

PROCESSING OF OAK RIDGE MIXED WASTE LABPACKS

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ABSTRACT

The Oak Ridge Site Treatment Plan (STP) issued under a Tennessee Commissioner's Order includes a compliance milestone related to treatment of mixed waste labpacks on the Oak Ridge sites. The treatment plan was written and approved in Fiscal Year 1997. The plan involved approximately 1,100 labpacks and 7,400 on-the-shelf labpackable items stored at three Department of Energy (DOE) sites on the Oak Ridge Reservation (ORR). The labpacks and labpack items consist of liquids and solids with various chemical constituents and radiological concerns. The waste must be processed for shipment to a commercial hazardous waste treatment facility or treatment utilizing a Broad Spectrum mixed waste treatment contract. This paper will describe the labpack treatment plan that was developed as required by the Site Treatment Plan and the operations implemented to process the labpack waste.

The paper will discuss the labpack inventory in the treatment plan, treatment and disposal options, processing strategies, project risk assessment, and current project status.

BACKGROUND

The approximately 1,100 drums and 7,400 on-the-shelf labpackable items that comprise the Oak Ridge mixed waste labpack inventory are an assortment of drums containing bulked liquids, individual small vials or bottles, and packages or bottles of solids. These wastes may include but are not limited to containers identified in the Secretary of Energy Peña's Initiative to prevent future storage container incidents at DOE facilities due to the presence of incompatible waste, waste not meeting Department of Transportation (DOT) requirements for public highway shipment, and other waste requiring repackaging. A cost benefit analysis was performed prior to completing the labpack treatment plan to assist in determining the most cost effective methods and strategy for processing labpacks. Processing of labpacks began first at the Oak Ridge National Laboratory (ORNL) in January 1998 and at the Y-12 Plant in March 1998. Labpack processing at the East Tennessee Technology Park (ETTP) was initiated in Fiscal Year 1999. The labpacks destined for Broad Spectrum treatment vendors were processed and shipped in Fiscal Year 2001 at all three sites.

Labpacks are unused or partially unused chemical product or laboratory materials placed in an outer packaging/drum with absorbent material. The outer packaging ranges from a 5-gallon bucket to an 85-gallon drum. The majority of the outer packaging is 55-gallon drums. The inner containers could be made of plastic or glass and may hold up to 5 gallons of waste. The labpacks may contain small containers of flammable liquids (solvents, oil), aqueous liquids (acids, bases), and solids. When shipped, the labpack contents are chemically compatible and the inner containers are surrounded by a sufficient quantity of absorbent material.

INVENTORY

The Labpack Treatment Plan identified approximately 1,094 potential labpacks in the inventory at all three sites weighing approximately 60,459 kg. In addition, there may be approximately 7,386 on-the-shelf labpackable items weighing 10,256 kg. that need to be evaluated, packaged, treated and disposed. Table I below shows the breakdown of total labpacks and on-the-shelf items inventory by sites (ORNL, ETTP, Y-12) as identified in the treatment plan in Fiscal Year 1997.

Table I. ORR Labpack Inventory

	No. of Labpacks	Weight (kg.)	No. of On-the-Shelf Items	Weight (kg.)
ORNL	150	10,367	5,115	7,074
ETTP	904	47,956	0	0
Y-12	40	2,136	2,271	3,182
Total	1,094	60,459	7,386	10,256

TREATMENT AND DISPOSAL STRATEGY

Treatment/Disposal Strategy

A. Hazardous Waste Treatment Facility:

This strategy is to treat and dispose No Added Radioactive Contamination (NARC) certified labpacks at a commercial hazardous waste treatment facility. The labpacks will be repackaged, NARC certified and sent to a commercial hazardous waste treatment facility. The NARC certification was done by process knowledge. The processing involved the following steps:

1. Identify NARC candidate labpack items in the inventory based on review of the available documentation.
2. Perform DOT compatibility review and package the items into DOT approved packages.
3. Perform NARC certification on the repackaged labpack.
4. Create manifests and Land Disposal Restriction (LDR) forms, coordinate the shipment to treatment vendor.
5. Waste Profiling of labpacks.
6. Transport the waste to a commercial hazardous waste treatment/disposal site.

B. Broad Spectrum Program Strategy:

This strategy is to treat and dispose of the labpacks that known or are assumed to be radiologically contaminated. The labpacks will be treated and disposed as mixed waste through the Oak Ridge Broad Spectrum contracts. The labpacks will be packed into DOT containers and segregated into waste groupings appropriate to the waste treatment categories under the Broad Spectrum contracts. It should be noted that the Broad Spectrum Procurement is a multi-year, multi-vendor activity. The processing steps are similar to the hazardous waste treatment facility steps except that these labpacks are shipped as mixed waste.

Four commercial treatment facilities are available for receipt of labpack mixed waste under the Broad Spectrum contracts. These are: East Tennessee Materials and Energy Corporation (M&EC) of Oak Ridge, Tennessee; Perma-Fix Environmental Services, Inc in Gainesville, Florida; Waste Control Specialists (WCS) of Andrews, Texas; and Allied Technology Group (ATG) in Richland, Washington.

Mixed waste labpacks were initially screened in accordance with their treatment requirements. WCS was the only available treatment facility in fall of 2000 when the first mixed waste labpacks were shipped. Therefore, labpacks that only required stabilization to meet land disposal treatment standards were shipped to WCS in the fall of 2000.

With the addition of the Perma-Fix Gainesville facility as an approved mixed waste facility, labpacks that required thermal and stabilization treatment were shipped to Perma-Fix in early summer of 2001. Additional shipments of labpacks were shipped to M&EC for treatment of those labpacks with Environmental Protection Agency (EPA) waste codes or waste acceptance criteria that are not acceptable to Perma-Fix Gainesville. Two shipments of labpacks were also made to ATG. Numerous labpacks in these shipments had EPA waste codes that only ATG was permitted to receive.

C. Shock Sensitive Disposition:

A portion of the labpack inventory consisting of approximately 281 potentially shock-sensitive items requires further assessment and deactivation due to the presence of peroxide formers and other properties. A plan and subcontract has been developed to deactivate, treat, and dispose of the potential shock-sensitive items. The proposed deactivation methods include: peroxide stabilization, aqueous stabilization, repackaging and ship to commercial treatment facility, on-site chemical detonation facility, and aqueous treatment of reactive metals.

LABPACK CATEGORIZATION METHODOLOGY

The labpacks can be categorized as either NARC or mixed waste based on meeting NARC criteria. The labpacks that are categorized as mixed waste are allocated to Broad Spectrum categories for treatment and disposal. The NARC labpacks are shipped offsite to a hazardous waste treatment site. The labpacks will be segregated into the following prioritized categories based on the results of the cost/benefit analysis:

NARC Criteria

A labpack is determined to be NARC by process knowledge if:

- a) it is generated in a Non-Radioactive Material Management Area (NRMMA) or
- b) it is a sealed/unopened container or
- c) it is currently stored in a Resource Conservation and Recovery Act (RCRA) permitted facility as a hazardous waste and not as a mixed waste (ORNL only).

The criteria are applicable to any labpack regardless of their state (i.e. solids or liquids)

Broad Spectrum Criteria

A labpack is determined to be a Broad Spectrum candidate if:

- a) it is categorized as mixed waste and
- b) it meets the WAC of the appropriate Broad Spectrum contract vendor.

All labpacks will be evaluated and allocated to the above categories. The priority of the categories was developed from the results of the cost/benefit analysis.

REPACKAGING PLAN OVERVIEW

At the ORNL, two mobile processing trailers were used in the bulking and repackaging operations. The trailers utilized HEPA filters and video monitors to provide oversight and personnel safety. Individual items were bulked into an appropriate compatible "bulking" storage container (e.g., a jug of weak hydrochloric acid was removed from inside a drum full of other containers and emptied into a container with other aqueous acid compatible wastes). The empty container was then surveyed and disposed of in accordance with applicable RCRA regulations and DOE orders. Field characterization and compatibility evaluation was performed on all the individual waste items. All compatibility evaluations and testing was performed under the supervision of the project chemist. The field evaluation included reconciliation of items found in the container to the expected items listed in waste documentation, visual inspection of the item, pH determinations, use of LEL meters or portable total hydrocarbon analyzers to determine if a liquid is an organic, and a small scale, controlled mixing of all liquids which were bulked in order to determine compatibility within the bulking categories. In the event that an item was unidentifiable using the field evaluation methods described above, the item was identified as "not acceptable for bulking". The item was then placed aside in a safe storage configuration. The bulked liquid was shipped for treatment to a broad spectrum treatment vendor.

Items for which bulking was not advisable from a compatibility standpoint or advantageous from a waste management standpoint were segregated into one of waste groupings under the Broad Spectrum contracts. These waste groups were labpacked for shipment in accordance with DOT regulations and to satisfy Treatment Storage Disposal Facility (TSDF) Waste Acceptance Criteria (WAC). The final decision to bulk or not bulk certain waste items was based on the rationale that bulking should only be utilized when the benefit to the overall management of the waste exceeds the risk associated with the bulking process.

RISK ANALYSIS

There are potential risks associated with the repackaging operations set forth in this plan. These and other potential risks, hazard effects, possible causes and hazard controls are given in Table II. The two largest potential risk factors in the bulking project are the improper classification and subsequent bulking of potentially incompatible individual waste items and the undetected presence of shock sensitive items in the lab pack containers. All of the risks and associated hazards identified in the table can be acceptably mitigated by the control methods also identified in that table.

Table II. Labpack Risk Analysis

Potential Problems or Failure Modes	Hazard Effects	Possible Causes	Hazard Control(s)
Fire	Worker Injury Worker/Public Exposure Facility Damage Equipment Damage	Improper Classification and Bulking of Individual Waste Items	Installed fire suppression system in containment building and adherence to detailed bulking plan and field characterization and compatibility determination methodology
Explosion	Worker Injury Worker/Public Exposure Facility Damage Equipment Damage	Undetected presence of shock-sensitive waste items Improper Classification and Bulking of Individual Waste Items	Training and experience in the identification and handling of shock sensitive and explosive waste, deployment of remote handling equipment and vital organ shields, and adherence to detailed bulking plan and field characterization and compatibility determination methodology
Faulty Monitoring Equipment	Worker Exposure Worker Injury Release of contamination	Damaged or uncalibrated equipment	Periodic inspection and calibration of monitoring equipment
Sharp Edges on Contents of Drum	Cuts and punctures of the skin	Unexpected material in labpack	Use leather or other puncture resistant gloves during all phases of operations.
Spread of Contamination Into and Out of Work Place	Worker exposure Public exposure	Failure to follow procedures	Worker training in all project procedures
Bulking facility loses negative pressure	Fumes, airborne contaminants released into atmosphere	Facility door opened while drums are open Failure of ventilation system	Periodic inspection of ventilation system and adhere to procedures; facility access continuously monitored
Puncture or rupture of drum	Spilling of drum contents	Forklift punctures drum Drum is dropped	Adhere to procedures
Drum contains high level of combustible gas	Worker injury Worker exposure Release of drum contents into area	Drums not properly vented and stored	Monitor combustible gas levels in accordance with H&S Plan
Radioactive contamination	Worker exposure Release of contamination into atmosphere	Unknown drum contents	Standard direct reading radioactivity surveys

PROCESSING SUMMARY

Bechtel-Jacobs, LLC (BJC) subcontracted the processing and shipment of mixed waste labpacks to WESKEM, LLC for all three sites. WESKEM, LLC has a multi-year contract with Bechtel-Jacobs, LLC to manage legacy and newly generated waste at the Oak Ridge Reservation. WESKEM implemented the elements of Integrated Safety Management Systems (ISMS) to ensure zero accident during staging, opening, repackaging and shipment of the labpacks.

The processing of mixed waste labpacks at the ORNL has been completed with the bulked or repackaged waste shipped for treatment. Approximately 8,000 kgs. of NARC-certified labpack waste were shipped to a commercial hazardous waste facility by September 30, 1998, meeting a STP milestone. Additionally, approximately 9,000 kgs. of bulked organics for treatment at the TSCA Incinerator and aqueous waste for treatment at onsite wastewater treatment facilities were generated. The remaining 4,800 kgs. of repackaged labpacks were shipped for treatment through the Broad Spectrum contracts. The last non-shock sensitive labpack from ORNL was shipped on November 15, 2001 to meet the STP milestone. Approximately 20 potentially shock sensitive labpacks remain at ORNL to be processed by a subcontractor with expertise in deactivating chemicals.

At the Y-12 Plant, all NARC-certified labpack waste totaling 5,000 kgs. were shipped for treatment at a commercial hazardous waste treatment facility. This meets a STP milestone to complete shipment of the Y-12 NARC-certified labpack waste by December 31, 1998. Bulking of the aqueous and organic liquids has also been completed with approximately 3,000 kgs. to be treated at an onsite wastewater treatment facility. The remaining labpacks and on-the-shelf items were processed to meet DOT requirements. Labpacks were repackaged, if necessary, and on-the-shelf items were packaged to meet DOT and shipped for treatment to Broad Spectrum contract vendors. Approximately 19,000 kgs. representing 417 labpacks were shipped for treatment to Broad Spectrum contract vendors. Approximately 80 potentially shock sensitive labpacks remain at Y-12 to be processed by a subcontractor with expertise in deactivating chemicals.

At the ETTP, approximately 197 labpack items weighing 159 kgs. were certified as having no-added radioactivity. These were shipped for treatment at a commercial hazardous waste treatment facility with the last shipment on December 17, 1999. The remaining labpacks and on-the-shelf items were processed to meet DOT requirements. Labpacks were repackaged, if necessary, and on-the-shelf items were packaged to meet DOT and shipped for treatment to Broad Spectrum contract vendors. Approximately 37,000 kgs representing 537 labpacks were shipped for treatment. Approximately 100 potentially shock sensitive labpacks remain at ETTP to be processed by a subcontractor with expertise in deactivating chemicals.

In total, approximately 1,400 labpacks were treated or shipped for treatment and four STP milestones were met on time. Table III provides the summary of the labpacks that were shipped to the various Broad Spectrum treatment vendors from each of the three sites. The project is expected to be completed in the spring of 2002 when the remaining potentially shock sensitive labpacks are

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deactivated. The labpack project successfully managed the thousands of labpacks and on-the-shelf items with no health or safety incidents to workers. This was due to the close scrutiny of the inventory, personnel training, waste handling practices, and adherence to procedures.

Table III. Broad Spectrum Treatment Vendor Shipment Summary

	ATG		WCS		M&EC		Perma-Fix		Total	
Site	Labpacks Shipped	Weight of Labpacks (kg)	Labpacks Shipped	Weight of Labpacks (kg)	Labpacks Shipped	Weight of Labpacks (kg)	Labpacks Shipped	Weight of Labpacks (kg)	Labpacks Shipped	Weight of Labpacks (kg)
ORNL	64	2,111	26	1,110	22	395	19	1,181	131	4,797
Y12	96	3,432	154	10,337	36	894	131	4,344	417	19,007
ETTP	55	2,685	88	5,889	135	6,810	259	22,032	537	37,416
Total	215	8,228	268	17,336	193	8,099	409	27,557	1,085	61,220