for the website is www.bechteljacobs/broadspectrum/bstihome.htm. The website includes descriptions of each Broad Spectrum contract waste category. These descriptions include waste matrix, EPA waste codes, and other significant parameters. The website contains descriptions of each vendor's capabilities. Waste acceptance criteria for M&EC and WCS are provided on the website. Contract responsibilities of the vendor and the originating site is also described. A task order form is attached to assist in completing an order for waste treatment. An interactive cost sheet is provided to let potential users develop estimates for treatment of specific waste streams. Table 1 is an example of the information required. By inputting information on the waste matrix, quantity, container type, and certain chemical parameters, an estimate is calculated that is used in completing the task order with the treatment vendor. The website will be updated periodically.

CASE STUDY 1

Waste Description

The waste consisted of process sludges from various operations on the Oak Ridge Reservation. The waste stream had a wide range of liquid content and free liquids present in one third of the sampled population. A total of 366 containers ranging from 55- to 85-gallon drums made up the inventory of 57,911 kilograms. The waste stream carries numerous EPA waste codes including D004-D013, F001, F002, and F006.

Treatment Requirements

As seen in Table II, the waste has high levels of heavy metal contaminants requiring treatment when compared to either hazardous characteristic regulatory levels or treatment standards based concentration limits. Many waste containers in the population have liquids present that will require treatment prior to disposal. The prime metal contaminants were cadmium and chromium that were a couple of orders of magnitude above the treatment standards. Concentrations were also slightly in excess of the treatment standards for lead and silver.

TABLE II. SIGNIFICANT TREATMENT STANDARD COMPARISON:

Waste Code	Contaminant	LDR Treatment STD	Avg Value	Max Value
D005	Cadmium	.11 mg/l TCLP	25.3 mg/l TCLP	301 mg/l TCLP
D007	Chromium	0.6 mg/l TCLP	36.8 mg/l TCLP	386 mg/l TCLP
D008	Lead	0.75 mg/l TCLP	.88 mg/l TCLP	9.6 mg/l TCLP
D011	Silver	.14 mg/l TCLP	.19 mg/l TCLP	2.7 mg/l TCLP
F001 & F002	All		Below Treatment Standards	Below Treatment Standards
F006	Chromium	.6 mg/l TCLP	36.8 mg/l TCLP	386 mg/l TCLP

Task Order Development

Based on the need to treat the waste for metal contaminants, a task order was completed with WCS to stabilize the sludge waste. A profile was completed utilizing the WCS profile form and inserting applicable information from analytical and process knowledge. WCS approved the profile in approximately one week. The cost calculator contained in the Broad Spectrum web page was used to determine the cost elements for treatment, handling, and transportation that were the basis of the task order. The task order was developed and signed by the generator and treatment vendor in approximately five days.

Treatment

The waste was shipped to WCS in the spring of 2001. WCS developed a treatment recipe for the waste based on additional in-house sampling and evaluation. Stabilization of the sludge was performed in the facility's bulk treatment pan using an articulated arm. Portland cement and other reagents were used as stabilization agents. Analysis of the treated waste demonstrated that the treatment standards had been met.

Disposal

Disposal of the treated waste sludge will be at Envirocare of Utah, Inc. under the DOE Oak Ridge Operations mixed waste disposal contract. WCS completed a profile for disposal at Envirocare. The profile was reviewed and revised by Bechtel Jacobs Company. The revised profile was submitted to Envirocare for approval along with a summary of analytical data for the treated waste. Following approval of the profile by Envirocare, DOE Oak Ridge Operations completed a delivery order to Envirocare for the quantity of treated waste. A notice to transport is provided by Envirocare and the waste was transported by WCS.

CASE STUDY 2

Waste Description

The waste consisted of spent carbon used to polish wastewaters from the Y-12 Plant. The waste stream had a wide range of liquid content and free liquids present in two third of the sampled population. A total of 836 containers ranging from 55- to 85-gallon drums made up the inventory of 196,000 kilograms. The waste stream carries numerous EPA waste codes including F001, F002, F006, and F007.

Treatment Requirements

The waste has levels of organics that are only slightly above treatment standards. Many waste containers in the population have liquids present that will require treatment prior to disposal. The prime organic contaminants were acetone, methanol, n-butyl alcohol, and nitrobenzene.

Task Order Development

Based on the need to treat the waste for organic contaminants and free liquids, a task order was completed with M&EC to thermally desorb the wastewater carbon. A profile was completed utilizing the M&EC profile form and inserting applicable information from analytical and process knowledge. The profile was approved by M&EC in approximately two weeks. The cost calculator contained in the Broad Spectrum web page was used to determine the cost elements for treatment, handling, and transportation that were the basis of the task order. The task order was developed and signed by the generator and treatment vendor in approximately seven days.

Treatment

The waste was shipped to M&EC in the summer of 2001. M&EC developed a treatment protocol for the waste based on additional in-house sampling and evaluation. The containers of waste were first sent through M&EC's material handling process to screen and sort the material and remove any free liquid. Further treatment of the waste was performed in the facility's thermal desorption unit. The waste was batch treated in the thermal reactor vessel at approximately 400 degrees F. Approximately 10 drum equivalents were processed in the reactor vessel at a time. The thermal desorber operated under vacuum. Condensate from the reactor was collected and the organic liquids were transported to Diversified Scientific Services Inc. in Kingston, Tennessee. Analysis of the treated waste demonstrated that the treatment standards had been met.

Disposal

Disposal of the treated waste will be at Envirocare of Utah, Inc. under the DOE Oak Ridge Operations mixed waste disposal contract. M&EC has completed a profile for disposal at Envirocare. The profile will be reviewed and revised by Bechtel Jacobs Company. The revised profile will be submitted to Envirocare for approval along with a summary of analytical data for the treated waste. Following approval of the profile by Envirocare, DOE Oak Ridge Operations will complete a delivery order to Envirocare for the quantity of treated waste. A notice to transport will be provided by Envirocare and the waste will be transported by M&EC.

CONTRACT IMPLEMENTATION

Responsibilities of the Vendor

The vendor's on-site activities will be limited to picking up containerized wastes from staging areas at each site. Vendors will only drive transport vehicles on-site to be loaded and secured by DOE contractor employees, then drive the loaded vehicles off-site to their treatment facility.

The treated waste must meet the Land Disposal Restriction treatment standards and the Waste Acceptance Criteria (WAC) of a disposal site under DOE contract at the time of disposal. After treatment, vendors will be required to package and transport to the dispose site all treated and ancillary waste.

Once taken, if the seller cannot treat the waste to disposal criteria, the waste will be returned to compliant storage at the site of origin at no cost to DOE with all vendor-developed characterization data.

Responsibilities of the DOE Site

The following is a list of the services to be provided by the DOE site, as called for in the approved contracts:

- Selection of all containerized waste awarded for treatment, and delivery of this waste, in accordance with an agreed-to schedule, to a designated staging area at a DOE site.
- Development of staging areas on the DOE sites, where containerized waste will be staged for loading prior to transport to the treatment facility.
- Obtain a waiver to DOE Order 5820.2A to allow disposal of radioactive waste off the DOE site.
- Provide NEPA documentation as required.
- If seller's treatment facility WAC requires completed waste profile forms, the origin site will complete as required.

- At the staging areas, provide all equipment and labor, and load all containerized untreated waste on the Seller's transporting vehicles.
- After loading, review all marking, labeling, and placarding activities as required by Department of Transportation (DOT) regulations 49 CFR 172 Subparts D, E, and F, respectively.
- Perform Health Physics survey for radioactivity and release for transport off-site.
- Perform Quality Assurance (QA) inspection and release for transport off-site.
- Provide required characterization data to meet RCRA, TSCA, DOT and vendor waste profile requirements to ship the wastes off site and fill out shipping papers and manifests for each load of untreated waste leaving a staging area for transport to the seller's treatment facility.

DOE-ORO will be conducting annual audits of the facilities. If other sites wish, they will be free to participate as members of the audits. If additional audits are needed, they will also be conducted by DOE approved personnel.

CONCLUSIONS

The Broad Spectrum Contracts are in place with numerous task orders written. Several waste streams have been treated and disposed using the contract vehicle. Any DOE contractor or subcontractor may access the contracts by completing direct task orders with the vendors and citing the Bechtel Jacobs Company contract number. Approximately 900,000 kilograms have been shipped to the M&EC treatment facility and 550,000 kilograms of waste have been shipped to WCS for treatment. The remaining Broad Spectrum contract vendor has received storage and treatment permits. Plans are for the vendor to complete First Article Test in the summer of 2002. The Broad Spectrum website provides detailed information on the contracts, their utilization, vendor descriptions, and cost calculation. The website will be updated to provide current status of the contracts and their use.

TABLE I
PRICE AGREEMENT

<u>Pricing Options</u>	<u>Independent Category Bids</u>			<u>Multiple Category Dependent Bids</u>		
	<u>Unit Price</u>	<u>Unit Price</u>	<u>Unit Price</u>	<u>Unit Price</u>	<u>Unit Price</u>	<u>Unit Price</u>
Treatment Category A Task Order Prices	Tier 1	Tier 2	Tier i	Tier 1	Tier 2	Tier i
Solids:						
Treatment for organics (\$/kg)	\$ _____	_____	_____	_____	_____	_____
Treatment for organics and metals						
Mercury above 260 ppm (\$/kg)	\$ _____	_____	_____	_____	_____	_____
Mercury below 260 ppm (\$/kg)	\$ _____	_____	_____	_____	_____	_____
Handling costs:						
55 Gal. Drums (\$/container)	\$ _____	_____	_____	_____	_____	_____
B-25 Boxes (\$/container)	\$ _____	_____	_____	_____	_____	_____
Sludges:						
Treatment for organics (\$/kg)	\$ _____	_____	_____	_____	_____	_____
Treatment for organics and metals						
Mercury above 260 ppm (\$/kg)	\$ _____	_____	_____	_____	_____	_____
Mercury below 260 ppm (\$/kg)	\$ _____	_____	_____	_____	_____	_____
Handling costs:						
55 Gal. Drums (\$/container)	\$ _____	_____	_____	_____	_____	_____
Overpacks (\$/container)	\$ _____	_____	_____	_____	_____	_____