ICP/EXT-04-00283
Revision 1

# *Excavation Plan and Sequential Process Narrative for the Accelerated Retrieval Project for a Described Area within Pit 4*

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Prepared for the
U.S. Department of Energy
Assistant Secretary for Environmental Management
Under DOE Idaho Operations Office
Contract DE-AC07-99ID13727

# ABSTRACT

This document describes the excavation plan and sequential process steps for the Accelerated Retrieval Project operations activities. Waste zones (i.e., areas containing specific waste types, such as graphite, sludges, or combustibles) within the excavation site are mapped and discussed, including comparisons with volatile organic compound survey data. Visual and physical characteristics of the different waste types are presented. The order or sequence of excavation for overburden and waste layer materials is described. Finally, a narrative of the operational process steps is given, which walks sequentially through the various activities of the project (e.g., overburden removal, waste retrieval, waste packaging). The process flow diagrams and narratives within this document do not bind operations to specific process strategies; rather, they provide a project overview. Project operations can use these narratives to develop operating procedures. As these procedures develop, they will supersede this narrative.

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# ACRONYMS

| | |
|---|---|
| ANL-W | Argonne National Laboratory-West |
| AR | Accelerated Retrieval |
| ARPO | Accelerated Retrieval Project operator |
| CCP | Central Characterization Project |
| CCTV | closed-circuit television system |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| DOE | Department of Energy |
| ECL | Environmental Chemistry Laboratory |
| EDTA | ethylenediaminetetraacetic acid |
| EO | equipment operator |
| EPA | U.S. Environmental Protection Agency |
| FMM | fissile material monitor |
| GGT | gas generation testing |
| HEO | heavy equipment operator |
| HEPA | high-efficiency particulate air (filter) |
| HPGe | hyper-pure germanium |
| ICP | Idaho Completion Project |
| INEEL | Idaho National Engineering and Environmental Laboratory |
| INTEC | Idaho Nuclear Technology Engineering Center. |
| NTW | nontargeted waste |
| OF | operations foreman |
| ORNL | Oak Ridge National Laboratory |
| PCB | polychlorinated biphenyl |
| PCS | potentially contaminated soil |
| PE | plutonium equivalent |

| | |
|---|---|
| PPE | personal protective equipment |
| RadCon | radiological control |
| RCRA | Resource Conservation and Recovery Act |
| RCT | radiological control technician |
| RE | retrieval enclosure |
| RFP | Rocky Flats Plant |
| RTP | return-to-pit |
| RTR | real-time radiography |
| RWMC | Radioactive Waste Management Complex |
| SDA | Subsurface Disposal Area |
| SS | shift supervisor |
| SWB | standard waste box |
| SWEPP | Stored Waste Examination Pilot Plant |
| TCA | Trichloroethane |
| TCE | Trichloroethene |
| TID | tamper-indicating device |
| TRU | transuranic |
| TW | targeted waste |
| VE | visual examination |
| VOC | volatile organic compound |
| WILD | Waste Inventory Location Database |
| WIPP | Waste Isolation Pilot Plant |
| WZM | waste zone material |

# Excavation Plan and Sequential Process Narrative for the Accelerated Retrieval Project for a Described Area within Pit 4

## 1. INTRODUCTION

U.S. Department of Energy (DOE), the State of Idaho, and the U.S. Environmental Protection Agency (EPA) have agreed to the performance of a Non-Time Critical Removal Action of selected Rocky Flats Plant waste at the Idaho National Engineering and Environmental Laboratory (INEEL).

The INEEL is a DOE facility, located 52 km (32 mi) west of Idaho Falls, Idaho, that occupies 2,305 $km^2$ (890 $mi^2$) of the northeastern portion of the Eastern Idaho Snake River Plain. The Radioactive Waste Management Complex (RWMC) is located in the southwestern portion of the INEEL, as shown in Figure 1. The Subsurface Disposal Area (SDA) is a 39-hectare (97-acre) area located within the RWMC. The SDA consists of 20 pits, 58 trenches, 21 soil vaults, Pad A, and the Acid Pit, where waste disposal activities occurred.

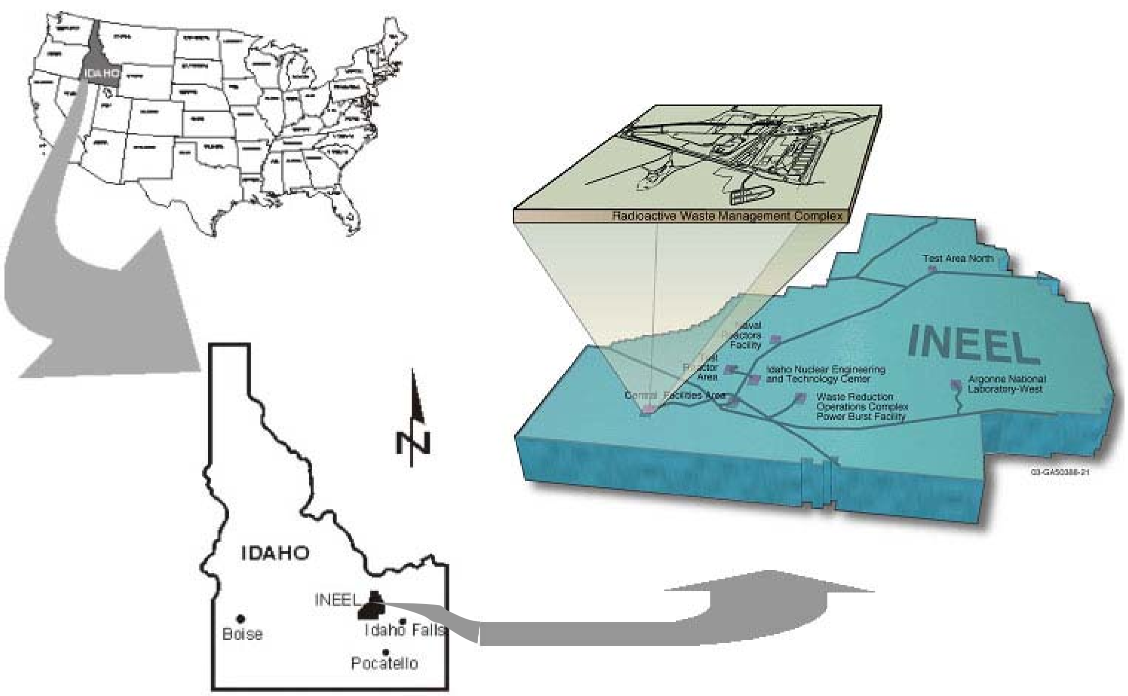



Figure 1. Map showing the location of the Radioactive Waste Management Complex at the Idaho National Engineering and Environmental Laboratory.

The selection of the described area within Pit 4 as the specific retrieval area for this project was based on an evaluation of shipping and burial records of containerized radioactive materials and sludge from the Rocky Flats Plant (RFP) and low-level radioactive waste (LLW) generated at the INEEL. From these records, several 1/2-acre areas within the SDA that contain relatively large amounts of transuranic (TRU) or other contaminated waste were targeted. A described area within Pit 4 (see Figure 2) was selected from these target areas by DOE Idaho Operations Office, with agreement from the EPA and the Idaho Department of Environmental Quality (Austad 2004).

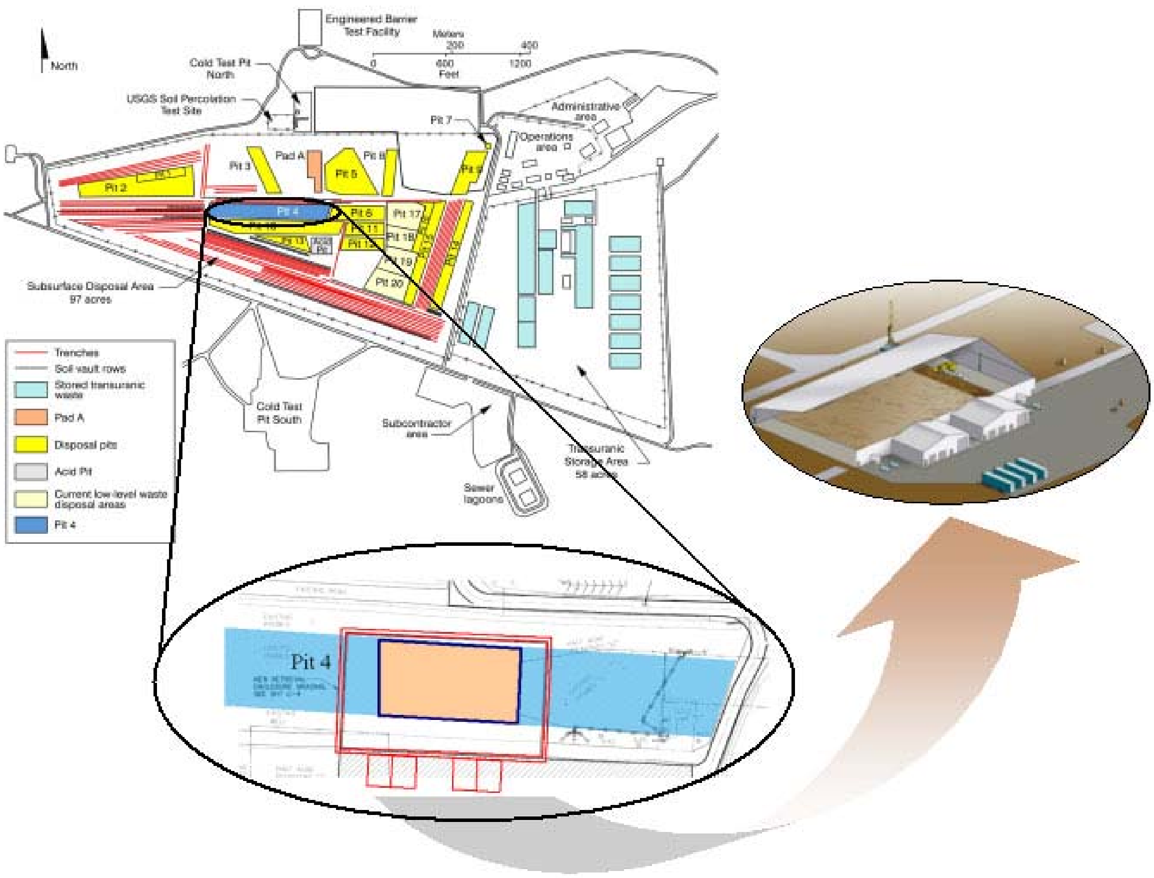



Figure 2. Map of the Subsurface Disposal Area showing location of the described area within Pit 4.

Waste removal objectives for the described area within Pit 4 are defined within the *Engineering Evaluation/Cost Analysis for the Accelerated Retrieval of a Designated Portion of Pit 4* (DOE-ID 2004). The removal objective is “To perform a targeted retrieval of Rocky Flats Plant waste streams that are highly contaminated with transuranic radionuclides, volatile organic compounds, and various isotopes of uranium.”

To achieve the targeted retrieval objective listed above, the retrieval activities will primarily focus on removal of the following waste streams (See Table 2): Series 741 and 743 sludge, graphite, filters, and roaster oxide waste.

## 1.1 Purpose of Document

The purpose of this document is two-fold. First, this document provides information regarding the general expected waste distribution across the excavation area (Waste Zones), visibly identifiable characteristics of the expected waste types (Waste Identification), and methodology for excavating the waste (Process Overview). Second, this document is intended to provide project personnel with narrative text and logic flow diagrams for planning the operational tasks that need to be performed as part of the project (Sequential Process Narrative, Section 5). The Process Logic Diagrams (see Appendix B) represent the flow sequence, decision points, and decision paths of the operational tasks to be performed. Steps identified in this document are not intended to bind operations to these specific steps; rather, they provide an overview of the project process logic, which was used to develop the design. These narratives will be used to prepare operational procedures; however, as operational procedures are developed, the procedures will supercede the narrative. There is no intent to keep the narrative up to date as operational planning evolves.

In this document, operations activities are broken down into the following processes: potentially contaminated soil removal, waste zone excavation, and packaging/transportation of targeted waste (including samples). Additional processes for handling special-case waste and safety basis outliers may be required during operations.

# 2. WASTE ZONES

## 2.1 Pit 4 Disposal Background

Pit 4 was open to receive waste from January 1963 through September 1967. Based on the disposal practices at the time, containerized waste, primarily from the RFP in Colorado, was initially stacked in the pit. As of November 1963, this practice was changed and containers were then randomly dumped into the pits rather than stacked to reduce labor costs and personnel exposures. Additional waste from INEEL waste generators and some waste from offsite generators are also disposed of in the pit. Based on today's definitions, the pit contains TRU, mixed TRU, mixed low-level waste (MLLW), and LLW (Holdren et al. 2002).

The disposal process involved excavating an area in the SDA with tractor-drawn scrapers to the outcroppings of the underlying basalt, followed by backfilling and leveling the newly constructed pit floor with a layer of native soil approximately 2 ft thick, on which the waste would be placed. Waste in drums; cardboard, wood, and metal boxes; and other containers (see Table 1) were then disposed of within the pit. After waste was emplaced, pits were backfilled and initially covered with about 3 ft of soil, commonly referred to as overburden soil. The estimated overburden thickness in Pit 4 ranges from 2 to 4 ft, although waste may be encountered at a shallower depth. After approximately 40 years of burial, the original disposal containers, including the carbon steel drums, are expected to be significantly corroded and degraded similar to the drums removed in early 2004 as part of the Glovebox Excavator Method Project activities.

Table 1. Waste within the defined area of Pit 4 (summation of Appendix A waste table).

| Waste Type | Container (s) | Volume (ft3) | Waste Description |
|---|---|---|---|
| Graphite | (496) 55-gal drums | 3,643 | Graphite mixed with various sludges, combustibles, Graphite, Paper, Rags, Scrap Metal, Glass, Wood, and Mixed Debris, Scrap Metal |
| Filters | (606) Cartons | 3,311 | Chemical Warfare System (CWS) Type HEPA Filters |
| | (83) Wooden Boxes | 10,167 | CWS Filters, Filters, Scrap Metal, Equipment, Beryllium |
| Roaster Oxides | (109) 55-gal drums | 801 | Roaster Oxide (Uranium Oxide) |
| Combustibles | (1) Bags and Crates | 162 | Unknown |
| | (7) Truck / Dump Truck / Dumpster Load | 856 | Scrap Metal, Wood, Paper, Rags, Packing Material |
| | (21) Wooden Box(s) | 2,471 | Scrap Metal, Rags, Paper, Equipment, Wood |
| | (44) Not Defined | 8,588 | Pipe, Wood, Ladder, Batteries, Turbine, Paint Cans, Blocks, Canvas, Scrap Metal, Concrete, General Hot Cell Trash, Floor Buffers, Manipulator, Dynamometer, Impacutter, Gravel, Paper, Weeds, Plastic Glovebox, Hoses, Wire, Glass, Straw, Lead, Rubber |
| | (3,342) 55-gal drums | 26,171 | Paper, Rags, Glass, Plastic, Metal, Wood, Beryllium |
| Noncombustibles | (1) Plastic Bags | 48 | Dirt |
| | (16) Truck / Dump Truck / Dumpster Load | 1,521 | Dirt, Pipe, Insulation, Valves, Scrap Aluminum, Scrap Metal |
| | (15) Not Defined | 13,346 | Carbon Steel Tank, Concrete, Lead Slag, Sand, Pipe, Metal Box, Reactor Skid, Reactor Shielding, Diatomaceous Earth, Scrap Metal, Iron Trays, Tubing, Refueling Machine Support Structure, Refueling Machine, Trolley Hoist, DP Cells, Lead, Beryllium Oxide, Vermiculite |
| | (83) Wooden Box(s) | 14,162 | Scrap Machinery, Scrap Metal, Equipment |
| | (1,721) 55&30-gal drums | 21,521 | Drained Oil Drums, Glass, Ceramics, Furnace, Clutch, Scrap Metal, (2 drums) Americium, Rags, Beryllium |
| 607 Sludge | (2) Truckload | 324 | Sewage Sludge |
| 744 Sludge | (90) 55-gal drums | 661 | Special Setups : Alcohols, Organic Acids, Versenss (EDTA), cement |
| 654 Sludge | (1) Not Defined | 948 | Sewage Sludge |
| 743 Sludge | (702) 55-gal drums | 5,161 | Organic Sludges : CCl4, Regal Oil, 111TCA, TCE, PCE, Oil Dry |
| 742 Sludge | (783) 55-gal drums | 5,755 | Second Stage Water Treatment : Pu, Am, Hydrated Oxides of Fe, Mg, Si: 50-70% water (lower activity than first stage) |
| 741 Sludge | (905) 55-gal drums | 6,652 | First Stage Water Treatment : Pu, Am, Hydrated Oxides of Fe, Mg, Si: sludge 50-70% water |

## 2.2 Targeted Waste Types

As mentioned previously, to achieve the targeted retrieval objectives, the retrieval activities will primarily focus on removal of the following waste streams.

1. **Series 743 sludge (VOC)**: The Series 743 sludge is primarily composed of organic sludge containing the volatile organic compound (VOC) carbon tetrachloride ($CCl_4$) and other VOC compounds (see Table 3).
2. **Roaster Oxides (U)**: Roaster Oxide waste form is defined as depleted uranium oxide (primarily composed of the U-238 isotope) produced by the thermal stabilization (self-sustained combustion) of chips produced during the machining of uranium metal.
3. **Graphite (TRU)**: Graphite wastes were generated from mold and crucible pieces scraped to remove excess plutonium, then broken into small pieces. As shown on Table 2, graphite is estimated to comprise 3% of the waste, but is estimated to contain 15% of the TRU activity disposed of within the described area at Pit 4.
4. **Filters (TRU)**: This waste consists primarily of high-efficiency particulate air (HEPA) filters from ventilation intake and exhaust filter plenums. As shown on Table 2, filter wastes are estimated to comprise 11% of the waste, but is estimated to contain 12% of the TRU activity disposed of within the described area at Pit 4.
5. **Series 741 sludge (TRU)**: Series 741 sludge contains plutonium and americium oxides, depleted uranium, metal oxides, and organic constituents. As noted in Table 2, the Series 741 sludge is estimated to comprise 5% of the waste, but is estimated to contain 63% of the TRU activity disposed of within the described area at Pit 4. Series 741 sludge contains the highest amount of TRU activity per pound in the disposal pit being approximately 4 times higher than the next highest waste type.

Volume percents within table 2 were derived from historical shipment data stated in Appendix A. TRU percentages within table 2 provide the TRU contribution of each waste type to the total TRU waste within the described area of Pit 4. The TRU percents were derived from average TRU activity concentrations for each waste type (EDF-3374) and the amount of each waste type within the described area.

Table 2. Estimated TRU activity by waste form summary.

| *Waste Form* | *Volume %* | *TRU %* |
|---|---|---|
| Series 741 sludge | 5% | 63% |
| Graphite | 3% | 15% |
| Filters | 11% | 12% |
| Noncombustibles | 40% | 8% |
| Combustibles | 30% | 2% |
| Series 742 sludge | 5% | 0.19% |
| Series 744 sludge | 1% | 0.08% |
| Series 743 sludge | 4% | 0.07% |
| Roaster Oxide | 1% | 0.00% |

## 2.3 Nontargeted Waste Types

The nontargeted waste types (waste that will remain within the retrieval enclosure) are wastes that do not contain a high percentage of transuranic materials, VOCs, or uranium. Based on historical shipment data for the described area within Pit 4, these waste forms are: Series 742 sludge, Series 744 sludge, non-RFP sludge (607/654 sludge), combustibles (including mixed debris), and noncombustibles.

## 2.4 Excavation Waste Zones

As shown in Appendix A, six waste types are anticipated to be present within the targeted area. These six waste types were generated within sixteen RFP buildings and nine locations on the INEEL. A summary of Appendix A waste types, containers, quantities, and descriptions is listed in Table 1.

In comparing the excavation site's historical waste shipment data with disposal location records for the excavation site, four general waste zones (as shown in Figure 4) were delineated. These waste zones are:

1. **Graphite and RFP Sludge Zone:** Located in the north half of the excavation site, existing data indicate that this zone may contain the majority of the graphite and the Rocky Flats Sludge (74X sludge). The zone is estimated to be composed of 6% graphite, 10% Series 741 sludge, 10% Series 742 sludge, 8% Series 743 sludge, 1% Series 744 sludge, 3% filter waste, 1% uranium roaster oxides, with the balance comprising combustible and noncombustible wastes. Percentages are given as volume percentages based on cubic feet of waste disposed of within the zone.
2. **Filters and Non-RFP Sludge Zone:** Located in the southern half of the excavation site, existing data indicate that this zone may contain the majority of the filter waste and the INEEL sludge (607/654 sludge). The zone is estimated to be composed of 18% filter waste, 2% 607/654 sludge waste, 10% Series 741 sludge, 3% Series 742 sludge, 1% Series 743 sludge, 2% graphite, with the balance comprising combustible and noncombustible wastes.
3. **Combustibles Zone:** The combustibles zone is the largest zone by area, within the defined excavation boundaries, covering approximately the northern two-thirds of the excavation region. Existing data indicate that this zone may contain the majority of the combustible waste types. The zone is estimated to be composed of approximately 40% combustibles, 23% noncombustibles, and the balance of previously mentioned wastes. Combustibles within this zone are assumed uniformly distributed.
4. **Noncombustible Zone:** Located in the southern third of the excavation site, existing data indicate that this zone may contain the majority of the noncombustible waste types. The zone is estimated to be composed of 83% noncombustibles, 40% combustibles, and the balance of sludge, graphite, and filters. Noncombustibles within this zone are assumed uniformly distributed.

Caution should be exercised when assuming the accuracy of shipping records. The *Excavation Plan and Sequential Process Narrative for the OU 7-10 Glovebox Excavator Method Project* (Jamison and Preussner 2002) compared shipment records of waste buried at Pit 9 to information gathered from probing data in the same area. As shown in Figure 4, recorded shipment locations for graphite (shown as red squares on the leftmost frame) did not agree with where probing data (shown as red plumes on the two rightmost frames) indicated graphite presence. Subsequent excavation of Pit 9 proved the probing data to be accurate.

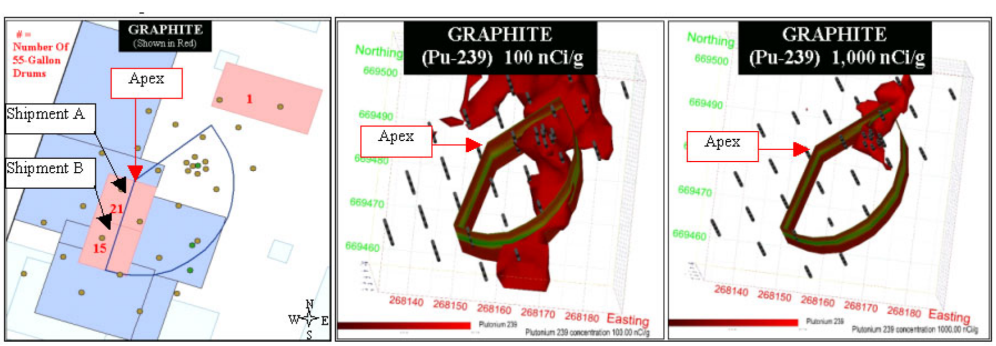
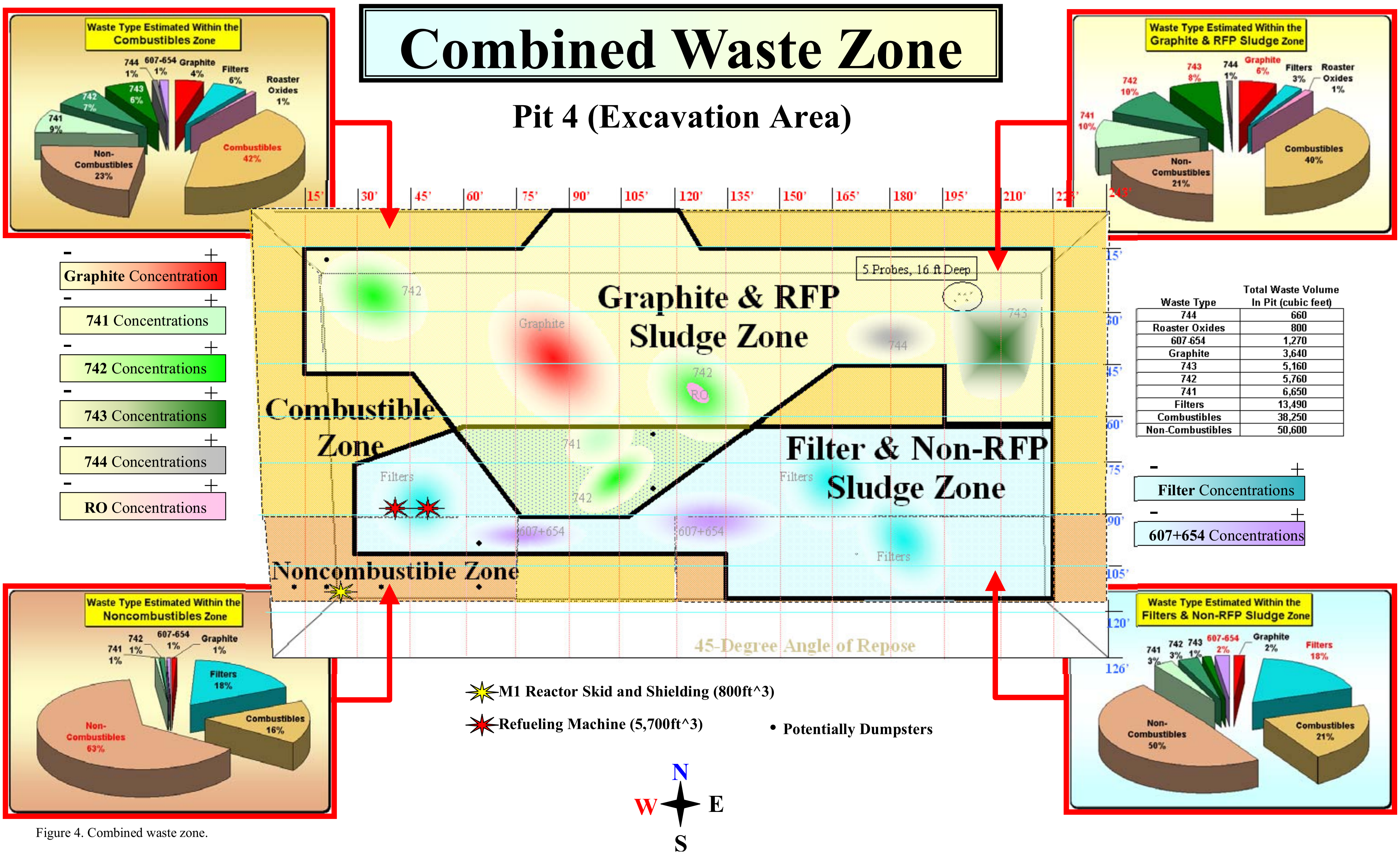



Figure 3. Comparison of Pit 9 shipment data to probing data.




| Waste Type | Total Waste Volume In Pit (cubic feet) |
|---|---|
| 744 | 660 |
| Roaster Oxides | 800 |
| 607-654 | 1,270 |
| Graphite | 3,640 |
| 743 | 5,160 |
| 742 | 5,760 |
| 741 | 6,650 |
| Filters | 13,490 |
| Combustibles | 38,250 |
| Non-Combustibles | 50,600 |

Figure 4. Combined waste zone.

## 2.5 Targeted Waste Zones

### 2.5.1 Series 743 Sludge Shipment Data vs. Probing Data

The Series 743 sludge waste stream comprises approximately 5,200 $ft^3$ (approximately 702 55-gal drums) and 4% of the waste disposed of within the described area of Pit 4. The Series 743 sludge contains approximately 0.07% of the TRU activity estimated to be within the disposal area.

Figure 5 provides the historical shipment data for all shipments containing Series 743 Sludge around the excavation site. The squares shown in varying shades of yellow indicate the disposal locations of Series 743 sludge. The numbers on the squares indicate the number of cubic feet of Series 743 sludge within that 15 × 15-ft square of the pit.

| 0,0 ft | 15ft | 30ft | 45ft | 60ft | 75ft | 90ft | 105ft | 120ft | 135ft | 150ft | 165ft | 180ft | 195ft | 210ft | 225ft |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15ft | 743 Sludge (in cubic feet) | | | | | 0 | 3 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30ft | 0 | 0 | 0 | 0 | 0 | 7 | 8 | 35 | 24 | 1 | 0 | 0 | 0 | 68 | 91 |
| 45ft | 0 | 0 | 0 | 0 | 0 | 54 | 86 | 194 | 218 | 80 | 116 | 203 | 170 | 407 | 352 |
| 60ft | 0 | 0 | 0 | 0 | 0 | 68 | 92 | 121 | 141 | 141 | 64 | 90 | 204 | 334 | 266 |
| 75ft | 0 | 0 | 11 | 17 | 1 | 20 | 72 | 139 | 156 | 19 | 50 | 19 | 64 | 127 | 92 |
| 90ft | 0 | 0 | 11 | 18 | 1 | 0 | 46 | 16 | 14 | 1 | 0 | 0 | 0 | 0 | 0 |
| 105ft | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 120ft | 743 Sludge ($Ft^3$): 0 - 300; 300 - 600; Vol > 600 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 135ft | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | N W E S |

**Pit 4 (Described Area)**

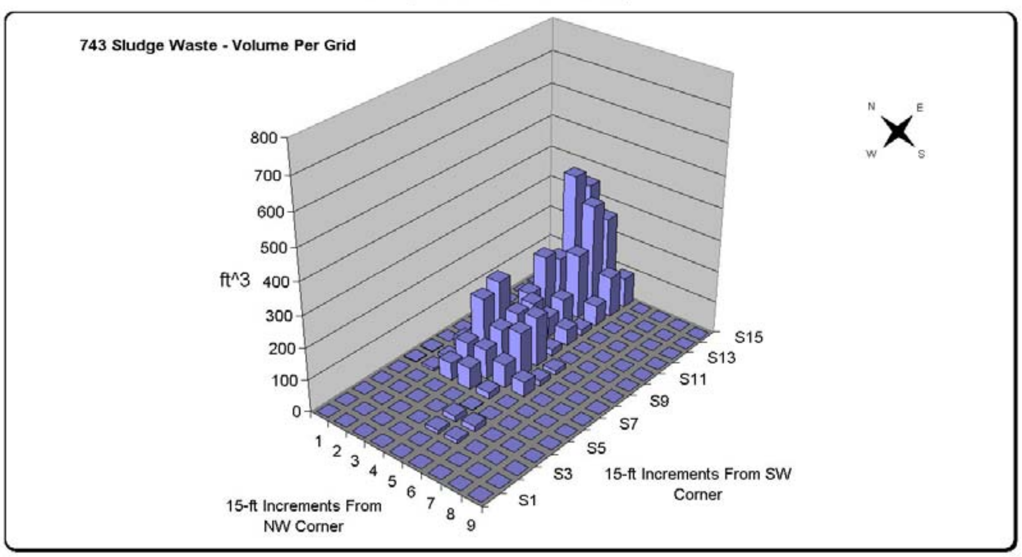



Figure 5. Disposal locations of shipments containing Series 743 sludge.

The Series 743 sludge is primarily composed of organic sludge, which consists largely of carbon tetrachloride ($CCl_4$). Other VOCs found in the sludge include Regal Oil, 1,1,1-TCA, and TCE (for additional contents see Table 3). For this reason, the presence of Series 743 sludge can be detected through the use of soil gas data within the excavation site area. A shallow soil gas survey shown on Figure 6 (right) provides the survey results for $CCl_4$ within the described area of Pit 4 (shown with a pink outline). Figure 6 (left) restates, for comparison, Series 743 sludge disposal locations and quantities that were provided in the previous figure. The samples were collected at a depth of 30 in. below the ground surface. Both the shallow soil gas survey results and the approximate disposal locations of Series 743 sludge are shown on the figure. The samples were collected in 2000 and the survey results were included in the 2002 Soil Gas Survey report (Housley, Sondrup, and Varvel 2002). A comparison of the two drawings indicates a relatively good match of the soil gas data with the disposal locations of the Series 743 sludge. There are some slight differences that may be due to how VOCs move through the soil column, voids in the waste allowing for the movement of VOCs from the actual placement location, and/or errors in the disposal location records.

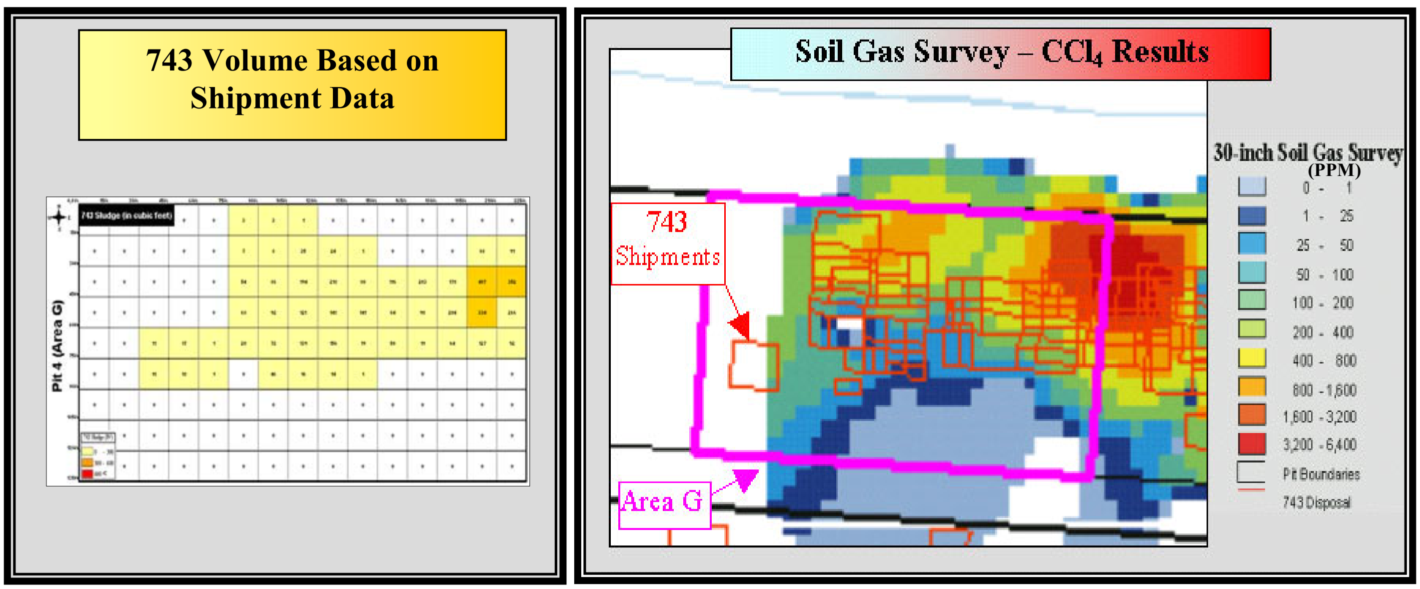



Figure 6. Comparison of Series 743 sludge with $CCl_4$ Soil Gas Survey.

### 2.5.2 Roaster Oxides Shipment Data

Approximately 109 55-gal drums of roaster oxides are distributed within the described area of Pit 4. Roaster oxides are the primary source of uranium within the described area of Pit 4 (based on shipping records). Figure 7 provides the historical shipment data for all shipments containing uranium roaster oxides around the excavation site. The shipment locations that did not contain uranium roaster oxides are shown as white squares and the shipment locations that did contain uranium roaster oxides are shown as varying shades of yellow squares. The numbers on the squares indicate the number of cubic feet of uranium within the 15 × 15-ft grid area. As noted in Table 1, uranium roaster oxide wastes are only estimated to comprise 1% of the waste disposed of within the excavation area and has no measurable TRU activity.

Roaster Oxide (in cubic feet)

| 0,0 ft | 15ft | 30ft | 45ft | 60ft | 75ft | 90ft | 105ft | 120ft | 135ft | 150ft | 165ft | 180ft | 195ft | 210ft | 225ft |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15ft | | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30ft | 0 | 57 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 35 | 38 | 15 | 0 |
| 45ft | 0 | 19 | 9 | 0 | 0 | 21 | 21 | 24 | 37 | 1 | 0 | 26 | 28 | 11 | 0 |
| 60ft | 0 | 0 | 0 | 0 | 0 | 23 | 24 | 62 | 111 | 8 | 16 | 16 | 6 | 0 | 0 |
| 75ft | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 21 | 3 | 12 | 12 | 4 | 0 | 0 |
| 90ft | 31 | 35 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 105ft | 10 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 120ft | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 135ft | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |

Roaster Oxides ($Ft^3$): 0 - 300; 300 - 600; Vol > 600

N, E, S, W

**Pit 4 (Described Area)**

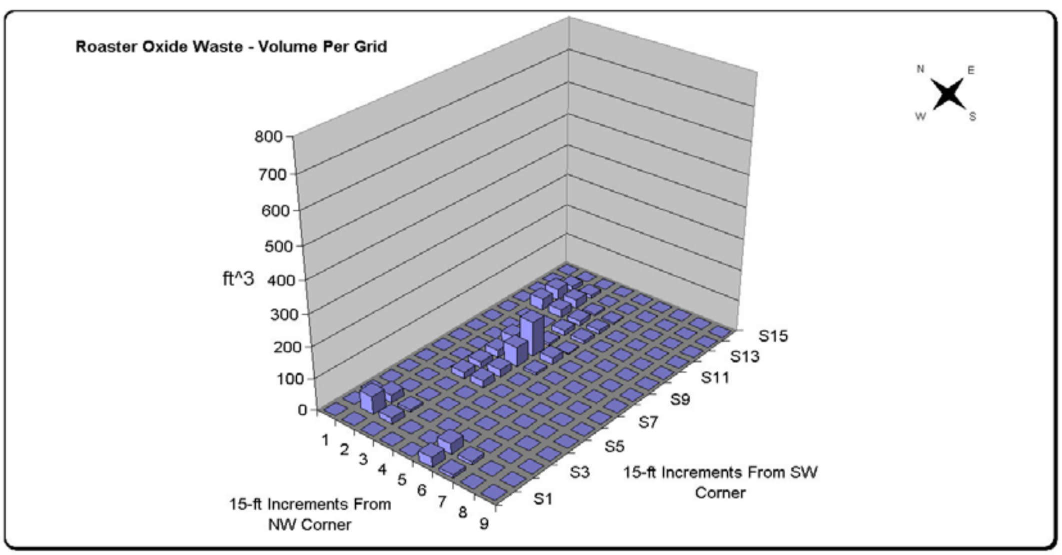



Figure 7. Disposal locations of shipments containing uranium roaster oxides.

## 2.5.3 Graphite Shipment Data

Approximately 496 55-gal drums of graphite in various forms are distributed within the described area of Pit 4. As shown on Table 1, graphite wastes are estimated to comprise 3% of the waste, but contains approximately 15% of the TRU activity disposed of within the described area at Pit 4. Figure 8 provides the historical shipment data for all shipments containing graphite around the excavation site. The shipment locations that did not contain graphite are shown as white squares and the shipment locations that did contain graphite are shown as varying shades of yellow squares. The numbers on the squares indicate the number of cubic feet of waste containing graphite within that shipment.

Graphite (in cubic feet)

| 0,0 ft | 15ft | 30ft | 45ft | 60ft | 75ft | 90ft | 105ft | 120ft | 135ft | 150ft | 165ft | 180ft | 195ft | 210ft | 225ft |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15ft | | | | | 55 | 94 | 39 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30ft | 0 | 4 | 2 | 0 | 111 | 264 | 94 | 6 | 16 | 1 | 0 | 3 | 4 | 23 | 21 |
| 45ft | 0 | 1 | 1 | 0 | 114 | 429 | 106 | 18 | 49 | 8 | 11 | 12 | 10 | 51 | 42 |
| 60ft | 0 | 22 | 9 | 0 | 3 | 231 | 224 | 101 | 18 | 25 | 8 | 21 | 27 | 14 | 16 |
| 75ft | 0 | 67 | 27 | 0 | 0 | 244 | 239 | 105 | 18 | 19 | 4 | 4 | 16 | 24 | 18 |
| 90ft | 8 | 9 | 36 | 56 | 2 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 105ft | 3 | 3 | 76 | 116 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 120ft | | | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 135ft | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |

Graphite (Ft³): 0 - 300; 300 - 600; Vol > 600

**Pit 4 (Area G)**

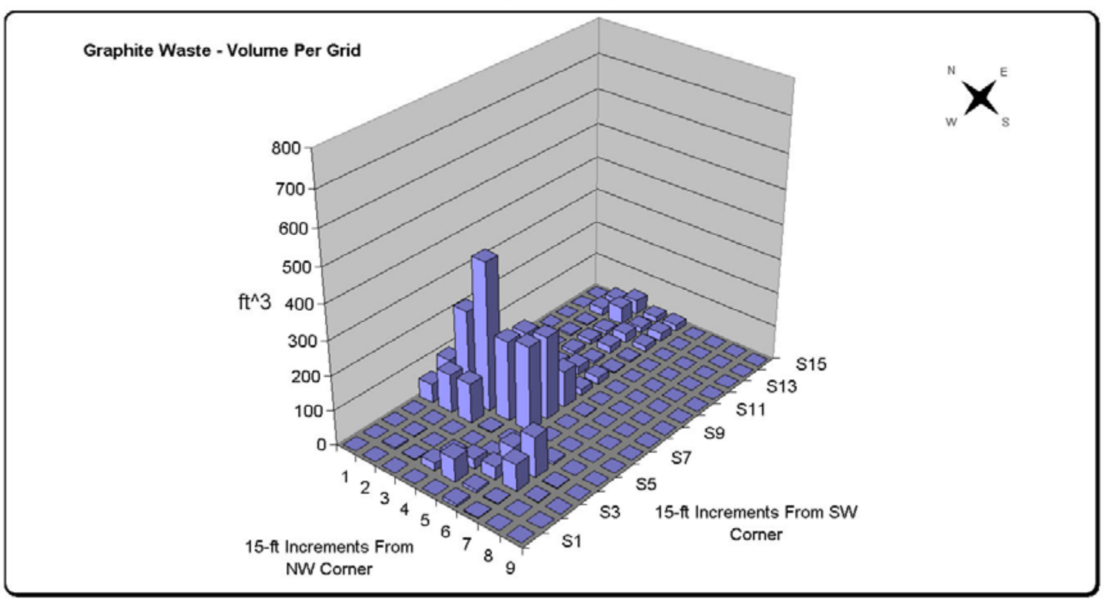



Figure 8. Disposal locations of shipments containing graphite.

### 2.5.4 Filter Shipment Data

Approximately 606 cartons and 83 wooden boxes containing filters are distributed within the described area of Pit 4. Filter wastes are estimated to make up 11% of the total waste disposed of in the area. This waste stream contains approximately 12% of the TRU activity disposed of within this area (see Table 1). Figure 9 provides the historical shipment data for all shipments containing filters around the excavation site. The shipment locations that did not contain filters are shown as white squares and the shipment locations that did contain filters are shown as varying shades of yellow squares. The numbers on the squares indicate the number of cubic feet of waste containing filters disposed of within that grid area.

**Filters (in cubic feet)**

| 0,0 ft | 15ft | 30ft | 45ft | 60ft | 75ft | 90ft | 105ft | 120ft | 135ft | 150ft | 165ft | 180ft | 195ft | 210ft | 225ft |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15ft | | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30ft | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 45ft | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 60ft | 0 | 0 | 0 | 0 | 47 | 77 | 74 | 55 | 0 | 72 | 256 | 256 | 99 | 0 | 0 |
| 75ft | 0 | 0 | 0 | 0 | 159 | 258 | 238 | 137 | 143 | 260 | 344 | 302 | 116 | 258 | 465 |
| 90ft | 0 | 11 | 623 | 368 | 252 | 108 | 9 | 6 | 133 | 764 | 615 | 365 | 233 | 38 | 234 |
| 105ft | 0 | 0 | 345 | 389 | 114 | 37 | 0 | 0 | 0 | 126 | 294 | 522 | 1015 | 30 | 59 |
| 120ft | | | 4 | 9 | 0 | 0 | 0 | 0 | 0 | 57 | 187 | 254 | 815 | 23 | 57 |
| 135ft | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |

Filters (Ft³): 0 - 300; 300 - 600; Vol > 600

N, W, E, S

**Pit 4 (Area G)**

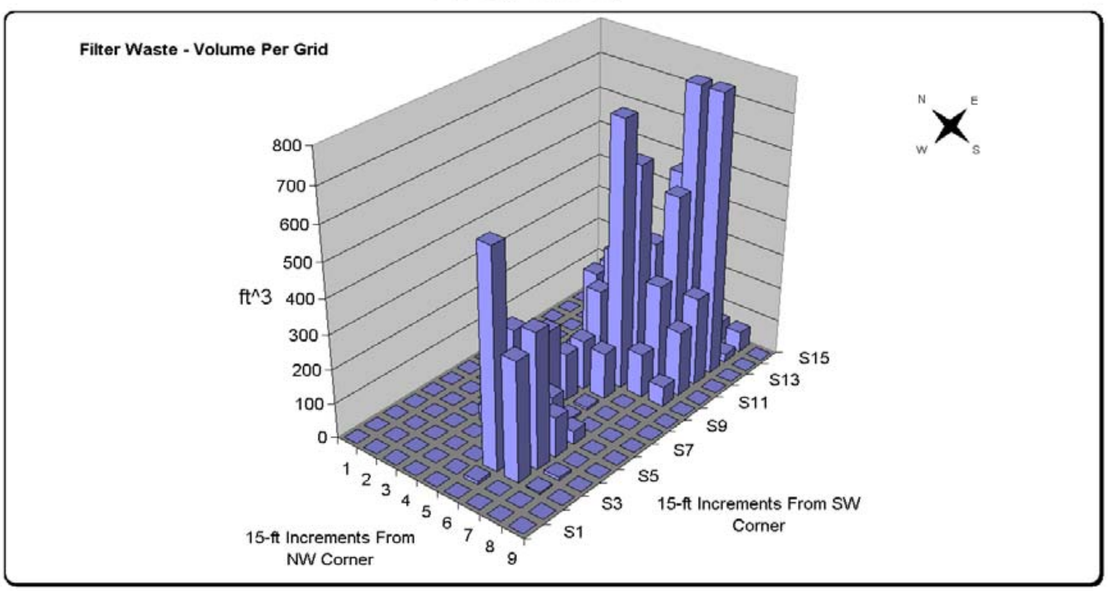



Figure 9. Disposal locations of shipments containing filters.

### 2.5.5 Series 741 Sludge Shipment Data

Approximately 905 55-gal drums of Series 741 sludge are distributed within the described area of Pit 4. As noted in Table 1, the Series 741 sludge is estimated to make up 5% of the waste, but contains approximately 63% of the TRU activity disposed of within the described area of Pit 4. The Series 741 sludge contains the highest amount of TRU activity per pound in the disposal pit, being approximately four times higher than the next highest waste type. Figure 10 provides the historical shipment data for all shipments around the excavation site containing Series 741 sludge. The shipment locations that did not contain Series 741 sludge wastes are shown as white squares that did contain Series 741 sludge are shown in varying shades of yellow squares. The numbers in the squares indicate the number of cubic feet of waste containing Series 741 sludge that was thought to be disposed of within an individual 15 × 15-ft grid cell.

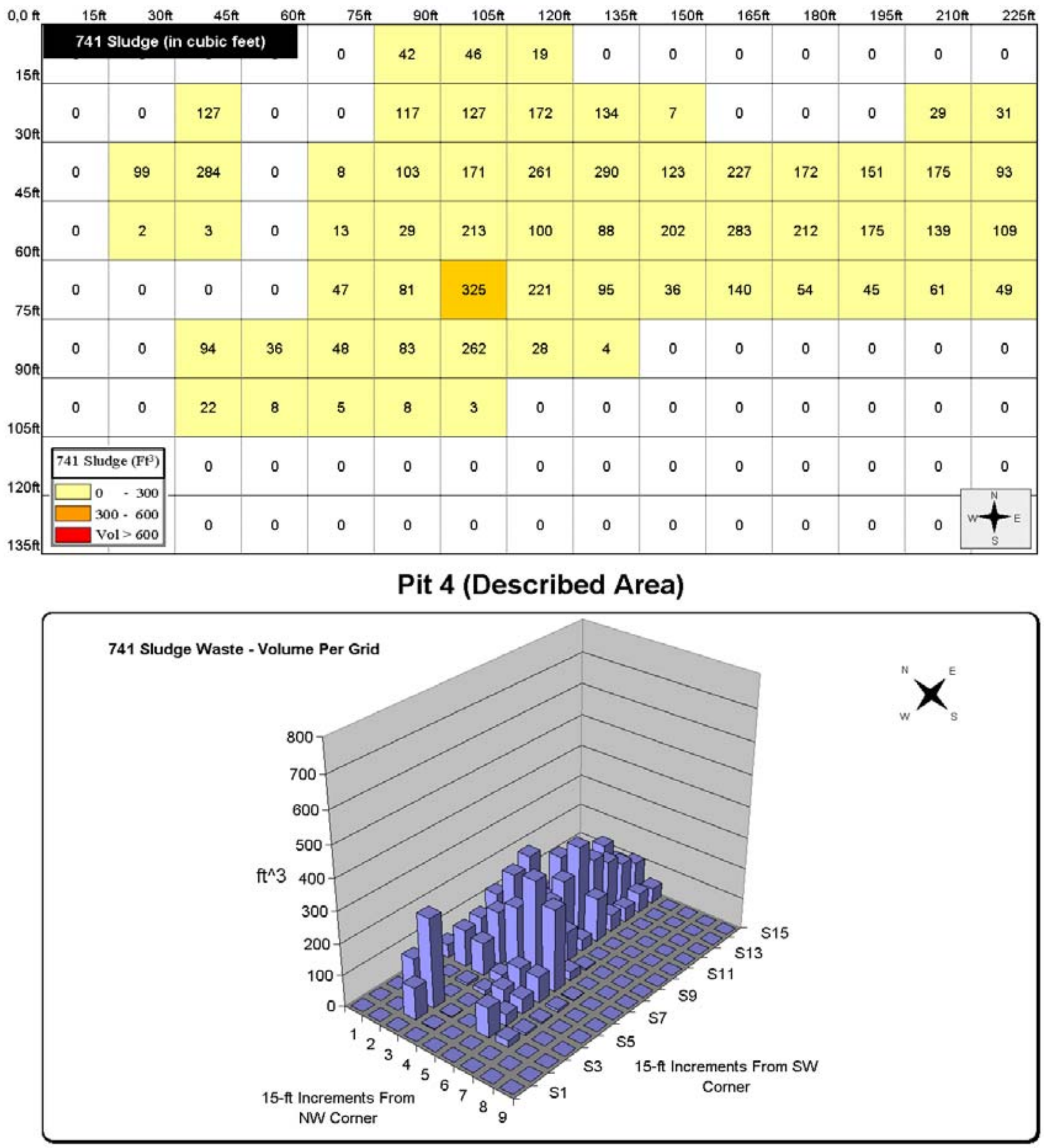



Figure 10. Disposal locations of shipments containing Series 741 sludge.

# 2.6 Nontargeted Waste Zones

## 2.6.1 Series 742 Sludge Shipment Data

Approximately 783 55-gal drums of Series 742 sludge are distributed within the described area of Pit 4. Series 742 sludge makes up approximately 5% of the waste, but only contains 0.2% of the TRU activity disposed of within the described area of Pit 4 (see Table 1). Figure 11 provides the historical shipment data for all shipments around the excavation site containing Series 742 sludge. The shipment locations that did not contain Series 742 sludge wastes are shown as white squares that did contain Series 742 sludge are shown in varying shades of yellow squares. The numbers in the squares indicate the number of cubic feet of waste containing Series 742 sludge that was thought to be disposed of within an individual 15 × 15-ft grid cell.

742 Sludge (in cubic feet)

| 0,0 ft | 15ft | 30ft | 45ft | 60ft | 75ft | 90ft | 105ft | 120ft | 135ft | 150ft | 165ft | 180ft | 195ft | 210ft | 225ft |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15ft | | | | | 0 | 28 | 31 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30ft | 0 | 529 | 84 | 0 | 0 | 42 | 45 | 114 | 54 | 1 | 0 | 0 | 0 | 13 | 21 |
| 45ft | 0 | 111 | 255 | 0 | 14 | 96 | 122 | 239 | 192 | 45 | 42 | 58 | 37 | 62 | 65 |
| 60ft | 0 | 2 | 3 | 0 | 23 | 117 | 151 | 288 | 344 | 119 | 74 | 65 | 39 | 34 | 34 |
| 75ft | 0 | 0 | 37 | 60 | 60 | 114 | 96 | 267 | 243 | 17 | 39 | 20 | 17 | 21 | 15 |
| 90ft | 0 | 0 | 133 | 100 | 61 | 100 | 318 | 35 | 19 | 1 | 0 | 0 | 0 | 0 | 0 |
| 105ft | 0 | 0 | 22 | 8 | 8 | 14 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 120ft | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 135ft | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |

742 Sludge (Ft³): 0 - 300; 300 - 600; Vol > 600

Pit 4 (Described Area)

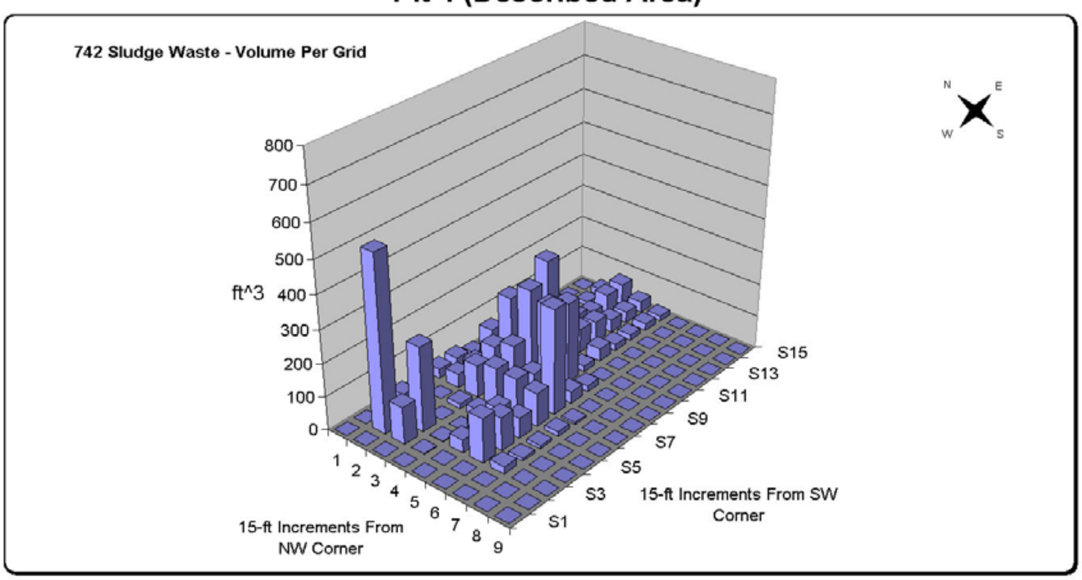



Figure 11. Disposal locations of shipments containing Series 742 sludge.

### 2.6.2 Series 744 Sludge Shipment Data

Approximately 90 55-gal drums of Series 744 sludge are distributed within the described area of Pit 4. Figure 12 provides the historical shipment data for all shipments around the excavation site containing Series 744 sludge. The shipment locations that did not contain Series 744 sludge wastes are shown as white squares that did contain Series 744 sludge are shown in varying shades of yellow squares. The numbers in the squares indicate the number of cubic feet of waste containing Series 744 sludge that was thought to be disposed of within an individual 15 × 15-ft grid cell. As noted in Table 1, the Series 744 sludge is estimated to comprise 1% of the waste, but only contains approximately 0.1% of the TRU activity disposed of in the described area of Pit 4.

| 0,0 ft | 15ft | 30ft | 45ft | 60ft | 75ft | 90ft | 105ft | 120ft | 135ft | 150ft | 165ft | 180ft | 195ft | 210ft | 225ft |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15ft | 744 Sludge (in cubic feet) | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30ft | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 13 |
| 45ft | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 12 | 24 | 61 | 70 | 35 | 30 | 33 |
| 60ft | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 10 | 39 | 40 | 45 | 29 | 28 | 27 |
| 75ft | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 10 | 3 | 16 | 17 | 9 | 9 | 10 |
| 90ft | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 105ft | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 120ft | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 135ft | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |

744 Sludge (Ft³)
0 - 300
300 - 600
Vol > 600

N W E S

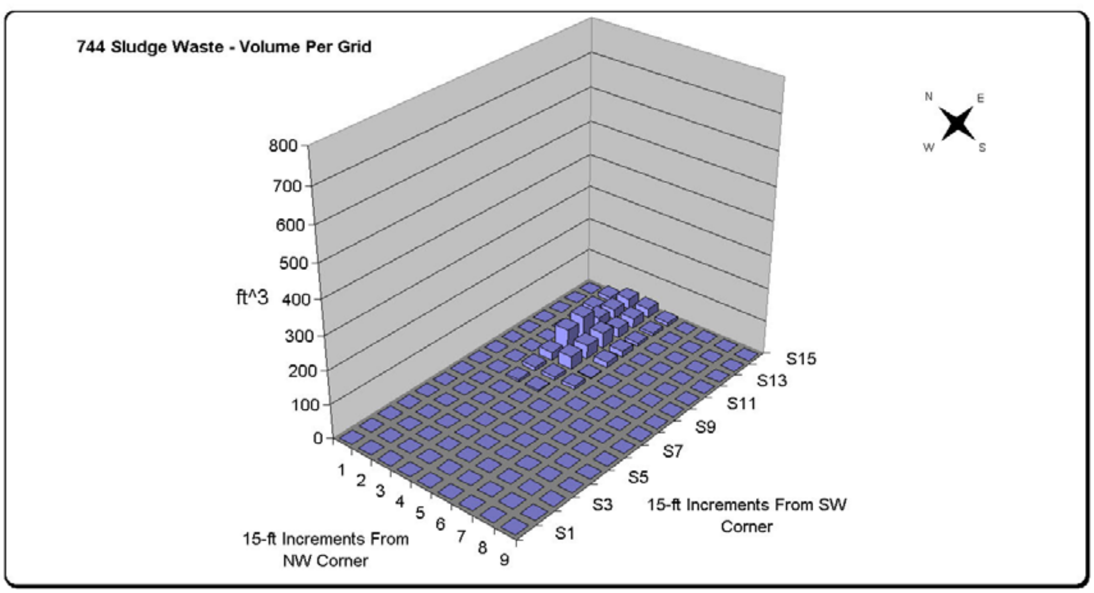



Figure 12. Disposal locations of shipments containing Series 744 sludge.

### 2.6.3 Non-Rocky Flats Sludge (607/654) Shipment Data

Approximately 1,270 $ft^3$ (truckload and unknown container) of 601 and 654 sludges are distributed within the described area of Pit 4. Figure 13 provides the historical shipment data for all shipments around the excavation site containing 607 and 654 non-RFP sewage sludge. The shipment locations that did not contain sewage sludge are shown as white squares. Shipment locations containing the sewage sludge are shown in varying shades of yellow squares. The numbers in the squares indicate the number of cubic feet of sewer sludge contained within an individual 15 × 15-ft grid cell. The non-RFP sludge waste contains no amount of TRU activity.

607+654 Sludge (in cubic feet)

| 0,0 ft | 15ft | 30ft | 45ft | 60ft | 75ft | 90ft | 105ft | 120ft | 135ft | 150ft | 165ft | 180ft | 195ft | 210ft | 225ft |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15ft | | | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30ft | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 45ft | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 60ft | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 75ft | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 90ft | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 86 | 287 | 10 | 0 | 0 | 0 | 0 | 0 |
| 105ft | 0 | 0 | 0 | 0 | 228 | 89 | 0 | 127 | 424 | 14 | 0 | 0 | 0 | 0 | 0 |
| 120ft | | | 0 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 135ft | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |

607+654 Sludge ($Ft^3$)
- 0 - 300
- 300 - 600
- Vol > 600

Pit 4 (Described Area)

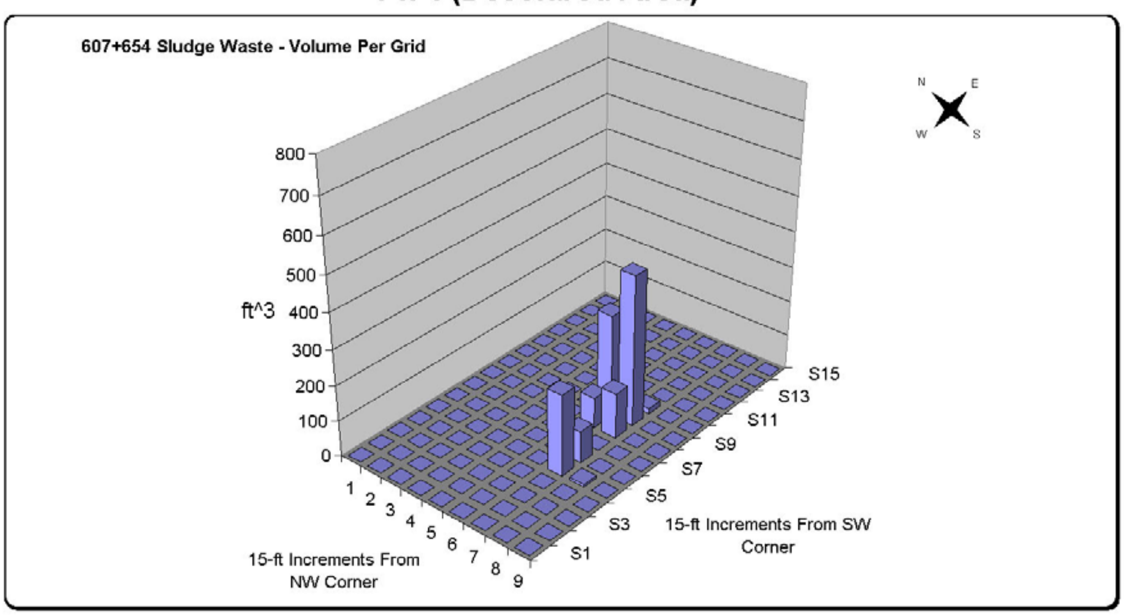



Figure 13. Disposal locations of shipments containing 607 and 654 Sludge.

### 2.6.4 Combustibles Shipment Data

Combustible waste is estimated to comprise 30% of the waste, but only contains approximately 2% of the TRU activity disposed of within the described area of Pit 4 (see Table 1). The historical data indicates that approximately 38,250 $ft^3$ of combustible waste (within bags, crates, boxes, drums, and possibly noncontainerized) has been disposed of within this area; approximately 615 $ft^3$ contains beryllium waste mixed with the combustible waste. Figure 14 provides the historical shipment data for all shipments around the excavation site containing combustibles. The shipment locations that did not contain combustible wastes are shown as white squares; those that did contain combustibles are shown in varying shades of yellow squares. The numbers in the squares indicate the number of cubic feet of combustible waste disposed of within an individual 15 × 15-ft grid cell.

Combustibles (in cubic feet)

| 0,0 ft | 15ft | 30ft | 45ft | 60ft | 75ft | 90ft | 105ft | 120ft | 135ft | 150ft | 165ft | 180ft | 195ft | 210ft | 225ft |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15ft | | | | | 49 | 86 | 38 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30ft | 0 | 624 | 304 | 0 | 101 | 458 | 403 | 205 | 253 | 17 | 0 | 154 | 166 | 290 | 245 |
| 45ft | 0 | 213 | 125 | 0 | 114 | 981 | 1154 | 730 | 854 | 163 | 391 | 380 | 315 | 522 | 405 |
| 60ft | 0 | 168 | 68 | 0 | 57 | 716 | 1004 | 801 | 1061 | 480 | 464 | 410 | 479 | 553 | 339 |
| 75ft | 0 | 512 | 396 | 233 | 191 | 691 | 795 | 915 | 821 | 979 | 502 | 142 | 215 | 635 | 667 |
| 90ft | 430 | 801 | 269 | 515 | 720 | 258 | 732 | 669 | 160 | 57 | 87 | 195 | 176 | 39 | 234 |
| 105ft | 143 | 470 | 76 | 54 | 292 | 138 | 303 | 357 | 143 | 4 | 89 | 309 | 306 | 10 | 0 |
| 120ft | | | 840 | 264 | 136 | 630 | 736 | 783 | 671 | 112 | 166 | 0 | 0 | 0 | 0 |
| 135ft | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |

Combustibles ($Ft^3$): 0 - 300; 300 - 600; Vol > 600

N W E S

Pit 4 (Described Area)

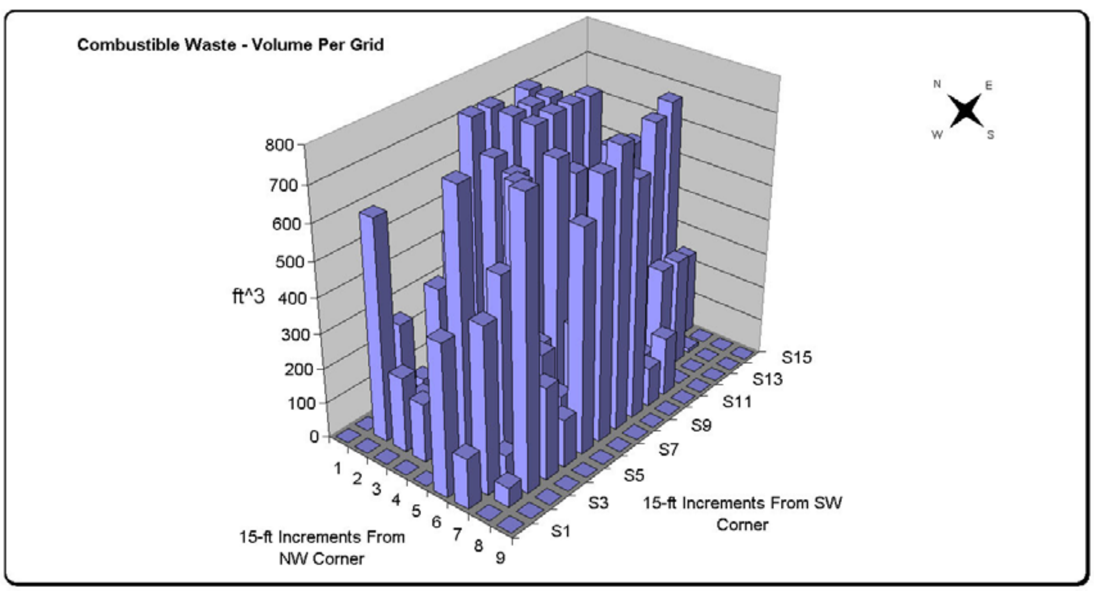



Figure 14. Disposal locations of shipments containing combustibles.

### 2.6.5 Noncombustibles Shipment Data

At approximately 40%, noncombustible waste makes up the highest majority of waste deposited within the excavation area, but only contain 8% of the TRU activity (see Table 1). The historical data indicates that there has been approximately 50,600 $ft^3$ of combustible waste (within bags, boxes, drums, and possibly noncontainerized) disposed of in this region, approximately 752 $ft^3$ contains beryllium waste mixed with noncombustible waste such as scrap metal, and two drums of waste contaminated with americium. Figure 15 provides the historical shipment data for all shipments around the excavation site containing noncombustibles. The shipment locations that did not contain noncombustible waste are shown as white squares; those that did contain noncombustibles are shown in varying shades of yellow squares. The numbers in the squares indicate the number of cubic feet of noncombustible waste disposed of within an individual 15 × 15-ft grid cell.

Noncombustibles (in cubic feet)

| 0,0 ft | 15ft | 30ft | 45ft | 60ft | 75ft | 90ft | 105ft | 120ft | 135ft | 150ft | 165ft | 180ft | 195ft | 210ft | 225ft |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15ft | | | | | 1 | 62 | 46 | 12 | 0 | 0 | 0 | 23 | 11 | 0 | 0 |
| 30ft | 0 | 199 | 101 | 0 | 1 | 91 | 337 | 87 | 75 | 5 | 5 | 64 | 69 | 78 | 64 |
| 45ft | 0 | 101 | 59 | 0 | 0 | 223 | 567 | 222 | 280 | 116 | 394 | 624 | 545 | 432 | 204 |
| 60ft | 0 | 8 | 3 | 0 | 37 | 246 | 446 | 353 | 455 | 258 | 273 | 313 | 327 | 397 | 545 |
| 75ft | 0 | 24 | 19 | 15 | 123 | 274 | 462 | 433 | 720 | 892 | 533 | 357 | 172 | 283 | 461 |
| 90ft | 104 | 295 | 786 | 992 | 1144 | 358 | 71 | 61 | 594 | 1355 | 941 | 1245 | 476 | 0 | 23 |
| 105ft | 35 | 816 | 1687 | 1651 | 1353 | 177 | 4 | 140 | 731 | 1372 | 1844 | 1113 | 245 | 695 | 1182 |
| 120ft | 39 | 600 | 1382 | 1905 | 892 | 58 | | 38 | 486 | 389 | 1344 | 530 | 14 | 651 | 1128 |
| 135ft | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |

Noncombustibles (Ft³): 0 - 300; 300 - 600; Vol > 600

N W E S

Pit 4 (Described Area)

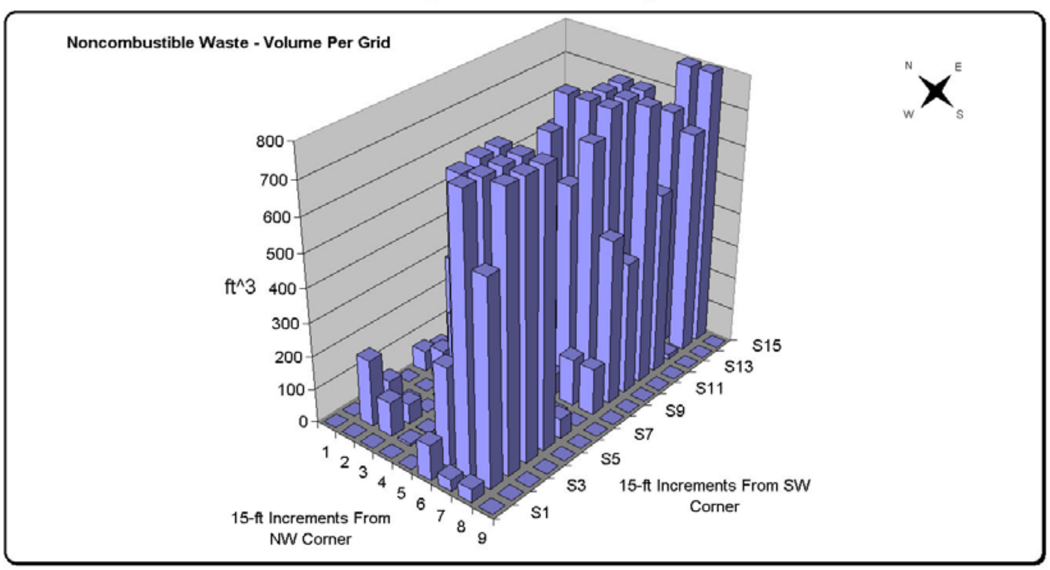



Figure 15. Disposal locations of shipments containing noncombustibles.

# 3. WASTE IDENTIFICATION

In-pit segregation will be the primary method for determining what wastes are removed from the building (targeted wastes) and what wastes remain within the enclosure (nontargeted wastes). Preacquired visual characteristic knowledge of the different waste types encountered during excavation enables operations to identify targeted wastes when unearthed.

Waste pictures within this section were obtained from:

1. Video footage taken during a 1983 to1985 Rocky Flats Plant waste characterization campaign.

2. Photographs taken during a 1980 Argonne National Laboratory-West (ANL-W) gas generation testing campaign.

3. Photographs taken during a 2004 INEEL Glovebox Excavator Method Project waste excavation campaign.

4. Photographs extracted from a 2004 waste identification operator aid manual for the INEEL Glovebox Excavator Method Project.

5. Oak Ridge National Laboratory (ORNL), specifically from the operators of the depleted uranium chip oxidizing facility at the Y-12 facility.

In 1983, 3-year-old and 12-year-old RFP-generated wastes were retrieved from interim storage at the INEEL. These containers were radiographed and shipped to RFP for videotaped sampling and characterization. This video footage was captured and converted into still frame photographs for inclusion into this document. Although waste forms (shown in the 1983 RFP photographs) were generated after 1970, the waste generating processes are assumed to be similar to those used by RFP between 1966 and 1967 (date of Pit 4 disposal).

Pictures of Series 743 sludge (organic setups) were taken at ANL-W during confirmatory sampling for the 3,100 $m^3$ Project. Although the sludges shown in the ANL-W photographs were generated in 1980, the waste generating processes are assumed to be similar to those used by RFP between 1966 and 1967 (date of Pit 4 disposal).

The 2004 INEEL Glovebox Excavator Method Project unearthed RFP waste buried within Pit 9 at the INEEL RWMC. RFP waste was buried within Pit 9 between 1967 and 1968. Waste forms photographed during this excavation campaign are assumed to be similar to waste forms buried within Pit 4 between 1966 and 1967.

The majority of information concerning the generation processes and contents of specific waste types were obtained from INEL (2003).

## 3.1 Targeted Waste Types

### 3.1.1 Series 743 Sludge

***Quantity.*** Approximately 702 55-gal drums of Series 743 sludge (waste code[a] 003) are distributed within the northeast corner of the described excavation area of Pit 4 as shown in the previous section.

***Description***. Series 743 sludge (commonly called organic setups) are organic liquid waste solidified using calcium silicate. When generated, Series 743 sludge appeared as a paste or grease-like substance. The waste drums were packed with Oil Dri as the absorbent, not cement. As shown on the following RFP photograph (figure 16), organic setups may have separated leaving liquid on top. Additionally, visual examination of Series 743 sludge indicated either a white paste-like substance or a brown paste-like substance as shown in the following photographs.

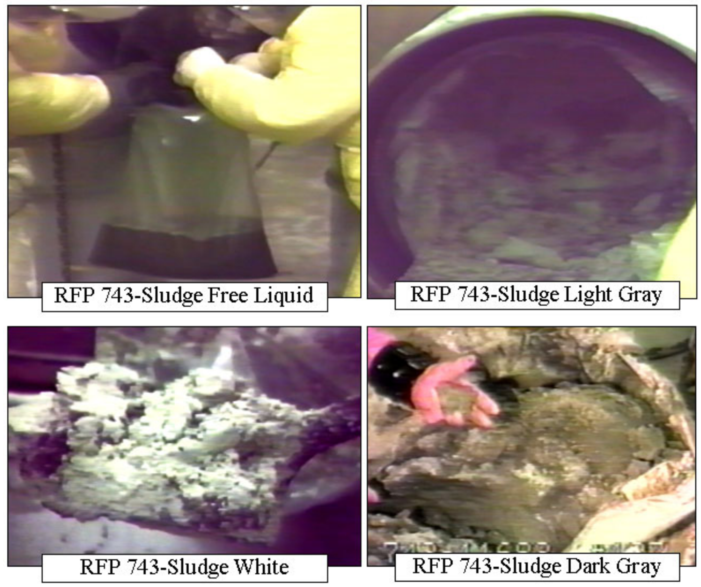



Figure 16. Rocky Flats Plant Series 743 Sludge sampled during a 1983 visual examination.

The following are pictures of Series 743 sludge taken at ANL-W during gas generation tests on Stored Waste Examination Pilot Plant (SWEPP) drums. According to field representative logbooks (Olson 2004a, 2004b), sludges observed from the INEEL Pit 9 dig were similar in appearance to those shown in Figure 17, and exhibited a wide range of colors.


Figure 17. Picture of Series 743 sludge taken at Argonne National Laboratory-West during gas generation tests on Stored Waste Examination Pilot Plant drums.

Field representative's Glovebox Excavator Method logbooks (Olson 2004a, 2004b) indicate that the Series 743 Sludge encountered during the Glovebox Excavator Method Project excavation varied in color from moderate yellow to light brown to red. Figure 18 (left) shows a suspected Series 743 sludge smear on the excavation surface at the Glovebox Excavator Method facility.

Figure 18 (right collection) shows several Series 743 sludge samples collected during the Glovebox Excavator Method Project. These samples were sent to the Idaho Nuclear Technology Engineering Center (INTEC) for Gamma analysis and then to TRA for subsequent mobility testing.

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[a] Waste codes (also referred to as Content Codes) are a series of numbers (001-999) used to identify nuclear material forms or process materials.


Figure 18. Picture of suspected Series 743 sludge smear at the Glovebox Excavator Method facility.

***Generation Process.*** According to Clements (1982), approximately 30 gal of the organic mixture were blended with 100 lb of calcium silicate and another 10 to 20 lb of Oil Dri, before being double-bagged in plastic. Another 15 to 20 lb of Oil Dri was added to the bags before placement in a drum. Even with the addition of these absorbents and solidifying agents, the liquids could separate from the sludge to form free liquids.

***Waste Contents.*** EDF-2322 estimated the average gallons per drum for each of the principal organic materials present in 743 sludge as shown in Table 3.

Table 3. Waste contents of Series 743 sludge.

| Organic Material Present in 743 | Gals/drum |
|---|---|
| Carbon tetrachloride | 14 |
| Texaco Regal, lube oils | 12 |
| Trichloroethene | 4 |
| Tetrachloroethene | 4 |
| 1,1,1-Trichloroethane | 4 |
| Methylene chloride | 0.03 |
| Chloroform | 0.03 |

Transformer oils were occasionally present in Series 743 sludge. Clements (1982) states that polychlorinated biphenyls (PCBs) were present in transformer oils in concentrations >500 ppm. The only other toxic wastes identified were beryllium and nitrobenzene.

### 3.1.2 Roaster Oxides

***Quantity.*** Approximately 109 55-gal drums of roaster oxides (no waste code available) are distributed near the center of the designated excavation area of Pit 4 as shown in the previous section.

***Description.*** Near jet-black and varied in texture from relatively fine grained (similar to the appearance of fine graphite encountered at Glovebox Excavator Method Project) to a more coarse-grained jet-black material, approximately 3–4mm in diameter (possibly still in the shape of U turnings). Fully oxidized $U_3O_8$ can be slightly green in color but most heat-treated material is black. Roaster oxides may have been packaged in bulk, partially filling 30- or 55-gal drums.

The following pictures in Figure 19 are from ORNL, specifically from the operators of the depleted uranium chip oxidizing facility at the Y-12 facility. Bechtel Jacobs Corp. is the operator of the depleted uranium chip oxidizing facility. ORNL indicated that the pictures of the oxidized uranium oxides should be similar to the RFP roaster oxides that may be encountered during the excavation of the described area within Pit 4.

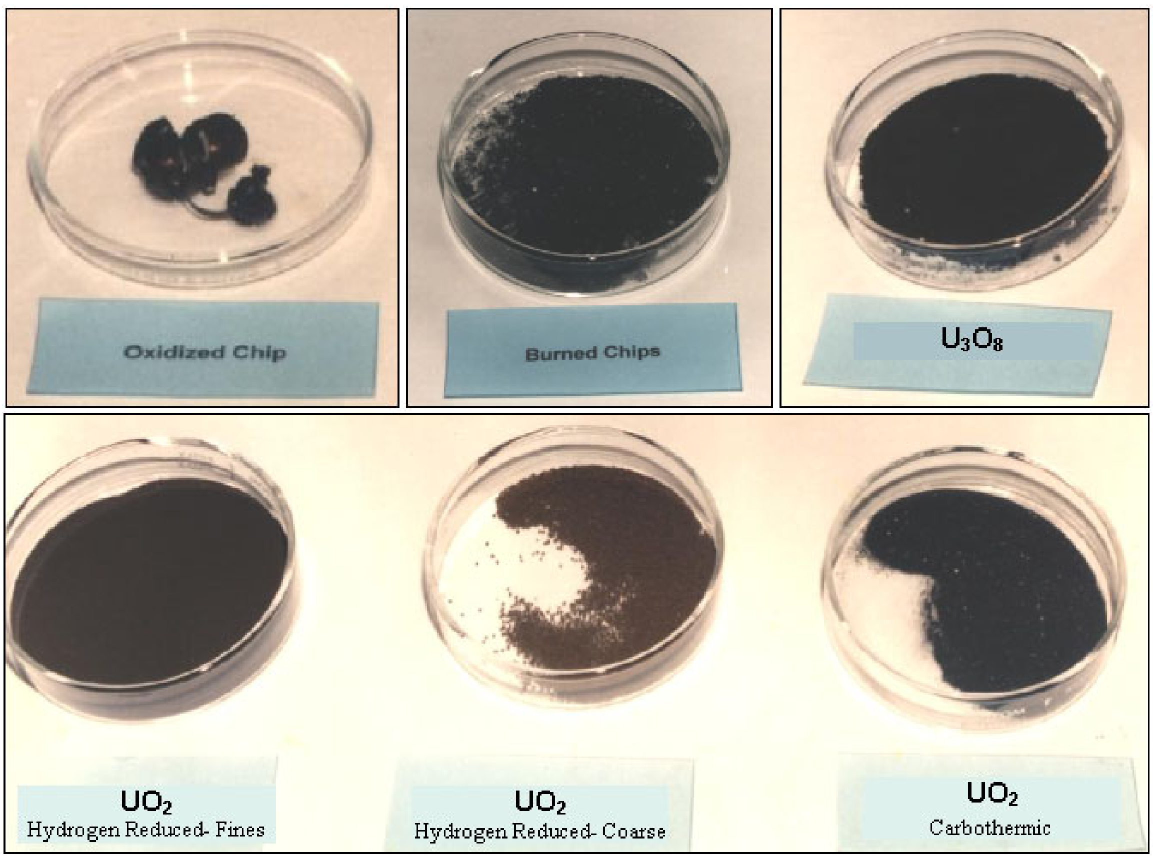



Figure 19. Picture of Roaster Oxides from Oak Ridge National Laboratory.

***Generation Process.*** The uranium machining chips and uranium fines were oxidized to lessen the pyrophoric nature of the depleted chips and fines.

***Waste Contents.*** Roaster oxides contain $UO_2$ and $U_3O_8$.

### 3.1.3 Graphite

***Quantity.*** Approximately 496 waste drums in this category are from RFP and may contain pieces of graphite molds (waste code 300), graphite cores (waste code 301), broken pieces of graphite molds and cores (waste code 303), and coarse graphite from the cleaning of graphite molds (waste code 312). Because of uncertainties in the shipping records, up to 96 of these drums may not contain graphite wastes (see Appendix A).

Graphite wastes are distributed within the north side of the designated excavation area of Pit 4 with the highest concentration near the excavation's center (see previous section).

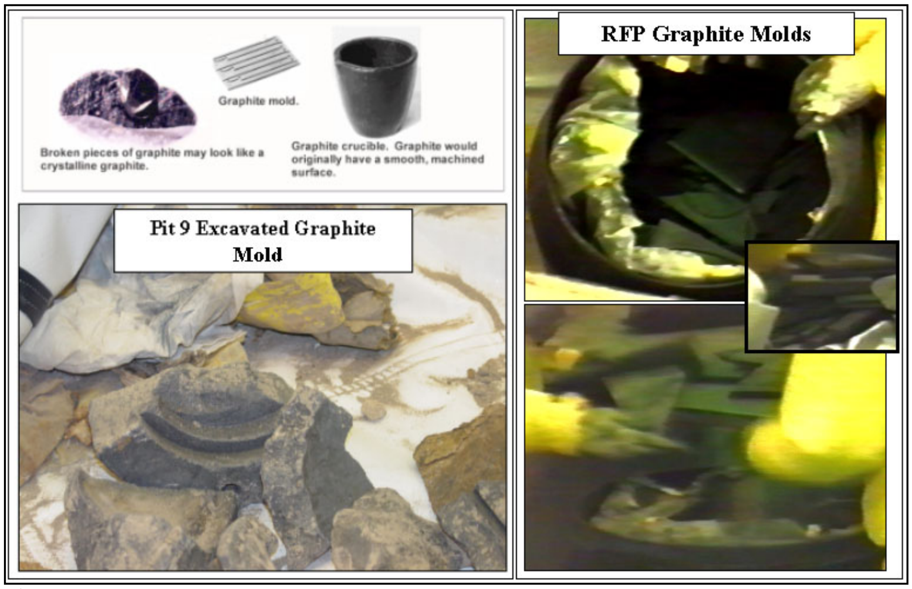



Figure 20. Predisposal pictures of graphite molds and crucibles (top left); picture of graphite crucible pieces taken at Pit 9 during retrieval operations (bottom left); RFP graphite mold video footage (right).

***Description.*** Clements (1982) reported that the large pieces of graphite were typically double-bagged in plastic before being packaged in the drums. Smaller graphite wastes were typically placed in 1-gal polyethylene bottles before being bagged and packaged in drums. Graphite molds, cores, and crucibles will appear dull black as shown in Figure 20. Graphite fines may look like dry black ocean sand as shown in Figure 21.

***Generation Process.*** Mold pieces scraped to remove excess plutonium, then broken into small pieces, 1/4-in. to 1-in., before packaging.

***Waste Contents.*** The graphite wastes should not contain toxic or hazardous wastes, or free liquids; however, occasionally some surgeon's gloves were included.


Figure 21. Predisposal pictures of graphite fines packaged in a drum (left); picture of graphite fines taken at Pit 9 during retrieval operations (right).

### 3.1.4 Filter Material

***Quantity.*** Approximately 606 cartons and 83 wooden boxes containing filters (waste code 490) are distributed primarily within the south side of the designated excavation area of Pit 4 with the highest concentrations near the west and east corners (see previous section).

***Description.*** High-efficiency particulate air (HEPA) filters come in various sizes, and may be 4 to 12 in. thick. Prefilters were used in front of HEPA filters. They are thinner and the pleats are further apart. Prefilters were usually changed out along with HEPA filters. Although smaller filters were often packaged in 55-gal drums, there are no records of such drums disposed of in the described area (see Figure 22).

Each filter is assumed to have been double-bagged, placed in its original shipping carton for disposal, or boxed with a few other filters for disposal. Clements (1982) stated that 12 uncrushed or 25 to 30 crushed HEPA filters could fit in a waste box.

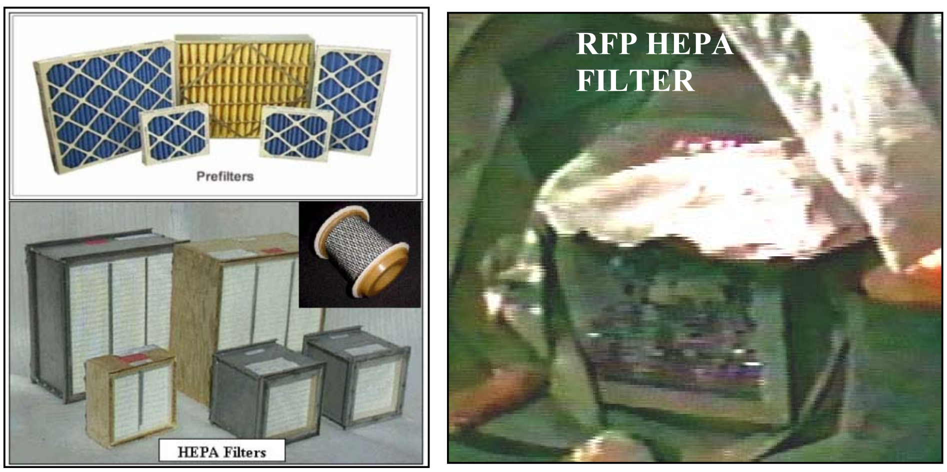



Figure 22. Predisposal pictures of prefilters (top left); HEPA filters (bottom left); RFP HEPA filter video footage (right).

***Generation Process.*** This waste consists primarily of 24 × 24 × 12-in. HEPA filters from ventilation intake and exhaust filter plenums. The waste may also include various other sizes of plenum HEPA filters, prefilters, and glovebox HEPA filters.

***Waste Contents.*** According to Clements (1982), two types of filter media were used: asbestos and fiberglass. Up to 50 lb of Portland cement were added to a box if it contained damp filters; therefore, no free liquids should be present. Although there should be no toxic materials in the waste filters, some of them were contaminated with nitric acid. The acid was neutralized with the addition of Portland cement.

Filter frames are constructed of either fire-retardant plywood or particleboard. The filter media is made of Nomex (glass and aromatic polyamide fibers), fiberglass, or asbestos. The waste may also contain metal canister filters that were used for respiratory protection during chemical spill cleanup. The waste may include filters that had been potentially contaminated with acid vapors (acid-contaminated), solvent vapors (solvent-contaminated), and filters that are not expected to have been contaminated with either acid or solvent vapors (nonacid-contaminated).

### 3.1.5 Series 741 Sludge

***Quantity.*** Approximately 905 55-gal drums of Series 741 sludge (waste code 001) are distributed within the center of the designated excavation area of Pit 4 as shown in the previous section.

***Description.*** Series 741 sludge (salt precipitate called "first stage sludge") contains plutonium and americium oxides, depleted uranium, metal oxides, and organic constituents. As shown in Figure 23, Series 741 sludge may be containerized in jars, appear as dark gray fractured cemented blocks, light gray monolith retaining the shape of the disposal drum, red adobe clay with white chunks, or red adobe clay only. The sludge may be wrapped in 1/8-in.-thick lead sheet used as shielding against gamma radiation. Contains high levels of alpha activity from high Am-241 loading. Up to 50 lb of Portland cement were added to each drum of sludge waste to absorb any free liquids present; however, free liquids could be present because of separation phenomena.

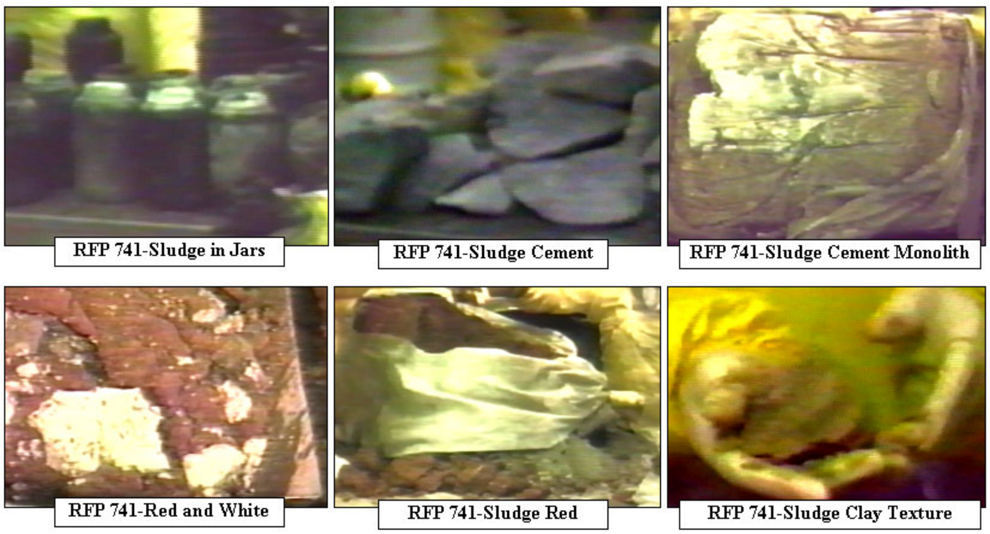



Figure 23. Rocky Flats video footage of Series 741 sludge.

***Generation Process.*** This waste consists of immobilized materials generated from first-stage treatment operations in RFP Building 774. Aqueous liquids coming into the process originated from RFP Building 771 recovery operations. The liquids were made basic with sodium hydroxide to precipitate iron, magnesium, etc., which also carried down the relatively small amount of precipitate of plutonium and americium hydrated oxides. The precipitate was filtered to produce a sludge, which was placed in a drum with Portland cement (see Table 4).

***Waste Contents.***

Table 4. The typical waste material parameters for Series 741 sludge.

| Potential Waste Material Parameter | Description |
|---|---|
| Steel (packaging materials) | 55-gal drum |
| Plastics (packaging materials) | 90-mil drum liner, O-ring bag, drum bag |
| Other Inorganic Materials | Portland cement, vermiculite, Oil-Dri®, Aquaset® |
| Other Metals | Lead sheets or lead tape |
| Inorganic Matrix | First stage sludge |

## 3.2 Nontargeted Waste Types

The following waste forms are nontargeted wastes and are not expected to contain high concentrations of TRU, volatile organic compounds, or uranium. Therefore, it is not expected that these will be removed from the described area within Pit 4.

### 3.2.1 Series 742 Sludge

***Quantity.*** Approximately 783 55-gal drums of Series 742 sludge (waste code 002) are distributed within the center and northwest corner of the designated excavation area of Pit 4 as shown in the previous section.

***Description.*** Series 742 sludge (salt precipitate called "second stage sludge") contains plutonium and americium oxides, metal oxides, and organic constituents. The Series 742 sludge will look similar to Series 741 sludge, but will not have a lead liner. The sludge in each drum was usually double-bagged in plastic. Up to 50 lb of Portland cement were added to each drum of sludge waste to absorb any free liquids present. However, free liquids could be present because of separation phenomena. Some drums may contain some of the following wastes: electric motors, mercury batteries, lithium batteries, bottles of chemical wastes, radioactive sources, and small amounts of mercury in pint bottles (see Figure 24).

***Generation Process.*** This waste consists of immobilized materials generated from second-stage treatment operations in RFP Building 774. The aqueous liquids to be treated originated from first-stage treatment (generator or Series 741 sludge) and from numerous buildings. The liquids were treated in the same manner as the liquids from the first-stage, and the resulting sludge was placed into a drum with Portland cement.

***Waste Contents.*** The typical waste material parameters for second stage sludge are similar to Series 741 sludge.

In addition to the above-mentioned contents, Series 742 sludge may contain potassium cyanide pellets, batteries, lithium, and mercury. Within the SDA, at least two 25-lb bags of sodium or potassium cyanide were distributed among the drums containing 742-series sludge (Einerson and Thomas, 1999).

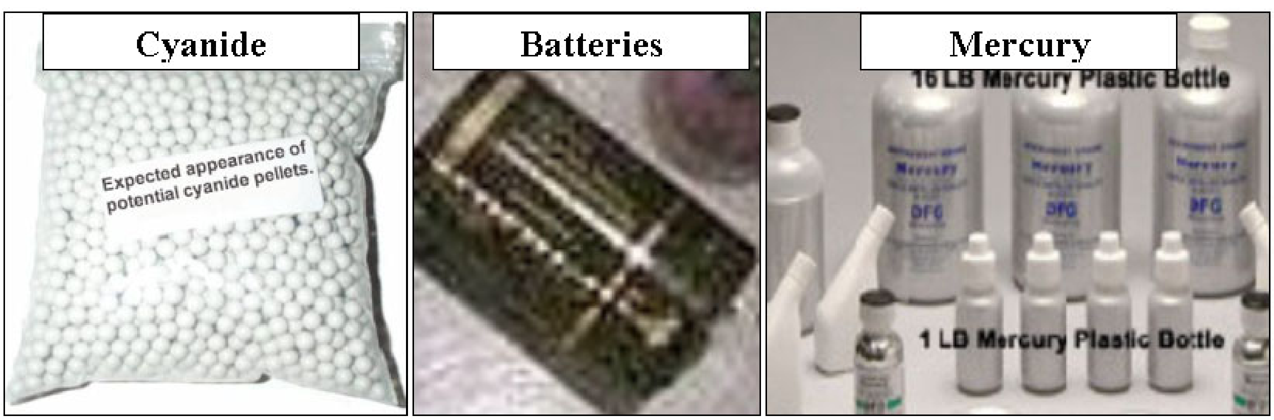



Figure 24. Cyanide pellets, batteries, and mercury that may be found within a Series 742 sludge drum.

### 3.2.2 Series 744 Sludge

***Quantity.*** Approximately 90 55-gal drums of Series 744 sludge (waste code 004) are distributed within the northeast corner of the designated excavation area of Pit 4 as shown in the previous section.

***Description.*** Series 744 sludge or special setups are complexing chemicals (liquids) including organic acids and alcohols solidified with cement and packaged in layers. Appearance will be similar to Series 741 sludge. General appearance of Series 744 sludge should be cement gray rather than reddish (see Figure 25).

***Generation Process.*** Two bags of Portland cement blended with one bag of insulation (some containing asbestos) or other absorbent, were mixed and placed in a drum, where liquid waste was added and allowed to solidify. Approximately 190 lb of Portland cement and 50 lb of pipe-insulation cement (like magnesia cement) were mixed in a 55-gal drum, double-lined with plastic bags. Then, approximately 26 gal of liquid waste were poured onto the cement mixture and allowed to solidify. Another 10 to 15 lb of Portland cement was added on top of the cemented liquid waste. No free liquids should be present.

Figure 25. RFP video footage of Series 744 Sludge.

***Waste Contents.*** Series 744 sludge consists of liquid wastes that could not be processed by the Series 741, 742, or 743 sludge-processing methods and were treated separately because of the plutonium-complexing nature of the wastes. Complexing chemicals included some alcohols, organic acids, and versenes (i.e., forms of ethylenediaminetetraacetic acid [EDTA]). Toxic materials were sometimes included in the Series 744 waste drums. One example involved MOCA (i.e., 4,4-methylene-bis, 2-chloroaniline), a carcinogenic hardening agent used in resins. Approximately 10 to 20 gal of MOCA were mixed with cement in cylindrical plastic or cardboard containers, double-bagged, and placed in several drums.

### 3.2.3 Non-Rocky Flats Sludge (601/654 Sludges)

***Quantity.*** Approximately 1,270 $ft^3$ (truckload and unknown container) of 601 and 654 sludges are distributed within the south side of the designated excavation area of Pit 4 as shown in the previous section.

***Description.*** These sludges were sewage sludges from the INEEL 601 and 654 facilities. There were three shipments of sludge totaling approximately 1300 $ft^3$. The most likely color for the 601 and 654 sewage sludges is black or a soil color. The sludges are expected to have the same color and texture as loamy soil.

### 3.2.4 Combustible and Noncombustible Waste

***Quantity.*** Combustible and noncombustible wastes are the most abundant waste types within the designated excavation area of Pit 4. The combined volume of the two waste types total approximately 70% of all waste deposited within the described area. Combustible wastes are most prevalent in the northern three-quarters of the excavation area and noncombustible waste are most prevalent within the southern most quarter of the excavation area as shown in the previous section.

***Description.*** Noncombustible waste includes dirt, pipe, insulation, scrap metal, cement blocks, gravel, beryllium, americium (2 drums), vermiculite, glass, ceramics, rags, and scrap machinery (e.g., reactor skid, shielding, trays, hoists). Combustible waste includes paper, rags, plastics, cloth coveralls, and polyethylene bottles, wood, straw, and some beryllium (see Figures 26 and 27).


Figure 26. Predisposal pictures of combustible waste (top); picture of excavated combustible waste taken at Pit 9 (bottom).

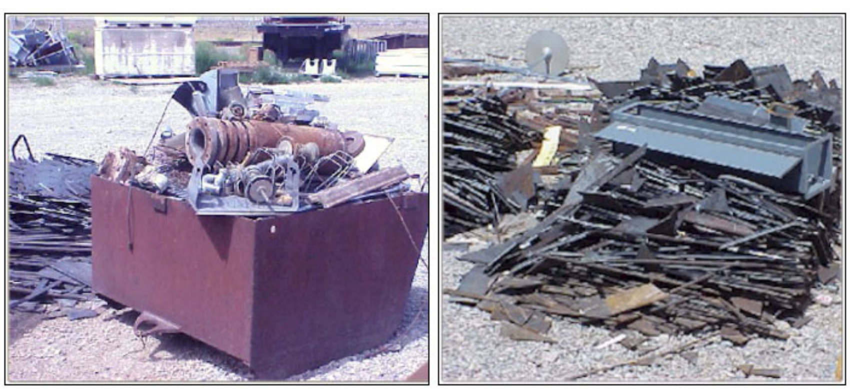


Figure 27. Predisposal pictures of noncombustible waste.

## 3.3 Special Categories

Except as noted, the items in these categories were obtained from information found within the shipping and disposal records for shipments disposed of within the designated excavation area of Pit 4. Additional, potentially present objects, not noted within the shipping and disposal records, are listed within EDF-4591.

### 3.3.1 Large Objects

There are at least five types of large objects recorded within the shipping records. The first four are noted within the noncombustible section in Appendix A. The last object is noted within both the combustible and noncombustible sections in Appendix A. The waste types are:

1. The ML-1 reactor skid and shielding weighing 9 tons consisting of the skid and shielding which occupied a volume of 800 $ft^3$. This shipment is also recorded as having 20 Ci of activity and having a 30-mrem/hr dose rate on contact.
2. Refueling machine support structure, which occupied a volume of 5,750 $ft^3$. This support structure is recorded as having 25 μCi of activity.
3. Refueling machine fixture, which occupied a volume of 5,750 $ft^3$. This support structure is recorded as having 10 μCi of activity and had dose rates of 150 mrem/hr on contact.
4. One 15 $ft^3$ carbon-steel tank from PM-2A vessel test from Test Area North.
5. Twenty waste dumpsters containing various combustibles and noncombustibles.

### 3.3.2 Beryllium-Contaminated Wastes

Various forms of beryllium wastes (i.e., beryllium metal and beryllium oxide) may be encountered in the following waste categories: 743 sludge, combustible debris, metal debris, and miscellaneous mixed debris (Clements 1982; RWMC-EDF-761; and the shipping records noted within the combustibles and noncombustibles section of Appendix A).

Minor amounts would not be recognized as beryllium, which looks like a shiny metal or stainless steel (See Figure 28). The only known deposit of beryllium includes turnings or grinding fines from machining operations. The oxides or chlorides of beryllium are white or colorless. Beryllium metal is very expensive, and it is highly unlikely that any beryllium object large enough to see would have been disposed of.

Note: Beryllium turnings and fines are incompatible with carbon tetrachloride (component of 743 sludge). The combination flashes and sparks occur under heavy impact (National Research Council 1981).

Figure 28. Predisposal pictures of Beryllium waste.

### 3.3.3 Americium-Contaminated Wastes

From the shipping records, two drums containing undisclosed amounts of americium are noted. The drums each weigh less than 200 lb, indicating lead lining was not used to shield the activity in them. (RWMC-EDF-761 stated that a 1/8-in.-thick lead drum liner weighs about 150 lb, and a drum weighs about 60 lb). This may indicate that there is not enough activity from the americium to require shielding.

### 3.3.4 Lab-Generated Waste

Lab-generated waste is defined in EDF-2459, "Waste Categorization Matrix for the OU 7-10 Glovebox Excavator Method Project," as follows:

> "… a drum packaged with numerous small bottles of analytical waste and is referred to as a lab pack."

The shipping and disposal records (see Appendix A) for wastes in the described area do not specifically list any lab-generated wastes; however, such wastes might be found within the miscellaneous mixed debris and the combined non-RFP waste categories, based on Clements's (1982) descriptions of the kinds of waste that were included in these categories.

### 3.3.5 Magnesium Oxide (Crucible Heels)

Magnesium oxide was not mentioned within the waste disposal records for the designated excavation area of Pit 4. Magnesium oxide was not mentioned within the shipping records for the designated excavation area of Pit 9, but several bottles were unearthed within a waste drum during Pit 9 excavation activities (the bottles were mixed with bottles of graphite fines). Figure 29 provides a photograph of magnesium oxide found during the excavation of Pit 9 in 2004. During Pit 9 excavation activities, the unearthed magnesium oxide bottles were placed in gloveboxes for radiological monitoring and packaging. Gamma radiation surveys were performed outside the gloveboxes, resulting in readings of 45 mrem/hr. Normal radiation levels outside the glovebox during waste handling operations were between 0.1 to 0.3 mrem/hr.

Figure 29. Picture of magnesium oxide taken at Pit 9 during retrieval operations.

Magnesium oxide (waste code 393) consists of undissolved or precipitated calcium fluoride (slag) and undissolved magnesium oxide sand and crucible remaining after pulverizing and leaching of sand, slag, and crucible. The waste may also contain trace amounts of aluminum nitrate and aluminum fluoride. The actinides remaining in the heel will be in the form of fluorides and oxides.

Sand, slag, and crucible heels were packaged in 1/2- and 1-gal polyethylene bottles (see Figure 29). Documentation was not identified for the packaging configuration of unpulverized sand, slag, and crucibles.

# 4. PROCESS OVERVIEW

This section provides a general overview of the basic excavation process for the described area within Pit 4. Please note that the excavation process discussed in this document does not cover installation of an interim cover after retrieval is complete, facility shutdown, or deactivation, decontamination, and decommissioning activities.

Figure 30 provides an isometric view and cross-section of the different retrieval zone materials likely to be encountered and are referred to in the following discussion of the excavation process. Based on probing data, the first 2 to 4 feet of overburden (first layer) is most likely uncontaminated and will be stored outside the retrieval area for return to the pit. The next 2 ft of potentially contaminated soil (PCS) is also assumed to be acceptable for return to the pit.

All of the overburden down to PCS within the retrieval enclosure, as shown in figure 30, will be removed as part of the construction activities. The level to basalt varies from 16 to 28 ft.

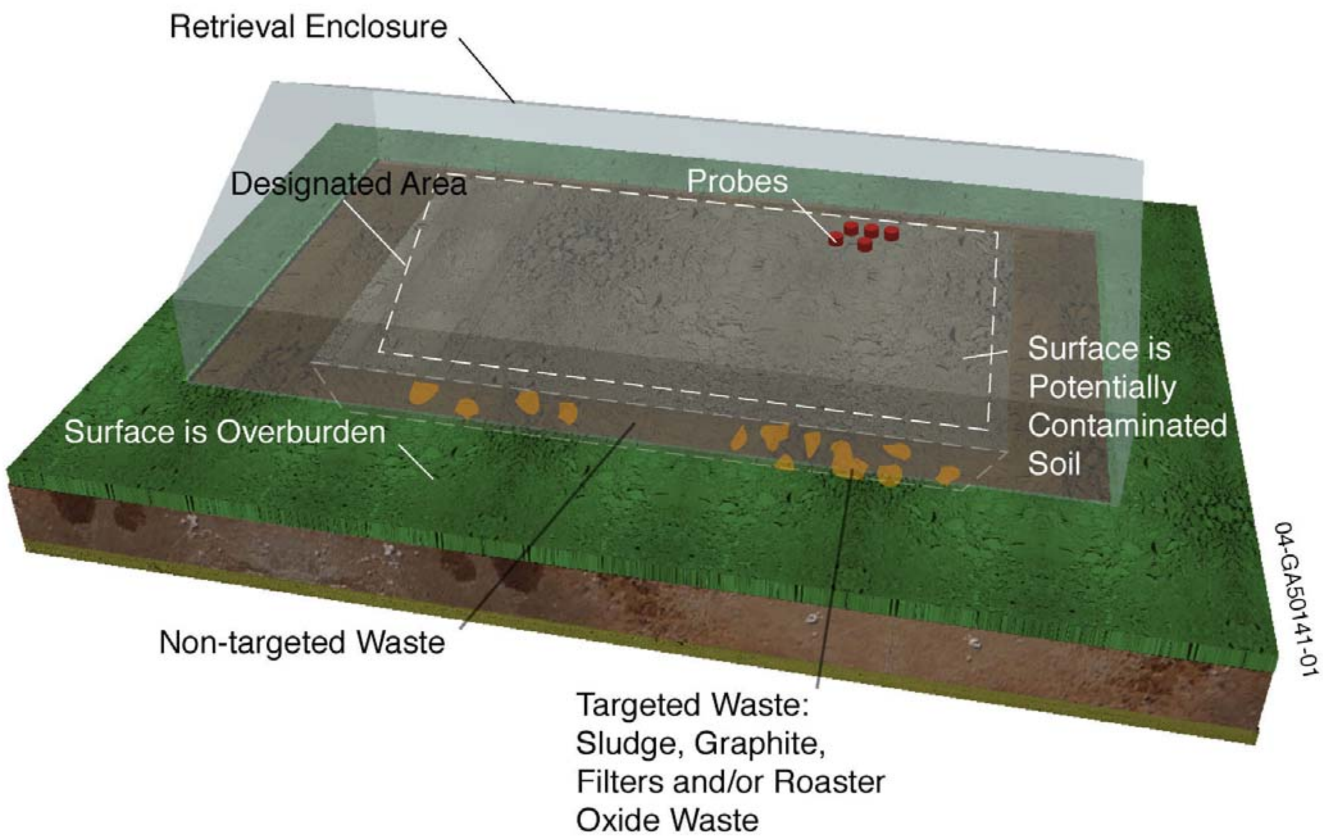



Figure 30. Postconstruction Accelerated Retrieval Project configuration before excavation.

## 4.1 Excavation Coordinates

In an effort to accurately determine the location of RCRA samples retrieved from within the excavation site, the project will use a bucket position monitor in concert with markers suspended from the ceiling (positioned directly above the RCRA sample locations). The bucket position monitor provides the horizontal reach (from the cab) and vertical depth (below the excavator tracks) of the bucket.

While viewing the bucket position monitor the excavator touches a suspended marker and notes the horizontal distance from the cab. The excavator operator then maintains the same horizontal distance while digging at the prescribed depth (noted on the marker).

Visual marks are provided along the perimeter of the excavation site to provide additional record-keeping capability. The visual markings provide a means to measure the location of excepted large objects and remote-handled radioactive sources not removed from the pit relative to a fixed reference point.

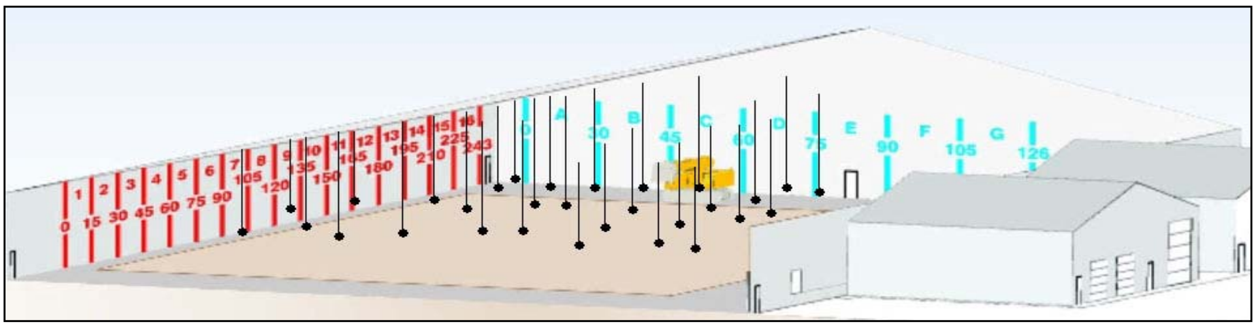


Figure 31. Excavation site suspended markers and perimeter indicators.

## 4.2 Excavation Depth

On March 20, 2004, the Accelerated Retrieval Project's construction crew unearthed the top of a waste drum at an elevation of 5,011 ft while removing what was thought to be overburden. The waste drum was encountered after removing 4 ft of topsoil. A topographical basalt map of the described area within Pit 4 is provided on Figure 32. Assuming that a layer of underburden starts at 2 ft above the highest elevation of the basalt (4,999 ft), thickness of the waste zone is estimated to be 10 ft (5,011 ft waste drum - 4,999 ft highest basalt - 2 ft underburden). The waste zone could be between 10 ft and 14 ft thick depending on the actual depth of basalt. Topographical information was obtained from the small probe cluster within the northeast corner of the described area and probes outside of the described area.

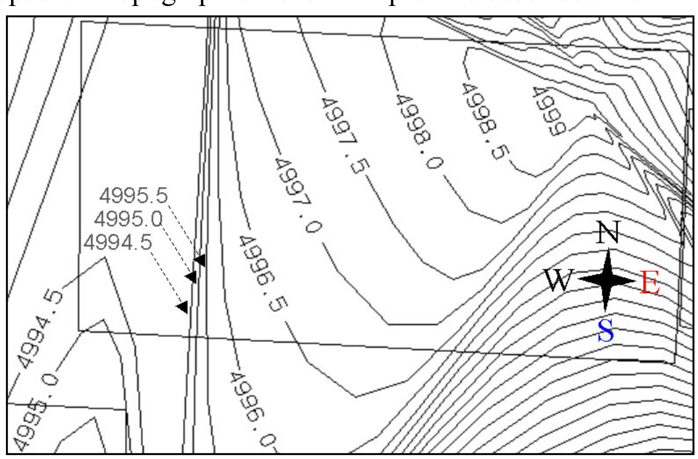



Figure 32. Topographical map of basalt based on probing data.

## 4.3 Pre-Excavation

After the top layer of clean overburden is removed from the retrieval area, the graded soil will be treated with a vinyl acrylic copolymer emulsion that binds the soil particles together so that a durable surface is available for operations. The product being proposed is Soiltac, manufactured by Soilworks, LLC in Gilbert, Arizona. After the graded soil is treated, the product will be mixed into the soil to a depth of 4 in. When cured and compacted, a hard, dust free surface is produced that can support the operation of construction equipment. After a few months of operation, a topical spray may be reapplied to restore the surface if required. Retreatment would be applied using the Gradall fixant spraying system and the backside of a bucket or other attachment to compact the loosened soil.

Five probes are located in the northeast portion of the excavation area (see figure 33). Before retrieval operations, the project will modify the existing probes by filling the probe with sand, cutting the probes off below ground level, and capping the probes with bentonite and soil (TPR-7441).

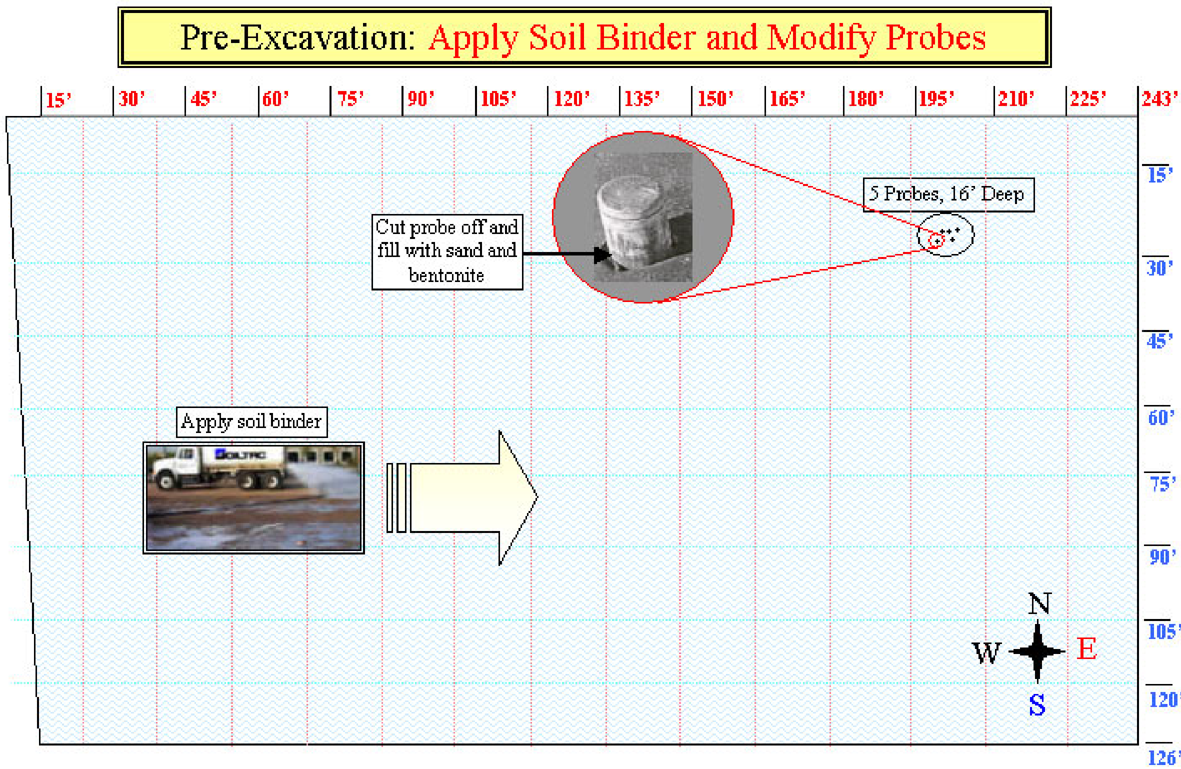



Figure 33. Pre-excavation activities.

Before the start of retrieval operations, staging of waste containers, radiological monitoring equipment, fogging and fixant systems, closed-circuit television (CCTV) systems, and sampling equipment will be performed.

## 4.4 Waste Excavation

Operators in personal protective equipment (PPE) will operate a Gradall XL-5200 excavator to retrieve material from a described area within Pit 4 (see Figure 2) into waste containers. The waste zone is expected to be 10–14 ft deep and the walls will be sloped to maintain an angle of repose of approximately 1:1 (i.e., 45 degrees). At the digface, the excavator will retrieve targeted waste (e.g., graphite, filters, sludge, uranium, and commingled soil) and place the waste in a tray with a plastic liner (soil intermixed with targeted wastes are expected within the tray). The targeted/nontargeted determination will be made by an individual assisting the excavator operator by way of CCTV cameras at the digface and mounted on the excavator. Nontargeted wastes (e.g., debris, soil, and nontargeted sludge) will remain within the excavation area. The trays of targeted waste will be transported to a drum packaging station by telehandler.

The project plans a staged excavation campaign. The staged operation will segment the excavation site into an initial trench digging campaign and a moving trench campaign. The initial trench excavates and relocates approximately one-eighth of the total pit volume and is required to open a region within the pit for the second moving trench operation. The initial trench campaign stages nontargeted wastes within the retrieval enclosure, removes targeted wastes from the pit, and collects RCRA samples. The moving trench campaign will transfer the nontargeted waste from the initial trench campaign into the pit, remove targeted wastes from the pit, relocate nontargeted waste from the east face of the pit to the west face, and collect RCRA samples.

### 4.4.1 Initial Trench (5 steps)

***Step 1.*** Starting at the west end of the designated retrieval area, a 32-ft wide 2-ft-deep layer of PCS will be removed across the entire width of the excavation area. The removed PCS is piled on the west side of the pit as shown on Figure 34. Note: This excavation plan assumes that material will be located to the west of the pit. There is no requirement that the material be placed there. Operations can decide to locate material anywhere in the Retrieval Enclosure as dictated by operational needs. It is not necessary to sample the PCS layer. Routine radiological monitoring by radiological control technicians (RCTs) will be performed during removal of the PCS layer. Periodic monitoring for VOCs or particulates may also be performed during PCS removal, as determined by the industrial hygienist.

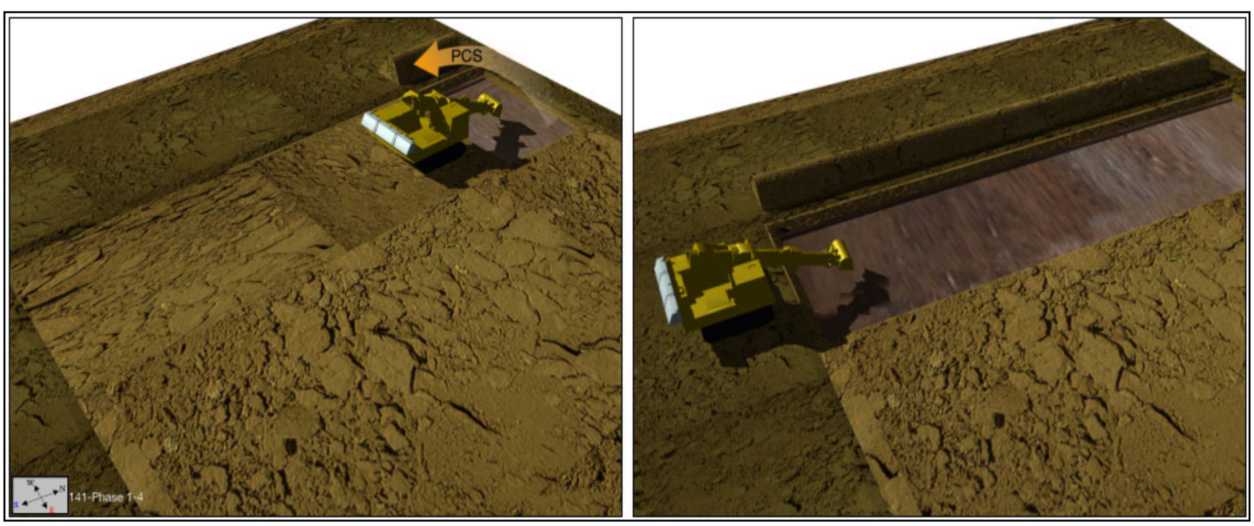



Figure 34. Initial trench formation step 1.

***Step 2.*** Following removal and relocation of PCS, the excavator will be positioned within close proximity to the PCS/waste edge as shown in Figure 35. From this vantage point a swath of waste (approximately 10 to 14 feet wide) on the western most portion of the exposed waste area will be excavated to the maximum depth allowed by the excavator. As stated previously, the waste excavation walls will be sloped to maintain an angle of repose of approximately 1:1. An operator assisting the excavator operator by way of closed-circuit television cameras will make a targeted/nontargeted waste determination. Retrieved targeted wastes (TW) are placed within TW trays and transported to a drum packaging station by telehandler. Nontargeted wastes (NTW) are staged and transported to the east end of the retrieval enclosure by telehandler.


Figure 35. Initial trench formation step 2.

***Step 3.*** Following removal of waste zone material in the west end of the trench, the excavator will be positioned approximately 10 to 14 feet away from the PCS/waste edge as shown in Figure 36. From this vantage point a swath of waste (approximately 10 to 14 feet wide) within the midsection of the exposed waste area will be excavated, in lifts, to the maximum depth allowed by the excavator. As in the previous step, the waste is segregated into targeted and nontargeted waste and placed within TW trays, or staged, respectively.

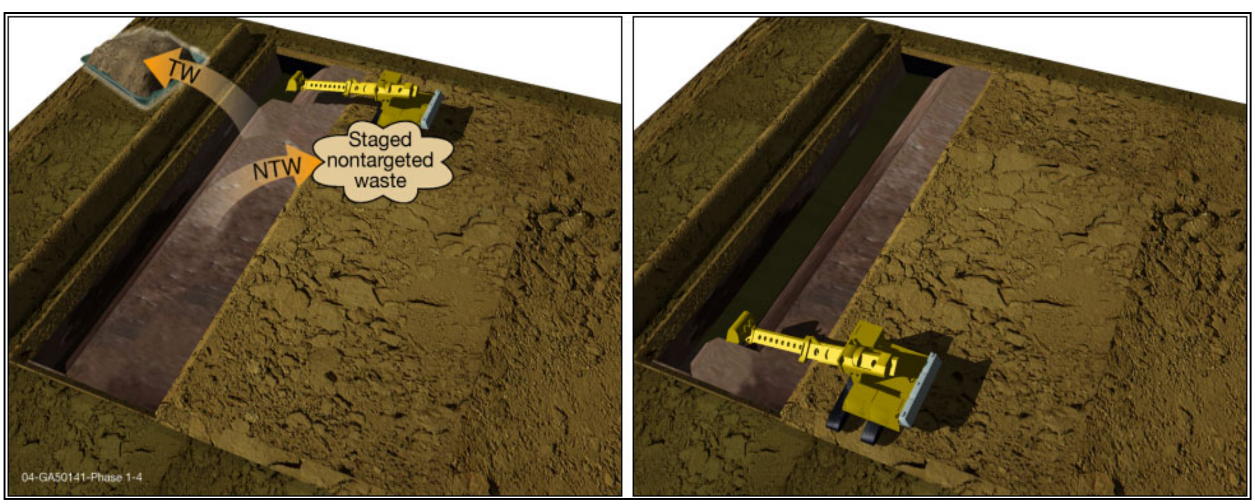



Figure 36. Initial trench formation step 3.

***Step 4.*** Following removal of waste zone material in the midsection of the trench, the excavator will be positioned approximately 20 to 28 ft away from the PCS/waste edge as shown in Figure 37. From this vantage point a swath of waste (approximately 10- to 14 ft wide) within the eastern most portion of the exposed waste area will be excavated, in lifts, to the underburden. Following this excavation step, a 6- to 10-ft wide swath of underburden should be exposed. An additional 4- to 8-ft swath of PCS and waste may need to be removed from the East face of the pit (if underburden is deeper than anticipated) to maintain a 6- to 10-ft underburden width.  As in the previous step, the waste is segregated into targeted and nontargeted waste and placed within TW trays, or staged, respectively.

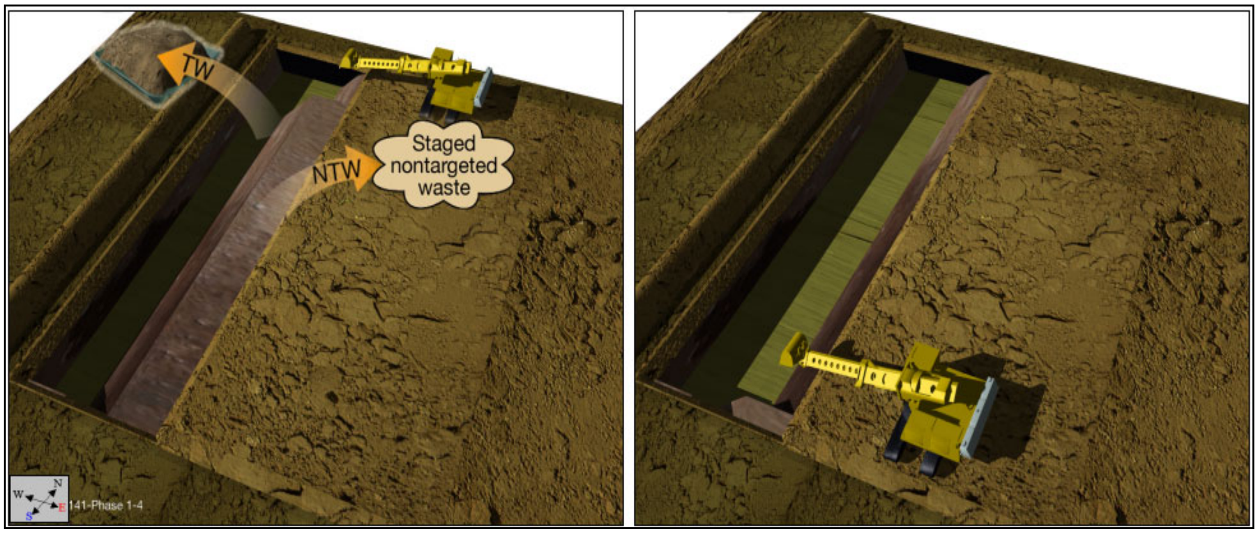



Figure 37. Initial trench formation step 4.

***Step 5.*** Following waste removal, a 5-ft-wide 2-ft-deep layer of PCS will be removed across the entire width of the excavation area. This PCS layer will be directly adjacent to the previously generated trench as shown on Figure 38. The removed PCS is added to the existing PCS pile on the west side of the pit.

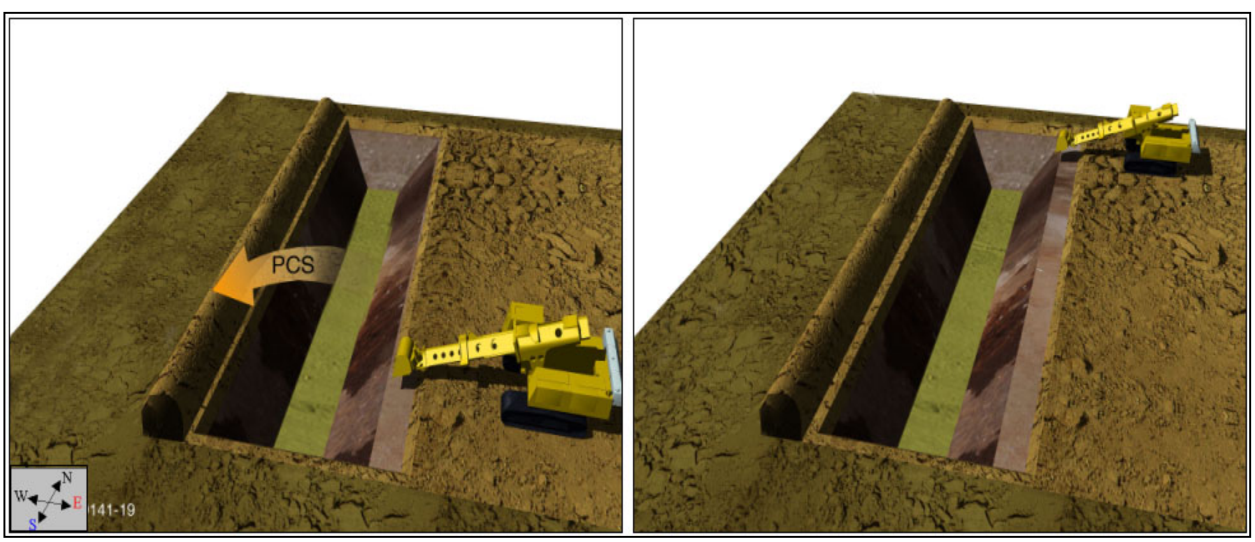



Figure 38. Initial trench formation step 5.

### 4.4.2 Moving Trench (4 repeated steps)

Once the initial waste retrieval pit has been created, waste retrieval will be accomplished by excavating targeted and nontargeted wastes on the east face of the trench while maintaining a one-to-one angle of repose and placing/compacting nontargeted wastes on the west face while maintaining a similar angle of repose. The progression of the pit is from west to east.

***Step 1.*** Maintaining an angle of repose of approximately 1:1, an approximate 2-ft-deep layer of the exposed waste shelf is excavated. An individual assisting the excavator operator by way of CCTV cameras will make a targeted/nontargeted determination. The excavators will retrieve TW and place it in a TW tray to be transported to a drum packaging station by telehandler. Nontargeted waste will be placed directly on the west face of the trench at the waste/underburden interface as shown in figure 39. The nontargeted waste (west face) is then compacted to prevent subsidence.

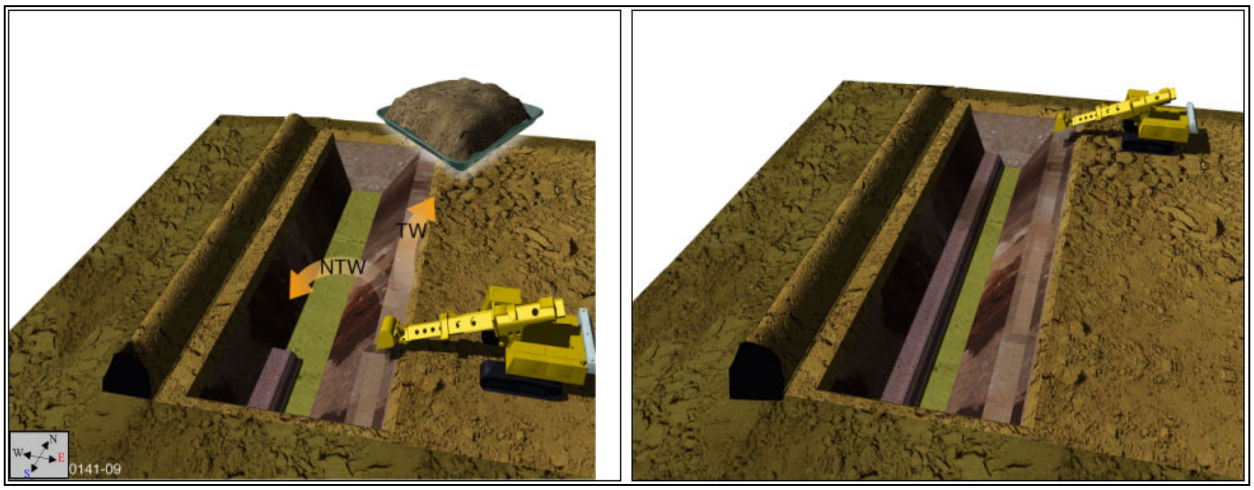



Figure 39. Moving trench formation step 1.

***Step 2.*** Following compaction of nontargeted waste, nontargeted waste (staged from the initial trench campaign) are retrieved from a staging area within the enclosure and placed on the lower newly formed nontargeted waste shelf (see Figure 40).

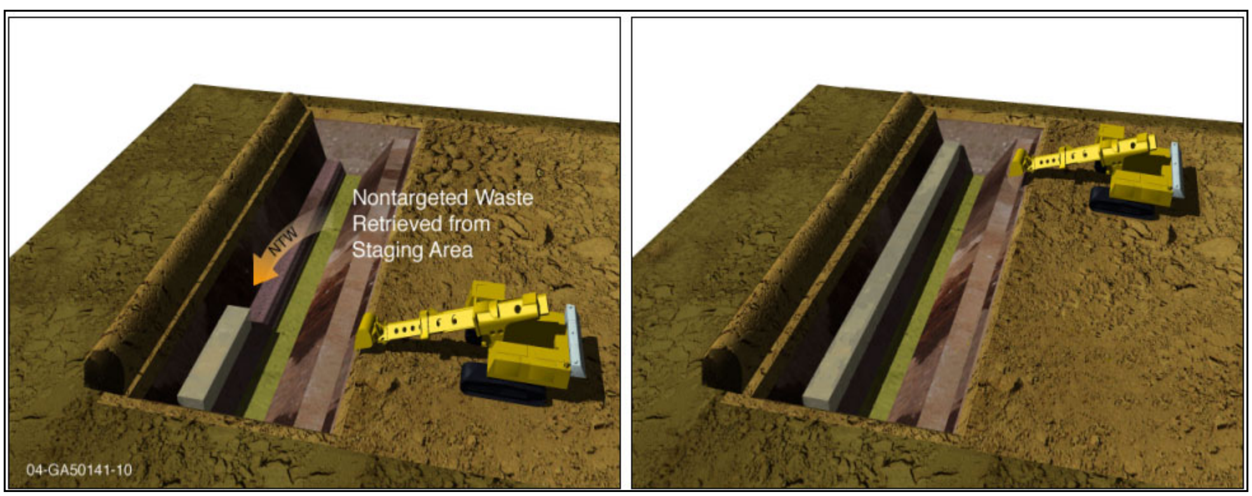



Figure 40. Moving trench formation step 2.

***Step 3.*** Maintaining an angle of repose of approximately 1:1 (45 degrees), the 5-ft-wide ledge of exposed waste zone material, on the east side of the trench, will be excavated in lifts across the entire width of the described area (see figure 41). The waste is again segregated into targeted and nontargeted waste and placed within TW trays or on the west side of the trench respectively. Figure 41 shows the last lift excavation pass made by the excavator. Following excavation, a 10-ft-wide strip of underburden should be exposed.

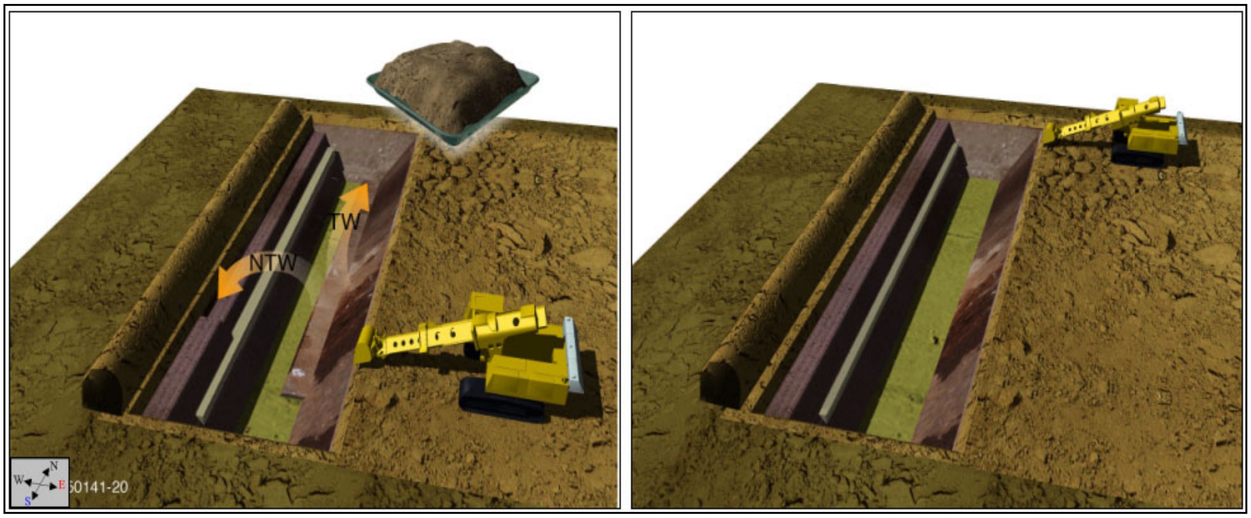



Figure 41. Moving trench formation step 3.

***Step 4.*** On the east side of the trench, a 5-ft-wide 2-ft-deep layer of PCS is removed across the entire width of the excavation area. The removed PCS is placed on top of the nontargeted waste located on the west side of the pit as shown on Figure 42. Following relocation of this PCS layer, steps 1 through 4 are repeated.

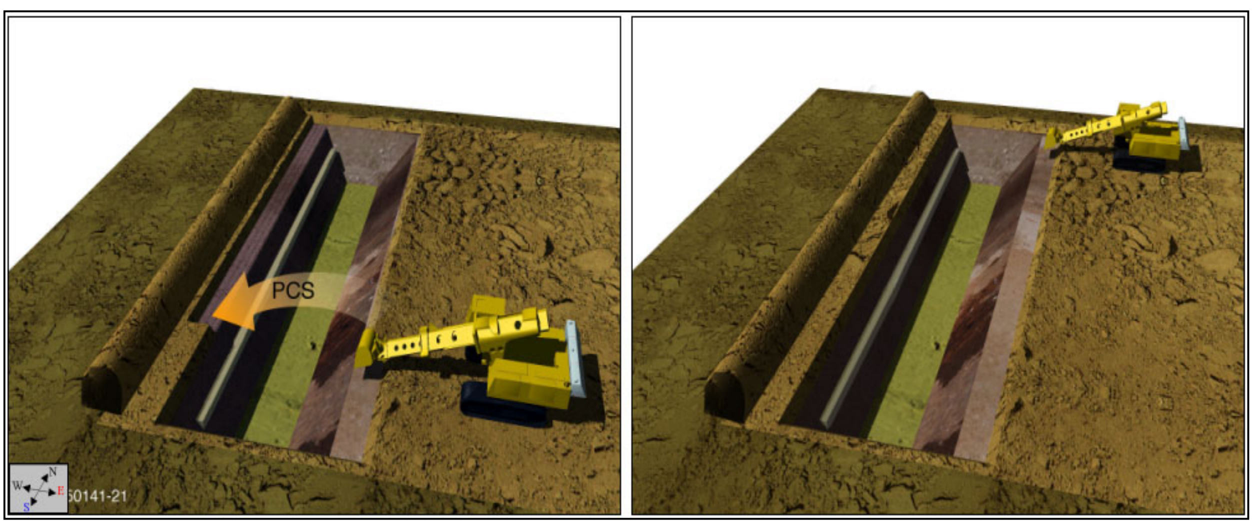



Figure 42. Moving trench formation step 4.

### 4.4.3 Completion of Retrieval

Once the retrieval campaign is complete, staged PCS and any remaining staged NTW from the initial trench campaign will be used to back fill the remaining trench (see Figure 43). Additionally, wastes removed from the facility that cannot be sent to the Waste Isolation Pilot Plant (WIPP) and have been treated for volatile organics could potentially be placed within the remaining open trench prior to backfill. In the event that the open trench volume is not completely filled with PCS, NTW, or potentially treated waste, the trench volume could be filled using several methods including:

1. Filling the open trench volume with grout using a hose penetrating the enclosure

2. Transfer of soil sacks (potentially overburden removed during construction) through the enclosure airlock

3. Upon the construction of an adjacent attached building, used for future Pit 4 excavation activities, transfer overburden from the future pit to the existing pit

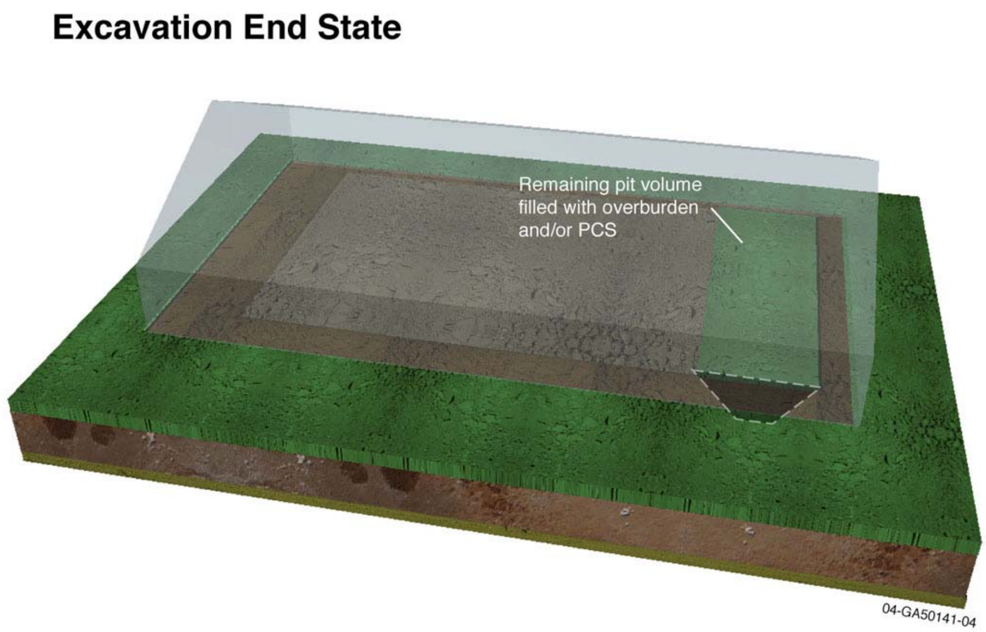



Figure 43. Final pit configuration.

## 4.5 RCRA Sampling

### 4.5.1 Samples

The approximate dimensions of the described area of Pit 4 are 243 ft × 126 ft × 12 ft deep. The initial excavation will include one-half of this area (by January 31, 2005 the Accelerated Retrieval Project will retrieve one-half of the pit), or 121 ft × 126 ft × 12 ft deep. This is approximately one-quarter acre. For RCRA purposes (WIPP acceptance), the initial 1/4 acre will be sampled. This will be accomplished by partitioning the described area into 216 cubical (15 × 15 × 4-ft) volumes within the pit and randomly selecting volumes for sampling. Each of the 216 cubical volumes within the waste zone will be assigned a number from 1 to 216. Thirty of the 216 cubical volumes will be randomly selected (using random number tables) for sampling and analysis.

### 4.5.2 Excavation Location

Sampling location, within the 30 randomly selected cubical volumes, will be identified using an x, y, z coordinate system. The location of the center of each cubical volume on the plane (i.e., x, y) will be designated. The excavator will determine the appropriate position use a bucket position monitor in concert with markers suspended from the ceiling (positioned directly above the RCRA sample locations). The z-coordinate corresponds to a depth below the top of the waste zone of 2, 6, and 10 ft. These depths are the vertical center of the three layers assuming 4-ft-thick cubical volumes and a total waste zone depth of 12 ft. In the event that the overall depth of the waste zone is not actually 12 ft throughout, the sampling location of a cubical volume in the third layer will be as close to the predetermined vertical center of that cubical volume as reasonably achievable.

### 4.5.3 Replacement Strategy

In the event that a selected cubical volume consists entirely of debris or underburden, a replacement cubical volume will be necessary. The replacement strategy entails shifting the sampling location laterally, in the direction that excavation is proceeding, until an acceptable waste form is identified. The replacement x, y, z coordinate location will be documented.

### 4.5.4 Excavation and Sample Tracking

X, y, z coordinates will be used to identify the sampling location and recognized in the day's dig plan. As the location is approached, the waste zone will be evaluated to determine the material type, (e.g. homogeneous solids [inorganic or organic waste forms] and soil/gravel or debris [combustibles, metals, glass]). With the exception of all debris materials, the waste will be excavated for sampling regardless of whether it is a targeted waste form. The excavator shovel will be used to collect approximately 5–8 cubic ft of material with the x, y, z coordinates located roughly in the center of the cubical volume. The material will be placed in a cart and tracked from the excavation site to the repackaging station, at which point chain-of-custody commences and sample collection activities will begin. Tracking at a minimum will include the x, y, z collection location and the date.

## 4.6 Maintaining Underburden

Underburden provides an absorption barrier aiding in the reduction of contaminant migration to the aquifer. Additionally, presence of a two-foot deep layer of underburden maintains the existing assumptions for transport modeling of contaminants of concern. To insure that waste excavation is complete and a two-foot deep layer of underburden remains the operator will (1) periodically take an extra scoop (approximately 2 feet deep) of what is thought to be underburden, (2) verifying that it is all soil while dumping it back into place, (3) and then tamping it back down. If waste is observed, excavation of that area is not complete. If no waste is observed, the 2-foot deep underburden requirement is verified. If rock is hit, then additional soil (PCS) will be placed on the rock outcropping to achieve a minimum 2-foot depth of underburden.

## 4.7 Return of Pit Material

Targeted wastes that have been removed from the excavation area will be visually inspected within a drum packaging station. If results from the visual inspection indicate that the material is nontargeted waste, the waste will be transported back to the excavation area and placed back into the pit.

## 4.8 Outliers

### 4.8.1 High Radiation Waste

During retrieval, high radiation waste could be encountered. If retrieved targeted wastes are found to contain high radiation levels (≥ 200 mrem/hr on contact) the preferred method of packaging the waste is into an externally shielded container for transport and storage.

### 4.8.2 Targeted Waste Under Large Objects

Inaccessible targeted wastes beneath a large object that cannot be size-reduced (i.e., broken up or sheared) or lifted safely using end-effectors will be exempted from retrieval. Targeted wastes lodged benieth a large object will be identified by name based on acceptable knowledge and the location recorded. For a list of anticipated large objects within the described area of Pit 4, see Section 3.3.1.

### 4.8.3 Existing Probes

There are five probes located in the northeast corner of the excavation area. Towards the end of the retrieval campaign, the moving trench will encounter the probes. These probes will be removed as they are encountered and placed within the pit.

# 5. SEQUENTIAL PROCESS NARRATIVE

The Accelerated Retrieval (AR) Project provides a method for performing a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) non-time critical removal action to retrieve and manage the TRU material buried in Pit 4 at the RWMC. As shown in Figure 44, the retrieval process consists of:

- Removing clean overburden – subcontractor performed
- Excavating a soil layer declared as potentially contaminated soil
- Excavating the waste zone material and separating targeted waste (i.e., filters, sludges, graphite, uranium) from nontargeted waste
- Leaving nontargeted materials (PCS and nontargeted waste) in the excavation area
- Visual examination (VE) and packaging of targeted waste in containers (e.g., 55-gal drums)
- RCRA random sampling of the excavation site per agreement with WIPP.
- Assaying and segregating the material into: (1) TRU (>100 nCi/g), (2) non-TRU (<100 nCi/g) waste suitable for load managing to WIPP, (3) and non-TRU waste streams that are not suitable for load managing to WIPP
- Load managing suitable non-TRU waste
- Performing headspace gas sampling on TRU and load managed drums
- Performing gas generation testing (GGT) on drums that exceed the allowable headspace gas sampling thermal wattage limit
- Performing GGT on drums that contain test category waste
- Performing limited VOCs treatment of drums that failed GGT
- Shipping the packaged TRU material to WIPP

The waste retrieval work will occur in a large fabric enclosure constructed over the retrieval area to minimize contamination spread and provide protection from the weather.

Each process section provides a step-by-step overview describing how Operations will carry out a particular process cycle. This section describes the sequential process steps presented in the process logic diagrams within Appendix B. Heading numbers within this section correlate to the appropriate block numbers in Appendix B. Graphics used at the beginning of each subsection are taken from the process logic diagrams in Appendix B, and illustrate the point at which the process is operating. Prerequisites are included within each subsection. The prerequisites will be expanded in greater detail as operational procedures are generated.

The process flow diagrams and narratives do not bind operations to specific process strategies; rather they provide a project overview. Project operations can use these narratives to develop operating procedures. As these procedures develop they will supercede this narrative.

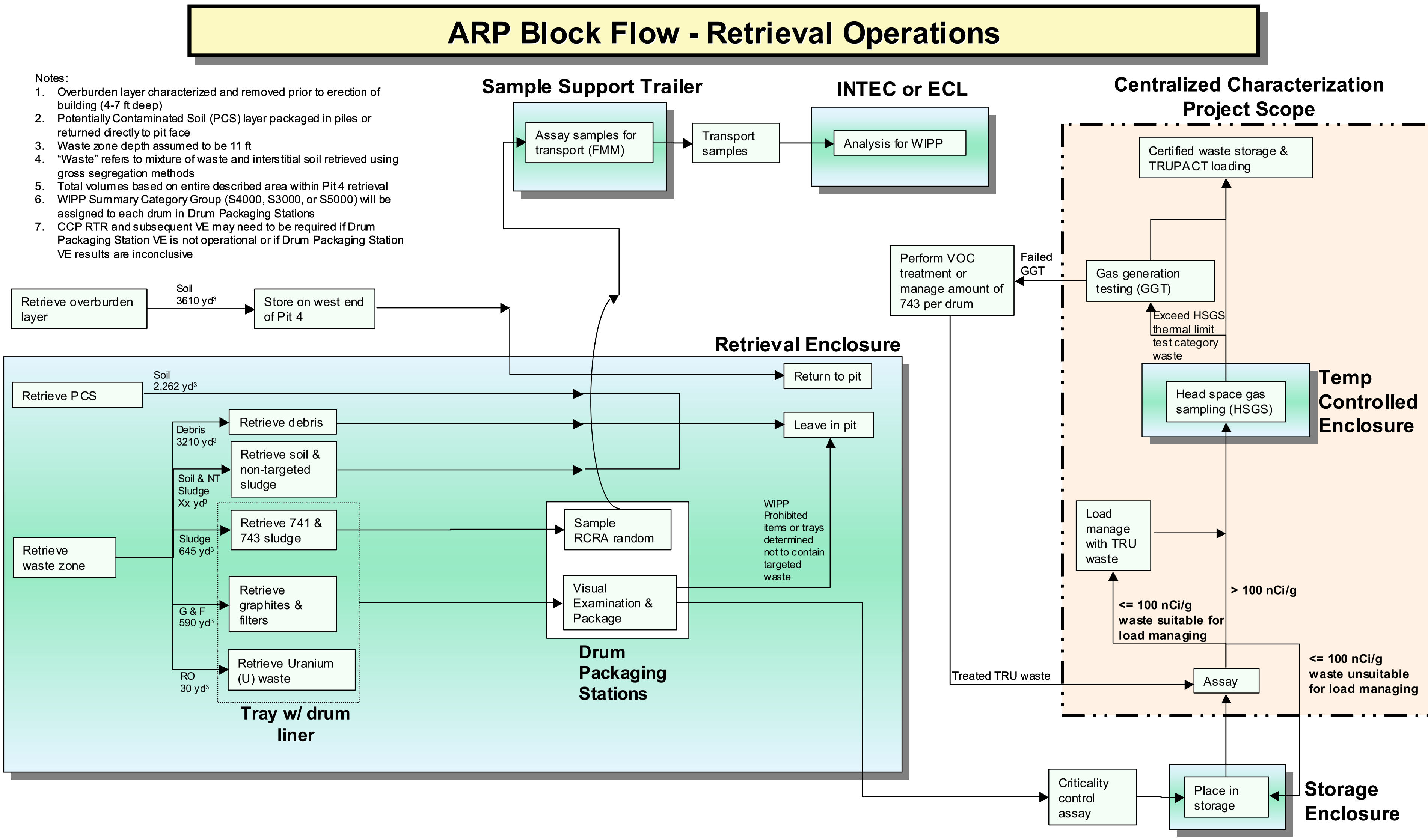
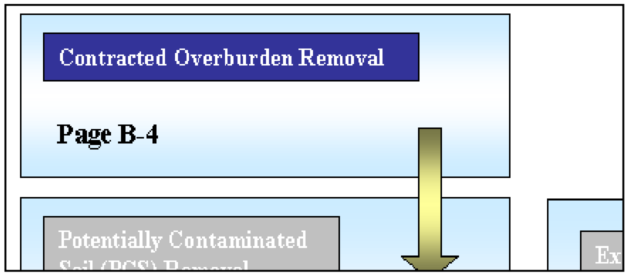



Figure 44. Simplified AR Project flow diagram.

## 5.1 Contracted Overburden Removal




Removing the overburden layer minimizes the time required to excavate the described area within Pit 4. Thereby, reducing the radiological exposure to radiological control (RadCon) personnel and equipment operators.

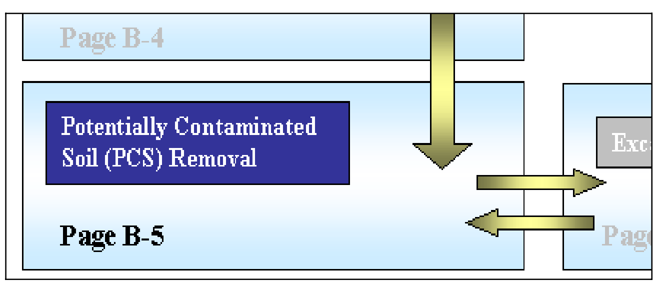
**Prerequisites**

- Subcontract activities are complete
- DOE Idaho Operations Office authorizes Idaho Completion Project (ICP) to proceed with removing overburden.

**Subcontracted Activities**

As part of the Retrieval Enclosure (RE) construction activity, the subcontractor will remove the first 2–4 ft of overburden soil, in bulk, from the described area within Pit 4. Furthermore, the subcontractor will place the overburden soil away from the area designated for Retrieval Enclosure construction. When overburden removal is complete, the subcontractor will apply a fixant to the overburden pile(s) that limits dust/dirt migration.

## 5.2 Potentially Contaminated Soil Removal




**Prerequisites**

- Gradall excavator is in place and prepared for operation
- Telehandler is in place and prepared for operation
- Waste containers are staged

- Accelerated Retrieval Project operators (ARPOs), RCTs, and heavy equipment operators (HEOs) are available and dressed in appropriate PPE

- Closed-circuit television equipment is available and prepared for operation

- Air handling/ventilation unit is prepared for operation

- Sampling equipment is available and prepared for operation

- Sampling analysis equipment is available and prepared for operation

- Monitoring equipment, including RadCon and Industrial Hygiene, are available and prepared for operation

- RE floor is graded with fixant applied.

**General**

The initial effort to retrieve waste from the excavation area will begin with removal of approximately 2 ft of PCS that lies directly atop the waste. Using the Gradall excavator, the HEO will scrape and lift PCS from a predetermined area, without driving the excavator bucket directly on the waste. The PCS will either be deposited near the west wall of the retrieval enclosure or used as a cap for nontargeted waste material left within the pit.

**Activities**

The following subsections define the sequential activities to be performed during excavation of the PCS. Activities within these subsections do not bind Operations to specific process strategies; rather they provide a project overview. Accelerated Retrieval Project Operations can use these narratives to develop operating procedures. As these operating procedures develop, they will supercede this narrative. The following subsection numbers correlate to numbers found within the "Potentially Contaminated Soil (PCS) Removal" flow diagram in Appendix B, page B-5.

### 5.2.1 Stage Supplies and Equipment

- As necessary, Radiological Control and Industrial Hygiene personnel monitor the RE and the airlock prior to allowing personnel entry into the RE (ensuring radiological work permit and operations requirements are met) or airlock.

- Equipment operator(s) perform preoperational checks on support systems including but not limited to breathing air, heating and ventilation, CCTV, and dust suppression systems.

- Equipment operator(s) don and check PPE.

- The heavy equipment operator(s) enters the airlock and completes any additional preoperational checks for the Gradall excavator, telehandler, and support systems, including determining if equipment refueling or dust suppression system refilling is required.

- As required, equipment operators perform equipment refueling or dust suppression system refilling operations.

- Once all checks are completed, equipment operator(s) start the excavator and/or the telehandler and drives it into the RE.

### 5.2.2 Prepare Digface and Scoop PCS

- Using the Gradall excavator, the HEO prepares the digface PCS and removes scoops of PCS. If HEO unearths waste, and the PCS layer is not fully removed from the target area, then the HEO returns the excavated PCS and swings the excavator boom to a new location, within the target area, and pulls a different scoop containing PCS.

- If the HEO unearths waste, and the PCS layer is fully removed from the target area, then the HEO will begin waste zone retrieval.

### 5.2.3 Placement of PCS Material

- The HEO must decide where retrieved PCS material is to be placed. If the PCS material being removed from the excavation area is part of the initial trench, then the HEO places the PCS scoop in the designated staging area on west side of pit.

- If the PCS material being removed is not from the initial trench, then the HEO places the PCS scoop as a covering over materials remaining within the digface. The HEO determines where to place the PCS, visually or via communication with an operator using CCTV views.

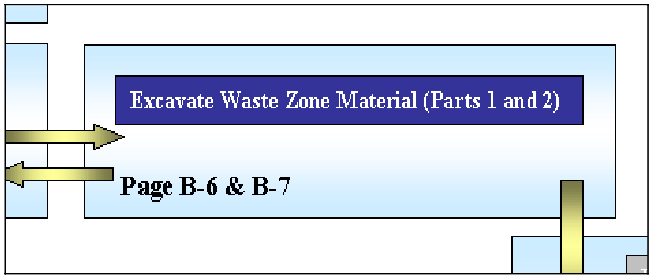
- As needed, the HEO using the excavator compacts the PCS placed on the waste material. After compaction, the HEO may apply soil fixant to the compacted PCS's surface, again as required.

### 5.2.4 Additional PCS Removal Needed

- If additional PCS material remains in the target area, then the HEO will return to Step 5.2.2 and obtain an additional scoop of PCS material.

- If all PCS material is removed from the target area, then the HEO begins retrieving waste zone material.

## 5.3 Excavate Waste Zone Material




**Prerequisites**

Similar prerequisites are required for waste zone material excavation as were performed for PCS removal (see Section 5.2.1). In addition, preoperational checks will be made of the packaging stations and associated supplies.

**General**

An AR Project HEO will excavate a swath of waste zone material (WZM), approximately equal in width to the PCS just removed. Targeted waste will be loaded directly into waste handling trays, while nontargeted waste will be staged during the initial trench formation and will be placed on the opposite digface during the moving trench campaign.

Retrieval begins at the west end of the excavation area and will proceed east. Preselected RCRA/WIPP samples will be retrieved as designated in the project sampling plan. The excavator operator will maintain a digface angle of repose of about 1:1.

The Equipment Operators (EOs) will control digface dust by using a water-based, process-compatible fixant, which they will apply to exposed waste before and during excavation.

In addition, EOs will use a dust suppressant to mitigate airborne contamination at the digface and when moving and dumping a filled bucket into the trays. Using controls inside the excavator cab, the equipment operator will disperse the fixant and fog from the telescoping boom.

During the retrieval process, targeted waste (filters, sludges, graphite, and uranium) will be identified by visual examination at the digface. The EO will place this waste into trays that will be moved by telehandler from the RE to a drum packaging station, at which time further visual examination will take place. Acceptable targeted waste will then be packaged in 55-gal drums and prepared for assay; any needed decontamination will be completed. Nontargeted, non-RCRA sample waste will not leave the enclosure.

After decontamination, EOs will transport the drums to the assay system trailer(s). EOs will continue waste zone material excavation to the underburden soil.

In addition, during excavation activities RCRA/WIPP samples will be taken to support WIPP acceptance. X, y, z coordinates will be used to identify the sampling location and be recognized in the day's dig plan. As the location for sampling is approached, the waste zone will be evaluated by the HEO and support personnel viewing the digface via CCTV to determine the material type (e.g., homogeneous solids [inorganic or organic waste forms] and soil/gravel or debris [combustibles, metals, glass]). With the exception of all debris materials, the waste will be excavated for sampling regardless of whether it is a targeted waste form. The excavator shovel will be used to collect approximately 5–8 $ft^3$ of material with the x, y, z coordinates located roughly in the center of the cubical volume. The material will be placed in a tray and tracked from the excavation site to the packaging station, at which point chain-of-custody commences and sample collection activities will begin. Tracking at a minimum will include the x, y, z collection location and the date.

**Activities**

The following subsections define the sequential activities to be performed during waste zone material excavation. Activities within these subsections do not bind operations to specific process strategies; rather they provide a project overview. Project operations can use these narratives to develop operating procedures. As these operating procedures develop, they will supercede this narrative. The following subsection numbers correlate to numbers found within the "Excavate Waste Zone Material (Part 1) and Excavate Waste Zone Material (Part 2)" flow diagrams in Appendix B, pages B-6 and B-7.

### 5.3.1 Stage Supplies and Equipment For Initial Excavation

- ARPOs, EOs, and RCTs will stage needed process equipment and supplies inside the RE and/or airlock as needed.

- Personnel will perform preoperational checks similar to those outlined in Step 5.2.1.

### 5.3.2 Move Tray(s) to Digface

- Equipment operators or ARPOs will move and place needed trays for targeted waste near the excavator, if not previously done in staging supplies (see Step 5.3.1).

### 5.3.3 Move Sampling Probes

- As excavation continues, sampling probes will need to be moved to allow waste retrieval activities. When a probe is encountered, the EO will attach the needed end-effector to the excavator in order to grapple and move the sampling probe to the pit.

### 5.3.4 Scan Digface for Targeted Waste – RCRA/WIPP Sample Location

- To gather information about the waste zone material, the EO will visually scan the digface for signs of nontarget candidate material, or for targeted waste material (e.g., filters, sludges, graphite, uranium). In addition, to augment visual scanning, the EO will feed images into the closed-circuit television system, while a Shift Supervisor (SS) and Operations Foreman (OF) designee look for indications of targeted waste.

- Before taking a scoop of waste zone material, the OF/HEO will determine if the area to be excavated has been selected as a RCRA/WIPP sample location. For RCRA purposes (WIPP acceptance), the excavation area (approximately 1/4 acre) will be sampled. This will be accomplished by partitioning the excavation area into 216 cubical (15 × 15 × 4-ft) volumes within the pit. Thirty of the 216 cubical volumes will be randomly selected (using random number tables) for sampling and analysis. Sampling location within the 30 randomly selected cubical volumes will be identified using an x, y, z coordinate system. The location of the center of each cubical volume on the plane x, y will be designated. The excavator will determine the appropriate position use a bucket position monitor in concert with markers suspended from the ceiling (positioned directly above the RCRA sample locations). The z-coordinate corresponds to a depth below the top of the waste zone at 2, 6, and 10 ft. These depths are the vertical center of the three layers assuming 4-ft-thick cubical volumes and a total waste zone depth of 12 ft. If the overall depth of the waste zone is not actually 12 ft throughout, the sampling location of a cubical volume in the third layer will be as close to the predetermined vertical center of that cubical volume as reasonably achievable.

- If a selected cubical volume consists entirely of debris or underburden, a replacement cubical volume will be necessary. The replacement strategy entails retrieval of cubical volume immediately to the north of the unacceptable cubical volume. If this cubical volume is also unacceptable, selection will continue clockwise around the first unacceptable cubical volume until an acceptable cubical volume for sampling is found.

- If the area to be excavated is a RCRA/WIPP sample location, then the HEO using the excavator will take a scoop of material in the described area as described above. It should be noted that a scoop of material from the sample location will be taken and placed in a tray, regardless of whether "targeted waste" has been identified.

- If a RCRA/WIPP sample is taken, x, y, z coordinates of the sampling location will be recorded along with the date. As mentioned at the front of this section, as the sample location is approached, the waste zone will be evaluated to determine the material type, (e.g., homogeneous solids [inorganic or organic waste forms] and soil/gravel or debris [combustibles, metals, glass]). With the exception of all debris materials, the waste will be excavated for sampling regardless of whether it is a targeted waste form.

### 5.3.5 Scan for Free Liquids and Handle Appropriately When Digging into the Waste Zone

- If uncontained free liquids are found during retrieval, the free liquid will be allowed to absorb naturally into the ground, or surrounding soil will be used to absorb the liquid.

### 5.3.6 Scan Digface for Outliers, High Radiation Material/Objects, Extra Large Objects and Heavy Objects

- As the EO pulls waste from the dig area, the EO searches (both visually and with CCTV) for items that are considered outliers, high radiation objects, extra-large objects, or objects that appear unusually heavy. If any of these items are unearthed, special-case processing is invoked.

### 5.3.7 Size or Vent Large Sealed Container, Box, or Drum

- If the excavator operator unearths a sealed container (other than a compressed gas cylinder), sealed box, or intact drum, then the excavator operator, with direction from an SS or OF, will attach the proper excavator end-effector to the Gradall and either size or puncture (vent) the object. Special-case processing may be invoked, in which case other procedure(s) will need to be consulted, depending on the situation.

### 5.3.8 Retrieve Scoop of Candidate Targeted Waste Zone Material or RCRA/WIPP Sample

- If the waste to be excavated comes from a location designated for RCRA sampling, regardless of whether the candidate waste is targeted or not, the EO will take a scoop of the material and place it onto a tray.

### 5.3.9 Additional Waste Zone Material Accessible?

- Once candidate waste zone material is placed onto a tray, the EO returns the excavator to the digface and determines if additional WZM is accessible from the current position.

- If additional WZM is accessible, the HEO using the telehandler places a new lined tray near the excavator for the next load of targeted waste or for a RCRA/WIPP sample load. Proceed to Excavate WZM (Part 1) process.

- If additional WZM is not accessible, proceed to maintaining underburden section 5.3.15

### 5.3.10 Transport Tray to Drum Packaging Station

- The HEOs move the waste via telehandler to the Drum Packaging Station for the Package and Transport Waste Process (see Step 5.4).

### 5.3.11 In Initial Trench?

- If excavating in the initial trench, then digface material that is determined to be nontargeted waste is staged and transported to the interior northeast corner of the enclosure.

- If on the other hand, the initial trench has been excavated, then nontargeted wastes removed from one face of the pit are placed on the opposite face.

### 5.3.12 Nontargeted Waste Return

- The excavator operator takes a scoop of the nontargeted waste and places it on the opposite side of the digface, assisted as needed by CCTV views.

- As needed, the excavator operator compacts the transferred material until there are no voids.

### 5.3.13 Nontargeted Waste Return

- The excavator operator, with assistance from the SS/OF, determines if nontargeted waste can be placed near the bottom of the pit. Nontargeted waste is placed within the pit, as space is available.

- If space is available for nontargeted waste, the HEO retrieves the waste from temporary storage at the east end of the RE and places it near the excavator.

- ARPOs will make necessary connections for transferring nontargeted waste into the pit.

- The EO using the excavator will lift and place the nontargeted waste into the designated location in the pit.

- If no space is available for placing nontargeted waste in the pit, the excavator operator returns the excavator to the pit digface and determines if additional waste material is accessible for retrieval.

- If additional WZM is accessible, the HEO using the telehandler places a new lined tray near the excavator for the next load of targeted waste or for a RCRA/WIPP sample load. Proceed to Excavate WZM (Part 1) process.

- If additional WZM is not accessible, proceed to maintaining underburden section 5.3.15

### 5.3.14 Staging of Nontargeted Waste

- If nontargeted waste is identified and excavation is in the initial trench, then there is no place in the pit to put the waste. Therefore, the excavator operator will stage the nontargeted waste for transport to the interior northeast corner of the enclosure.

- The HEO transports the staged NTW, via telehandler, to the designated storage area at the east end of the RE and places the NTW as directed by the SS/OF.

- If additional WZM is accessible, the HEO using the telehandler places a new lined tray near the excavator for the next load of targeted waste or for a RCRA/WIPP sample load. Proceed to Excavate WZM (Part 1) process.

- If additional WZM is not accessible, proceed to maintaining underburden section 5.3.15

### 5.3.15 Maintaining Underburden

- To insure that underburden has been reached and to insure that a 2-ft deep underburden layer exists, the excavator periodically (approximately every 10 to 15 feet) retrieves a 2-ft deep scoop of underburden.

- The excavator operator inspects the underburden scoop for waste while dumping it back into place.

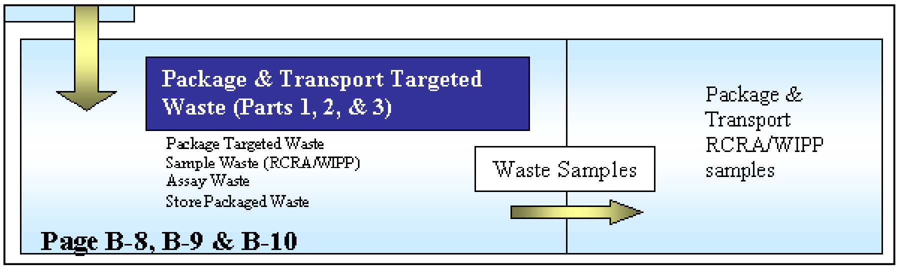
- If the underburden scoop does contain waste, the HEO using the telehandler places a new lined tray near the excavator for the next load of targeted waste or for a RCRA/WIPP sample load. Proceed to Excavate WZM (Part 1) process.

- If the underburden scoop does not contain waste and is 2 ft in depth, the excavator tamps the underburden down and checks the digface for additional waste zone material. Excavator operator determines if additional PCS material is available to be removed.

- If the underburden scoop does not contain waste and is less than 2 ft in depth, PCS is retrieved from the west end of the enclosure, added to the underburden layer, and tamped down. Excavator operator determines if additional PCS material is available to be removed.

- The excavator operator proceeds with PCS removal (see Step 5.2.1), moving the excavator as needed to accomplish the task. This process is repeated as necessary until no further WZM or PCS is accessible. If no more PCS or WZM remains in the retrieval area, then proceed to completion of retrieval.

## 5.4 Package and Transport Targeted Waste




**Prerequisites**

- RadCon air sampler is set up.
- The HEPA vacuum has a current in-place leak test.
- Weigh station has a current INEEL calibration sticker.
- Torque wrench with a range of 0–100 ft-lb is available, with current calibration.
- Tools and supplies are property staged.
- Items used for changing out drums are identified as quality significant by having legible quality assurance (QA) number marked on them with permanent marker. These items include: Drum assembly (QL-2) and Drum bags (QL-2).

**General**

The packaging and transportation of targeted waste encompasses several activities, as follows: visual examination of waste-filled trays; RCRA/WIPP sampling of preselected waste in accordance with the WIPP/RCRA Field Sampling Plan[b]; drum changeout activities; packaging of acceptable waste into drum; and transport to the sample support trailer for drum assay.

**Activities**

The following subsections define the sequential activities to be performed during the packaging and transportation of targeted wastes. Activities within these subsections do not bind operations to specific process strategies; rather they provide a project overview. Project operations can use these narratives to develop operating procedures. As these operating procedures develop, they will supercede this narrative. The following subsection numbers correlate to numbers found within the Package & Transport Targeted Waste (Part 1), Package & Transport Targeted Waste (Part 2), and Package & Transport Targeted Waste (Part 3) flow diagrams in Appendix B, pages B-8, B-9, and B-10.

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b. Arbon, Rodney, 2004, *WIPP/RCRA Field Sampling Plan for the Accelerated Retrieval Project for a Defined Area Within Pit 4*, ICP/EXT-04-00329, Idaho Completion Project, Rev. Draft.

### 5.4.1 Place Tray in Available Drum Packaging Station

- HEO/EO places tray of targeted waste or RCRA/WIPP sample material in the next available packaging station (there are six packaging stations)

### 5.4.2 RadCon Survey 1

- Radiological levels are monitored in two locations prior to the Drum Packaging Station operations. First, a reading is taken through a window prior to allowing the tray into the packaging station. Second, once inside the Drum Packaging Station a near contact reading of the waste is taken.

- If Radiological levels are high (predetermined mRem at the window and 200 mRem near contact), then the contents are analyzed for the presence of Americium. If Americium is not present the ARPO will request the telehandler remove the tray from the packaging station. The SS or OF along with radiological engineers will determine need to either add shielding or return the item to the pit. If Americium is present, the SS or OF along with radiological engineering will determine the shielding need for subsequent Drum Packaging Station processing.

### 5.4.3 RCRA/WIPP Sample?

- If the waste in the tray was identified as a RCRA/WIPP sample scoop, then the ARPO will sample the waste, based on the Sampling Plan (see footnote b).

### 5.4.4 Bag-in Sampling and Decontaminate Materials

- The ARPO will bag-in sampling and decontamination supplies to support sampling activities, if required

### 5.4.5 Sample Waste

- The ARPO will load sample bottle and enter sample information on sample tracking form

- If the waste from which the sample is taken is placed in a drum, then enter the drum ID information on sample tracking form.

### 5.4.6 Prepare and Transport Sample Bottle

- Decontaminate sample bottle and remove sample from packaging station

- Sample is transported to sample support trailer and placed in the fissile material monitor (FMM)

- Sample is assayed for transportation (FMM or hyper-pure germanium [HPGe] counter)

- The ARPO will package sample(s) and transport to INTEC or Environmental Chemistry Laboratory (ECL).

### 5.4.7 Targeted Waste Present?

- If no targeted waste is found in the tray, then the ARPO will complete the examination record and notify the OF

- Using a telehandler, the EO will remove the waste tray from the packaging station and return it to the pit.

### 5.4.8 Visually Examine Contents and Initiate VE Record

- The VE technician with assistance from ARPO will examine the tray of waste

- After the VE technician determines waste stream identity, the waste stream information is recorded on a VE data form and the waste is dispositioned per OF direction

- The VE technician will examine the waste for presence of free liquids and outliers.

### 5.4.9 Free Liquids

- The ARPO will use soil to absorb free liquid encountered within the packaging station.

### 5.4.10 Outliers Present?

- If outliers are present, then the ARPO will place them in described area

- The ARPO will stop activities and notify the OF (see Contingency Plan, PLN-114[c])

- Special handling procedures are followed per OF direction.

### 5.4.11 Rig Tray Liner

- ARPOs will rig the drum liner, which may include grabbing the eyelets, shaking the liner and securing the eyelets together on the hoist hook

- Move the hoist a few feet down the station to the drum port hole

- Ensure drum port hole is open, and that funnel is lowered over drum for contamination control, then position the liner package directly over the open hole, under which sits the previously staged empty drum.

### 5.4.12 Package Waste

- The ARPO will place the tray liner and contents into a prepared drum

- The ARPO will clean up glovebox equipment, if required.

### 5.4.13 Complete Visual Examine Record

- After the ARPO places the waste within the drum, the VE technician will record the drum weight and complete, print, and sign the VE data form

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[c] PLN-114-3-TBD, 2004, "Emergency Preparedness - Addendum 3 Radioactive Waste Management Complex RWMC - Accelerated Retrieval Project," *Manual 16A-3 - Emergency Preparedness - RWMC Addendum*, Rev. Draft, Idaho National Engineering Laboratory, 2004.

- If weight estimates are dramatically different (i.e. factor of 2) than the actual weight, the ARPO may be required to remove materials from the drum for VE reevaluation.

#### 5.4.14 Packaging Station Housekeeping

- The ARPO will clean tray, if needed
- The ARPO will install a new tray liner, if needed
- Using telehandler, EO will remove the tray from the packaging station and stage in RE.

#### 5.4.15 RadCon Survey 2

- RadCon engineering will survey the exterior of the drum to insure contact handled radiation fields. If drum fields are too high, drum shielding will be installed.

#### 5.4.16 Rotate Drum

- The ARPO will rotate the drum, thereby twisting the bag.

#### 5.4.17 Insure Local Ventilation Turned On

- The ARPO will position the vacuum hood over bag cutting tool and around bag cut area.

#### 5.4.18 Cut Bag and Tape Cut Ends

- The ARPO will place zip ties on twisted bag, allowing space between zip ties for cutting the bag
- The ARPO will take a bag cutting tool and cut the bag between the zip ties
- An RCT hold occurs until an RCT performs a contamination survey on bag ends, cutting tool, and vacuum hood.

#### 5.4.19 RadCon Survey 3

- RadCon engineering will take smears of the bag stubs and cutting tools. If contamination is too high, the RCT will notify the RadCon Forman and OF for guidance.

#### 5.4.20 Place Lid on Drum, Secure Locking Ring, and Weigh

- After ensuring drum filter is positioned away from personnel, the ARPO will seal drum as follows:
    - Compress bag into drum
    - Ensure barcode numbers on lid and drum match
    - Place lid on drum and secure locking ring
    - Ensure drum closure date is recorded.
- Following lid attachment, the drum is weighed for CERCLA waste labeling purposes.

#### 5.4.21 RadCon Survey 4

- RCT will perform drum survey and collect smears
- RCT will perform count on drum smears
- If smears show contamination, then The ARPO will decontaminate drum.

#### 5.4.22 Label Drum

- If drum weighs more than 700 lb, The ARPO will place two weight stickers on drum about 180 degrees apart on top one-third of drum
- Also, if drum weighs more than 700 lb, The ARPO will place three “greater than 700 lb” labels on drum about 120 degrees apart on bottom third of drum
- RCT will ensure all applicable radiological stickers are on the drum
- The ARPO will label drum with CERCLA and hazardous waste label.

#### 5.4.23 Drum Processing

- The ARPO will move full drum to next airlock bay
- Next, ARPO torques the locking ring bolt to at least 75 ft-lb and tightens the jam nut tight against threadless lug
- The ARPO places tamper-indicating device (TID) on drum locking ring bolt, per INEEL waste acceptance criteria
- The Data Recorder will ensure TID number is recorded on drum tracking form
- The ARPO will stage the drum for transfer to assay trailer.

#### 5.4.24 Prepare New Drum

- The ARPO will place new bag and tray liners into new drum, as needed
- The ARPO will attach the drum filter into the lid of the drum
- The ARPO will place a barcode label on the drum
- RCT will inspect and approve the drum bag liner installation
- The ARPO will make necessary adjustments per RCT direction.

#### 5.4.25 Begin Bag Attachment to Drum Port

- The ARPO will attach the drum bag to the bottom of the drum port.

### 5.4.26 Remove Old Bag Stub and Place in Drum

- The ARPO will remove the old drum bag stub and place it in the newly positioned drum, ensuring bag glove sleeves are outside drum bag.

### 5.4.27 Complete Bag Attachment to Drum Port

- The ARPO will complete bag attachment to drum port, ensuring bag integrity is maintained.

### 5.4.28 Remove Drum Contents, If Any

- The ARPO will remove the preinstalled packaging station supplies from the drum (for example, tray liners, sample bottles, other supplies).

### 5.4.29 Transport Drum to Assay Trailer

- Using telehandler, HEO/EO will transport drum to assay trailer.

### 5.4.30 Assay Drum for Criticality Safety

- Drum assay will be performed by subcontractor to determine fissile content.

### 5.4.31 Criticality Safety Determination

- If drum assay results are >380 fissile-gram equivalent (FGE), then special storage conditions are required.

### 5.4.32 Transport Drum to Temporary Storage

- EO will transport the assayed drum to the Storage Enclosure for temporary storage.

### 5.4.33 Transport Drum to Central Characterization Project

- When the Central Characterization Project (CCP) is ready to accept drums for processing, an EO will transport a drum to the CCP facility.

### 5.4.34 TRU Determination

- TRU determination is made of the drum contents by CCP. Waste drums determined to have activities >100nCi/g are considered TRU waste.

### 5.4.35 Waste Suitable for Load Managing to WIPP?

- Drums that are <100 nCi/g are evaluated for suitable load manage criteria. Load managing criteria include:

  1. Waste must contain transuranic isotopes at concentrations that exceed the lower limit of the assay detection unit

  2. Waste must have originated from a defense transuranic waste stream

3. Plutonium equivalent (PE)-Ci and FGE concentrations must be within WIPP acceptable limits.

### 5.4.36 Load Manage with TRU Waste in SWBs

- Drums that meet the requirements for WIPP load management will be load managed with TRU waste in standard waste boxes (SWBs) and sent to either real-time radiography (see step 5.4.38) or head space gas sampling (see step 5.4.39).

### 5.4.37 Place in Storage

- Drums that do not meet the criteria for load managing will be transported via telehandler to the Storage Enclosure. These waste forms will remain in the storage enclosure awaiting additional testing for final disposition.

### 5.4.38 Real-Time Radiography (Optional)

- Real-time radiography (RTR) will be performed on drums with >100 nCi/g if the VE testing performed within the Drum Packaging Station is inconclusive or if the VE testing is not operational

- If the drum passes RTR, then headspace gas sampling can be performed (see Step 5.4.39)

- Once a drum passes RTR, then a QA sample is taken and examined

- Drums that fail RTR are visually examined and then repackaged such that they are acceptable to WIPP

- QA samples from drums that pass RTR are also examined for WIPP acceptance.

### 5.4.39 Obtain Headspace Sample

- Drums are moved into a temperature-controlled enclosure for headspace sampling

- CCP personnel pull a headspace gas sample.

### 5.4.40 Exceed Headspace Gas Sample Thermal Limit or Test Category Waste?

- CCP personnel determine if the headspace gas sample taken from a candidate drum is WIPP acceptable

- CCP personnel determine if the candidate drum is classified as test category waste.

### 5.4.41 Place Drum in Certified Waste Storage; Ready for TRUPACT Loading

- EO transports WIPP-acceptable waste drum to certified storage in preparation for loading in TRUPACT containers for shipment to WIPP.

### 5.4.42 Perform Gas Generation Testing

- If the candidate waste drum exceeds the headspace gas sample thermal limit or if the drum is classified as test category waste, then CCP personnel perform GGT.

### 5.4.43 Pass GGT?

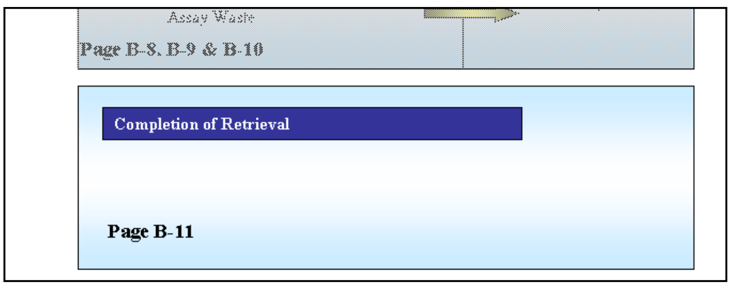
- If the drum passes the GGT, then using telehandler, HEO/EO will place drum in certified waste storage, ready for TRUPACT loading

- If the drum fails the GGT, then using telehandler, the HEO/EO will transfer the drum to storage pending VOC treatment or repackaging to manage the amount of 743 sludge.

### 5.4.44 Perform TRU VOC Treatment (TBD)

- If drum fails GGT, either TRU VOC treatment will be performed or the waste will be repackaged (method chosen depends on waste form present in candidate drum). If VOC treatment involves mixing, the waste will return to the assay step 5.4.34.

## 5.5 Completion of Retrieval




**Prerequisites**

- Waste removal from the excavation area is complete

- Any remaining NTW has been placed within the remaining trench

- Similar prerequisites are required for completion of retrieval operations as were performed for PCS removal (see Section 5.2.1)

- The SS or OF designates a locale for PCS and overburden material within the remaining trench.

**General**

Once the retrieval campaign is complete, staged PCS and any remaining NTW from the initial trench campaign will be used to back fill the remaining trench. In the event that there is not enough staged PCS or staged NTW to fill the entire trench volume, overburden (staged outside the enclosure during construction) will be used to fill the remaining empty pit volume to grade and level other areas.

**Activities**

The following subsections define the sequential activities to be performed during the completion of retrieval. Activities within these subsections do not bind operations to specific process strategies; rather they provide a project overview. Project operations can use these narratives to develop operating procedures. As these operating procedures develop, they will supercede this narrative. The following subsection numbers correlate to numbers found within the Completion of Retrieval flow diagrams in Appendix B, page B-11.

### 5.5.1 Staged PCS Present at West End of Pit?

- At completion of retrieval, if a staged pile of PCS remains within the building this material will be placed within the remaining trench

- At completion of retrieval, if a staged pile of PCS does not remain within the building then overburden from outside the building will be brought in to fill the trench void.

### 5.5.2 Leave in Pit Process for PCS Piled Inside Enclosure

- The SS or OF designates a locale for remaining PCS material.

- Using either the Gradall or Telehandler with front-end loader attachment (SS or OF also designates, based on condition and location), the HEO/EO obtains a scoop of PCS and places it in the remaining trench void and if required, compacts the PCS until firm. After compaction, the HEO will apply soil fixant to the compacted PCS surface, if required.

- This process is repeated if additional space is available for returning PCS material, and the SS/OF has provided direction for placement of additional PCS material.

### 5.5.3 Return to Pit Process for Overburden Piled Outside Enclosure

- The SS or OF designates a locale for return-to-pit overburden material.

- Using either the Gradall or telehandler with front-end loader attachment (SS or OF also designates, based on condition and location), the HEO/EO obtains a scoop of overburden and places it in the return to pit area and compacts the returned area until overburden is firm. After compaction, the HEO will apply soil fixant to the compacted overburden surface, if required.

- This process is repeated if additional space is available for returning overburden material, and the SS/OF has provided direction for placement of additional overburden material.

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# Appendix A

# Waste Disposal Data

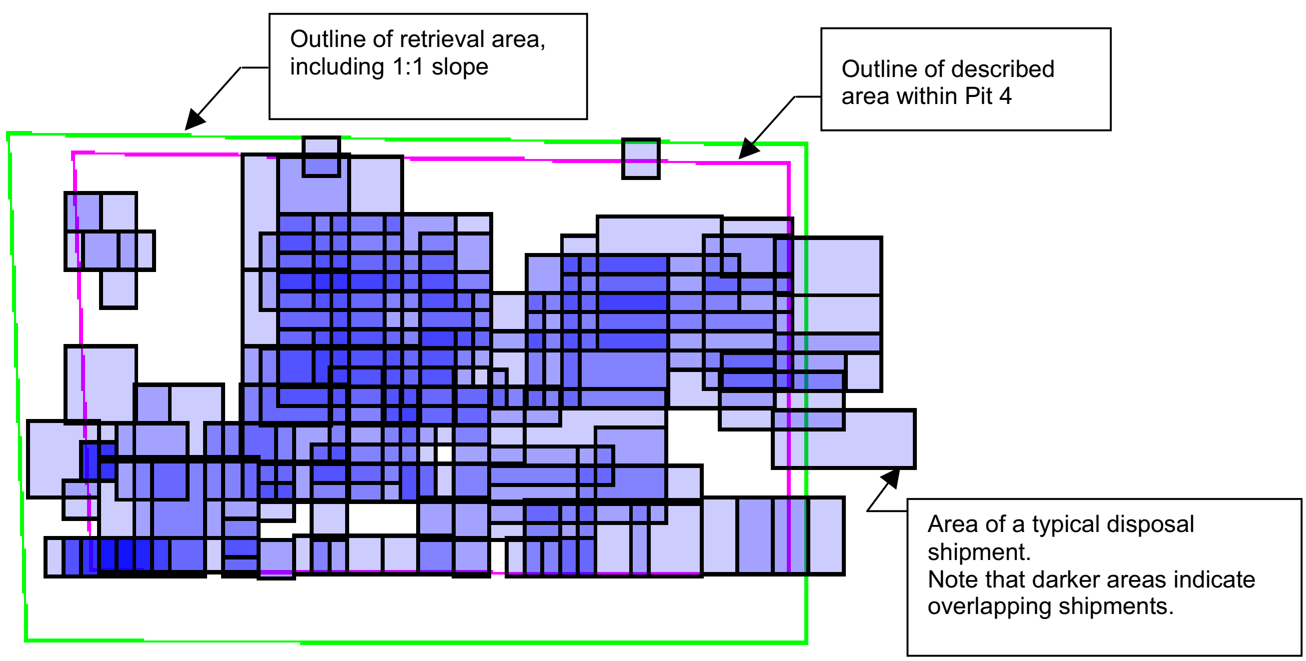
# Appendix A

# Waste Disposal Data

Disposal sheets for non-RFP shipments and trailer load lists for the RFP shipments are the ultimate source for the disposal locations and waste type designations (Clements 1982). These sheets are presently maintained in the OU 13/14 Project file, which is located in the Technical Support Building in Idaho Falls. The disposal sheets are also available from INEEL Electronic Document Management System. The location of the disposal, and in some cases, the area that the disposal containers covered, was recorded for each shipment to some extent. The information from the original shipments was transferred to the INEEL Geographical Information System, from which reports were developed.

Once the disposal shipments that reside completely or partially in the angle of repose surrounding the described area of Pit 4 were identified, the Waste Inventory Location Database (WILD) was queried to determine the types of wastes that were included in each disposal shipment. Typically, a shipment would contain various types of wastes. The types of waste varied by generator.

A previously generated document on the waste inventory within the described area of Pit 4 (EDF-4478) estimated slightly smaller quantities of each waste type than what is listed in the following table. This discrepancy in data is due to the boundaries from which the waste shipment data was taken. EDF-4478 estimated the waste volume based on the shipments that were deposited within the boundary of the described area (pink box shown below). The waste estimates in the following table account for the waste deposited inside the 1:1 angle of repose (green box shown below). This slightly larger area captured additional shipments that were not accounted for in earlier document.



# Waste Shipments Around the Excavation Area

## Graphite

| Description | Documented Radioactivity | # of Containers | Container | Volume (in ft3) | Waste Type(s) |
|---|---|---|---|---|---|
| Graphite (U, Pu) | Unknown | 3 | 55-gal drum(s) | 22 | G |
| LGW (Type Not Identified) & Possibly Graphite (U, Pu) | | 1 | | 7 | LGW |
| LGW Paper, Rags, Wood, Lgw Scrap Metal, Etc., & Possibly Graphite (U, Pu) | | 3 | | 22 | |
| Paper, Rags, Etc., & Graphite (Pu) | | 69 | | 507 | I, G |
| Paper, Rags, Scrap Metal, Etc., & Possibly Graphite (U, Pu) | | 31 | | 227 | LGW |
| Rags, Glass, Metal, & Possibly Graphite (U, Pu) | | 17 | | 125 | |
| Scrap Metal, Etc., & Possibly Graphite | | 15 | | 110 | |
| Scrap Metal, Etc., & Possibly Graphite (Pu) | | 297 | | 2,182 | V, G |
| Scrap Metal, Etc., & Possibly Graphite (U, Pu) | | 37 | | 271 | LGW, V |
| Scrap Metal, Rags, Paper, Glass, Etc. & Possibly Graphite | | 8 | | 59 | LGW |
| Scrap Metal, Rags, Paper, Mixed Debris, & Possibly Graphite | | 13 | | 96 | |
| Sludge (Misc Process), Etc., & Possibly Graphite (U, Pu) | | 2 | | 15 | IV |
| | | | Total (ft^3)= | 3,643 | |

## Filters

| Description | Documented Radioactivity | # of Containers | Container | Volume (in ft3) | Waste Type(s) |
|---|---|---|---|---|---|
| Contaminated Lab Waste, Paper, Filter (131, Pa233) | <0.01 mCi | 1 | Not Defined | 12 | III |
| CWS Type Filters (U, Pu) | Unknown | 408 | Cartons | 2,143 | |
| CWS Type Filters (U, Pu) | | 198 | Pasteboard Cartons | 1,168 | |
| CWS Type Filters (U, Pu) | | 23 | Wooden Box | 2,855 | |
| CWS Type Filters And Beryllium (U, Pu) | | 1 | | 122 | |
| Filters, Etc. (U, Pu) | | 42 | | 5,116 | |
| Scrap Metal, Equipment, & Filters (U, Pu) | | 17 | | 2,074 | |
| | | | Total (ft^3)= | 13,490 | |

## Roaster Oxides

| Description | Documented Radioactivity | # of Containers | Container | Volume (in ft3) | Waste Type(s) |
|---|---|---|---|---|---|
| Roaster Oxides (U, Pu) | Unknown | 109 | 55-gallon drum(s) | 801 | RO |

## Combustibles

| Description | Documented Radioactivity | # of Containers | Container | Volume (in ft3) | Waste Type(s) |
|---|---|---|---|---|---|
| 100' Pipe, 1 Plywood Box, 1 Whatisit, 1 10' Ladder, (MFP, <1 mCi) | <1 mCi | 1 | Containers Not Defined | 80 | I, V |
| Bags Of Wood Crates (Unknown Isotope) | 2mCi | 1 | Bags & Wood Crates | 162 | |
| Batteries, Turbine, Camera Lens, Paint Cans (Unknown Isotope) | 0.1 Ci | 1 | Containers Not Defined | 100 | |
| Blocks, Pipe, Wood & Miscellaneous Hot Waste (Unknown Isotope) | 11mCi | 1 | | 144 | |
| Canvas, Boxes, Wood, General Construction Waste (MFP) | 1.2 mCi | 1 | | 42 | |
| Cardboard Boxes & Stainless Pipe (Unknown Isotope) | 55 mCi | 1 | | 128 | |
| Clean Up Material (Unknown Isotope) | 105 mCi | 1 | | 380 | |
| Clean Up Material, Metal & Wood (Unknown Isotope) | 12 mCi | 1 | | 250 | |
| Concrete, Dirt, Wood (MFP) | Unknown | 1 | | 150 | |
| Critical Experiment Waste (Unknown Isotope) | 0.001 Ci | 1 | Dump Truck Load | 240 | |
| Empty Boxes, One (1) Guillotine Gate & Wood (Unknown Isotope) | 2.5 mCi | 1 | Containers Not Defined | 270 | |
| General Hot Cell Trash, Two Floor Buffers, GM Manipulator, Dynamometer, Impacutter (Unknown Isotope) | 0.2 Ci | 1 | | 130 | |
| Gravel, Wood, Paper, Metal (MFP) | 0.001 Ci | 1 | | 81 | |
| Misc Scrap From HP Storage Area | Unknown | 1 | | 450 | |
| | | | Total (ft^3)= | 2,607 | |

## Combustibles (Continued)

| Description | Documented Radioactivity | # of Containers | Container | Volume (in ft3) | Waste Type(s) |
|---|---|---|---|---|---|
| Paper, Rags, Etc. (U, Pu ) | Unknown | 1,453 | 55-gal drum(s) | 10,677 | I |
| Paper, Rags, Glass, Etc. (U, Pu) | | 379 | | 2,787 | |
| Paper, Rags, Plastic, Etc. (U, Pu ) | | 1 | | 7 | |
| Paper, Rags, Weeds, Etc. (MFP) | <1 mCi | 1 | Containers Not Defined | 220 | |
| Plastic Glovebox (MFP) | 0.03 Ci | 1 | | 72 | |
| Rags, Etc. (U, Pu) | Unknown | 12 | 55-gal drum(s) | 88 | |
| Rags, Glass, & Metal (U, Pu) | | 270 | | 1,984 | I, V |
| Rags, Wood Scraps, General Construction Waste (MFP) | <0.1 Ci | 1 | Containers Not Defined | 40 | |
| Scrap (Unknown Isotope) | 0.001 Ci | 1 | | 100 | |
| Scrap Metal, Equipment, Etc. | Unknown | 8 | Wooden Box(s) | 976 | |
| Scrap Metal, Glass, Paper, Rags, Etc. (U, Pu) | | 12 | 55-gal drum(s) | 88 | I |
| Scrap Metal, Glass, Paper, Rags, Wood, Etc. (U, Pu ) | | 6 | | 44 | I, V |
| Scrap Metal, Paper, Hoses (MFP) | 2.2 mCi | 1 | Containers Not Defined | 108 | |
| Scrap Metal, Paper, Rags, & Wood (Unknown Isotope) | 0.001 Ci | 1 | | 48 | |
| Scrap Metal, Paper, Rags, Etc. | Unknown | 16 | 55-gal drum(s) | 118 | |
| Scrap Metal, Paper, Wire, Glass (Unknown Isotope) | 0.03 uCi | 1 | Containers Not Defined | 60 | |
| Scrap Metal, Plywood Boxes, Angle Iron, Stainless Steel, Scrap Wood, & Rubber Hose (Unknown Isotope) | 0.041 Ci | 1 | | 500 | |
| Scrap Metal, Rags, Paper, Equipment, Etc. | Unknown | 9 | 55-gal drum(s) | 993 | |
| Scrap Metal, Rags, Paper, Equipment, Etc. | | 1 | Wooden Box(s) | 122 | |
| Scrap Metal, Rags, Paper, Glass, Etc. | | 1,021 | 55-gal drum(s) | 7,504 | |
| Scrap Metal, Rags, Paper, Glass, Plastic, Etc. (U, Pu ) | | 7 | | 51 | |
| Scrap Metal, Rubber, Wood (Unknown Isotope) | 0.017 Ci | 1 | Containers Not Defined | 656 | |
| Scrap Metal, Wire, Wood, Weeds (MFP) | 1E-05 Ci | 1 | | 50 | |
| Scrap Metal, Wood, Equipment, Etc. | Unknown | 6 | 55-gal drum(s) | 728 | |
| Scrap Metal, Wood, Equipment, Etc. (U, Pu ) | | 12 | Wooden Box(s) | 1,373 | |
| Scrap Metal, Wood, Paper (MFP) | 4 mCi - <0.1 Ci | 3 | Dumpster | 308 | |
| Scrap Metal, Wood, Poly, Paper, Rags (Unknown Isotope) | 0.5 Ci | 1 | Containers Not Defined | 252 | |
| Scrap Parts (Unknown Isotope) | 0.05 Ci | 1 | | 1,200 | |
| Scrap Wood, Wooden Boxes, Packing Material (Unknown Isotope) | 0.001 Ci | 1 | Dumpster | 100 | I |
| Straw, Lead, Junk (Unknown Isotope) | <0.01 mCi | 1 | Containers Not Defined | 96 | I, V |
| Waste Type Not Defined (Unknown Isotope) | 0.001 Ci | 2 | | 100 | |
| Wood & Junk (Unknown Isotope) | <0.01 mCi | 1 | | 96 | |
| Wood & Pipe (Unknown Isotope) | 0.01 Ci | 1 | | 216 | |
| Wood & Plastic, Low Level Contamination (Unknown Isotope) | 4uCi | 1 | | 35 | I |
| Wood & Scrap Metal (MFP) | 0.01Ci | 1 | | 200 | I, V |
| Wood (Unknown Isotope) | <0.01 mCi | 7 | | 1,000 | I |
| Wood Debris (MFP) | 0.01 mCi | 1 | Truckload | 108 | |
| Wood Skid & Scrap Metal Scrap (Unknown Isotope) | 0.004 Ci | 1 | Containers Not Defined | 250 | I, V |
| Wood, Paper, Rags, Etc. (U, Pu ) | Unknown | 66 | 55-gal drum(s) | 486 | I |
| Wood, Pipe, & Miscellaneous (Unknown Isotope) | <0.01 mCi | 1 | Containers Not Defined | 80 | I, V |
| Wood, Pipe, Rags, Scrap Metal (MFP) | 0.005 Ci | 1 | | 80 | |
| Wood, Rubber, Scrap Metal (Unknown Isotope) | 0.0165 Ci | 1 | | 600 | |
| Wood, Scrap Metal, Rags, Etc. (MFP) | 0.001 Ci | 1 | Dumpster | 100 | |
| Wood, Scrap Metal, Steel Pipe, General Construction Waste (MFP) | <0.1Ci | 1 | Containers Not Defined | 144 | |
| Wood, Straw, Misc. (Unknown Isotope) | <0.01 mCi | 1 | | 180 | I |
| **Beryllium** Waste, Etc. (U, Pu) | Unknown | 11 | 55-gal drum(s) | 81 | I,V |
| Paper, Rags, Etc., & **Beryllium** (U, Pu) | | 2 | | 14 | |
| Paper, Rags, Glass, Etc., & **Beryllium** (U, Pu) | | 5 | | 37 | |
| Paper, Rags, Scrap Metal, Etc. & **Beryllium** | | 34 | | 250 | |
| Paper, Rags, Wood, Scrap Metal, Etc., & **Beryllium** (U, Pu) | | 12 | | 88 | |
| Scrap Metal, Etc., & **Beryllium** (U, Pu) | | 3 | | 22 | |
| Scrap Metal, Rags, Paper, Equipment, Etc., & **Beryllium** | | 15 | | 110 | |
| Scrap Metal, Rags, Paper, Glass, Etc. & **Beryllium** | | 2 | | 14 | |
| | | | Total (ft^3)= | 35,641 | |

## Noncombustibles

| Description | Documented Radioactivity | # of Containers | Container | Volume (in ft3) | Waste Type(s) |
|---|---|---|---|---|---|
| Carbon Steel Tank from Pm-2A Vessel Test - Edm Equipment (Unknown Isotope) | 0.001 mCi | 1 | Container Not Defined | 15 | V |
| Concrete (Unknown Isotope) | 0.05 Ci | 1 | | 72 | |
| Dirt (MFP) | 0.2 Ci | 1 | Dumpster | 84 | |
| Dirt Wrapped In Plastic Bags (Unknown Isotope) | 0.007 Ci | 1 | Plastic Bags | 48 | |
| Dowtherm Piping from L-12/M-13 Area (MFP) | 10 mCi | 2 | Dumpster | 216 | |
| Drained Oil Drums - 46 In Boxes (U, Pu) | Unknown | 57 | 55-gal drum(s) | 646 | |
| Drained Oil Drums (U, Pu) | | 76 | | 559 | |
| Empty | | 229 | | 1,682 | |
| Glass, Ceramics, Etc. | | 16 | | 117 | |
| Glass, Etc. (U, Pu) | | 17 | | 124 | |
| IC Furnace, Crane Clutch, Fuel Pin Breaker, & Waste Can Lid (Unknown Isotope) | 2 Ci | 1 | | 8 | |
| Lead Slag & Sand (Unknown Isotope) | <0.001 Ci | 1 | Container Not Defined | 9 | |
| Metal Pipe & Insulation (Unknown Isotope) | 0.016 Ci | 3 | Dumpster | 324 | |
| Metal Sample Box & Pipe (Unknown Isotope) | 0.25 mCi | 1 | Container Not Defined | 16 | |
| Metal Valves, Etc. (MFP) | 3 mCi | 1 | Dumpster | 100 | |
| MI-1 Reactor Skid & Shielding (Unknown Isotope) | 20 Ci | 1 | Container Not Defined | 800 | |
| Piping & Material from L-12/M-13 Cubicle, Dowtherm (Unknown Isotope) | 0.016 Ci | 3 | Dumpster | 324 | |
| Residual Waste, Diatomaceous Earth, & Contaminated Scrap Iron (Unknown Isotope) | 75 mCi | 1 | Container Not Defined | 384 | |
| Scrap Aluminum (Unknown Isotope) | 0.001 Ci | 2 | Dumpster | 108 | |
| Scrap Machinery (Pu) | Unknown | 2 | Wooden Box | 1,216 | |
| Scrap Metal & Pipe (MFP) | 1.1 mCi | 1 | Container Not Defined | 108 | |
| Scrap Metal (U, Pu) | Unknown | 6 | 55-gal drum(s) | 44 | |
| Scrap Metal (Unknown Isotope) | 0.002 Ci | 2 | Container Not Defined | 252 | |
| Scrap Metal Debris (Unknown Isotope) | 0.1 Ci | 1 | | 12 | |
| Scrap Metal from L-12/M-13 Cubicle (Unknown Isotope) | 0.011 Ci - .938Ci | 3 | Dumpster | 316 | |
| Scrap Metal from Spert I Reactor (MFP) | < 1.0E-5 Ci | 1 | Dump Truck Load | 50 | |
| Scrap Metal, Equipment, Etc (U, Pu) | Unknown | 74 | Wooden Box | 12,067 | |
| Scrap Metal, Equipment, Etc. (U, Pu) | | 78 | 55-gal drum(s) | 8,923 | |
| Scrap Metal, Etc. (U, Pu) | | 1,074 | | 8,191 | |
| Scrap Metal, Etc., Including 2 Drums Identified As **Americium** Waste (U, Pu) | | 47 | | 346 | |
| Scrap Metal, Glass, Etc. (U, Pu) | | 2 | | 15 | |
| Scrap Metal, Machinery (U, Pu) | | 7 | Wooden Box | 879 | |
| Scrap Metal, Rags, Paper, Glass, Etc. | | 16 | 55-gal drum(s) | 118 | |
| Stainless Steel (SCH 304) 6 Inch Pipe, Iron Trays, Various Scrap Tubing (Unknown Isotope) | 500 mCi | 1 | Container Not Defined | 34 | |
| Steel Pipe (SCH 140), Refueling Machine Support Structure (Unknown Isotope) | 25 uCi | 1 | | 5,750 | |
| Steel Pipe (SCH 140), Refueling Machine, 046 Fixture (Unknown Isotope) | 10 uCi | 1 | | 5,750 | |
| Trolley Hoist, 5 DP Cells, & Lead (Unknown Isotope) | 1 mCi | 1 | | 140 | |
| Scrap Metal & **Beryllium** (U, Pu) | Unknown | 3 | 30-gal drum(s) | 20 | V |
| Scrap Metal, Etc., & **Beryllium** (U, Pu) | | 99 | 55-gal drum(s) | 728 | |
| Water Containing A Small Amount Of **Beryllium** Oxide. Vermiculite Has Been Added To Absorb The Water. | | 1 | Container Not Defined | 4 | |
| | | | Total (ft^3)= | 50,598 | |

## Sludges

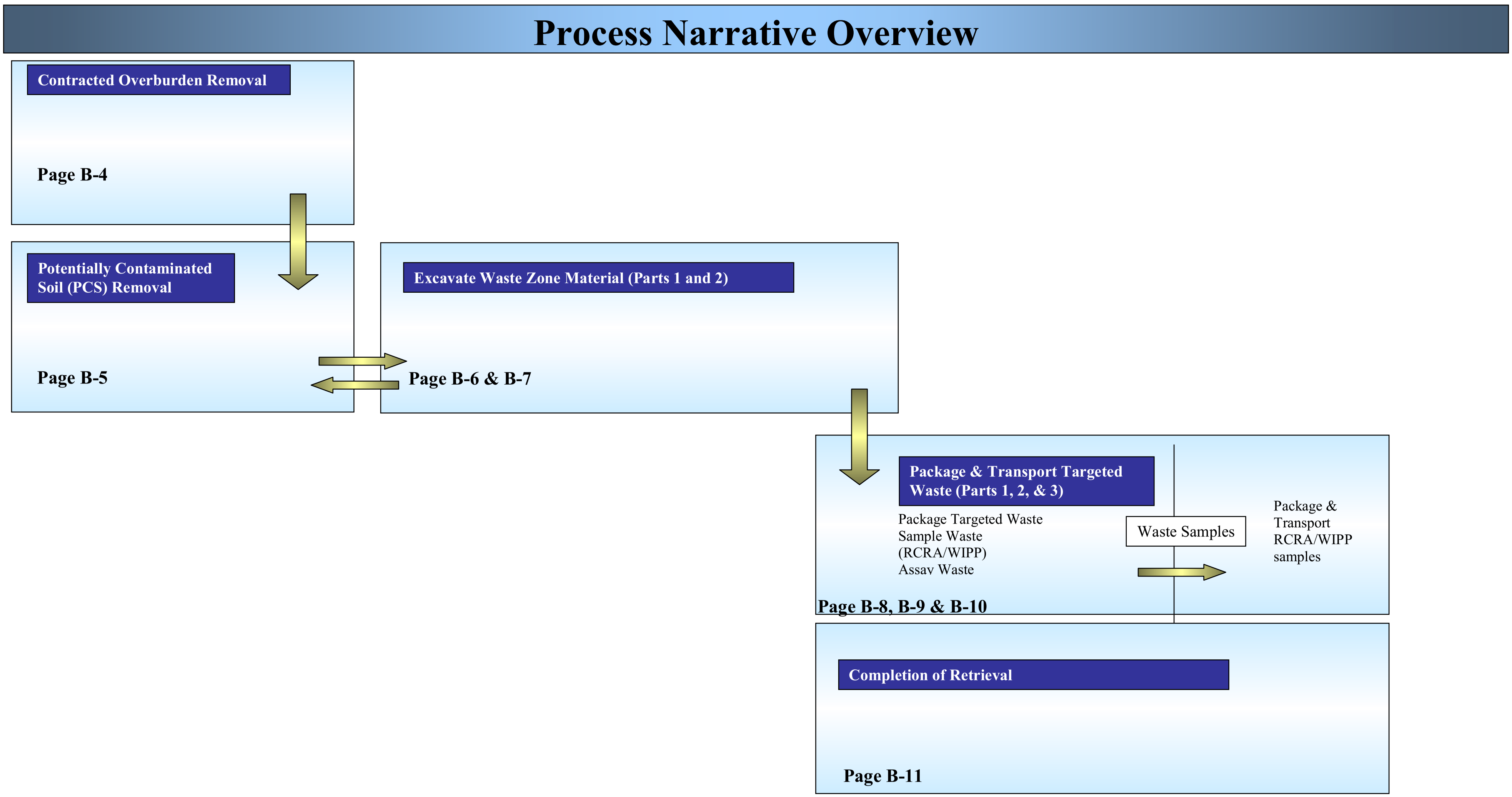
| Description | Documented Radioactivity | # of Containers | Container | Volume (in ft3) | Waste Type(s) |
|---|---|---|---|---|---|
| 444 Sludge (Unknown Isotope) | Unknown | 1 | 55-gallon drum(s) | 7 | IV |
| 607 Sewage Sludge (Unknown Isotope) | 0.003 To 0.004 Ci | 2 | Truckload | 324 | |
| 654 Sewage Sludge (Unknown Isotope) | 1.5 Ci | 1 | Not defined | 948 | |
| 741 Sludges (U, Pu) | Unknown | 905 | 55-gallon durm(s) | 6,652 | |
| 742 Sludges (U, Pu) | | 783 | | 5,755 | |
| 743 Sludges (U, Pu) | | 702 | | 5,161 | |
| 744 Sludges (U, Pu) | | 90 | | 661 | |
| 746 Sludges (U, Pu) | | 1 | | 7 | |
| | | | Total (ft^3)= | 19,515 | |

| TYPE |
|---|
| G - Graphite |
| LGW - Line generated waste - Graphite |
| RO - Roaster Oxides (Uranium) |
| Type I – Combustibles – paper, rags, wood, etc. wt<100lb/drum |
| Type II – Glass and ceramics |
| Type III – Chemical warfare system (CWS) High Efficiency Particulate Air |
| Type IV– Sludges from co-precipitation treatment |
| Type V – Non-combustibles – scrap metal, brick, etc. wt>100lb/drum |

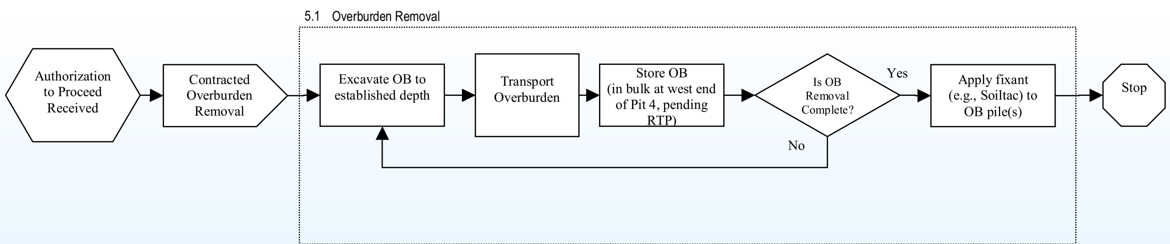
# Appendix B

# Process Logic Diagrams

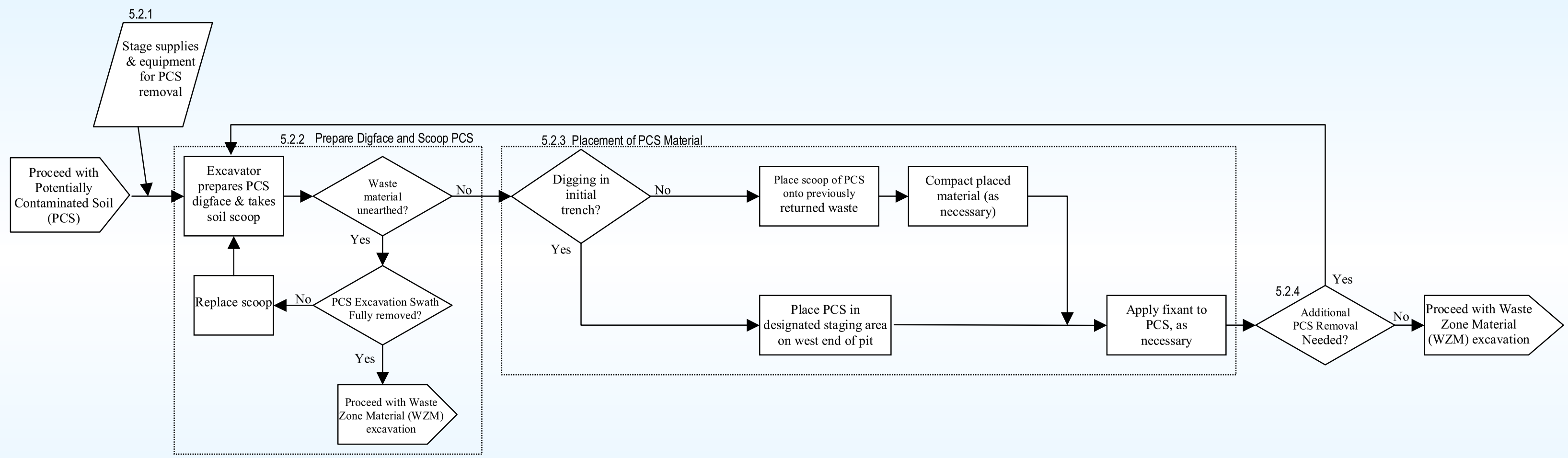
# Appendix B
# Process Logic Diagrams



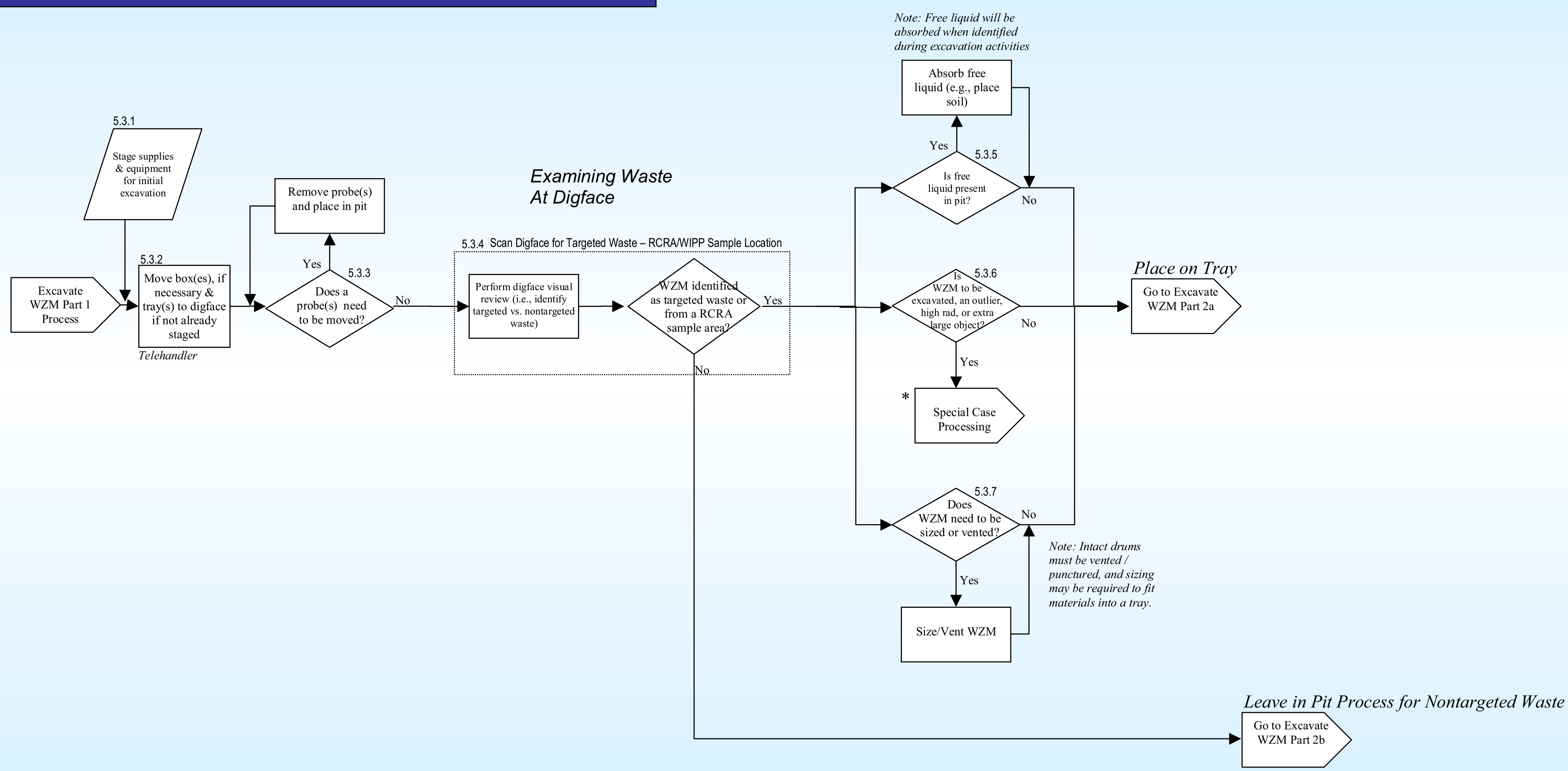
# Contracted Overburden Removal



# Potentially Contaminated Soil (PCS) Removal

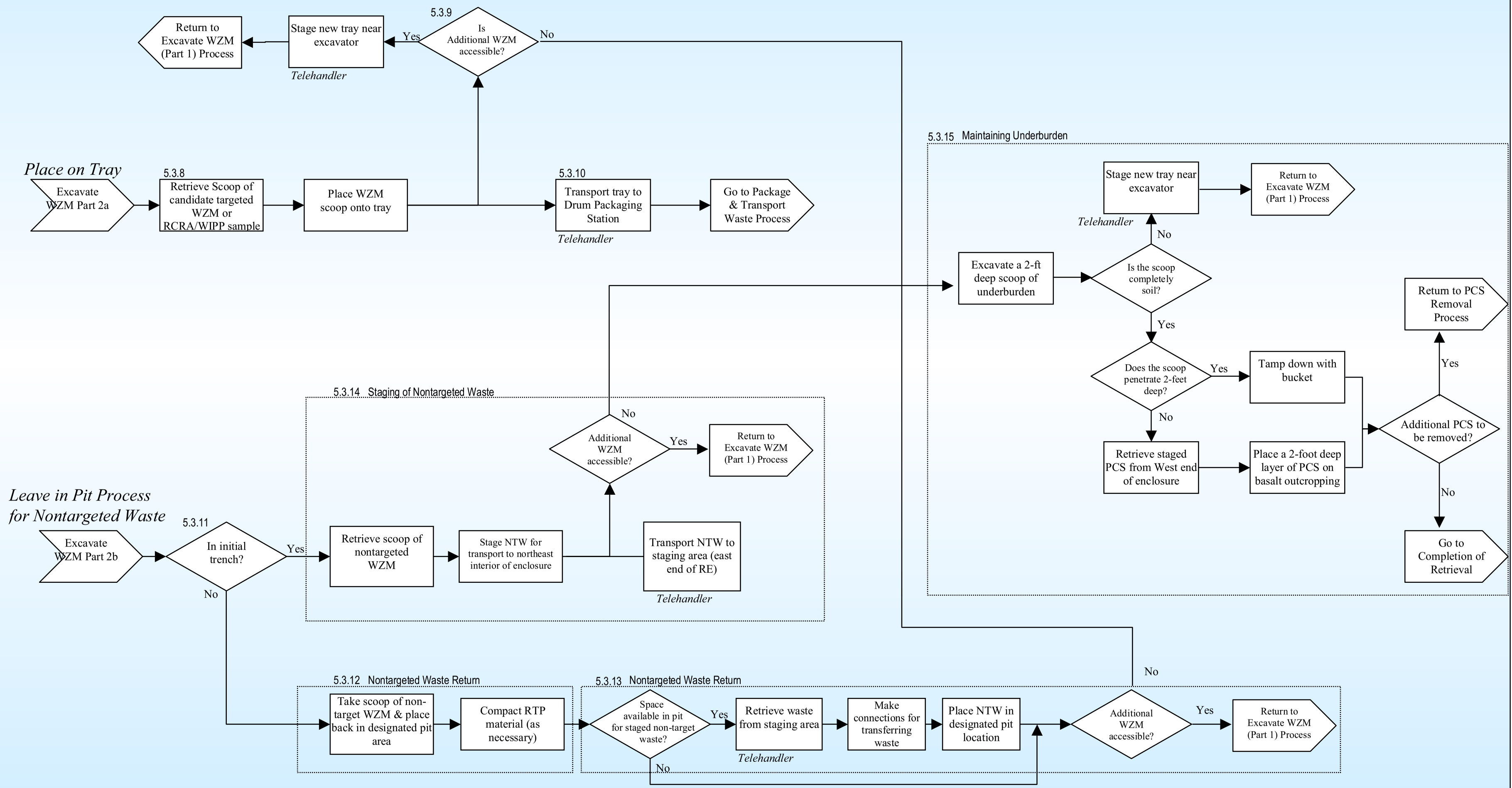


# Excavate Waste Zone Material (Part 1)

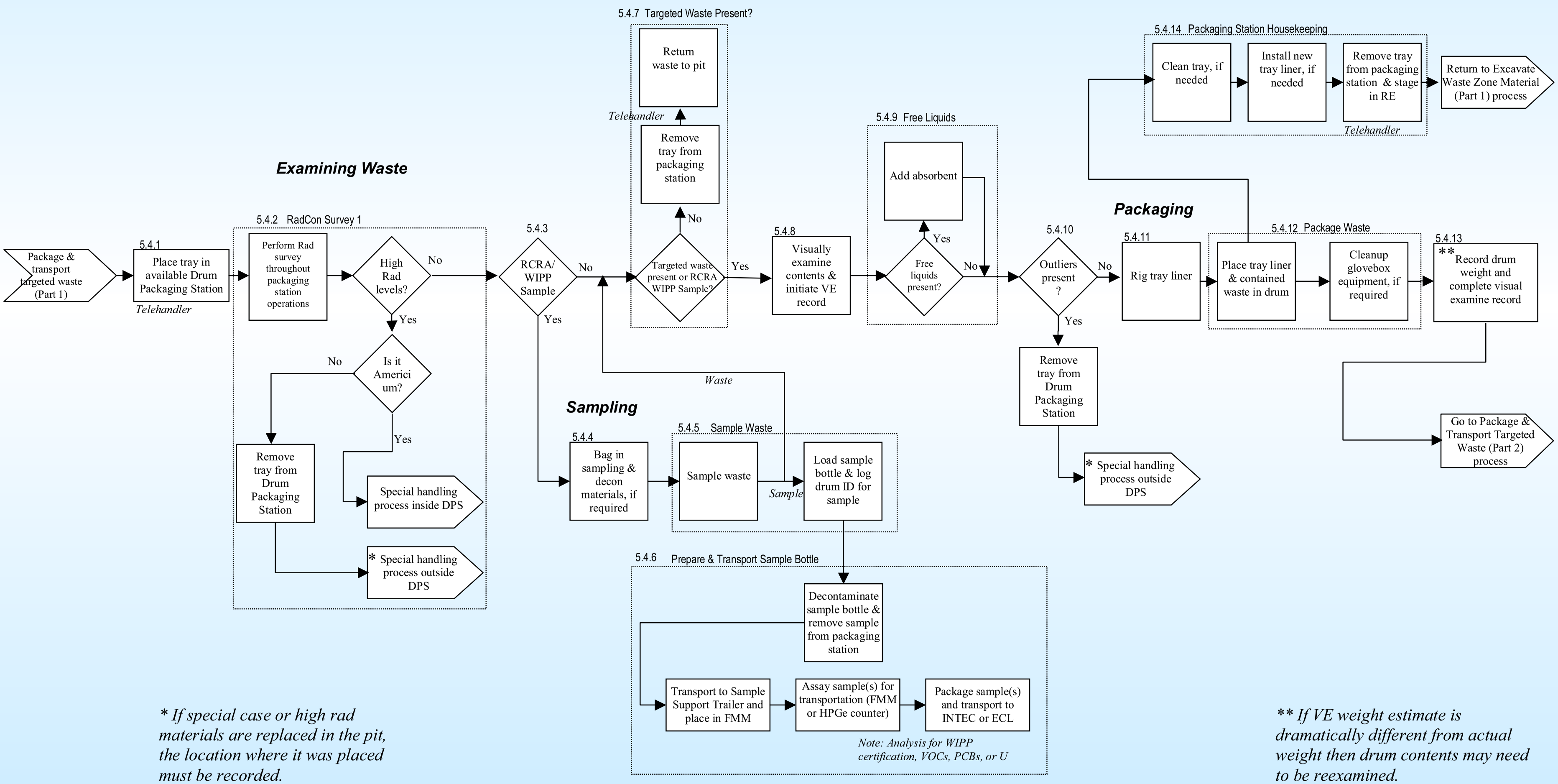



* Note: If special case materials are replaced in the pit, the location where it was placed must be recorded.

# Excavate Waste Zone Material (Part 2)



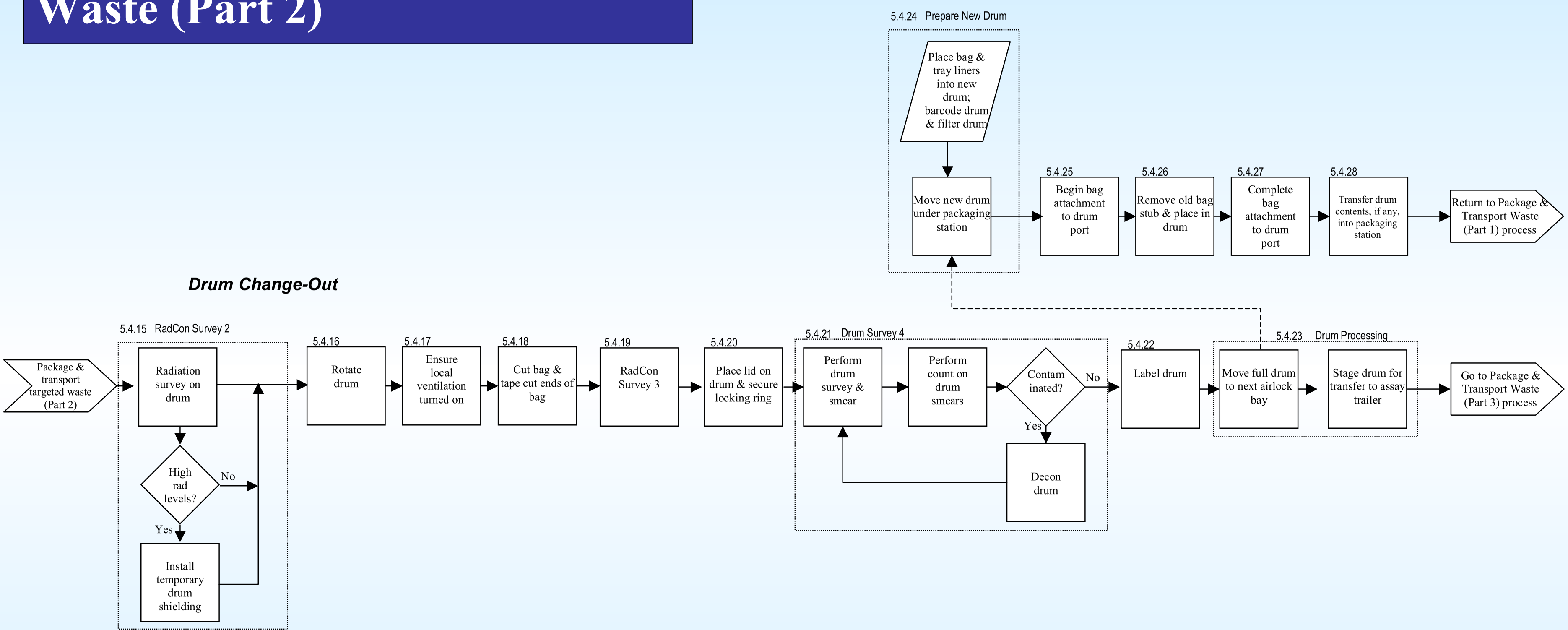
# Package & Transport Targeted Waste (Part 1)



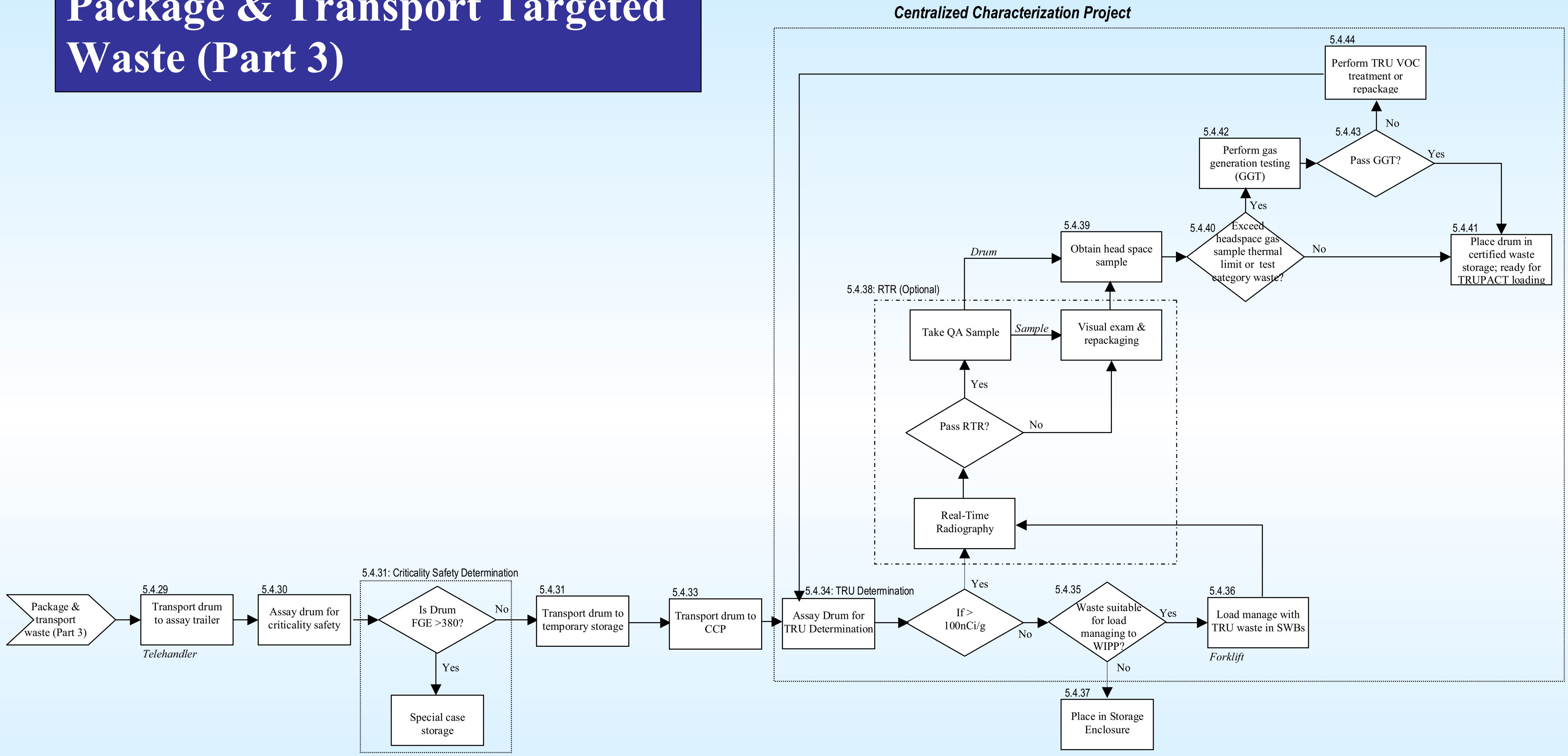

** If special case or high rad materials are replaced in the pit, the location where it was placed must be recorded.*

*** If VE weight estimate is dramatically different from actual weight then drum contents may need to be reexamined.*

# Package & Transport Targeted Waste (Part 2)



# Package & Transport Targeted Waste (Part 3)



# Completion of Retrieval