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Waste Management Plan for Operable Unit 7-13/14 Preremedial Design, Retrieved Waste and Soil Characterization, and Environmental Management Science Program Tests

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Approved

8/27/03	
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ABSTRACT

This Waste Management Plan describes methods for identifying, characterizing, and managing the waste streams associated with four separate groups of tests that will be performed for the Idaho National Engineering and Environmental Laboratory in support of the *Second Revision to the Scope of Workfor the OU 7-13/14 Waste Group 7 Comprehensive Remedial Investigation Feasibility Study*. The test results and characterization data will be used to support risk assessment, preremedial design studies, and a better understanding of the nature and extent of contamination for this study. This WMP also discusses regulatory considerations and waste management assumptions and identifies and describes the waste streams associated with the tests. Wastes from the following test groups are included:

- Preremedial Design Testing will be performed on Operable Unit (OU) 7-10 (known as Pit 9) material samples, Pad **A** Nitrate Salt samples, and on surrogate waste material. The tests will examine the effectiveness of in situ thermal desorption, in situ grouting, and ex situ grouting.

- Organic Contamination in the Vadose Zone OU 7-10 samples will have tests performed to characterize material composition.

- Retrieved Waste and Soil Characterization Tests will be performed on excavated OU 7-10 samples to provide information on the extent of actinide leachability from interstitial soils, to determine whether soils surrounding the waste constitute a secondary source of contaminants.

- Energy Environmental Management Science Program tests could be performed if the work proposals are selected by the Department of Energy for hnding. Two projects are proposed to examine the role of organoplutonium complexes, colloids, and the microbial ecology extant within the OU 7-10 waste.

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ACRONYMS

Ac	Actinide metals
RAR	applicable or relevant and appropriate requirement
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFA	Central Facilities Area
CFR	Code of Federal Regulations
DOE	U.S. Department of Energy
DOE-ID	U.S. Department of Energy Idaho Operations Office
DOT	U.S. Department of Transportation
EMSP	Environmental Management Science Program
EPA	U.S. Environmental Protection Agency
ESG	ex situ grouting
HWD	hazardous waste determination
ICDF	INEEL CERCLA Disposal Facility
INEEL	Idaho National Engineering and Environmental Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
IRC	INEEL Research Center
ISG	in situ grouting
ISTD	in situ thermal desorption
IW	industrial waste
IWTS	Integrated Waste Tracking System
LDR	land disposal restriction
LLW	low-level waste
MLLW	mixed low-level waste
MTRU	mixed transuranic
OCVZ	Organic Contaminant Vadose Zone

OU	operable unit
PCB	polychlorinated biphenyl
PRDT	Preremedial Design Testing
RCRA	Resource Conservation and Recovery Act
RFP	Rocky Flats Plant
RWMC	Radioactive Waste Management Complex
RWSC	Retrieved Waste and Soil Characterization
SDA	Subsurface Disposal Area
TRA	Test Reactor Area
TRU	transuranic
TSCA	Toxic Substances Control Act
TSDF	treatment, storage, and disposal facility
WAC	waste acceptance criteria
WGS	Waste Generator Services
WIPP	Waste Isolation Pilot Plant
WMP	Waste Management Plan
WNPD	Waste with No identified Path to Disposal
WTS	waste technical specialist

Waste Management Plan for Operable Unit 7-13/14 Preremedial Design, Retrieved Waste and Soil Characterization Tests and Environmental Management Science Program Tests

1. INTRODUCTION

The Subsurface Disposal Area (SDA) at the Idaho National Engineering and Environmental Laboratory (INEEL) will be remediated under the jurisdiction of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, 42 USC § 9601 et seq.). On October 1,2001, the INEEL published the *Waste Area Group 7 Analysis of OU 7-10 Stage II Modifications* report (INEEL 2001), which identified a feasible approach for retrieving waste from Operational Unit (OU) 7-10. The OU 7-10 Glovebox Excavator Method Project was established to demonstrate waste zone material retrieval, provide information on any contaminants of concern present in the underburden, and characterize waste zone material for safe and compliant storage. Four separate groups of tests are planned using samples from OU 7-10 and surrogate waste material. The test results and characterization data will be used to support risk assessment, preremedial design studies, and a better understanding of the nature and extent of contamination for the Comprehensive Remedial Investigation/Feasibility Study (RI/FS) for OU 7-13/14, which is under development. The plan describing the data requirements for the RI/FS is in the *Second Revision to the Scope of Work for the OU 7-13/14 Waste Group 7 Comprehensive Remedial Investigation Feasibility Study* (Holdren and Broomfield 2003). Tests that will be supporting the RI/FS activities are as follows:

- Preremedial Design Testing (PRDT) will be conducted on samples acquired from OU 7-10 and on samples of surrogate waste material. In situ grouting (ISG) and in situ thermal desorption (ISTD) are among the treatment options identified in the second addendum to the OU 7-13/14 Work Plan (Holdren et al. 2003, draft). Details of the testing are described in the *Test Plan for the Evaluation of In Situ Thermal Desorption and Grouting Technologies for Operable Unit 7-13/14 (Draft)* (Yancey et al. 2003). Bench scale tests for ISTD and ISG will be performed on cold and hot surrogates and on samples of actual OU 7-10 waste. Ex situ grouting (ESG) bench scale tests will be performed on samples of Pad-A waste. Testing will provide data to fill performance-based data gaps on both implementability and effectiveness.

- The Organic Contamination in the Vadose Zone (OCVZ) program wants characterization tests to be performed on OU 7-10 organic sludge. OCVZ routinely monitors the levels of volatile organic contaminants escaping the SDA and will use the characterization data to better understand the concentration of the organic constituents remaining in the OU 7-10 sludges and how they may relate to the monitoring results. Sample characterization will be limited to the initial characterization and no hrther testing is planned.

- Retrieved Waste and Soil Characterization (RWSC) Tests will also be performed on excavated OU 7-10 samples to provide information on leachability of actinides from interstitial soils to determine if contaminated soils might constitute a secondary source term. In addition, the total actinide content of the soils will be measured. Leaching at various pH conditions will enable a more realistic assessment of what might be released, compared with a single pH leach. The actinide release measured will be correlated with "operationally defined speciation," which will be generated using sequential aqueous extractions. In addition, samples of two waste forms (the "organic sludge" and the "cemented sludge") will be leached to provide pH sensitivity and operationally defined speciation.

- Applied research and testing may be performed through sponsorship of the Environmental Management Science Program (EMSP) if the proposed work is selected for hnding. Two EMSP research projects have been proposed to acquire information critical to scientific knowledge and understanding of the buried waste, at the SDA, entitled "Impact of Organic Complexes and Colloids on the Mobilization of Pu" and "Identification of Critical Microbial Populations and Processes in Buried Mixed Waste." These projects will examine the role of organoplutonium complexes, colloids, and the microbial ecology extant within the sample.

This Waste Management Plan (WMP) describes the management of waste generated during activities of the four studies. Section 2 provides background and descriptions of the materials and samples to be tested. Section 3 provides additional detail on the testing programs. Section 4 discusses waste streams and their management and Section 5 describes container management.

1.1 Purpose and Scope

The purpose of this WMP is to describe the methods for identifying, characterizing, and managing the waste streams associated with the preremedial Design Studies, Retrieved Waste and Soil Characterization Tests, EMSP tests, and support to the OCVZ Program through characterization of samples. Bounding estimates of the waste volumes are provided, as certain testing may not be performed, depending on the outcome of other testing. This plan addresses waste management considerations associated with waste from characterization, tests and studies, associated secondary waste streams, and any unused and unaltered samples. This WMP supports waste management planning requirements found in U.S. Department of Energy (DOE) Order 435.1, *Radioactive Waste Management*.

This WMP describes the management of waste generated during project activities performed at the INEEL, including the following:

- Analytical waste (waste generated in the laboratory and during preparation and performance of tests)
- All materials, solutions, residuals, and test products produced in the PRDT, RWSC, and EMSP tests
- Unused retrieved samples
- Unused surrogate material and unmixed grout material.

2. BACKGROUND AND STUDY MATERIAL DESCRIPTION

The remedy for OU 7-10 in the OU 7-10 Record of Decision (U.S. Department of Energy Idaho Operations Office [DOE-ID] 1993) calls for the excavation of transuranic (TRU) waste from OU 7-10. On October 1, 2001, the INEEL published the *Waste Area Group 7 Analysis of OU 7-10 Stage II Modifications* (INEEL 2001), which identified a feasible approach for retrieving waste from OU 7-10 using the Glovebox Excavator Method. Stage II was established to demonstrate waste zone material retrieval, provide information on contaminants present in the underburden, characterize waste zone material for safe and compliant storage, and package and store waste onsite, pending final disposition.

Under the *Federal Facility Agreement and Consent Order for the Idaho National Engineering Laboratory*, Waste Area Group 7 (WAG 7) was divided into 14 operable units (OUs), including OU 7-13 and OU 7-14. Operable Unit 7-13 consisted of the transuranic pits and trenches remedial investigation/feasibility study (RI/FS). Operable Unit 7-14 consisted of the WAG 7 comprehensive RI/FS, which included the remainder of the buried waste in the SDA. When it became apparent that the transuranic pits and trenches could not be evaluated separately from the remainder of the buried waste in the SDA, OU 7-13 and OU 7-14 were combined into the OU 7-13/14 SDA pits and trenches, the comprehensive OU for WAG 7; thus, only one comprehensive RI/FS will be completed for the combined OU 7-13/14.

Operable Unit 7-10 will collect waste and underburden soil samples in accordance with INEEL/EXT-02-00542, *Field Sampling Plan for the OU 7-10 Glovebox Excavator Method Project* (Salomon et al. 2003). These samples will be collected to support OU 7-10 and OU 7-13/14 objectives. OU 7-10 will primarily focus on waste characterization analyses. OU 7-13/14 will perform waste characterization and treatment testing on the OU 7-10 waste material samples. In addition OU 7-13/14 will perform testing on hot (radioactive) and cold (nonradioactive) surrogate material and on contaminated nitrate salts from Pad A, which are currently in storage. Additional testing may be performed on waste samples as part of research funded under the EMSP. All information and analytical results obtained from testing will be available to both OU 7-10 and the OU 7-13/14 projects. The program for which the samples were collected will be responsible for interpreting the results.

Figure 1 shows the various materials to be tested and the tests or programs that will be using this material. The remainder of this Section describes the materials that will be tested in more detail.

The composition of tested material will determine the waste types that must be managed. Since the precise composition of the OU 7-10 material will not be known until characterization testing is performed, waste types were determined using composition estimates derived from historical records and sampling. Waste types for the surrogate material were determined made based on the specified composition.

2.1 OU 7-10 Material

The TRU waste disposed of at OU 7-10 was produced primarily at the Rocky Flats Plant (RFP) during weapons processing. These wastes contain a variety of radionuclides and organic and inorganic compounds. Radionuclides include weapons-grade plutonium and uranium isotopes together with Am-241 and Np-237. The primary organic chemicals are carbon tetrachloride, trichloroethene, 1,1,1-trichloroethane, tetrachloroethene, lubricating oils, Freon 113, alcohols, organic acids, and Versenes (ethylenediaminetetraacetic acid). Other wastes disposed of at OU 7-10 include low-level waste (LLW) from INEEL waste generators. In addition to buried waste, OU 7-10 contains overburden soil, soil surrounding waste drums (referred to throughout this plan as interstitial soil), and underburden soil that lies below the buried waste.

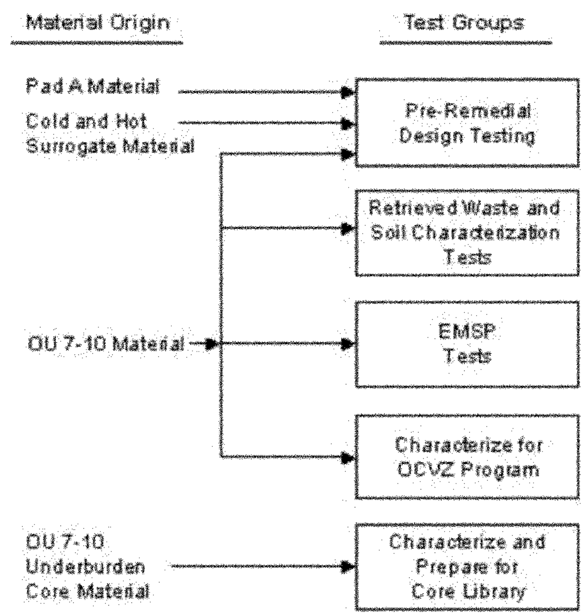

Figure 1. Material origin for the test groups.

The OU 7-10 Record of Decision inventory was compiled from two documents: (1) *Nonradionuclide Inventory in Pit 9 at the RWMC* (Liekhus 1992), which was converted from an earlier report, *Nonradionuclide Inventory in Pit 9 at the RWMC* (Liekhus 1991); and (2) *Methodology for Determination of a Radiological Inventory for Pit 9 and Corresponding Results* (King 1991). Since the OU 7-10 Record of Decision was written, a number of refinements to the inventory estimates have been made based on various new information sources. The current OU 7-10 inventory document is *Pit 9 Estimated Inventory of Radiological and Nonradiological Constituents* (Einerson and Thomas 1999), which documents the estimated inventory for the entire disposal pit from all generators.

Some of the RFP waste consists of radioactively-contaminated sludges (inorganic, organic, and nitrate salt). The sludges that are important for the planned tests are identified as RFP Series 741, 742, 743, and 745 sludges (see Table 1 for primary chemical/radiological attributes of these wastes). Over 80% of the sludge-containing drums encountered during Stage II retrieval activities are anticipated to contain Series 743 sludge. During processing at RFP, the Series 743 organic waste was mixed with calcium silicate forming a mixture with greaselike or pastelike appearance (Clements 1982). Small amounts of Oil-Dri absorbent also were typically mixed with the waste. The waste is expected to exhibit colors ranging from brownish green to green to yellow.

The Series 741 and 742 liquid wastes were treated during processing at RFP to precipitate plutonium and americium from the waste. The precipitate or slurry was filtered to produce a sludge containing 50–70% water by weight. Portland cement was added to ensure absorption of any free liquids that might be formed from the sludge (Clements 1982). Small amounts of Oil-Dri absorbent also were typically mixed with the waste. The waste is expected to exhibit colors ranging from reddish to dark gray to black.

Table 1. Waste content of the sludges in Operable Unit 7-10 Stage I and Operable Unit 7-10 Glovebox Excavator Method Project retrieval areas.

Waste Stream	Summary Characteristics	Other Materials
Series 741: first stage sludge	Salt precipitate containing plutonium and americium oxides, depleted uranium, metal oxides, and organic constituents.	18.1–22.7kg (40–50 lb) of Portland cement added to top and bottom of drum to absorb any free liquids. Two plastic bags.
Series 742: second stage sludge	Salt precipitate containing plutonium and americium oxides, metal oxides, and organic constituents.	18.1–22.7kg (40–50 lb) of Portland cement added in layers to absorb any free liquids. Two plastic bags.
Series 743: sludge organic setups	Organic liquid waste solidified using calcium silicate (pastelike or greaselike).	113.6 L (30 gal) of organic waste mixed with 45.4 kg (100 lb) calcium silicate. Small quantities (4.5–9.1kg [lo–20 lb]) of Oil-Dri added to top and bottom, if necessary. Two plastic bags.
Series 744: sludge special setups	Complexing chemicals (liquids) including Versenes, organic acids, and alcohols solidified with cement.	86.2 kg (190 lb) of Portland cement and 22.7 kg (50 lb) of magnesia cement in drum followed by the addition of 99.9 L (26.4 gal) of liquid waste. Additional cement top and bottom. Two plastic bags.
Series 745: sludge evaporator salts	Salt residue from evaporated liquids from solar ponds containing 60% sodium nitrate, 30% potassium nitrate, and 10% miscellaneous.	Salt residue packaged in plastic bag and drum. Cement added to damp or wet salt, when necessary.
Noncombustible waste	Various miscellaneous waste such as gloveboxes, lathes, ducting, piping, angle iron, electronic instrumentation, pumps, motors, power tools, hand tools, chairs, and desks.	Varies by process line generating the waste. Waste may have been wrapped in plastic or placed directly into the waste container.
Combustible waste	Dry combustible materials such as paper, rags, plastics, surgeon's gloves, cloth coveralls and booties, cardboard, wood, wood filter frames, and polyethylene bottles.	Varies by process line generating the waste. Plastic bags used in some instances, but in other instances waste placed directly into waste container.
Graphite	Graphite mold pieces after excess plutonium removal. Molds are broken into large pieces before packaging.	Drums lined with polyethylene bags and, most likely, a cardboard liner.
Empty 55-gal drums	Empty drums that originally held lathe coolant at RFP. Some drums may contain residues.	Single drum placed in cardboard carton.

During Stage II excavation, operators will do their best to collect discrete samples of all types of sludges and samples that appear to be interstitial/underburden soil. Since the sludges and soils may not be in large, separate masses and may be difficult to identify readily, samples collected from OU 7-10 may include a mixture of soil, sludge, pieces of corroded waste drum, combustible materials, and unidentifiable waste. Samples could contain transuranic or non-TRU radionuclides, hazardous contaminants, uncontaminated soil or any mixture of these constituents. For planning purposes, it is assumed that the various target waste materials are obtained. Figure 2 outlines the process flow of the various types of samples received from OU 7-10 from the time of collection until the sample is delivered to the project for testing.

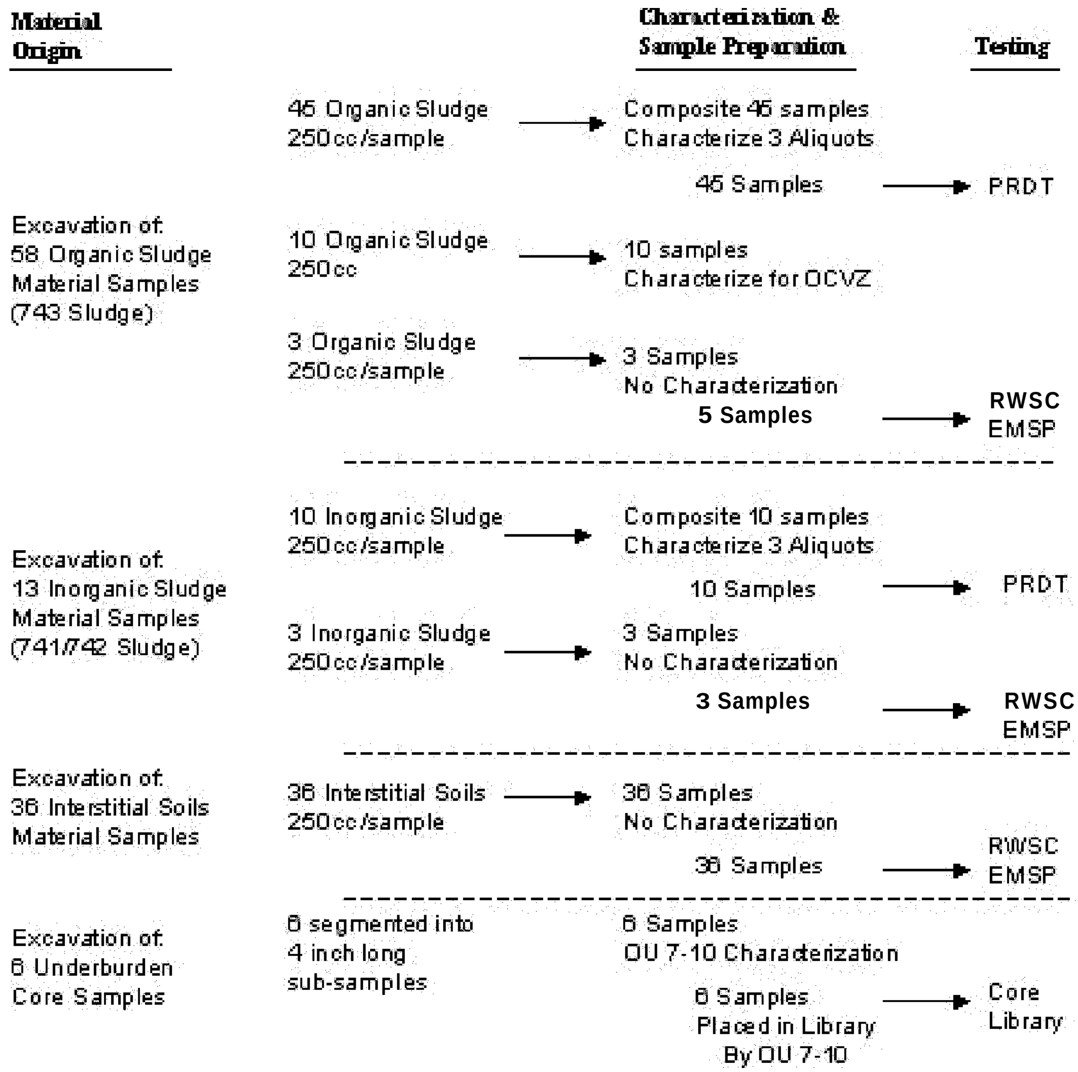

Figure 2. Sampling Strategy for OU 7-10 Material.

Sludge samples will be biased grab samples collected from material believed to be least affected by retrieval activities. To support this effort, the sludge sample material will be collected as close as possible to the central mass of sludge originating from a buried drum. Operators will be instructed on what the various types of sludges should look like, and they will attempt to collect materials that meet those descriptions (e.g., “peanut butter” consistency, green in color). Multiple samples may be collected from the same cartload of material.

Interstitial waste zone soil will be sampled in a biased manner to exclude any visually-obvious sludge, graphite, or debris waste within the sample. To make this determination, project personnel will visually examine waste zone material after it is placed in a transfer cart and enters the glovebox. When an interstitial soil sample is collected for the Environmental Protection Agency (EPA) (Salomon et al. 2003), a collocated sample will be collected for OU 7-13/14 Project. If no samples are collected for the EPA as outlined in the field sampling and analysis plan, 36 interstitial soil samples will be collected to meet the request of OU 7-13/14.

There is a layer of soil (underburden) between the waste and the basalt bedrock in OU 7-10. Six underburden soil cores will be collected beneath the waste zone, down to basalt refusal, to determine whether waste material has migrated into this region. The cores will each be cut into 4-in. segments and placed in the core library. It is assumed that OU 7-10 will be responsible for sample characterization and ensuring the samples are placed in the core library.

2.2 Surrogate Material

Hot (radioactive) and cold (nonradioactive) waste surrogate material will be formulated using historical information on the composition of both TRU and non-TRU waste. The composition of these materials will be controlled during formulation; thus, characterization of the surrogates will not be required before testing. Some of the surrogate material will be mixed with other materials (e.g., soil) before testing, which will affect the types of waste produced. All hot testing will be done at INEEL laboratories. Cold testing will be conducted at INEEL laboratories and off-site, by subcontracted laboratories. Management of the waste associated with the cold test surrogate tests, conducted by subcontracted offsite laboratories (MSE and EMRTC), will be the responsibility of those laboratories.

2.2.1 Surrogates for TRU Wastes

Surrogates will be used to simulate OU 7-10 inorganic sludge, organic sludge, and nitrate salt sludge. Following is a brief description of these surrogates:

Inorganic Sludge Surrogate. The simulated inorganic sludge formulation is based on the composition of inorganic precipitates processed at the RFP using the average contents of the Series 741 and 742 sludges. These inorganic surrogate sludges will contain indigenous soil, inorganic salts, water with terbium added, and some nitrate salts at the weight percentages shown in Table 2. The amount of water added will be based on the minimum needed to mix. Dry Portland cement will be added to all the surrogates, as was done in the actual waste processing to minimize free liquids.

Organic Sludge Surrogate. The simulated organic sludge will use the average constituents of the original RFP Series 743 organic sludge. The composition will include the constituents shown in Table 3. The organic oil and solvents are mixed and subsequently added to the solid absorbent.

Nitrate Salt Sludge Surrogate. A simulated salt sludge will be prepared using the average constituents of the sample from the RFP Series 745 retrieved from Pad A. The primary components are shown in Table 4. Trace constituents will be added to allow postulated effects to occur, such as catalytic oxidation by nitrite and bubble formation by bicarbonate decomposition.

Table 2. Composition of RFP Series Number 741, 742 Inorganic Sludge Surrogate for ISTD Testing

Compound	Specified Wt%
Soil	20
$CaCO_3$,	10
Water	20
Portland cement	10
Rare-earth tracer	2
$CaNO_3$	3
$NaNO_3$,	10
KNO_3	5
Na_2HPO_4 $7H_2O$	20

Table 3. Composition of RFP Series 743 Organic Sludge Surrogate Waste for ISTD and ISG Testing.

Material	Swecified Wt%
Texaco oil	29
CCl_4	27
TCE	7
TCA	9
PCE	7
$CaSiO_3$	13.5
Oil Dri	7.5

Table 4. Composition of RFP Series 745 Nitrate Salt Sludge Surrogate for ISG and ISTD Testing.

Salts	Specified Wt%
KNO_3	30
$NaNO_3$	60
NaCl	3
NaF	0.5
Na_2HPO_4	2
Na_2SO_4	2.96
$NaHCO_3$	0.5
$Cr(NO_3)_6$	0.04
EDTA	1
$NaNO_2$	0.5

The nitrate salt sludge surrogate will also be used for preparing mixtures of salts with soil or inorganic sludge simulants. The amount of water in these waste simulant preparations is typical of what might be present if originally dry salts (<2 **wt%** moisture) had partially hydrated over time in the 15 **wt%** moisture soil.

SDA Groundwater Simulant. A simulated groundwater will be prepared, which is similar to INEEL aquifer composition in salt content, major anion and cation composition, and pH (Yancey et al. 2003). The simulant constituents and final characteristics are shown in Tables 5 and 6.

Rare-Earth Element Spiked Sample Preparation. Terbium will be used as a contaminant surrogate to test procedures and provide baseline data before actual radioactive waste samples are used. Solid samples of each matrix (soil, organic, and inorganic sludge/waste) will be spiked first with terbium either as ground oxides or as solutions. The nitrate form, terbium nitrate $Tb(NO_3)_3$, dissolved in the water is mixed with each sludge (inorganic and organic) and soil. The oxide form, 200 mesh (<75 micron) powder terbium oxide (Tb_4O_7) is mixed dry. About 1–2% of the tracer is placed in each mixture giving the resultant treated waste a background concentration and source term sufficient to assess the affect of heating in terms of solubility change.

Table 5. SDA groundwater simulant recipe for ISG and ISTD leach testing.

Salt	Grams per 50 L Nanopure water
$MgSO_4 \cdot 7H_2O$	11.252
$CaCl_2$	9.7
$NaNO_3$	0.17
$NaHCO_3$	4.62
$KHCO_3$	0.31
KNO_3	0.20
Nanopure H_2O	50 L

Table 6. Simulated groundwater characteristics.

Water Characteristics	Value
SO_4	88 ppm
Cl	124 ppm
NO_3	5 ppm
Na	26 ppm
HCO_3	71 ppm
K	4 ppm
Ca	70 ppm
Mg	22 ppm
Total Dissolved Solids	410 ppm
Conductivity	567 µS/cm
pH	8

Radiological Spiked Surrogate Matrix Preparation. Radiological spiked matrices will then be used for leach testing to determine the affect of heating or grouting on contaminant leachability. Four actinides will be studied for applicability to TRU pits and trenches: plutonium (Pu), americium (Am), uranium (U), and neptunium (Np). Actinide nitrates (the most leachable form) will be added in the same manner as the rare-earth nitrates. Actinide oxides more closely resemble the chemical form of contaminants that exists after 30+ years of burial, while nitrates show more clearly the changes actinide solids undergo upon heating from soluble to an insoluble form. Oxides will be added as a powder. For the nonorganic surrogates (no Resource Conservation and Recovery Act [RCRA]-regulated constituents), sufficient radioactive material will be added for the residual waste to assay less than 100 nCi/g. Radioactive material will be added for the organic surrogate so the residual waste will assay less than 10 nCi/g

Debris Surrogate. Debris surrogate will consist of combustible (such as paper, rags, gloves, cardboard, PPE, and plastic) and noncombustible (such as cement, metal, asphalt, soil, and glass) materials. The exact proportions of the materials will be determined before testing.

2.2.2 Surrogates for Non-TRU Wastes

Non-TRU (LLW) wastes buried at the SDA were generated from a variety of processes. Actual LLW waste will not be available for testing, so the physical and chemical states expected for the contaminated soil will be simulated. Also, debris surrogates are only practical in field scale testing where they can be properly scaled. Testing will be done using hot surrogates composed of soil spiked with radionuclides.

Hot Surrogate Soil Preparation. Tc-99 will be used to make contaminated surrogate INEEL soil. The soil will be spiked with Tc-99 oxide or a pertechnate solution. Sufficient Tc-99 will be placed in each mixture to ensure that the resultant surrogate waste has a sufficiently high source term to assess the effect of grouting, in terms of solubility, during testing. The concentration of the radioactive spike will be based on SDA inventories, historical practices as non-TRU waste has been generated, and analytical test limits.

2.2.3 Pad-A Waste

Pad-A salts consist of 30 wt% potassium nitrate and 60 wt% sodium nitrate flakes with about 400 ppm soluble chromate (much as Cr^{+6}) and 180 pCi/g uranium as the primary hazardous and radioactive components. Samples from a retrieved Pad-A drum have been obtained and will be used for this mixing study. The objective of this study is to test encapsulation agents to see if uranium and nitrate will be immobilized.

3. PROCESSES AND PROCESSING LOCATIONS FOR THE STUDIES

What follows is a brief description of the processes and processing locations for the PRDT, RWSC, and EMSP tests. Detailed process information is provided because it is likely that the WMP will be issued before all test plans are published. This information will aid in understanding the types of wastes that will be generated and the influence of generation location on the management of test related waste. Additional information on the OCVZ Program and the underburden core samples is not presented because no testing is currently planned beyond initial material characterization.

3.1 Processes and Locations for Preremedial Design Testing

Treatment options are being considered for remediation of SDA wastes through the OU-7 13/14 RI/FS. Preremedial Design Tests will be conducted to aid in determining the effectiveness of ISTD, ISG, and ESG in treating these wastes. The bench-scale studies for ISTD and ISG will be performed so that interactions between the two technologies can be evaluated. The waste generated by these tests will result from the preparation and analyses of surrogate and actual waste material that has undergone ISTD treatment, ISTD treatment followed by grouting, and grouting treatment alone.

The ISTD testing is designed to obtain data to determine if thermal desorption would be a viable and effective treatment for the wastes contained in TRU pits and trenches at the SDA. The test results will estimate the destruction and removal efficiencies for organic and inorganic compounds, and will also estimate the extent the ISTD process may immobilize actinides at various temperatures.

While bench-scale studies for ISG have been conducted to evaluate performance of various grouts to waste in the TRU pits and trenches (Loomis et al. 2002), grouts have not yet been identified for in situ application to the non-TRU pits and trenches and soil vault rows wastes or for ex situ stabilization of Pad A nitrate salts. In addition, all work to date on grouts applicable to waste in the TRU pits and trenches was performed with nonradioactive tracer materials in surrogate waste; studies using radionuclides of concern and actual waste material retrieved from the SDA will reduce uncertainty. The test results for ISG and ESG will enhance information regarding the effectiveness and implementability of these technologies for stabilizing waste at the SDA.

3.1.1 Materials Tested

PRDT will be performed using cold surrogates, hot surrogates, and actual samples of waste from the SDA. Excavated samples from OU 7-10 will include inorganic sludge and organic sludge. Nitrate salts from Pad A will also be tested. These materials were each discussed in Section 2.

3.1.2 PRDT

PRDT can be subdivided according to the materials being tested. Tests using cold surrogates will be conducted as precursors to hot surrogate testing and testing on actual excavated samples of waste. Testing will be primarily conducted at the INEEL, although specialized cold surrogate tests will be performed at: (1) MSE in Montana, (2) EMRTC in Albuquerque, and (3) Argonne National Laboratory West.

3.1.2.1 Cold Surrogate Testing. Both ISTD and ISG bench scale testing will be performed on the cold surrogate materials. ISTD testing will include heating the test materials in a tube hrnace and performing Differential Scanning Calorimetry (DSC) on small amounts of material. The testing will include performing a mass balance and measuring off-gas generation during heating. ISG testing will include stabilization of cold surrogates directly and after treatment with ISTD. Physical properties (such as compressive strength and porosity) and chemical properties (such as leaching) will be evaluated. All of this work will be conducted at the INEEL Research Center (IRC).

Larger scale ISTD tests using cold surrogates will be performed at MSE. For these tests, 55-gal drums of cold surrogate waste will be heated using resistance heaters to simulate ISTD. The waste generated from the work at MSE will be managed by MSE. A small amount of the material generated at MSE will be brought to the INEEL for hrther testing. This is the ISTD-treated cold surrogate that will receive ISG treatment. Larger scale ISTD tests will also be conducted in EMRTC. For these tests, approximately 5-gal-quantities of cold surrogate will be heated. The waste generated from the work at EMRTC will be managed by EMRTC.

3.1.2.2 Hot Surrogate Testing. ISTD and ISG testing will be conducted using hot surrogates. Work utilizing hot surrogates for TRU wastes will be conducted at the Test Reactor Area (TRA), Idaho Nuclear Technology and Engineering Center (INTEC), and ANL-W. Work utilizing hot surrogates for non-TRU wastes will be conducted at INTEC. All hot surrogate testing will be performed at laboratories approved for radiological work. Laboratories at INTEC and TRA at the INEEL and laboratories at ANL-W will be used for this work. The wastes generated by the work performed at ANL-W will be managed by ANL-W. The compositions of the hot surrogate materials for TRU wastes are very similar to those of the cold surrogate materials, except for the inclusion of radionuclides in the hot surrogates. The ISTD testing will include heating hot surrogate materials in a tube furnace in a manner similar to that used for the cold surrogate work. The testing will include performing a mass balance, measuring off-gas generation during heating, determining the destructiodremoval of organic and inorganic compounds, and evaluating the mobility of radionuclides before and after treatment. Four grouts, GMENT-12, U.S. Grout, TECT HG, and Waxfix, will be used for the ISG testing. The ISG work will evaluate the mobility (using an ANS 16.1 or K_d leachability test) of radionuclides and organic and inorganic compounds after grouting. Hot surrogates will be grouted directly and after treatment with ISTD. Two tests will be conducted at ANL-W: (1) hydrogen generation and (2) Pu aerosolization. These tests will use soil and/or grout amended with radionuclides. The hydrogen generation test will evaluate the radiolysis-based production of hydrogen from a paraffin-based grout when it contains radionuclides. The Pu aerosolization test will evaluate the potential for the release of Pu from cured grout temporarily exposed to the surface (as might occur during the placement of grout in the subsurface).

Soil and neat grout amended with radionuclides will be used for hot surrogates for the non-TRU wastes. This ISG work will evaluate the mobility of radionuclides after grouting, using an ANS 16.1 leachability test. Four grouts, GMENT-12, U.S. Grout, TECT HG, and Waxfix will be used for the ISG testing of non-TRU wastes.

3.1.2.3 Testing on OU 7-70 and Pad A Samples. ISTD, ISG, and ESG testing will be conducted using samples of actual wastes. Work utilizing samples of organic sludges and inorganic sludges from OU 7-10 (TRU wastes) will be conducted at TRA and INTEC. Work utilizing samples of Pad A waste will be conducted at INTEC and TRA. All testing of waste samples will be performed at laboratories approved for radiological work.

ISTD testing will be conducted at TRA (with some analysis work performed at INTEC or Central Facilities Area [CFA]) using samples of organic sludges and inorganic sludges from OU 7-10 and samples from Pad A will be used as a surrogate for nitrate salt sludge from OU 7-10. The ISTD testing will include heating sample materials in a tube furnace in a manner similar to that used for the hot surrogate work. The testing will include performing a mass balance, measuring off-gas generation during heating, determining the destructiodremoval of organic and inorganic compounds, and evaluating the mobility of radionuclides before and after treatment.

ISG testing will be conducted at TRA (with some analysis work performed at INTEC) using samples of organic sludges and inorganic sludges from OU 7-10. Four grouts, GMENT-12, **U.S.** Grout, TECT HG, and Waxfix, will be used for the ISG testing. The ISG work will evaluate the mobility (using an ANS 16.1 or K_d leachability test) of radionuclides and organic and inorganic compounds after grouting; samples of waste will be grouted directly and after treatment with ISTD.

ESG testing will be conducted at INTEC using samples of Pad A waste. Three grouts, Saltstone, Polysiloxane, and Waxfix, will be used for the ISG testing. The ESG work will evaluate the mobility (using an ANS 16.1 or TCLP leachability test) of radionuclide and inorganic compounds after grouting.

3.2 Procedures and Locations for Retrieved Waste and Soil Characterization and EMSP Tests

3.2.1 Purpose

Actinide metals (Ac), in particular Pu, display a variety of chemistry that is manifest in transport behavior that ranges from immobile to fast. This has led to speculation regarding the chemical form of the actinides and how it relates to their transport behavior. The Glovebox Excavator Method samples represent a unique opportunity to examine the actinide chemistry, which will provide a much more informed basis for evaluating efficacy of preremedial design studies, and also estimating Ac transport.

Because of the terrific potential for varied actinide chemistry, extensive experimentation could be envisioned that would require substantial resource investment. Therefore, a two-tiered approach has been identified for examination of actinide mobilization. Total metals content, pH dependent partitioning studies, and “operationally defined speciation” constitute the first tier of basic information, which have been termed the RWSC Tests. Potentially more complex investigations of possible organoactinide complexes and colloids are referred to as the EMSP Investigations. Other EMSP testing will focus on identification of the microbial ecology via characterization of the DNA of collected microbes.

Characterization of the RWSC samples will be performed at INTEC. All testing will be conducted at TRA.

3.2.2 Samples Required

The RWSC/EMSP testing uses interstitial soil samples, and 36 such samples are designated for collection in the OU 7-10 sampling plan (see Table 3).

In addition, six sludge samples will be investigated in a similar fashion. Three of these will be “organic” sludge, which is anticipated to be principally calcium silicate. Three are expected to be “inorganic” sludge, which may be evaporated salts that have been grouted.

3.2.3 RWSC Tests.

The RWSC tests will generate Ac solubilization behavior on a more phenomenological basis, but will nevertheless be geochemically defendable in terms of likely Ac speciation. Explicit Ac speciation data may not be generated; however, “operationally defined’ behavior that has speciation implications will be derived from the testing. We expect that these results will represent the behavior of the vast majority of the Ac.

The tests are divided up into determining (1) the total Ac content of the samples, (2) the Ac leachability as a function of pH, and (3) the Ac leachability in response to a sequential aqueous extraction.

***3.2.3.1 Total Ac Content*.** Total actinide content will be measured by performing a complete dissolution of the soil samples using either an acid dissolution or a potassium fluoride fusion method followed by the analysis of the resulting solution with inductively coupled plasma-mass spectrometry. Briefly, the acid dissolution will include an optional pretreatment with HNO_3, complete digestion with HF, evaporation to near dryness after the addition of HNO_3, optional removal of excess fluoride with boric acid, and dilution to volume with a dilute HNO_3 or HCl solution. The dissolution will involve HF/HNO_3, decomposition of the resulting cake with H_2SO_4, addition of Na_2SO_4 followed by heating to create a pyrosulfate fusion, and final dissolution/dilution to volume with dilute HNO_3 or HCl.

3.2.3.2 Ac leachability as a Function of pH. Briefly, Ac leachability as a function of pH will be assessed by immersing 1 g of the interstitial soils in 10 mL of simulated groundwater that has been adjusted to pH 3–12, using either nitric acid or sodium hydroxide. After equilibration for 18–24 hours with gentle agitation, a 500 µl sample will be pulled for ICP-MS analysis. Subsequently, the pH will be adjusted downward one unit using nitric acid. After equilibration, another 500 µl sample will be pulled for ICP-MS analysis. This process will be continued until the pH of the leachate reaches 3. This method follows that of Kinniburgh et al (1981). The total volume per sample will be on the order of 11 mL.

3.2.3.3 Sequential Aqueous Extractions. Briefly, this procedure divides Ac into five operationally defined "speciation" categories: (1) cation exchangeable, (2) carbonate bound, (3) organic bound (oxidizable), (4) sesquioxide bound (principally Fe, reduceable), and (5) residual. A series of reagents are used to chemically attack specific mineral fractions and mobilize bound metals. The method is based on the sequential aqueous extraction methods pioneered by Tessier (Tessier et al. 1979), Ibrahim (Litaor and Ibrahim 1996), and more recently Clark (Loyland Asbury et al. 2001).

1. Cation exchangeable: Ac are measured by leaching the soil samples with 0.01M $CaCl_2$ for 1 hour, and then analyzing the leachate using ICP-MS.

2. Carbonate bound: Upon completion of (1), the leachate is decanted, and the residual soil is leached with 1 M HOAc / NaOAc buffer (pH 5) for 6 hours. The acetate leachate is then analyzed for metals using ICP-MS.

3. Oxidizable: After completion of (2), the leachate is decanted, and the residual soil is leached using 30% H_2O_2 at pH 3 with nitric acid for 3 hours. The leachate is analyzed for metals using ICP-MS.

4. Reduceable: After completion of (3), the leachate is decanted and the residual soil is leached using the Citrate/Bicarbonate/Dithionite procedure of Jackson et al. (1986). The leachate is then analyzed for metals using ICP-MS.

5. The residual bound is then determined by a HF/HNO_3 fusion as described above in Section 3.2.3.1.

3.2.4 EMSP Investigations

The EMSP investigations consist of two projects that have been submitted to the EMSP for funding consideration. Hence, execution of these projects is dependent on selection of these projects for funding by the EMSP. Tests will be conducted at TRA and IRC (DNA associated testing).

3.2.4.1 OrganoPu Complexes and Colloids. The first project is entitled "Impact of Organic Complexes and Colloids on the Mobilization of Pu," by G. S. Groenewold, et al. The project is motivated by two hypotheses. The first is that chemical complexes consisting of organic ligands and actinides have been formed in the Radioactive Waste Management Complex (RWMC) that have the ability to resist adsorption to mineral surfaces. The second is that Ac either binds to, or forms, colloids that are capable of remaining suspended in groundwater. Both of these phenomena would result in movement in the subsurface at rates faster than predicted.

Analysis for organoactinide complexes would involve performing liquid chromatography/mass spectrometry (LC/MS) analyses on extracts collected from the pH gradient leach and sequential aqueous extractions described in Sections 3.2.3.2 and 3.2.3.3. In addition, alternative extractions will be performed using organic solvents that have a range of hydrophobicity. In these studies, 1–10 g of the interstitial soils will be extracted with 2–20 mL of organic solvents ranging from polar, hydrophilic compounds such as ethanol, tetrahydrofuran, or acetonitrile to hydrophobic compounds like toluene or hexanes. The resulting extracts will then be concentrated to approximately 200 µl for analysis using liquid chromatography/mass spectrometry (LC/MS). Both inductively coupled plasma-mass spectrometry (ICP-MS) and electrospray ionization-mass spectrometry (ESI-MS) will be used as detectors for the LC.

Analysis for colloidal material will involve separation of the colloids by leaching of 1–5 g subsamples with 10–50 mL of nanopure water, followed by filtration to remove particles having diameters < 1 pm. The leachate will be analyzed using ESI-MS, and ICP-MS. In addition, centrifugation will be performed that will enable separation of smaller size ranges. Once separated, the samples will be dried under ambient conditions to remove water, and analyzed using a suite of surface analysis techniques.

3.2.4.2 ***Microbial Ecology.*** The second project is entitled “Identification of Critical Microbial Populations and Processes in Buried Transuranic/Mixed Waste,” by Mike Lehman and colleagues. Ten of the interstitial soil samples and three organic sludge samples will be subsampled for microbiological characterizations. The subsamples will consist of 50 g for each of the 13 samples identified.

Forty g of the 50-g subsample will be measured for headspace gas, but are otherwise unaltered. Ten g of each sample would be subjected to the nucleic acid extraction approach described below. We anticipate performing the headspace gas analyses and DNA extraction at TRA. The project will be coordinated with the PRDT.

The DNA extracts will no longer be designated as mixed waste (ICP-MS analyses of µl samples will be used to ascertain this), and will be transported to IRC and ISU laboratories for hrther analysis. Any hrther requirements for the disposition of waste associated with the analysis of the DNA would be handled under facility-specific (IRC and ISU) procedures.

Microbial DNA isolation uses the following procedure: 1 g of soil is added to a reagent containing TRIS (hydroxymethyl) aminomethane (CAS# 77-86-1) that is titrated with hydrochloric acid to desired pH (referred to as Tris-HCL) and sodium dodecylsulfate (SDS) (260 µl) and the reagent guanidine isothiocyanate (550 µl) associated with glass beads. The cells are lysed following vigorous vortexing. Solid waste (2.5 g) is generated containing the soil, guanidine isothiocyanate, beads, and tubes. The liquid (400 µl) containing the DNA is separated from the proteins by precipitation following the addition of acetate (250 µl). Solid wastes (1 g) include tube, precipitated cell material, and proteins. The DNA (450 µl) is treated with guanidine HCL (900 µl) and the DNA is separated by solid phase affinity extraction. Liquid guanidine HCL waste is generated (1300 µl). The DNA is washed with Tris-HCL, EDTA, NaCl, and ethyl alcohol (300 µl). Liquid waste is Tris-HCL, EDTA, NaCl, and ethyl alcohol (300 µl). DNA can then be recovered with Tris-HCL (50 µl) free of nuclides. Solid waste tube (1.5 g) is generated.

4. WASTE STREAM IDENTIFICATION AND MANAGEMENT

Waste streams generated by sample characterization tests and the tests described in Section 3 will either be managed by the laboratories where the tests are conducted or by organizations within OU-7 13/14. All waste management activities will be closely coordinated with Waste Generator Services (WGS). In addition to the waste generated directly by sample characterization and performance of the tests, there is the possibility that samples of surrogate materials not involved in testing will need to be disposed of as waste. This Section discusses the assumptions and regulatory considerations associated with the waste streams, identifies the expected waste streams and the types of wastes generated based on a current understanding of the sample composition and expected test outcomes, and indicates waste management responsibilities based on the expected waste types and the policies and regulations governing the laboratories performing the tests. Section 5 address waste packaging, labeling, storage, transportation, and potential waste disposal options.

Figure 3 shows the relationship between the different sample and material types, the material characterization and tests that will be conducted, and how they relate to possible waste stream groups. Characterization of Pad A samples is discussed in the PRDT test plan, but is not expected to be performed because significant Pad A material characterization data exists. Characterization of the OU 7-10 samples and the OU 7-10 underburden material is being conducted for OU 7-10. Expected waste types and responsibilities for the waste from the waste stream groups are discussed in Sections 4.2 and 4.3

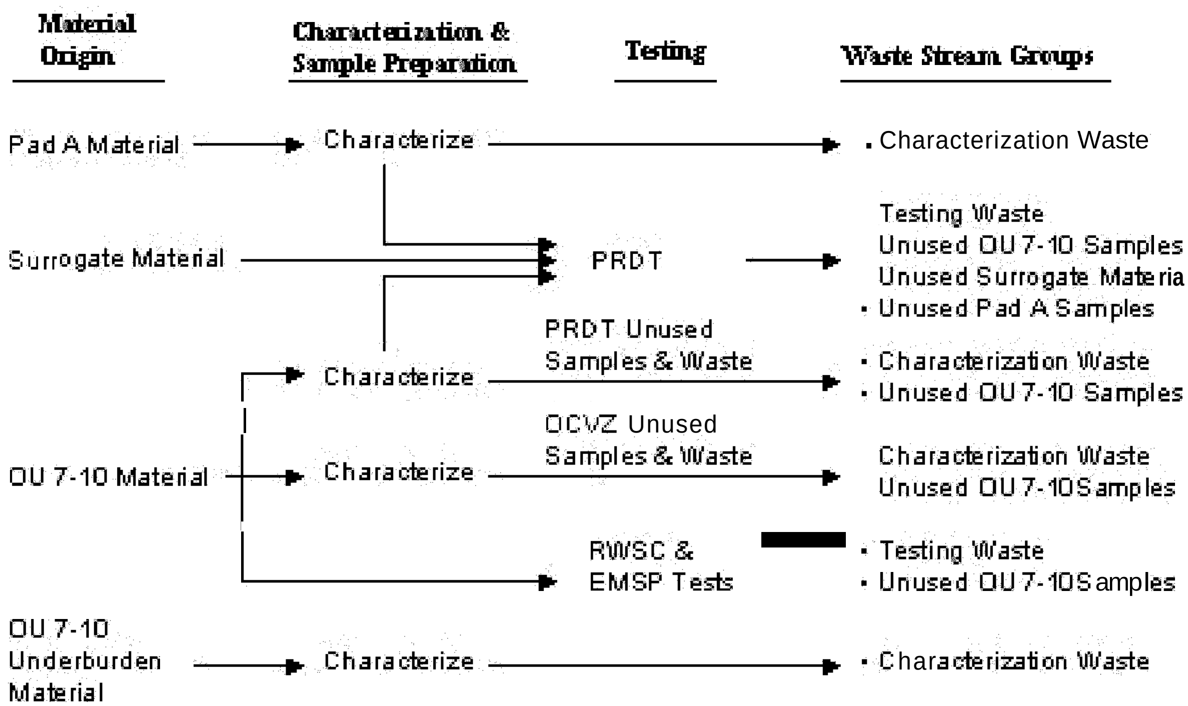

Figure 3. Materials to be characterized and tested, and resulting waste stream groups

Characterization results and hazardous waste determinations will establish the final storage or disposition location for the waste. Various levels of hazardous and radioactive contamination are expected for the waste in each of the waste groups. Waste material from each individual test could range from Industrial Waste to Waste with No identified Path to Disposal (WNPD), depending on the type of material (surrogate or OU 7-10 sample) and residuals after testing. Since the size of each test sample will be small, the amount of waste generated for each test will also be small. It is important to recognize that waste generated during testing at each individual facility will be accumulated in containers as the testing proceeds. Facility personnel will consult with WGS to determine which wastes can be combined. The containers will then be characterized and managed, based on the total contents. On a total waste container basis, contents can be managed to ensure WNPD is not generated. Since the TRU concentration in wastes from individual tests will be either significantly below 10 nCi/g (LLW or mixed low-level waste [MLLW]) or above 100 nCi/g wastes (TRU or mixed transuranic [MTRU]), waste from each category can be separately accumulated to ensure that designation of the total waste container contents is in a final waste category other than WNPD.

Much of the waste associated with testing of the cold surrogate materials, particularly the inorganic sludge surrogate, the soil wastes, and ISG of other cold surrogate materials, will not contain hazardous or radioactive constituents and will be managed as industrial waste (IW). Waste associated with testing of cold surrogate organic sludge will generally have RCRA hazardous constituents (See Table ***3)*** that will require management as hazardous waste.

Concentrations of TRU constituents for the hot surrogate material containing no RCRA hazardous constituents will be selected such that the individual waste forms will assay less than 100 nCi/g, and will therefore be managed either as LLW, or Alpha LLW (less than 100 nCi/g with no RCRA-hazardous constituents). Hot surrogate samples with RCRA hazardous constituents will be formulated such that the accumulated testing waste will assay less than 10 nCi/g and will be managed as MLLW.

It is assumed that much of the OU 7-10 associated waste will be RCRA-regulated and will therefore require management as MTRU or MLLW. For this WMP, it is considered unlikely that samples will contain polychlorinated biphenyls (PCBs) in concentrations that trigger Toxic Substances Control Act (TSCA) requirements, therefore no wastes are identified for management as (TSCA) waste; however, if OU 7-10 sample characterization identifies PCBs, waste from that material will be managed according to TSCA regulations.

Waste will be evaluated within each of these categories through analytical data and process knowledge. Depending on the storage and disposition location chosen, waste will be defined and characterized in accordance with waste acceptance criteria (WAC) from the appropriate facility. Table **8** identifies expected waste disposition locations.

Table **8.** Expected waste disposition locations.

Waste Type	Waste Disposition Location
Industrial Waste (nonhazardous, nonradioactive)	CFA Landfill, Bonneville County Landfill (IW from IRC)
Hazardous Waste	Treatment, storage, and disposal facility (TSDF) off site and RCRA permitted
LLW	INEEL CERCLA Disposal Facility (ICDF), RWMC
Alpha Low-Level Waste (Alpha LLW)	Hanford Low-level Burial Grounds or Nevada Test Site
MLLW	ICDF, Envirocare
TRU Waste and MTRU Waste	Storage at WAG 7/Waste Isolation Pilot Plant (WIPP)

4.1 Waste Management Assumptions and Regulatory Considerations

As stated in Section 1.1, the purpose of this WMP is to describe the methods for identifying, characterizing, and managing the waste streams associated with the Preremedial Design Tests, Retrieved Waste and Soil Characterization Tests, Environmental Management Science Program tests, and to support the OCVZ Program through characterization of samples. Data generated from the investigation activities that this waste management plan supports will be used in support of the WAG 7 OU-13/14 preremedial design efforts and the RI/FS.

Studies and investigations conducted during the RI/FS phase are considered removal actions by EPA and are undertaken pursuant to Section 104(b) of CERCLA. As such, it is EPA's policy that the RI/FS-related activities supported by this waste management plan when conducted on-site, will comply with applicable or relevant and appropriate requirements (ARARs) "to the extent practicable, considering the exigencies of the situation (Ref - Federal Register, Volume 55. No. 46, March **8,** 1990, 8756)." A listing of relevant ARARs was developed and is presented in Appendix A. The ARARs apply to the portions of the preremedial Design Studies and RWSC tests being conducted on the INEEL site. The ARARs are limited to the substantive requirements of environmental regulations. Administrative requirements, such as timeframes or reporting requirements, do not apply to the on-site portion of the testing. Testing conducted at off-site locations (e.g., surrogate testing conducted at Idaho Falls facilities) must comply with all administrative and substantive regulatory requirements relevant to the test activities and materials being tested. Investigation derived waste subjected to testing at off-site facilities must be performed at facilities that satisfy the applicable requirements of the CERCLA off-site Rule (40 Code of Federal Regulations [CFR] 300.440, "Procedures for Planning and Implementing Off-Site Response Actions").

All waste streams generated will be identified, characterized, and managed in accordance with the requirements and processes defined in WGS management control procedures. The materials addressed by this plan fall in two major categories: (1) samples of actual waste forms excavated from either OU 7-10 or Pad A, and (2) surrogate waste materials generated to represent characteristics of transuranic and nontransuranic waste streams known to be located in the SDA. From a hazardous waste standpoint (i.e., under the Resource Conservation and Recovery Act), samples collected for the sole purpose of determining their characteristics or composition, are not subject to RCRA requirements while in the analytical process loop, as defined in 40 CFR 261.4(d) as follows":

1. The sample is being transported to a laboratory for the purpose of testing; or
2. The sample is being transported back to the sample collector after testing; or
3. The sample is being stored by the sample collector before transport to a laboratory for testing; or
4. The sample is being stored in a laboratory before testing; or
5. The sample is being stored in a laboratory after testing, but before it is returned to the sample collector; or

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a. 40 CFR 261.4(d)(2) further clarifies a number of shipping requirements that must be satisfied to qualify for the sample exemption.

6. The sample is being stored temporarily in the laboratory after testing for a specific purpose (for example, until conclusion of a court case or enforcement action where hrther testing of the sample may be necessary).

The studies and analyses associated with this plan involve both characterization activities and testing. As described in Section 2.1.1 (Figure 2), some samples originating from OU 7-10 are collected solely for characterization purposes (e.g., OCVZ samples), while other samples are subjected to a combination of characterization and/or testing activities. Consequently, in a purely RCRA context, both the sample exclusion of 40 CFR 261.4(d) and the treatability study sample exclusions of 40 CFR 261.4(e) and (f) would apply to the management of the sample materials; however, because the testing associated with the OU 7-10 and Pad-A-related materials is all occurring at facilities located on the INEEL site under CERCLA, the administrative requirements of the Federal treatability study sample exemption rule of 40 CFR 261.4 (e) and (f) are not applicable. As stated in EPA guidance, the on-site testing must be conducted in accordance with applicable or relevant and appropriate requirements identified for the activities under Federal and State environmental laws (EPA 1998); thus, certain substantive provisions of the Federal treatability study sample exemption rule have been identified as relevant and appropriate requirements for the on-site portions of the testing activities addressed in this waste management plan. Administrative provisions identified in the rule, including notification requirements, are not identified as ARARs; however, it is noted that similar notifications and coordination occurs under CERCLA through submission of FFA/CO required documentation and coordination of CERCLA program personnel with IDEQ and EPA project managers. The full listing of ARARs identified as requiring implementation for the on-site testing activities are identified in Appendix A.

The testing activities addressed in this plan also involve the generation of a significant number of surrogate waste streams that include both chemical and radiological constituents. Manufacture of surrogate test materials for the testing described in this plan does not result in the generation of RCRA hazardous waste. The surrogate test material constitutes a test product rather than a solid or hazardous waste. It is important to note, however, that the process of testing will lead to the generation of a number of test and analytical process residuals, some of which may be hazardous waste or mixed hazardous waste that require appropriate management. Examples of these waste streams include unused sample material, analytical waste, modified test materials, unused surrogate test material, and other laboratory waste streams. It is important to note that an unused surrogate could become a hazardous or mixed waste if the use for the surrogate no longer exists (e.g., if the surrogate were to require disposal because of cancellation of the planned testing activities).

4.1.1 Hazardous Waste Determination

To guide appropriate management of waste generated during project activities, a hazardous waste determination (HWD) conducted in accordance with 40 CFR 262.11 will be performed. Detailed discussion of HWD assumptions are presented in the Glovebox Excavator Method Project Waste Management Plan for the samples originating in OU 7-10. Table 9 below presents the general waste stream information and potential waste codes associated with sample or test residuals, based on the Glovebox Excavator Method Project waste management plan. It is noted that the series 745 sludge waste identified in the table corresponds to the Pad A materials used in the testing.

The hazardous waste numbers in the table are presented as potential waste codes that may apply to the analytical residuals and other waste streams associated with the testing performed on OU 7-10 and Pad A sample materials. In accordance with WGS procedures, the final HWD will consider both process knowledge information (e.g., Table 9 and process information related to the testing) and analytical results to arrive at the proper assignment of hazardous waste numbers.

Table 9. Potential Hazardous Waste Numbers Associated with Glovebox Excavator Method Project Waste Streams (based on stored waste inventory similarity)."

Component Waste Stream	Potential Corresponding Stored Waste Inventory Item Description Code"	Idaho National Engineering and Environmental Laboratory Potential Hazardous Waste Numbers Associated with Stored Waste Inventory"
Series 741 sludge	001 first stage sludge	F001, F002, F003, F005, F006, F007, F009, D002, D004, D005, D006, D007, D008, D009, D010, DOll
Series 742 sludge	002 second stage sludge	F001, F002, F003, F005, F006, F007, F009, D002, D004, D005, D006, D007, D008, D009, D010, DOll
Series 743 sludge	003 organic setups, oil solids	F001, F002, F003, F005, D005, DOll, D022, D029, D036
Series 744 sludge	004 special setups (cement)	F001, F002, F003, F005
Series 745 sludge	005 evaporator salts	D001
Graphite	300 graphite molds	F002
Combustible waste	330 paper and rags—dry	F001, F002, F003, F005, F006, F007, F009 D006, D007, D008, D011, D022
Noncombustible waste	480 metal, scrap (nonspecial source)	F001, F002, F003, F005, F006, F007, F009, D001, D004, D005, D006, D007, D008, D009, D010, DOll
Empty containers	No definitive information to correspond to RWMC-EDF-803.[a]	No definitive information to correspond to RWMC-EDF-803.[a]
Interstitial Soils	NA	Hazardous waste numbers derived from surrounding waste streams (i.e., assumes cross-contamination)
Underburden cores	NA	F039 (Assumes assignment of multisource leachate code to underburden soils in lieu of initial listed waste codes as described in 40 CFR 261.31).[b]

a. Chemical Constituents in Transuranic Storage Area Waste (Major, Medeiros, and Hailey 2000)

b. F039 assignment to underburden soils and other media coming into direct contact with multisource leachate based on meeting held September 3,2002 between BBWI and DOE-ID personnel.

As discussed in Section 2, different surrogate formulations are planned for use in the testing. Because the composition of the surrogate materials is known, as are the test parameters, the amount of characterization testing required to complete the HWD will be limited. Nitrate containing waste will require verification of nonoxidizing properties before disposal, because the surrogate nitrate salts may be oxidizers under 49 CFR 173.151. Unless it can be determined through sufficient process knowledge, the verification will be performed using the U.S. Department of Transportation (DOT) solid oxidizer test (49 CFR 173.127). Because the nitrate salts may be oxidizers, the solidified nitrate salts may be RCRA-regulated as D001 characteristic hazardous waste (40 CFR 261.21). Because of the complexity of the testing and the number of surrogate formulations involved, hrther definition of the HWD associated with surrogate test residuals will be based on waste profile documentation prepared by WGS personnel, rather than presented in this WMP. Records of the completed HWD documentation are maintained by WGS in accordance with INEEL procedures.

4.1.2 Toxic Substance Control Act Assumptions

The OU 7-10 is suspected to contain PCBs; however, definitive information about the presence and concentration of PCBs is not available because of a lack of characterization information. Current inventory documentation indicates that PCBs were not a routine contaminant in OU 7-10 waste streams, but may have been placed in OU 7-10 waste occasionally. As a result of these uncertainties, OU 7-10 waste streams will be characterized for PCBs to determine if the materials required TSCA management. The OU 7-10 data will be relied upon to determine if the waste streams generated from the testing activities discussed in this plan require TSCA management for PCBs.

4.2 Waste Stream Identification for PRDT

The waste streams that are expected to be generated during the previously described OU-7 13/14 RI/FS preremedial Design Tests are identified in this section. Additional information is provided in the associated appendixes. Appendix B contains a set of summary diagrams that show the relationship between the input sample material, the tests, the expected waste streams, and the waste type. Appendix C is a more detailed set of figures that show which analytical tests are being performed on the test samples and how these analytical tests relate to the various waste streams. These two sets of figures provide the basis for assigning waste to various waste streams.

4.2.1 Waste Streams for PRDT

A summary of waste stream information for PRDT is provided in Table 10. The results presented indicate the waste type, responsible waste manager, estimated volume of solids and unstabilized liquids generated, planned disposition location (recognizing that the liquid will be stabilized for disposition), and a description of the expected waste form. For the OU 7-10 sample material, the waste type generated will depend on the initial concentrations of radioactive and hazardous materials, which will not be known until the material is excavated and characterized. To accommodate this unknown condition, two or more possible waste types may be listed.

Waste generated during performance of PRDT is categorized according to when, how, and for what reasons the waste is generated. The waste form descriptions in Table 10 use the following waste categories. Since the form and type of waste remaining after completion of the analytical tests is highly dependant on the type of analysis performed, additional detail on the individual components of the waste remaining after completion of analysis are provided in the table, rather than just the category (Modified Test Material Waste).

- *Laboratory Waste:* Laboratory waste is the general waste associated with preparing samples or performing analysis on these samples. It includes waste from analytical sample preparation, residuals from analysis, sample material, and disposable lab materials such as gloves, filter paper, glassware and plastic.

- *Process Waste:* Process waste is the waste generated during preparation of materials for testing and as a result of the testing. This includes materials such as molds for monoliths, mixing bowls, weigh boats, glass and plastic ware, and testing apparatus. This waste may be similar in nature to that described in laboratory waste that will be generated as a part of the analysis of samples, but results from conducting the tests, rather than the preparation and analyses and will therefore sometimes require a different disposal path or be generated in a different location.

Table 10. Waste type, responsible waste manager, estimated volume, and basic description of wastes expected to be generated during the PRDT.

Expected Waste Type	Waste Management Responsibility	Estimated Volume Cubic Meters (Cubic Yards)	Planned Disposition[b]	Waste Generated from Testing this Material	Expected Waste Form
Industrial Waste		Solid 0.065 (0.085) Liquid” 1.0 (0.130)			
	IRC		Bonneville County Landfill	WAXFIX Grout Qualification	ISG Grout Monolith, Remaining Grout, Process Waste, Laboratory Waste
				Cold Surrogate for TRU	
	IRC			Inorganic Sludge	ISTD - Leachate (liquid), Leach Solid, Liquid from Gas Trap, Process Waste, Laboratory Waste, Process Waste
	IRC			Organic Sludge	ISTD – Process Waste ISG – Process Waste ISG of ISTD – Process Waste
	IRC			Nitrate Salt Sludge	ISTD – Laboratory Waste, Process Waste ISG – Laboratory Waste, Process Waste
	IRC			Soil	ISTD - Leachate (liquid), Leach Solid, Liquid from Gas Trap, Process Waste, Laboratory Waste ISG - Liquid from Hydraulic Conductivity, Solids from Hydraulic Conductivity, Compressive Strength, and Fracture Propagation, Process Waste, Laboratory Waste
	IRC			Debris	ISTD - Leachate (liquid), Leach Solid, Liquid from Gas Trap, Process Waste, Laboratory Waste
				Cold Surrogate for LLW	
	IRC			Soil	ISG - Grout Monolith, Liquid from Hydraulic Conductivity, Remaining Grout, Process Waste, Laboratory Waste

Table 10. (continued)

Expected Waste Type	Waste Management Responsibility	Estimated Volume Cubic Meters (Cubic Yards)	Planned Disposition[b]	Waste Generated from Testing this Material	Expected Waste Form
Industrial or Hazardous		Solid 0.134 (0.175) Liquid" 0.077 (0.101)			
				***Cold Surrogate for** TRU*	
	IRC		Bonneville County Landfill (Industrial) or TSDF (Hazardous)	Organic Sludge	ISTD - Leachate (liquid), Liquid from Gas Trap, Leach Solid, Laboratory Waste ISG - Liquid from Hydraulic Conductivity, Grout monolith, Remaining Grout, Laboratory Waste ISG of ISTD - Liquid from Hydraulic Conductivity, Grout monolith, Remaining Grout, Laboratory Waste
	IRC			Nitrate Salt Sludge	ISTD - Leachate (liquid), Leach Solid, Liquid from Gas Trap ISG - Liquid from Hydraulic Conductivity, Grout Monolith, Remaining Grout
LLW		Solid 0.003 (0.004) Liquid" 3.28 (4.30)			
				***Hot Surrogate for** TRU*	
	TRA		ICDF or RWMC Low-level Waste (LLW) Pit	Soil	ISTD - Leachate (liquid), Liquid from Gas Trap, Process Waste, Laboratory Waste ISG - Leachate (liquid), Process Waste, Laboratory Waste
	INTEC-637 for solids WAG 7-13/14 for liquids			Soil	ISG - Leachate (liquid), Grout Monolith, Remaining Grout
	TRA			Neat Grout	ISG – Leachate (liquid), Process Waste, Laboratory Waste

Table 10. (continued).

Expected Waste Type	Waste Management Responsibility	Estimated Volume Cubic Meters (Cubic Yards)	Planned Disposition[b]	Waste Generated from Testing this Material	Expected Waste Form
				Hot Surrogate for LLW	
	INTEC-637			Soil	ISG – Leachate Liquid, Grout Monolith, Remaining Grout, Process Waste, Laboratory Waste
	ANL-W			Soil – Pu Aerosolization	ISG – Process Waste, Laboratory Waste
	ANL-W			Neat Grout – H_2 Generation	ISG – Grout Monolith, Remaining Grout, Process Waste, Laboratory Waste
LLW or MLLW		Solid 0.012 (0.015) Liquid" 2.44 (3.2)			
				Hot Surrogate for TRU	
	TRA		ICDF or RWMC LLW Pit (for LLW) or ICDF or Envirocare (MLLW)	Inorganic Sludge	ISTD - Leachate (liquid), Liquid from Gas Trap, Process Waste, Laboratory Waste
	TRA			Nitrate Salt Sludge	ISG - Leachate (liquid), Process Waste Laboratory Waste ISTD - Leachate (liquid), Liquid from Gas Trap, Process Waste Laboratory Waste
	WAG7-13/14			Pad A Salts	ESG - Leachate (liquid), ESG Leach Monolith, Remaining Grout, Laboratory Waste
	WAG7-13/14			Pad A Nitrate Salts as Surrogate for TRU Actual *OU 7-10* Waste	ISTD – Leach Solid

Table 10. (continued).

Expected Waste Type	Waste Management Responsibility	Estimated Volume Cubic Meters (Cubic Yards)	Planned Disposition[b]	Waste Generated from Testing this Material	Expected Waste Form
MLLW		Solid 0.0256 (0.033) Liquid” 4.5 (5.9)			
				Hot Surrogate for TRU	
	TRA for solids WAG7-13/14 for liquids		ICDF or Envirocare	Organic Sludge	ISTD - Leachate (liquid), Liquid from Gas Trap, Process Waste, Laboratory Waste ISG - Leachate (liquid), Process Waste, Laboratory Waste ISG of ISTD - Leachate (liquid), Laboratory Waste Process Waste
	WAG7-13/14			Organic Sludge	ISTD - Leach Solid ISG - Leach Monolith, Remaining Grout ISG of ISTD - Leach Monolith, Remaining Grout
	WAG7-13/14			Nitrate Salt Sludge	ISTD - Leach Solid ISG - Leach Monolith, Remaining Grout
	INTEC-637			Pad A Salts	ESG – Process Waste
	TRA for solids WAG7-13/14 for liquids			Pad A Nitrate Salts as Surrogate for TRU Actual *OU 7-10* Waste	ISTD – Leachate (liquid), Liquid from Gas Trap, Process Waste, Laboratory Waste
				OU 7-10 Waste	
	WAG7-13/14			Inorganic Sludge	ISTD Leachate (liquid), Liquid from Gas Trap, Process Waste ISG Leachate (liquid), Process Waste ISTD & ISG – Laboratory Waste
	WAG7-13/14			Organic Sludge	ISTD Leachate (liquid), Liquid from Gas Trap, Process Waste, Laboratory Waste ISG Leachate (liquid), Process Waste, Laboratory Waste ISG of ISTD – Process Waste, Laboratory Waste

Table 10. (continued)

Expected Waste Type	Waste Management Responsibility	Estimated Volume Cubic Meters (Cubic Yards)	Planned Disposition[b]	Waste Generated from Testing this Material	Expected Waste Form
MTRU or MLLW		Solid 0.018 (0.023) Liquid” 0.0			
				OU 7-10 Waste	
	WAG7-13/14		Ultimate Disposal at WIPP (TRU) or ICDF or Envirocare (MLLW)	Inorganic Sludge	ISTD – Leach solid ISG - Leach Monolith, Remaining Grout
	WAG7-13/14			Organic Sludge	ISTD – Leach solid ISG - Leach Monolith, Remaining Grout ISG of ISTD - Leach Monolith, Remaining Grout
Alpha LLW		Solid 0.020 (0.026) Liquid” 0.0			
				Hot Surrogate for TRU	
	WAG7-13/14		Hanford Low-level Burial Grounds or Nevada Test Site	Soil	ISTD - Leach Solid, ISG Leach Monolith, Remaining Grout
	WAG7-13/14			Neat Grout	ISG – Leach Monolith, Remaining Grout
	WAG7-13/14			Inorganic Sludge	ISTD – Leach Solid
LLW or Alpha LLW		Solid 0.023 (0.03) Liquid” 0.0			
				Hot Surrogate for TRU	
	ANL-W		ICDF or RWMC LLW Pit (for LLW) or Hanford Low-level Burial Grounds or Nevada Test Site	Soil – Pu Aerosolization	ISG Grout Monolith, Remaining Grout

a. Liquid volume prior to stabilization.
b. Recognizing liquid will be stabilized before disposition.

- Leachate (liquid): Liquids resulting from the leach tests
- Leach Solid: Solids remaining after leach of ISTD samples
- Liquid From Gas Trap: Liquid collected in the gas trap
- Leach Monolith: Solid material remaining after the grout sample is tested (ISG or ISG of ISTD)
- Remaining Grout: Grout that is mixed with sludge or surrogate material but remains after filling the grout form
- Liquid From Hydraulic Cond.: Liquid used in the hydraulic conductivity testing

4.2.2 Unused Samples or Material Waste

In addition to the waste described in Table 10, samples or material that are not used during testing may become waste that will require management. This waste could result from unused samples taken from and not returned to OU 7-10, OU 7-10 samples that are modified or altered after their receipt, surrogate material that is formulated but not used, and unused dry grout. The disposition options for each of these materials are very different. The Memorandum of Agreement (MOA) between WAG 7, OU 7-10, and OU 7-13/14 (IAG-185) designates waste management responsibilities for many of the unused samples and materials.

- Unused OU 7-10 Samples: It is currently anticipated that all of the samples obtained by OU 7-13/14 will be used in the testing; however, if some samples are not completely used up, the MOA (IAG-185) specifies that unaltered sample material not used in the studies can be transferred back to the RWMC. Upon return, this material will be managed according to the OU 7-10 Glovebox Excavator Method Project's Waste Management Plan. The return transfer of material must be completed before final decontamination and decommissioning (D&D). A concerted effort will be made to return any unused and unaltered sample material to the OU 7-10 Project within the agreed upon time frame; however, if the samples are not returned as agreed upon, a waste classification will be made according to the results of the characterization analysis performed before OU 7-13/14 sponsored tests. It is expected that this waste will contain TRU radionuclide materials and may also contain RCRA hazardous constituents, which will require management as legacy waste that is either: TRU, MTRU, Alpha MLLW, or MLLW (WNPD is not expected, but may be possible).

- Unused samples of altered OU 7-10 material will be the responsibility of OU 7-13/14, based on the MOA. There are no plans to alter samples unless they have undergone one of the testing procedures described previously. Materials that have had tests performed on them are included in Table 10. The wastes will be managed according to the associated waste types.

- Unused samples of surrogate material formulated for the PRDT are the responsibility of OU 7-13/14. If any surrogate material is unused, it will be offered to other programs that have interest in conducting experimental work on well-characterized hazardous or radioactive material If an interested program cannot be located, the material will be disposed of based on process knowledge as Industrial Waste, Hazardous Waste, LLW, MLLW, TRU or MTRU. Surrogate material with organics or nitrate salts may require thermal processing before waste disposal.

- If there is unmixed grout material, it will be offered to other programs with an interest in conducting grouting studies. In the situation where an interested program cannot be identified, the unused grouting will undergo a hazardous waste determination and then managed appropriately.

4.3 Waste Stream Identification for RWSC and EMSP Tests

The waste streams that are expected to be generated during the RWSC and EMSP tests are identified in Table 11. Appendix D contains a set of summary diagrams that show the relationship between the input sample material, the tests, the expected waste streams, and the waste type. Since OU 7-10 excavated sample material will be used, there is some uncertainty in the waste types that will be generated. It is expected that the accumulated sample residues will be MLLW, although there is a small possibility that the waste could be MTRU. Waste will be managed in accordance with ARARs.

4.3.1 Unused Sample from Subsampling

It is assumed that the interstitial soil samples will contain 300–400 g of material (corresponding to 250 cm^3 sample volume). It is expected that the RWSC and EMSP investigations will consume *ut most* 200 g of sample (see the summary in Table 11), which will be handled by subsampling. Therefore, there will be *ut least* 100–200 g of unused sample material leftover. The unused sample will remain in the shipping container and will be returned to the Glovebox Excavator Method Project for management.

Table 11. Waste streams originating from RWSC and EMSP testing.

Expected Waste Type	Waste Management Responsibility	Estimated Volume Cubic Meters (Cubic Yards)	Planned Disposition	Waste Generated from Testing this Material	Expected Waste Form
MLLW or MTRU	TRA	RWSC Stabilized Liquids, 0.031 (0.04) Lab debris, 0.031 (0.04)	ICDF or Ultimate Disposal at WIPP (MTRU)	Organic sludge (3 samples), Cemented sludge (3 samples), and Interstitial soils (36 soils)	From RWSC: Slightly > 15 L of unanalyzed leachate; < 0.5 L ICP-MS liquid waste; 252 g of residual soil and sludge; –1.5 kg of lab debris.
MLLW or MTRU	TRA	EMSP Stabilized Liquids, 0.046 (0.06) Lab debris, 0.061 (0.08)	ICDF or Ultimate Disposal at WIPP (MTRU)	Unanalyzed leachate solutions, low pH ICP-MS solutions, soil, lab debris, liquid DNA extract.	From EMSP: Slightly > 25 L of excess extractant / leachate; ~ 315 ml of ICP-MS and ESI-MS liquid waste; slightly > 3 kg of residual soil; –1.65 kg of lab debris.

Note: EMSP waste will onlv be generated in the event that the EMSP proiects are funded

5. CONTAINER MANAGEMENT

The following subsections describe the management of waste in containers generated from activities associated with OU 7-13/14 research. This waste may include original unaltered samples, sample residues from analytical procedures, analytical laboratory waste, stabilization and leach test materials, and any other material generated from the OU 7-10 materials or surrogate wastes. These wastes are generated from a CERCLA remedial activity and may include hazardous, mixed low-level waste (MLLW), low-level radioactive waste (LLW), and industrial waste (IW). These various waste types may contain contaminants such as polychlorinated biphenyls (PCBs) or asbestos that might be regulated by the Toxic Substances Control Act (TSCA) and the National Emissions Standards for Hazardous Air Pollutants. This waste may be disposed of at the INEEL, if it meets the specific facility's waste acceptance criteria. Typically, most of the CERCLA-generated waste will be sent to the ICDF for disposal, although CERCLA-generated IW is typically disposed of at the INEEL Landfill Complex. The use of the RWMC is an additional option for disposal of suitable CERCLA-generated LLW.

5.1 Packaging

Packaging of all waste material associated with the OU 7-13/14 samples will be in accordance with operation design details and procedures and the applicable WAC. Packaging will be in compliance with the following:

- Idaho National Engineering and Environmental Laboratory WAC
- Resource Conservation and Recovery Act regulations found in 40 CFR 264 Subpart I, "Use and Management of Containers"
- Toxic Substances Control Act requirements found in 40 CFR 761.65 (as necessary, depending on sample characterization results)
- Receiving TSDF WAC
- Applicable DOT regulations.

The INEEL WGS, along with the Packaging and Transportation organization, should be consulted before waste is generated to identify specific types of containers to be used for the anticipated waste. Typical containers may include 55-gal steel UN1A1 and UN1A2 drums.

5.2 Labeling

All waste containers will be labeled in accordance with WGS MCPs. All CERCLA waste will be labeled with CERCLA waste labels that include the following information:

- Accumulation start date
- Waste description
- Potential and final waste codes
- Name of waste generator.

Each container will have a bar code label generated from the Integrated Waste Tracking System (IWTS) database. The IWTS is the database used by the INEEL to track disposition of waste to the disposal facilities. Additional labels will be affixed to containers, as described in the design flow process. All container labels will be placed where they are clearly visible during storage and shipment. Drums will have a label on the top, and three labels on the side that are spaced at approximately 120 degrees. Boxes will be labeled on the top and on each side of the container. These directions are in accordance with INEEL company procedures and receiving facility WAC. In accordance with the *Radiation Protection–INEEL Radiological Control Manual* (PRD-183) radiation labels (in addition to assay results) will be completed and placed on each container, if required by a radiological control technician. Labels for PCBs will comply with TSCA regulations and will be applied to containers when necessary. In preparation for shipment, other information must be included on containers such as applicable DOT labels, manifest number, gross weight, and the complete name and address of the shipper.

5.3 Storage and Inspection

While the waste is accumulated at the INTEC and TRA laboratories, the waste will be managed in a Satellite Accumulation Area (SAA) and will meet the requirements of MCP-3469. As needed, waste will also be managed in a Temporary Accumulation Area (TAA) and will meet the requirements of MCP-3470.

5.4 Waste Tracking

Information pertaining to waste characteristics, waste generation and storage locations, disposition plans, and waste shipments for CERCLA MLLW, CERCLA LLW, CERCLA TRU, and nonroutine CERCLA IW generated at the INEEL is maintained in an electronic data-base called the Integrated Waste Tracking System (IWTS). Material profiles are developed by IWTS to provide characterization information that is specific to a particular waste stream. As the waste is generated, information pertaining to individual waste containers is reported in individual IWTS container profiles. The information in the IWTS material profiles and container profiles is certified by a WGS waste technical specialist (WTS), who certifies that a hazardous waste determination has been performed and that the information is complete and accurate, based on the analytical data or process knowledge used for characterization. The WTS also certifies that the information for the container falls within the bounds of the parent material profile. A different WGS **WTS** follows with an independent review of the information for completeness and accuracy. Finally, the information in the material and container profiles is approved by a WGS **WTS** who authorizes WGS to dispose of the waste in accordance with the disposition path defined in the IWTS material profile, and authorizes that the waste meets the acceptance criteria of the facility or facilities where the waste will be disposed of. This approval must not be performed by the WTS performing the review.

Waste technical specialists use the information in the IWTS material and container profiles to ensure that CERCLA waste meets the acceptance criteria of the receiving facility. The IWTS also tracks shipments of waste to various facilities using specific IWTS shipping tasks. All receiving facilities, including those located outside the boundaries of the INEEL, must approve waste shipments before they are shipped. This approval is not documented in the IWTS database, but is maintained in a hard copy file with the waste characterization information.

It should be noted that not all CERCLA IW is tracked in the IWTS database. An example of IW not tracked in the IWTS is routine office waste. This waste is placed into IW receptacles that are placarded with information pertaining to what is permissible to be placed in them. Some IW is tracked in the IWTS database to ensure that the INEEL Landfill Complex is aware that the waste is being shipped and that it meets the facility's acceptance criteria. An example of IW that would be tracked in the IWTS is color-coded material, such as yellow shoe covers. Since yellow shoe covers are typically used for protection against radioactive contamination, a special profile has been prepared for color-coded personal protective equipment that has been surveyed and found not to be contaminated with radioactivity, or that has been used for training purposes. Another example would be containers that have had all contents removed, and the empty containers are not contaminated radiologically. Container profiles are typically not prepared for IW because the waste is shipped to the facility in reusable receptacles, in bulk shipments, or is noncontainerized.

5.5 Transportation

The CERCLA remediation waste generated as a result of project activities will be transported in accordance with requirements identified in the INEEL WAC, appropriate DOT regulations, RCRA regulations, and company procedures (MCP-2669, "Hazardous Material Shipping," and MCP-2670, "Motor Carrier Operations") as necessary. If shipment of CERCLA remediation waste is necessary during the project, WGS and Packaging and Transportation organization personnel will be responsible for performing those activities. Industrial waste transported to the INEEL Landfill Complex can be transported by the waste generator or WGS personnel.

5.6 Disposal

Disposal of each type of waste stream generated during the project will be accomplished in accordance with all applicable requirements found in state and federal regulations, and INEEL company procedures and documents, including the INEEL WAC (DOE/ID, 2002a) and the ICDF WAC (DOE/ID 2002b). Disposal options for each type of expected waste stream are summarized below. In general, mixed TRU waste will not be disposed as part of the project work scope, but will be placed in interim storage, pending hture disposition consistent with other MTRU waste being generated as part of the OU 7-10 Glovebox Excavator Method Project. Disposition of all other waste streams will occur, where possible.

It is important to note that a number of liquid waste streams will be generated from project testing activities at TRA. Noncontainerized TRA liquid wastes are managed through the TRA Waste Management Authority (WMA) process. Initial review of the project waste streams indicates it is unlikely that project liquid waste streams will be eligible for disposal at the TRA evaporation pond; thus, careful coordination between WGS and TRA WMA personnel is required to ensure waste disposition meets the specific criteria associated with approved TRA WMA waste stream numbers before disposal.

Some of the waste generated during CERCLA remedial activities is expected to be sent to a TSDF located outside INEEL boundaries. However, CERCLA hazardous or mixed waste sent outside INEEL boundaries for treatment, storage, or disposal may be sent only to a permitted or interim status TSDF that has been found suitable to receive hazardous waste from CERCLA remediation sites by the TSDF's own Environmental Protection Agency (EPA) Regional Office, in accordance with 40 CFR 300.440(a)(4).

Wastes planned for disposal at non-CERCLA INEEL facilities must be evaluated to determine the appropriateness of management and disposal options for the anticipated waste. Appropriateness of a disposal option is based on whether a particular waste could reasonably be expected to cause or contribute to an environmentally significant release of hazardous substances from a selected facility. Releases of hazardous substances to the air or groundwater in quantities that could reasonably be expected to pose a significant threat to human health and the environment are considered environmentally significant. Any waste described in this Waste Management Plan that would be reasonably expected to exceed this threshold criterion will be evaluated separately to determine the suitability of the waste for disposal. This particular waste will not be shipped for disposal unless special provisions are made and documented to mitigate the potential for release. The primary list of hazardous substances under CERCLA is contained in 40 CFR 302.4, "Designation of Hazardous Substances." As the remedial process proceeds and additional information becomes available, more detailed reviews will be conducted (as described below), to ensure that waste planned for specific disposal options meets the detailed waste acceptance criteria for each specific facility.

5.6.1 Industrial Waste

This waste is solid, nonhazardous waste that is accepted for disposal at the INEEL Landfill Complex. Industrial Waste will be managed under MCP-63 (1999).

Industrial waste (IW) is solid waste that is neither radioactive nor hazardous. At the INEEL, industrial waste streams are typically disposed of at the INEEL Landfill Complex. Many types of CERCLA IW are generated in the area of contamination as a result of material used in a remediation project that the generator believes has not been contaminated with either radioactive or hazardous materials. This absence of contamination is validated by radiation surveys or visual inspections. A general hazardous waste determination is prepared for routinely generated IW to document that the waste is neither radioactive nor hazardous.

Industrial waste streams that have a higher probability of containing constituents restricted from disposal are considered nonroutine and will undergo a waste stream-specific hazardous waste determination. This determination is accomplished by sampling, performing radioactive surveys, using process knowledge of the waste-generating process (e.g., determining if the waste was mixed with a listed waste or derived from the treatment, storage, or disposal of a listed waste), and evaluating the composition of the IW.

Waste Generator Services evaluates CERCLA IW to determine if the waste meets the IW acceptance criteria. Industrial waste is generally collected in IW collection dumpsters posted with signs describing acceptable and prohibited items. However, to ensure that disposal of industrial waste is protective to human health and the environment, the INEEL Landfill Complex employs the following additional methods:

- Characterization of IW by WGS to ensure that the requirements of the waste acceptance criteria are met before shipment to the facility

- Prohibiting the receipt of radioactive and hazardous waste

- Prohibiting the receipt of free liquids at the landfill

- Periodically inspecting received waste to validate that it meets the acceptance and waste determination criteria

- Periodic location and sampling of groundwater monitoring wells near the INEEL Landfill Complex.

Environmental monitoring data has not indicated an environmentally significant release of hazardous substances to the air or groundwater from current IW disposal operations at the INEEL Landfill Complex. The current disposal area at the INEEL Landfill Complex is a solid waste management unit. As such, if hture environmentally significant releases to the air or groundwater are identified, those releases may be subject to response action, as stipulated by Section V. of the Federal Facility Agreement and Consent Order (FFA/CO) (DOE-ID 1991).

5.6.2 Hazardous Waste

Hazardous waste will be identified in accordance with the evaluation process described in Section 4.1. It is likely that hazardous waste will be dispositioned to the ICDF or to off-site TSDFs in accordance with the INEEL management and operating contract. Hazardous waste will be managed per MCP-69 (2003).

5.6.3 Low-Level Waste

Low-level waste will be identified in accordance with the evaluation process described in Section 4.1 and will go to either the RWMC LLW pit or to the ICDF. Low-level waste could include PPE and decontamination waste. Low-level waste will be managed per MCP-62 (2003).

The RWMC includes a LLW disposal unit that is operated by the DOE under the Atomic Energy Act, as amended. Operations of the LLW disposal facility at the RWMC are governed by DOE orders. Department of Energy Headquarters has determined that the RWMC LLW disposal facility complies with DOE orders and that the facility is authorized to operate. To ensure that the LLW sent to RWMC for disposal is appropriate and suitable for disposal at RWMC, the waste is evaluated by Waste Generator Services (WGS) to ensure that the waste will meet the RWMC waste acceptance criteria. The RWMC is not permitted by the Environmental Protection Agency or licensed by the Nuclear Regulatory Commission to dispose of RCRA hazardous or mixed waste. To ensure hazardous or mixed waste is not sent to RWMC, a hazardous waste determination for each waste stream will be completed by WGS to ensure that the CERCLA LLW (a) does not exhibit the characteristics of a hazardous waste and has not been in contact with a listed hazardous waste; or (b) that it has been analyzed to demonstrate that it no longer contains a hazardous waste above risk-based concerns. When appropriate, the hazardous waste determination may be based on process knowledge concerning the origin and history of the waste proposed for disposal. To help ensure that LLW is managed to protect human health and the environment, the RWMC employs the following methods:

- Characterization of CERCLA LLW by WGS to ensure the requirements of the waste acceptance criteria are met before shipment to the RWMC

- Prohibiting the receipt of RCRA hazardous or mixed waste

- Prohibiting the receipt of free liquids at the landfill

- Inspections of received waste to validate that the waste meets the waste acceptance criteria and is consistent with the waste profile

- Implementation of an environmental monitoring program at the RWMC.

Environmental monitoring data has not indicated an environmentally significant release of hazardous substances to the air or groundwater from current LLW disposal operations at the RWMC. If hture environmentally significant releases to the air or groundwater are identified, those releases may be subject to response actions, as stipulated by Section V. of the *Federal Facility Agreement and Consent Orderfor the Idaho National Engineering Laboratory* (DOE-ID 1991).

5.6.4 Mixed Low-Level Waste

Mixed LLW will be identified in accordance with the evaluation process described in Section 4.1. Options for MLLW include being sent to the ICDF, or to other off-INEEL disposal facilities, for disposal, depending on land disposal restrictions (LDRs) and radiological contamination levels. Waste acceptance criteria for each of these facilities must be met. Mixed LLW will be managed per MCP-70 (2003).

5.6.5 Transuranic Waste

Transuranic waste will undergo the evaluation process described in Section 4.1, and will be identified in accordance with the INEEL WAC. Transuranic-contaminatedwaste (higher than 100 nCi/g) will be packaged in accordance with the INEEL WAC with ultimate disposition anticipated to be at the WIPP as part of a subsequent project phase. It is expected that all TRU waste residuals from testing OU 7-10 samples will require management as mixed waste.

5.6.6 Mixed Transuranic Waste

Mixed TRU waste will undergo the evaluation process described in Section 4.1, and will be identified in accordance with the INEEL WAC. Transuranic-contaminatedwaste (more than 100 nCi/g) will be packaged in accordance with the INEEL WAC, with ultimate disposition anticipated to be at the WIPP.

5.6.7 Toxic Substances Control Act Waste

Toxic Substances Control Act waste will be identified in accordance with the evaluation process described in Section 4.1. Options for TSCA waste depend on radiological contamination levels and TSDF WAC.

6. REFERENCES

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Appendix A

Identification of Applicable or Relevant and Appropriate Requirements for On-site Testing Activities

Appendix A

Identification of Applicable or Relevant and Appropriate Requirements for on-site Testing Activities

This appendix identifies the applicable or relevant and appropriate requirements (ARARs) and to-be-considered guidances (TBCs) that must be implemented for the on-site testing activities identified in the test plan and addressed by this waste management plan *(Reference Test Plan for the Evaluation of In Situ Thermal Desorption and Grouting Technologies for Operable Unit 7-13/14, Draft*, INEEL/EXT-03-00059). Studies and investigations conducted during the RI/FS are considered removal actions by EPA, and are undertaken pursuant to Section 104(b) of CERCLA. As such, it is EPA's policy that the RI/FS-related activities described in this test plan, when conducted on-site, will comply with ARARs "to the extent practicable, considering the exigencies of the situation" (Ref - Federal Register, Volume 55. No. 46, March 8, 1990, 8756). The ARARs apply to the portions of the preremedial design and RWSC tests being conducted on the INEEL site (i.e., INTEC, TRA, and potentially Argonne-West). The ARARs are limited to the substantive requirements of environmental regulations. Administrative requirements, such as timeframes or reporting requirements, do not apply to the on-site portion of the CERCLA-related testing; however, administrative provisions of regulatory requirements may be implemented by INEEL facility personnel, because of existing permit-related requirements at locations where OU 7-13/14 testing is taking place (i.e., permit-related implementation requirements for non-CERCLA related activities also occurring at the test location or laboratory). Testing conducted at off-site locations (e.g., surrogate testing conducted at Idaho Falls facilities) must comply with all administrative and substantive regulatory requirements relevant to the test activities and materials being tested. Compliance for the off-site testing activities is therefore not limited to the substantive provisions of the ARARs listed in this appendix, as is the case for the on-site test activities.

Table A-1. Identification of Applicable or Relevant and Appropriate Requirements and to-be-considered guidance (TBCs) for OU 7-13/14 Preremedial Design and On-site Testing Activities.

Citation	Requirement Summary	Implementation and Comments
TSCA, 40 CFR 761	Requirements of TSCA regulate management of materials contaminated with polychlorinated biphenyls, including requirements for appropriate storage and disposal of PCBs.	Samples generated from OU 7-10 may contain PCBs at or above the regulatory threshold concentration of 50 ppm; thus, pending the outcome of OU 7-10 characterization results, requirements of TSCA are assumed to apply to residual waste streams potentially contaminated with PCBs originating in OU 7-10.
Hazardous Waste Determination, (IDAPA 58.01.05.006, 40 CFR 262.11)	Wastes generated during tests will be subjected to a hazardous waste determination before disposal.	Hazardous waste determinations will be conducted by WGS personnel, in consultation with project personnel, for waste generated as part of the testing activities.
Land Disposal Restrictions (IDAPA 58.01.05.011, 40 CFR 268.40)	RCRA land disposal restrictions will apply to analytical and test residuals determined to be associated with RCRA listed and characteristic hazardous waste numbers.	Hazardous waste determinations conducted by WGS personnel will also include evaluation of land disposal restrictions that apply to project waste streams. It is noted that any residuals returned to the OU 7-10 project for storage with OU 7-10 waste streams resulting from the Glovebox Excavator Method Project retrieval, are not subject to LDRs given the assumption that the ultimate disposal destination is the Waste Isolation Pilot Plant.
Federal Treatability Study Sample Exemption Rule [IDAPA 58.01.05.005, Substantive provisions identified as 40 CFR 261.4 (e)(1),(2)(i),(ii),(iii) and (iv) 40 CFR 261.4(f)(2), (3),(4),(6), and (10)].	The Federal Treatability Study Sample Exemption Rule includes requirements for persons who generate or collect samples for the purpose of conducting treatability studies as defined in 260.10. The rule defines mass limitations for treatability study samples, in addition to sample packaging, shipment, facility, and waste disposal requirements that are viewed as substantive under CERCLA.	Although the CERCLA testing activities are not defined as treatability studies in the test plan, identification of the substantive provisions of 40 CFR 261.4 (e) and (f) is deemed appropriate from a CERCLA relevant and appropriate requirements standpoint, because of the similar nature of the testing.

Table A-1. (continued).

Citation	Reauirement Summarv	Imdementation and Comments
National Emission Standards for Hazardous Air Pollutants (NESHAPS) for Radionuclides from DOE Facilities (40 CFR Part 61, Subpart H)	NESHAPS requirements apply to emissions of radionuclides from DOE facilities, and limit the radiation dose to offsite personnel to an annual effective dose equivalent not greater than 10 mrem/yr. Radionuclide emissions must be reported to the INEEL air program for aggregation with other INEEL sources.	Facility personnel will prepare estimates of emissions and perform reporting and/or monitoring of emissions in coordination with other facility release sources.
Standards Applicable to Generators of Hazardous Waste [IDAPA 58.01.05.006, 40 CFR 262.34 (a) and (c)]	Hazardous waste (e.g., OU 7-10 sample residues) stored in facility areas will be managed consistent with the applicable substantive requirements of RCRA for temporary accumulation areas (TAA) and satellite accumulation areas (SAA).	Facility personnel will manage residual hazardous waste streams consistent with existing procedures for managing wastes in SAAs and TAAs. The administrative provisions of the regulation do not specifically apply to the CERCLA wastes while being managed at on-site facilities.
Department of Energy Order 5400.5, Radiation Protection of the Public and the Environment	DOE O 5400.5 addresses criteria for radiation protection of the public and the environment.	DOE O 5400.5 is identified as a TBC rather than an ARAR as is consistent with EPA guidance. Facility implementation of the applicable requirements of the order is required by the INEEL M&O contract.
Department of Energy Order 435.1, Radioactive Waste Management	DOE O 435.1 and the associated Radioactive Waste Management Manual (DOE M 435.1-1) address management of low-level and transuranic waste streams that may result from the planned testing activities. The order also addresses mixed waste.	DOE O 435.1 is identified as a TBC, rather than an ARAR, as is consistent with EPA guidance. Facility implementation of the applicable requirements of the order is required by the INEEL M&O contract.

Appendix B

Waste Stream Summary for the PRDT Tests

Appendix B

Waste Stream Summary for the PRDT Tests

This appendix presents a set of diagrams that visually links the waste stream with the initial material and waste type. The following information is presented:

- Material: the input sample material on which the tests are being performed.

- Test: the general category of tests that are being performed on the material, e.g., in situ thermal desorption (ISTD), in situ grouting (ISG), in situ grouting of in situ thermal desorption (ISG of ISTD), and ex situ grouting (ESG).

- Waste Stream: the expected liquid and solid waste streams from the testing including,

  - *Laboratory Waste:* Laboratory waste is the general waste associated with preparing samples or performing analysis on these samples. It includes waste from analytical sample preparation, residuals from analysis, sample material, and disposable lab materials such as gloves, filter paper, glassware, and plastic.

  - *Process Waste:* Process waste is generated during preparation of materials for testing and as a result of the testing. This includes materials such as molds for monoliths, mixing bowls, weigh boats, glassware, plasticware, and testing apparatus. This waste is similar in nature to laboratory waste that will be generated as a part of the sample analysis, but results from conducting the tests (rather than the preparation and analysis) and will therefore sometimes require a different disposal path or be generated in a different location.

  - Leachate (liquid): Liquids resulting from the leach tests

  - Leach Solid: Solids remaining after leach of ISTD samples

  - Liquid From Gas Trap: Liquid collected in the gas trap

  - Leach Monolith: Solid material remaining after the grout sample is tested (ISG or ISG of ISTD)

  - Remaining Grout: Grout that is mixed with sludge or surrogate material but remains after filling the grout form

  - Liquid From Hydraulic Cond.: Liquid used in the hydraulic conductivity testing

- Waste Type: the types of waste expected for each waste stream will include: Industrial Waste, Hazardous Waste, Low-level Waste (LLW), Alpha LLW, Mixed LLW (MLLW), and Mixed Transuranic Waste (MTRU). In some cases, more than one waste type is identified because the exact composition of samples from OU 7-10 is not currently known. (There is a possibility that WNPD may be generated for a limited number of individual grout monoliths, ISTD leach solids, and remaining grout for tests using radioactive [hot] surrogates with RCRA hazardous constituents. This waste will be accumulated with other test waste in containers as the testing proceeds. Waste Generator Services will be consulted to determine which wastes can be combined. The hot surrogates with RCRA hazardous constituents will be formulated such that the containerized waste will be MLLW. There is also a possibility that certain waste streams resulting from testing the OU 7-10 samples may be WNPD, but the containerized waste is expected to have a path to disposition.)

- Generation Location – the location of the laboratory where the testing will be conducted including: INEEL Research Center (IRC), Idaho Nuclear Technology and Engineering Center (INTEC), and Test Reactor Area (TRA)

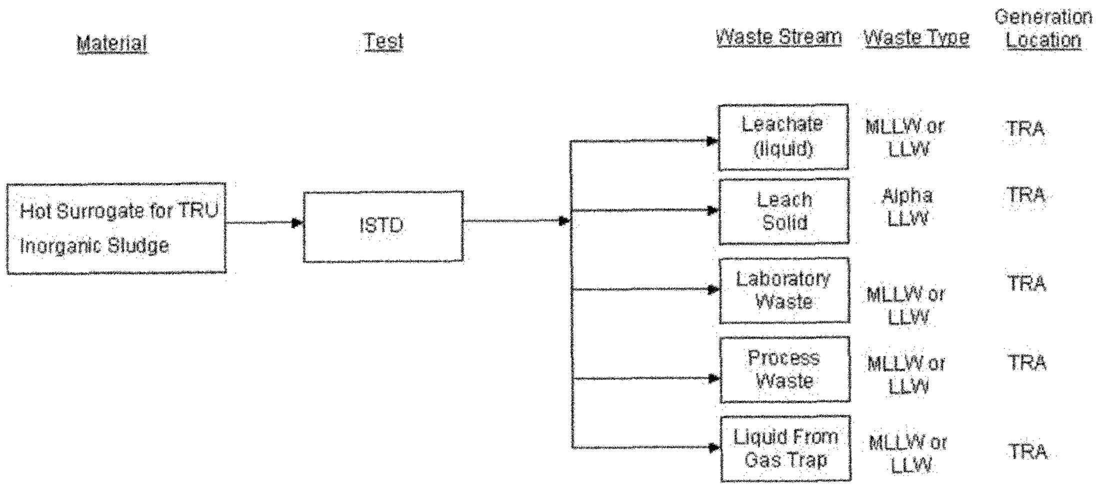

Figure B-1. Expected waste types for hot surrogate for TRU – inorganic sludge tests.

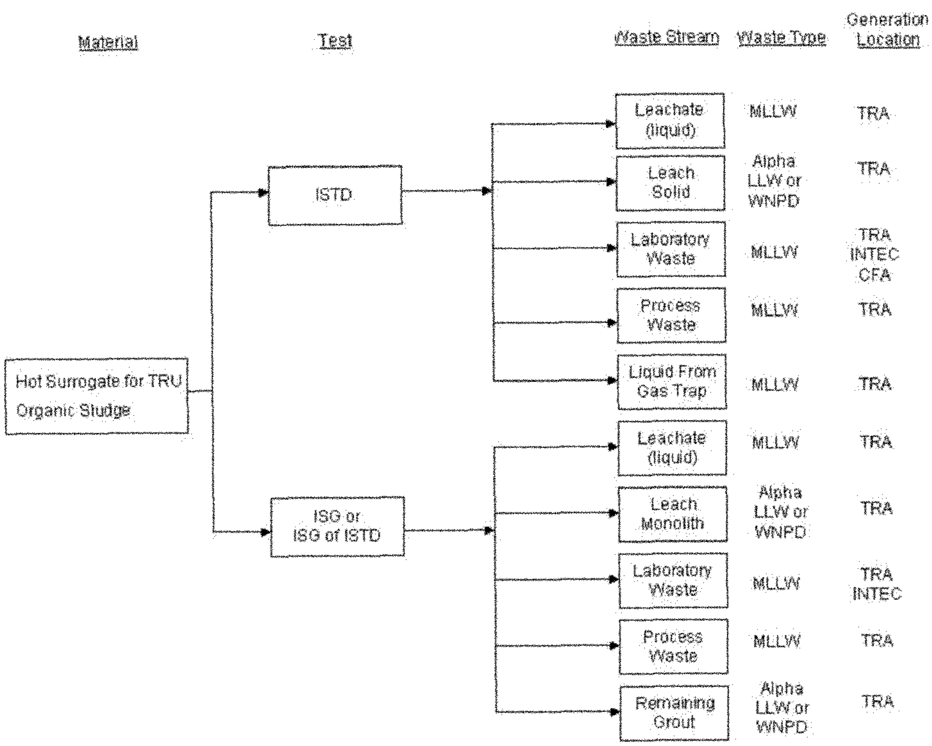

Figure B-2. Expected waste types for hot surrogate for TRU – organic sludge tests.

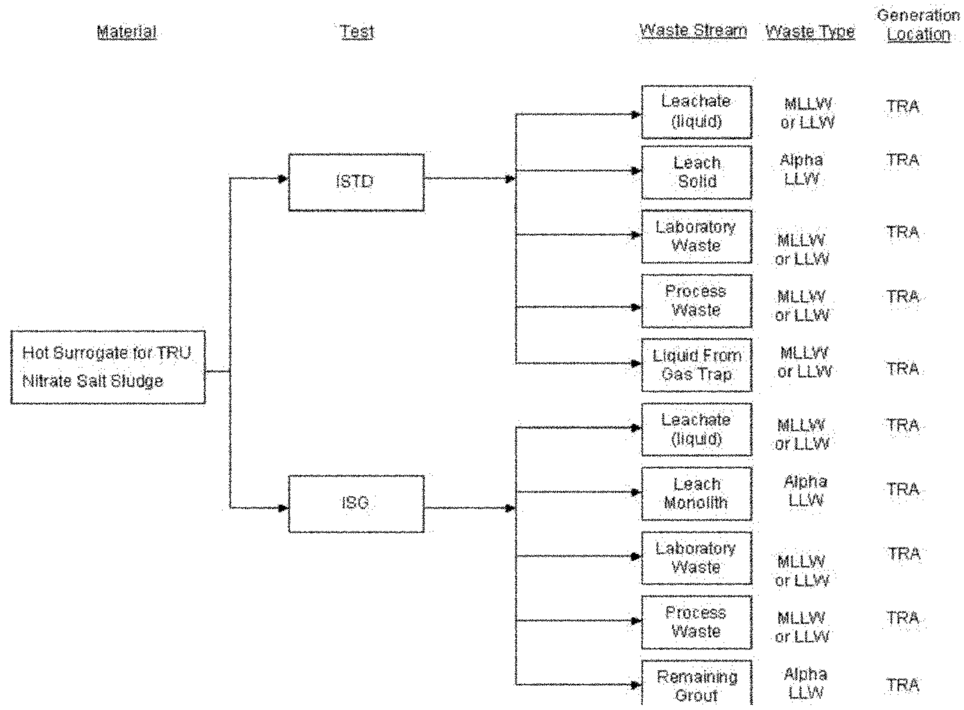

Figure B-3. Expected waste types for hot surrogate for **TRU** – nitrate salt sludge tests.

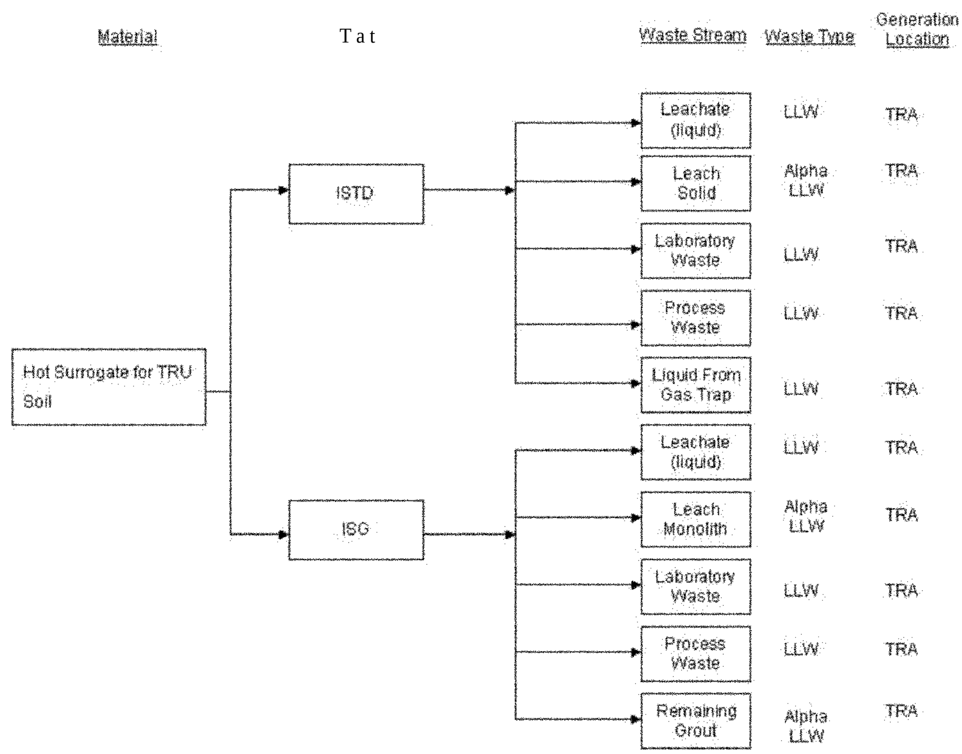

Figure B-4. Expected waste types for hot surrogate for **TRU** – soil tests.

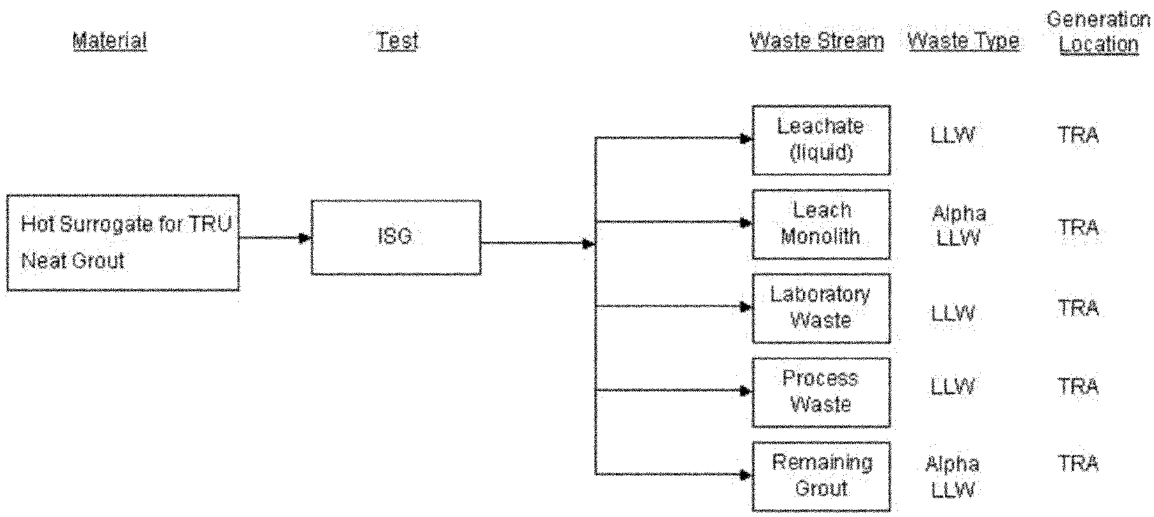

Figure B-5. Expected waste types for hot surrogate for **TRU** – neat grout tests.

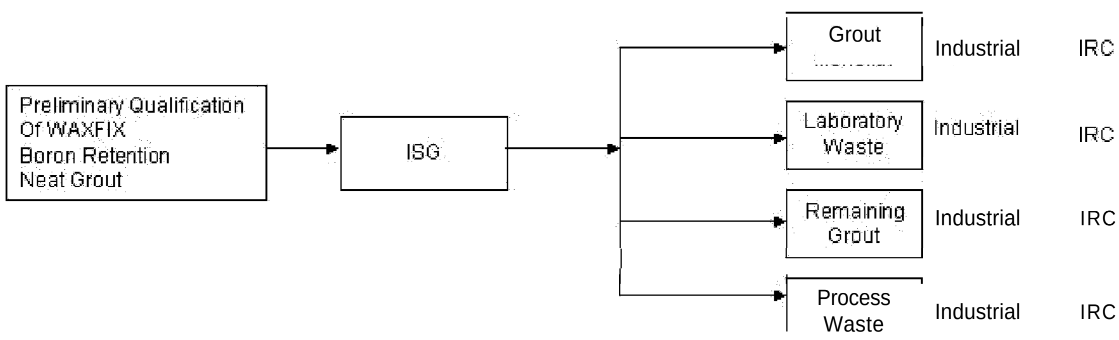

Figure B-6. Expected waste types for WAXFIX grout boron retention tests.

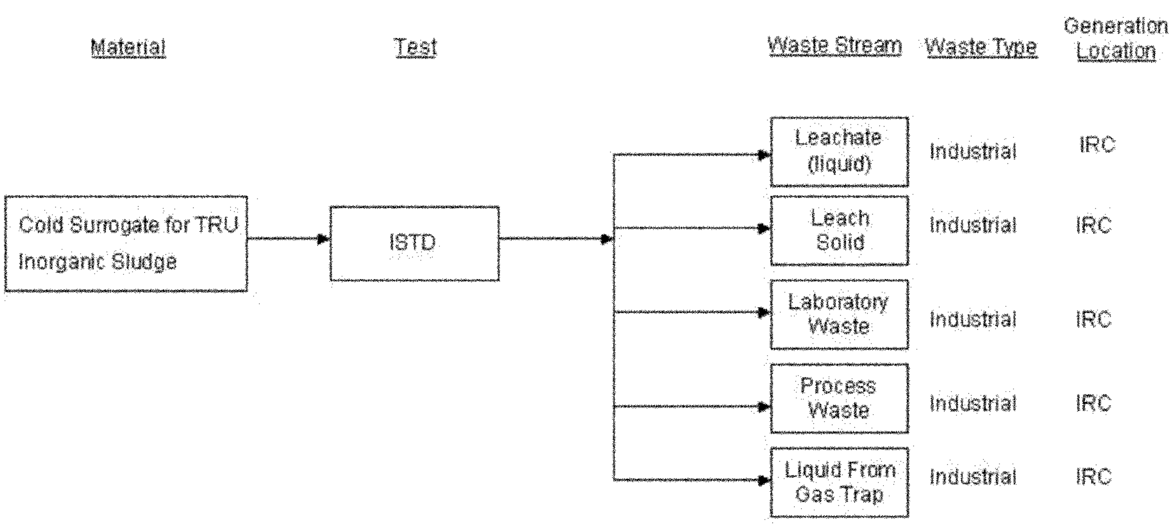

Figure B-7. Expected waste types for cold surrogate for **TRU** – inorganic sludge tests

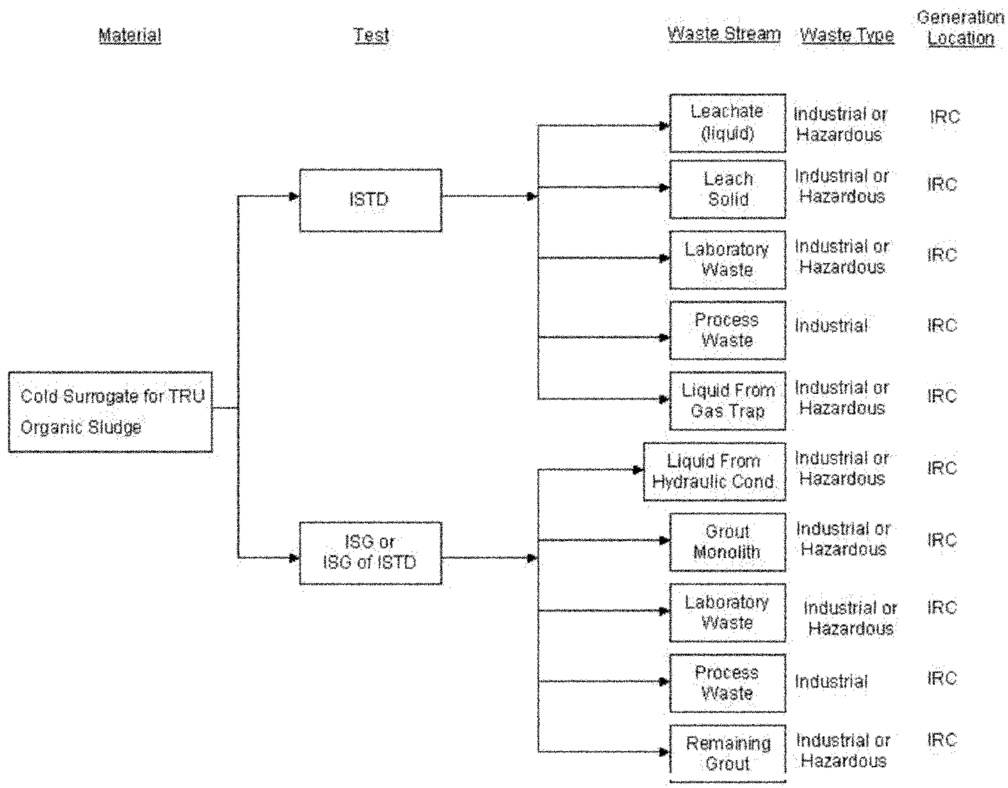

Figure **B-8.** Expected waste types for cold surrogate for **TRU** – organic sludge tests.

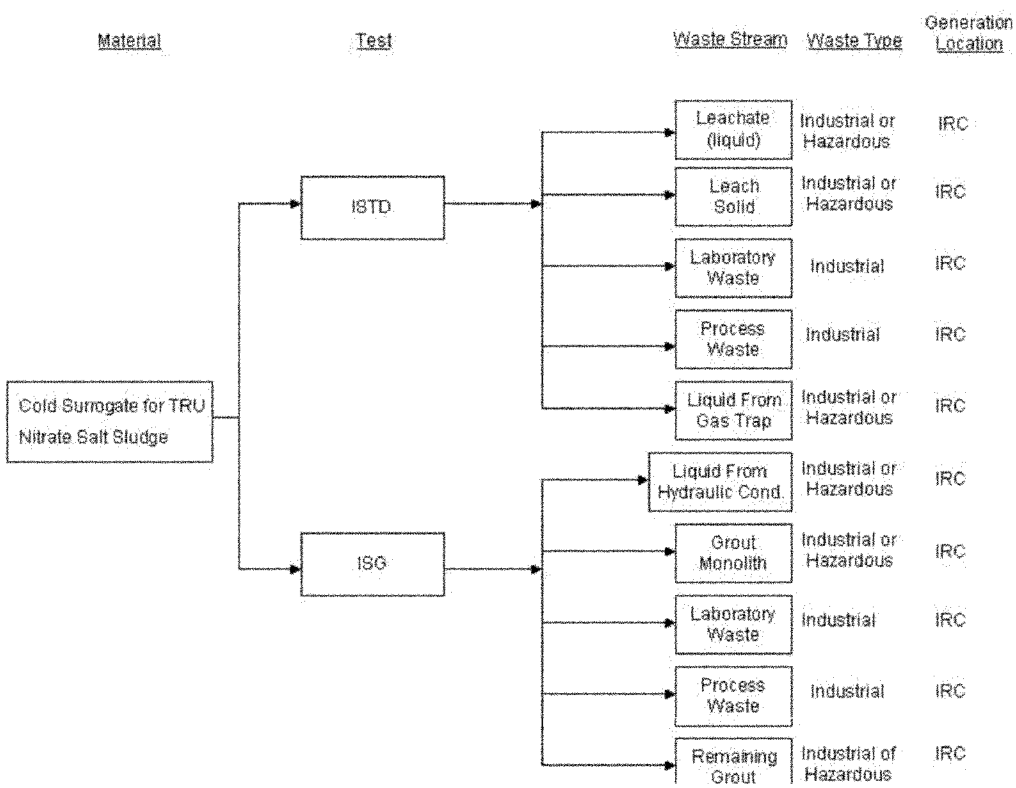

Figure B-9. Expected waste types for cold surrogate for **TRU** – nitrate salt sludge tests.

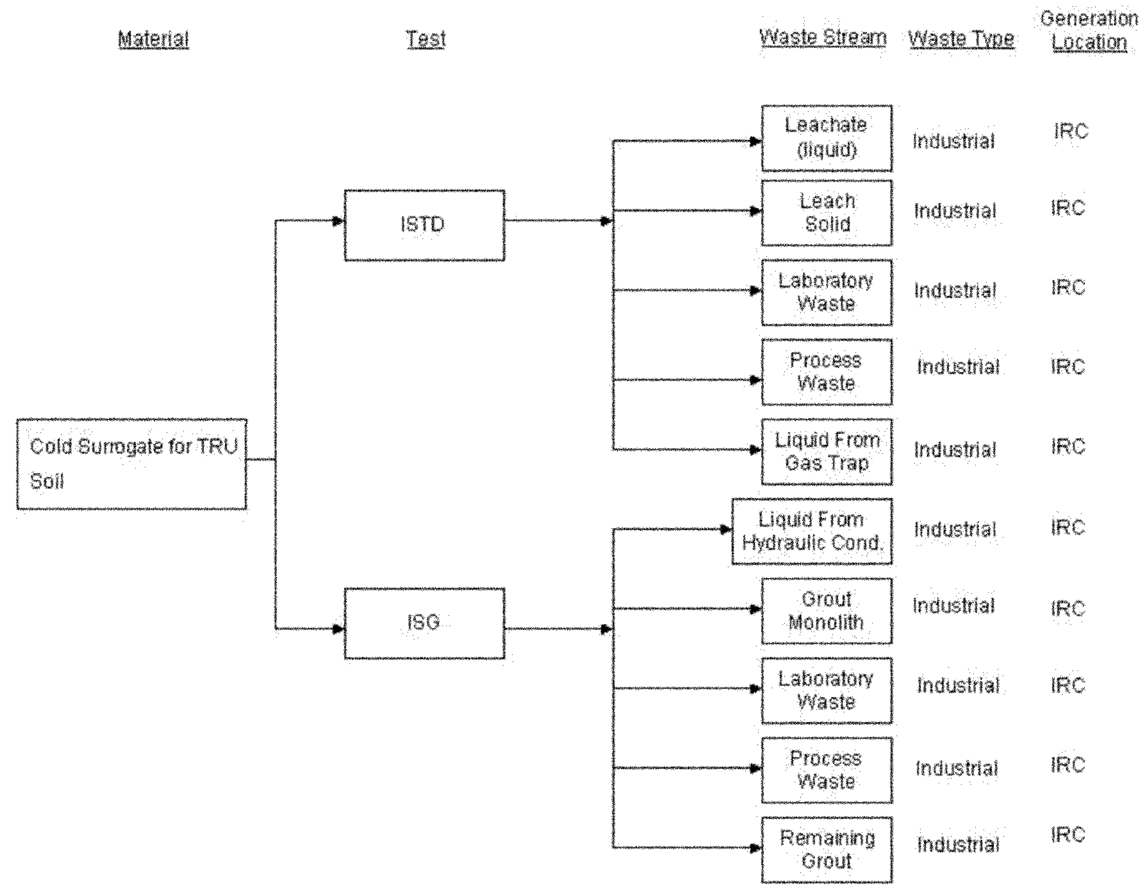

Figure B-10. Expected waste types for cold surrogate for TRU – soil tests

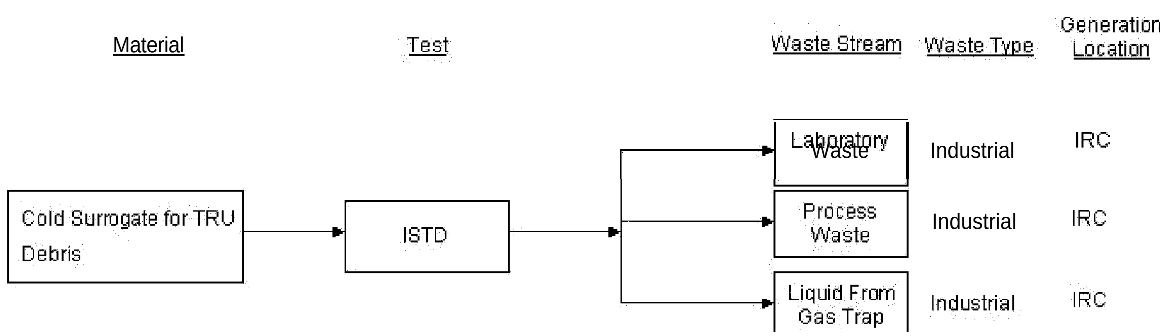

Figure B-1 1. Expected waste types for cold surrogate for TRU – debris sludge tests

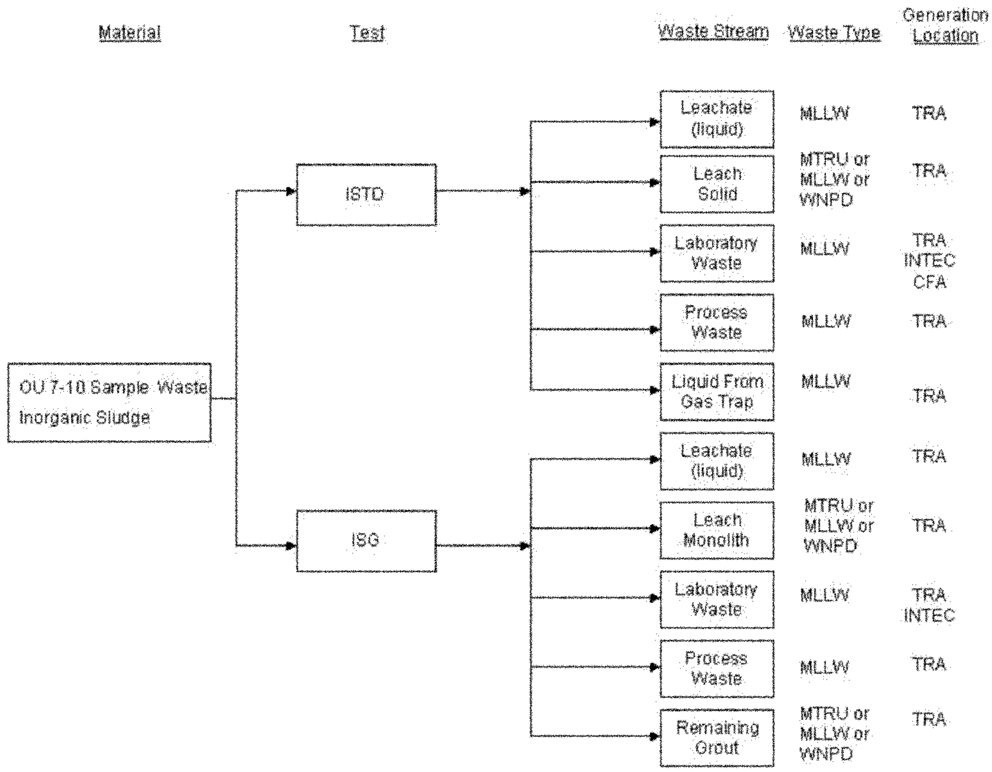

Figure B-12. Expected waste types for excavated waste samples – inorganic sludge tests.

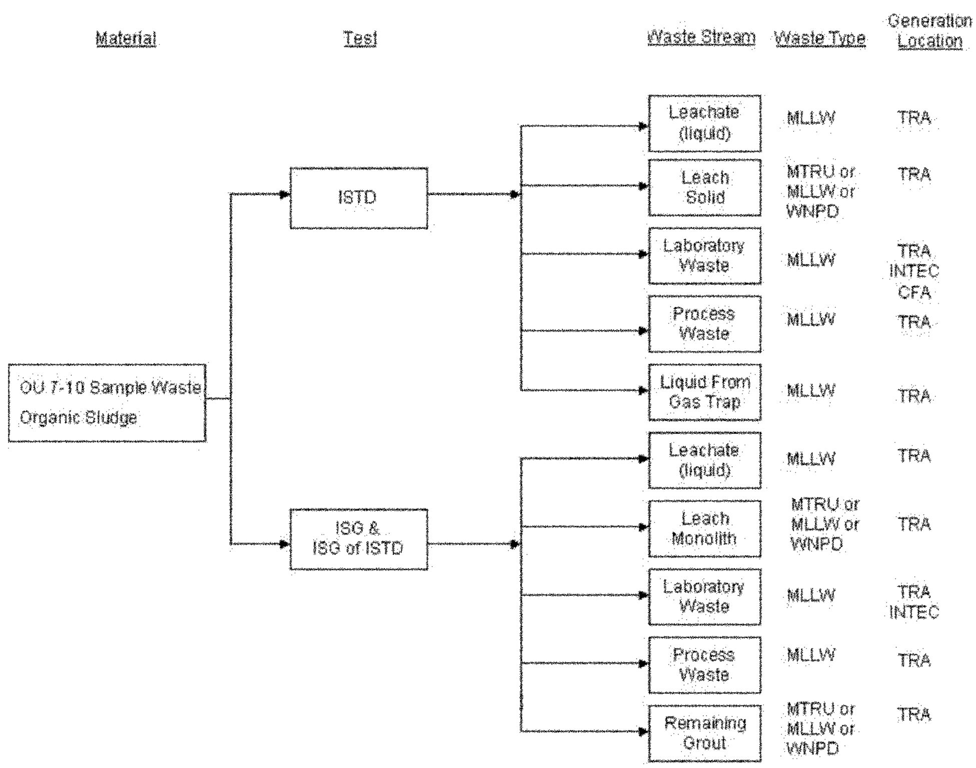

Figure B-13. Expected waste types for excavated waste samples – organic sludge tests

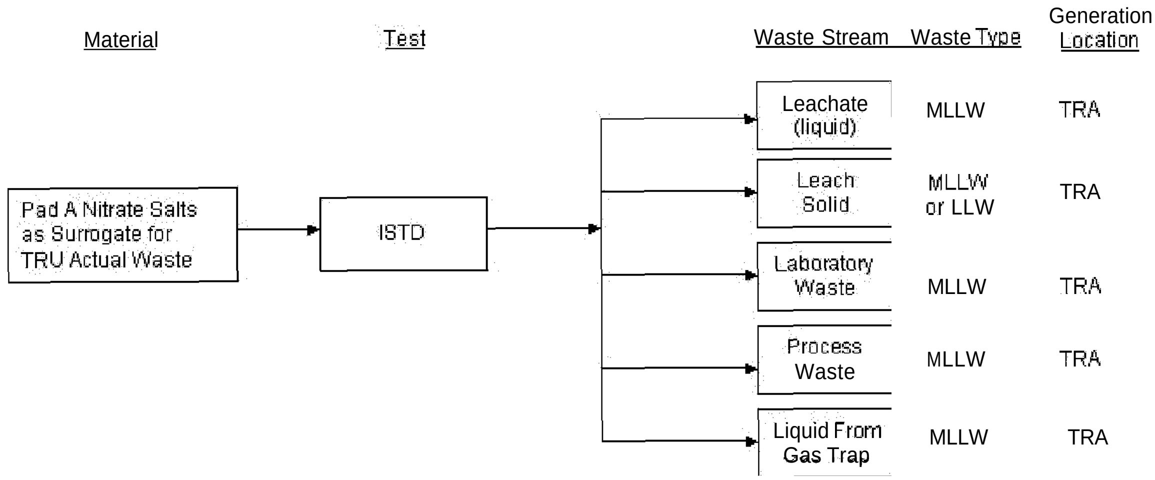

Figure B-14. Expected waste types for surrogate – Pad **A** nitrate salt sludge tests.

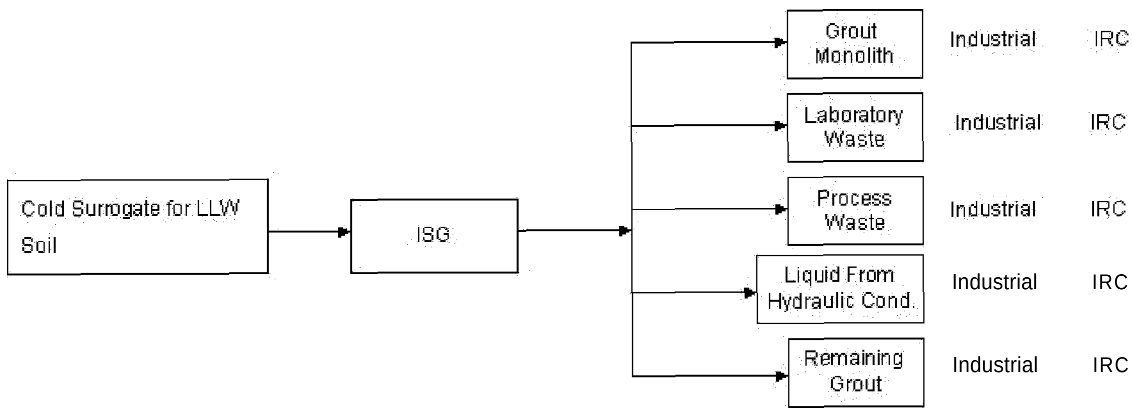

Figure B-15. Expected waste types for cold surrogate for LLW – soil tests

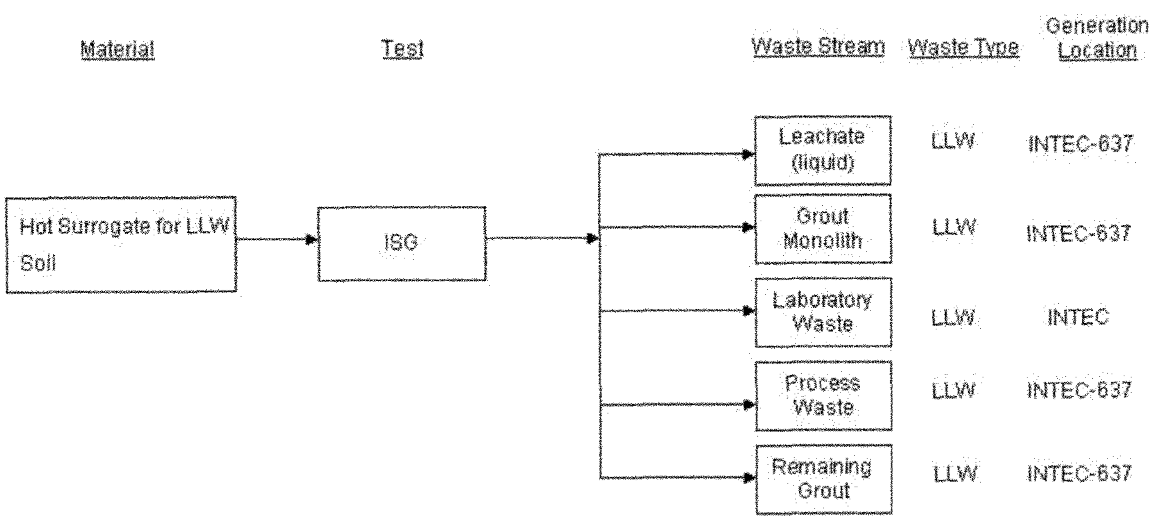

Figure B-16. Expected waste types for hot surrogate for LLW – soil tests.

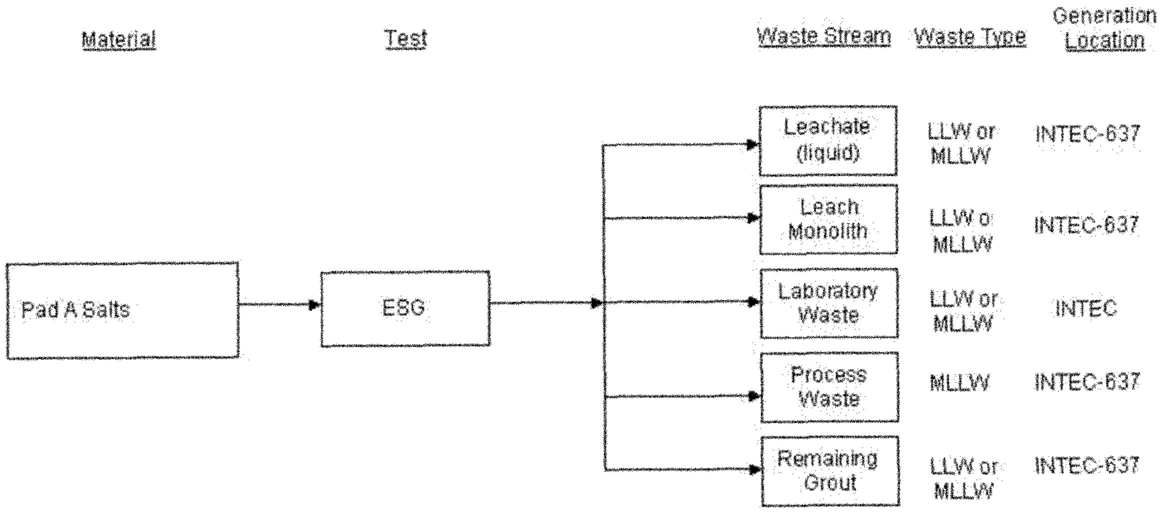

Figure B-17. Expected waste types for Pad A salts ESG tests.

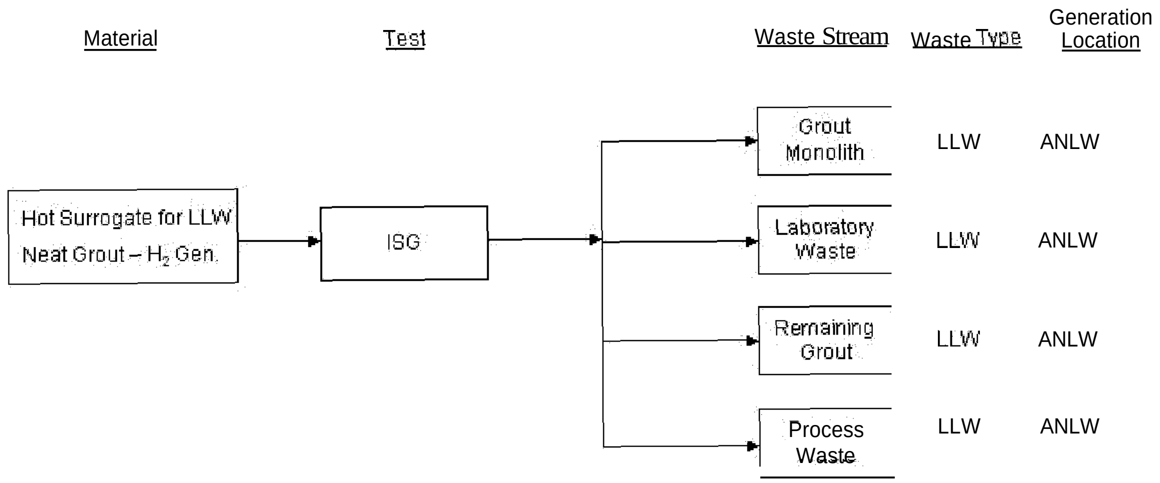

Figure B-18. Expected waste types for hot surrogate for LLW – hydrogen generation tests

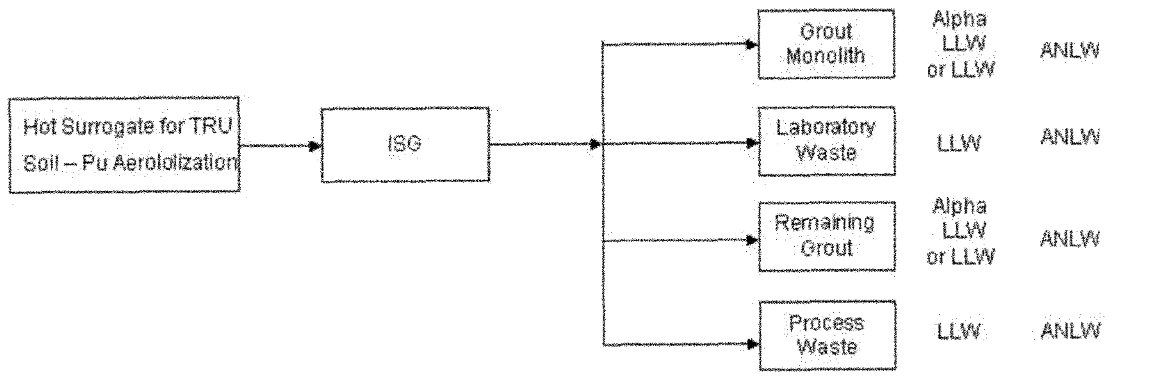

Figure B-19. Expected waste types for hot surrogate for TRU – Plutonium Aerosolization tests.

Appendix C

Detailed Waste Stream Figures for the PRDT Tests

Appendix C

Detailed Waste Streams Figures for the PRDT Tests

This appendix presents a set of diagrams that visually links the initial material and the waste produced from the various analytical tests. The following information is presented:

- Material: the input sample material on which the tests are being performed

- Test: the general category of tests that are being performed on the material, e.g., in situ thermal desorption (ISTD), in situ grouting (ISG), in situ grouting of in situ thermal desorption (ISG of ISTD), and ex situ grouting (ESG), together with additional information on the tests, such as temperatures for ISTD or grout types being used for ISG.

- Analytical Test: the analytical tests being performed on the test material, e.g. K_d Leach, ANS 16.1 Leach, Compositional Analysis, and Offgas Analysis.

- Waste: the waste generated from the analytical tests, including

  - *Laboratory Waste:* Laboratory waste is the general waste associated with preparing samples or performing analysis on these samples. It includes waste from analytical sample preparation, residuals from analysis, sample material, and disposable lab materials such as gloves, filter paper, glassware, and plastic.

  - *Process Waste:* Process waste is generated during preparation of materials for testing and as a result of the testing. This includes materials such as molds for monoliths, mixing bowls, weigh boats, glassware, plasticware, and testing apparatus. This waste is similar in nature to laboratory waste that will be generated as a part of the sample analysis, but results from conducting the tests (rather than the preparation and analysis) and will therefore sometimes require a different disposal path or be generated in a different location.

  - Leachate (liquid): Liquids resulting from the leach tests

  - Leach Solid: Solids remaining after leach of ISTD samples

  - Liquid From Gas Trap: Liquid collected in the gas trap

  - Leach Monolith: Solid material remaining after the grout sample is tested (ISG or ISG of ISTD)

  - Remaining Grout: Grout that is mixed with sludge or surrogate material but remains after filling the grout form

  - Liquid From Hydraulic Cond.: Liquid used in the hydraulic conductivity testing

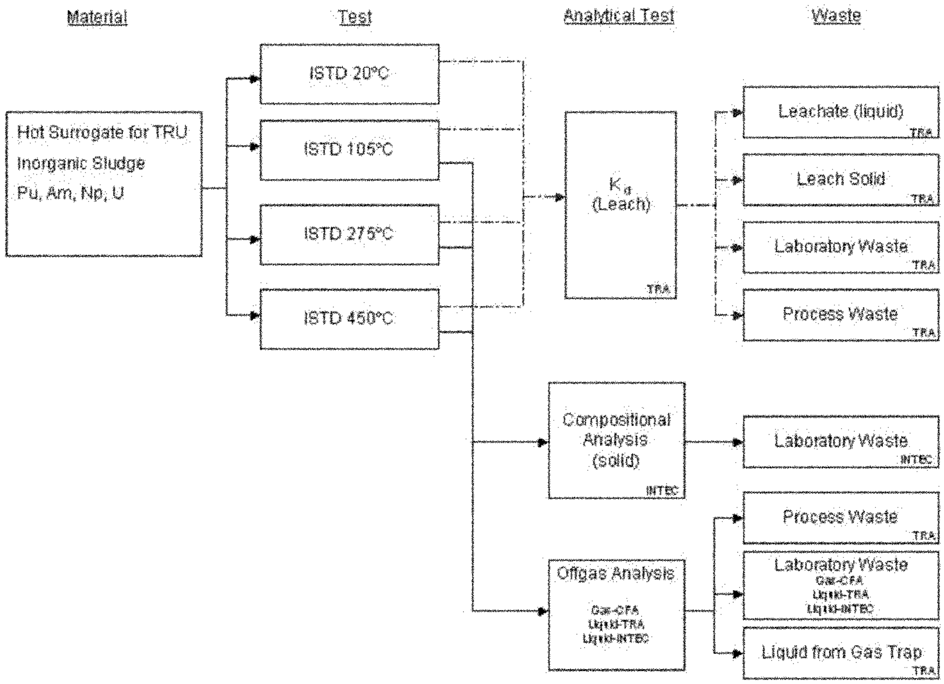

Figure C-1. Expected waste streams for hot TRU surrogate – inorganic sludge tests.

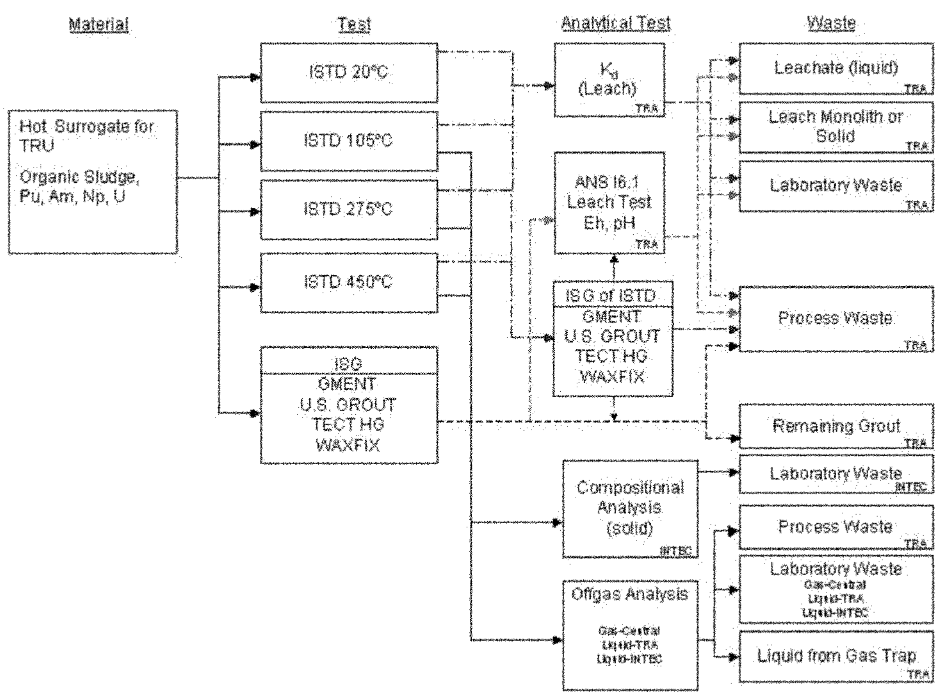

Figure C-2. Expected waste streams for hot TRU surrogate – organic sludge tests.

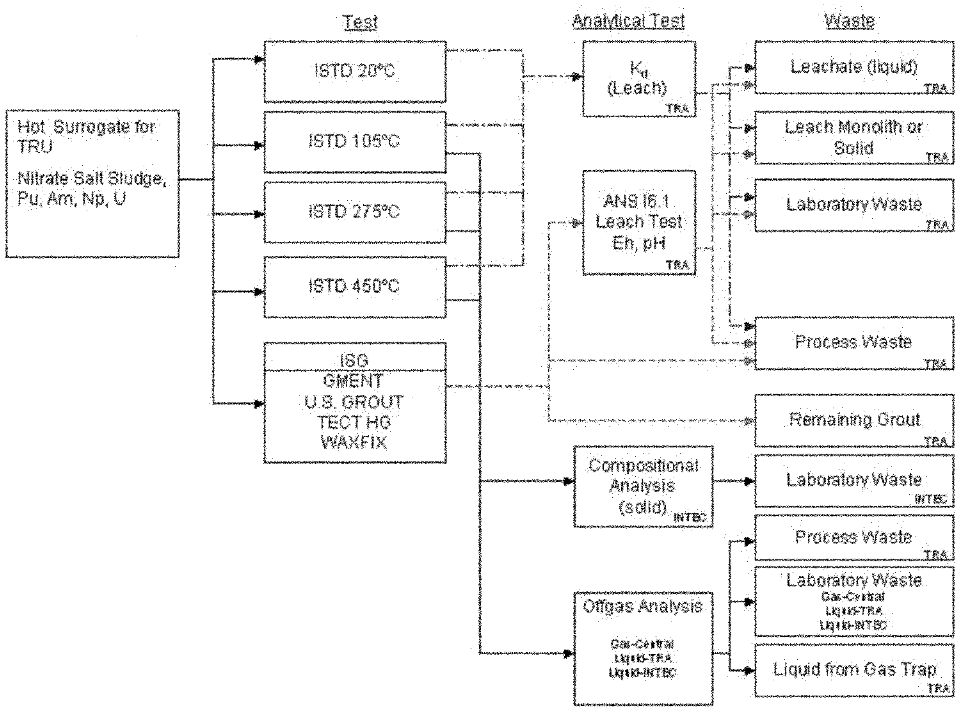

Figure *C-3***.** Expected waste streams for hot TRU surrogate – nitrate salt sludge tests.

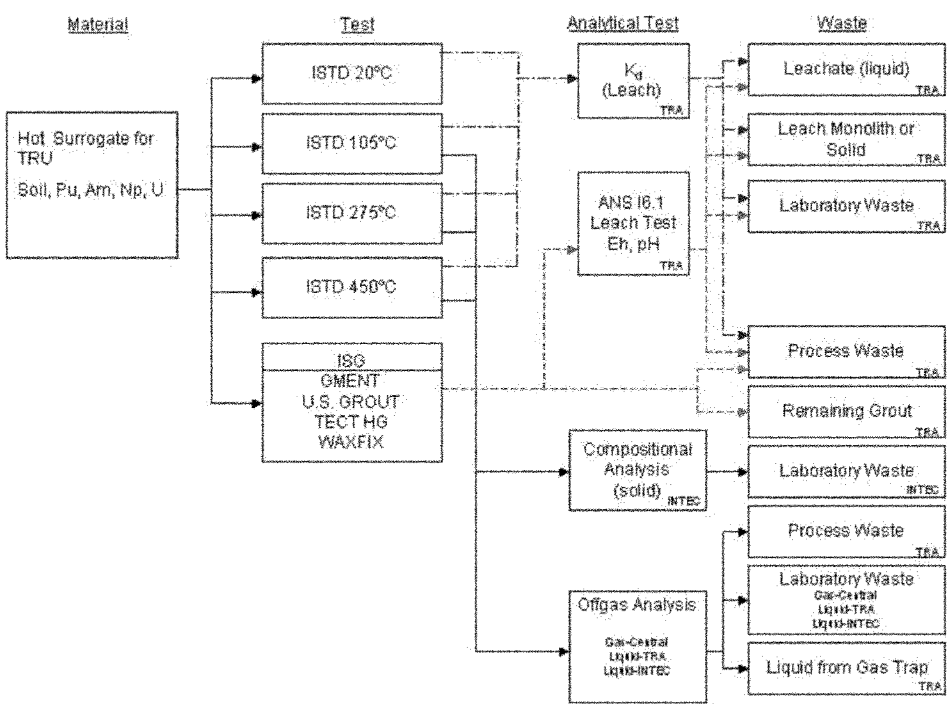

Figure C-4. Expected waste streams for hot TRU surrogate – soil sludge tests.

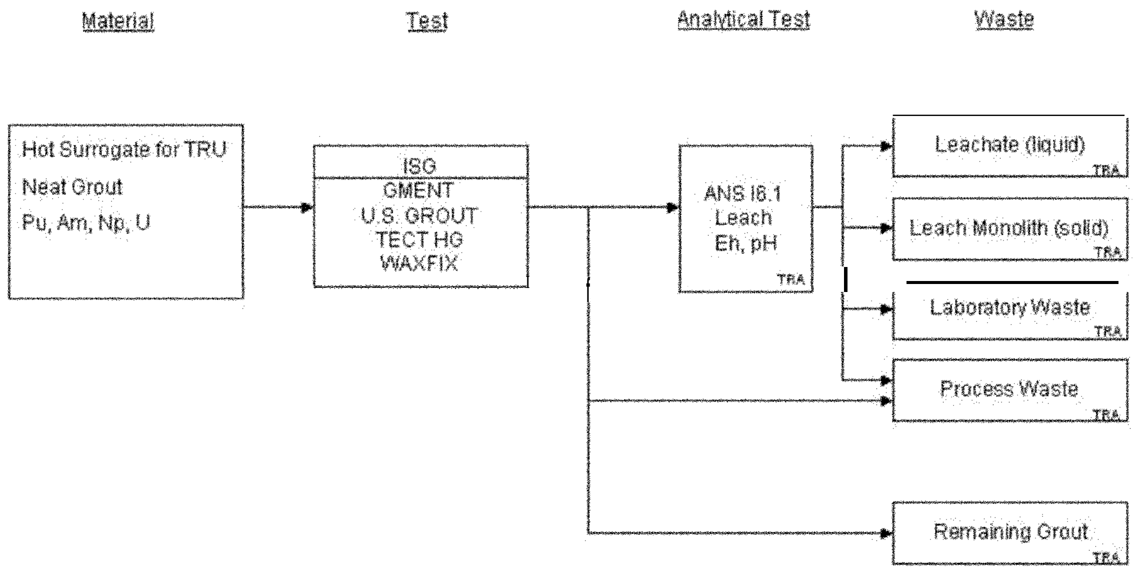

Figure C-5. Expected waste streams for hot TRU surrogate – neat grout tests.

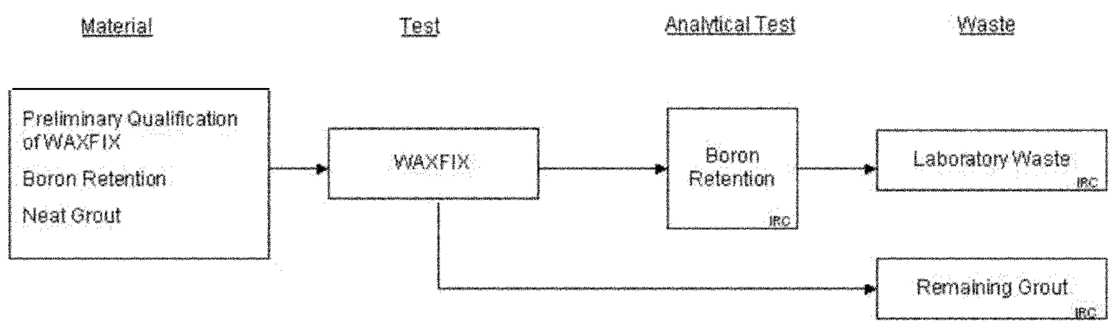

Figure C-6. Expected waste streams for WAXFIX grout boron retention tests.

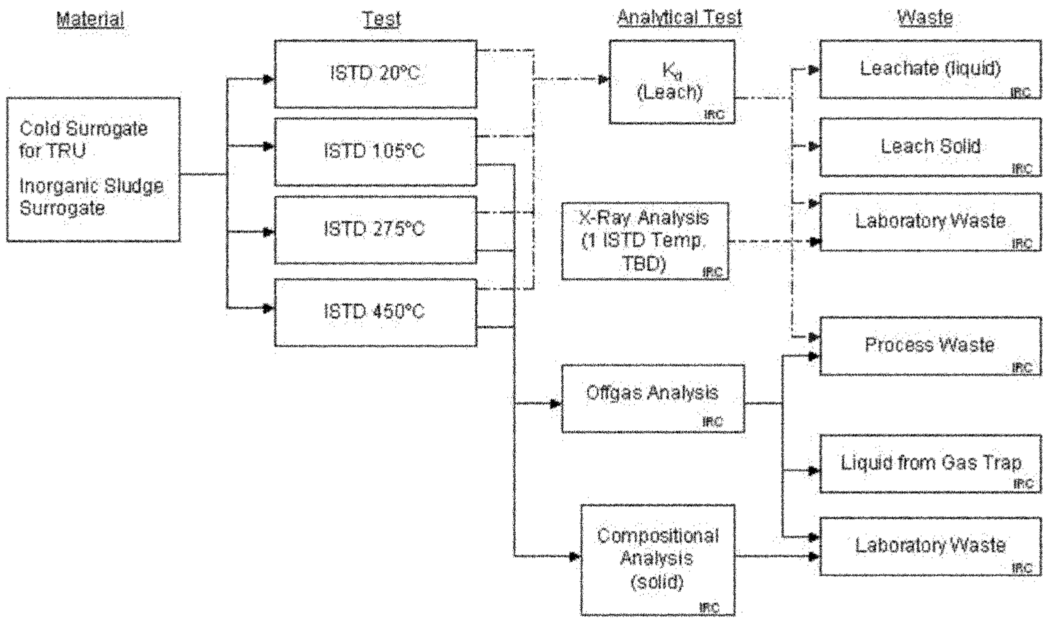

Figure C-7. Expected waste streams for cold **TRU** surrogate – inorganic sludge tests.

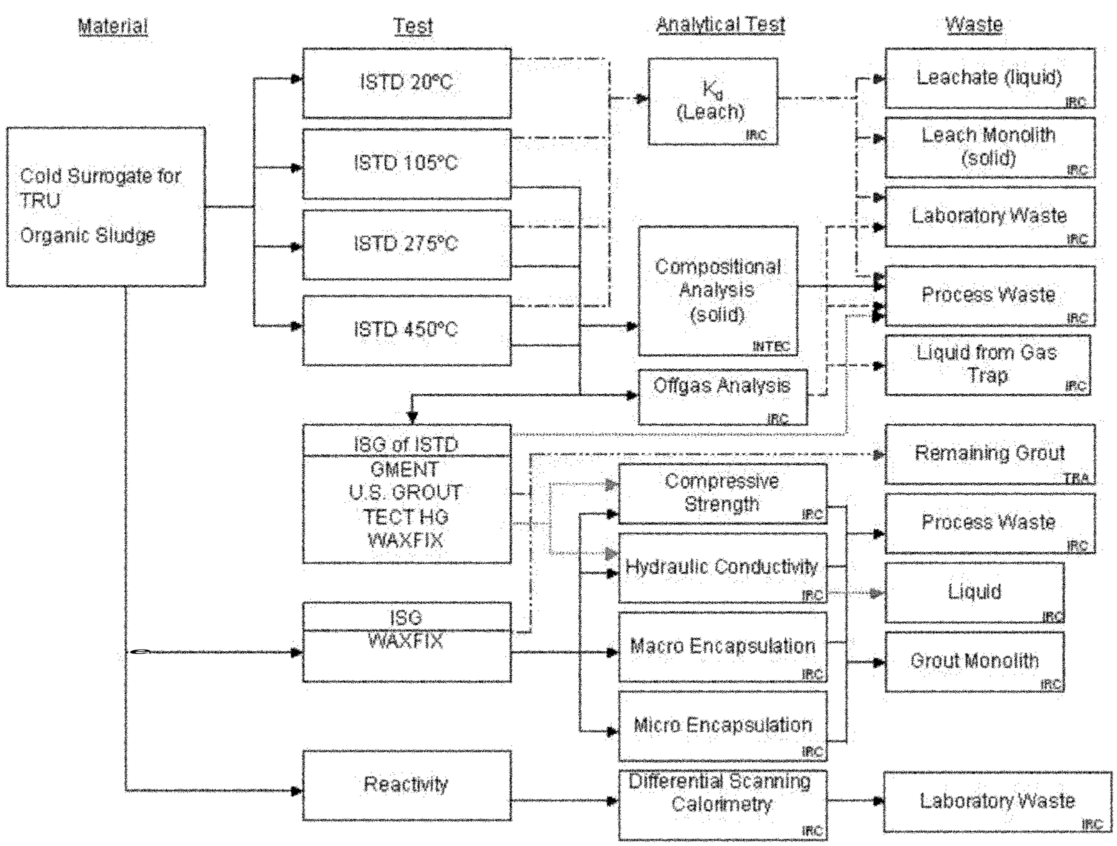

Figure C-8. Expected waste streams for cold **TRU** surrogate – organic sludge tests.

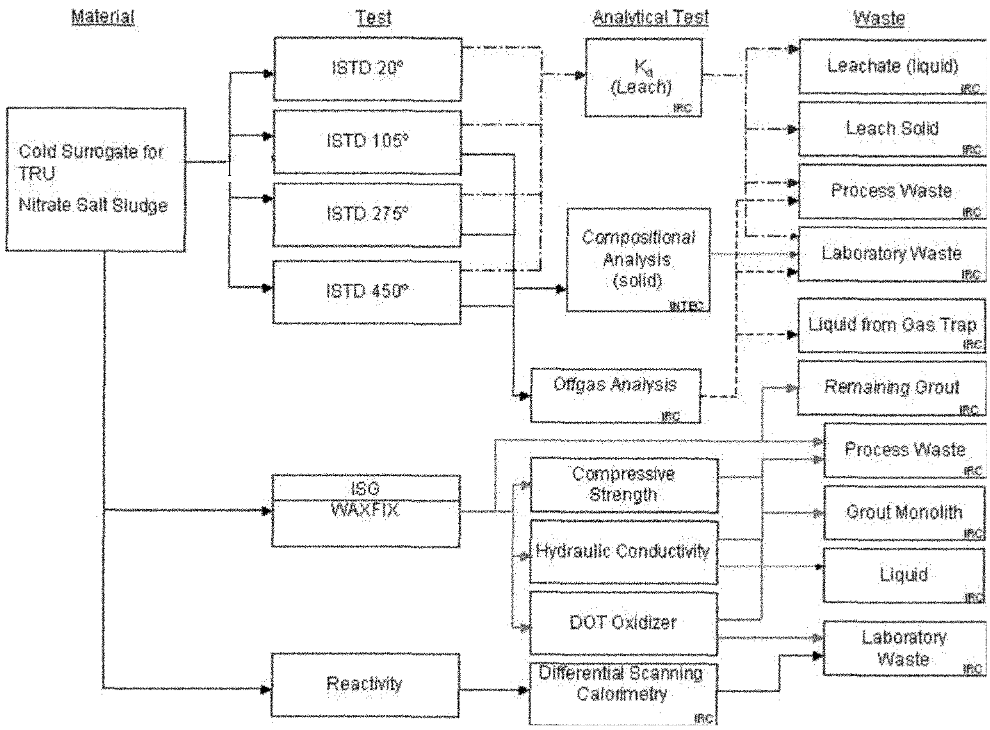

Figure C-9. Expected waste streams for cold TRU surrogate – nitrate salt sludge tests.

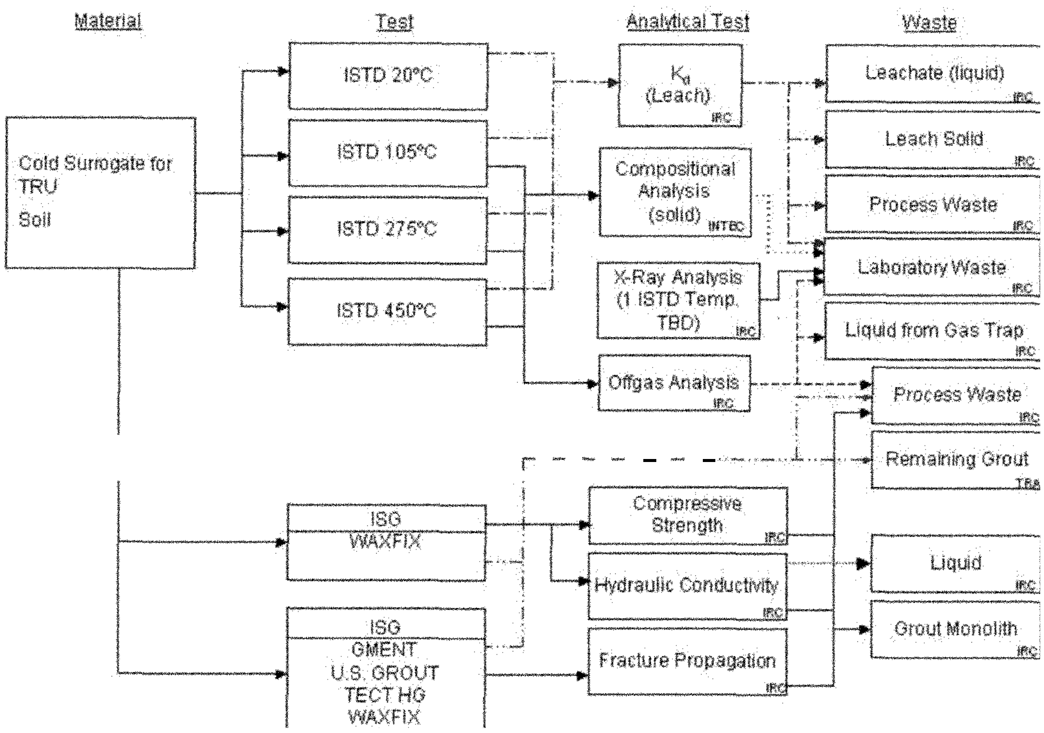

Figure C-10. Expected waste streams for cold TRU surrogate – soil sludge tests.

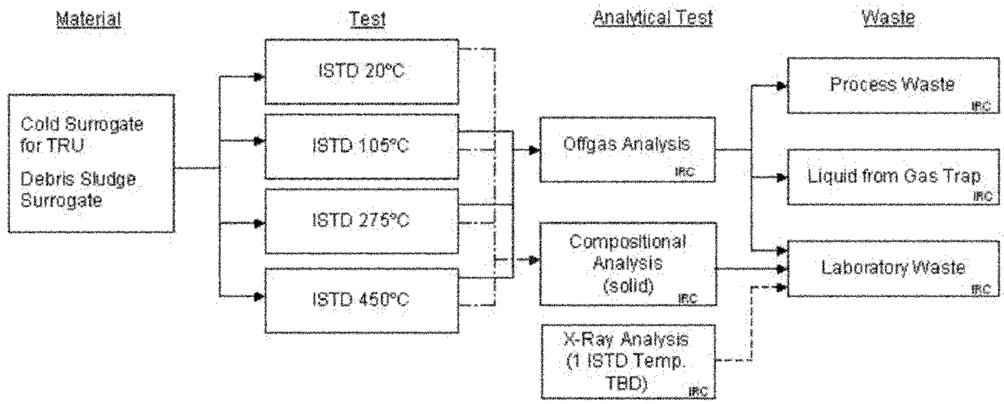

Figure C-11. Expected waste streams for cold TRU surrogate – debris sludge tests.

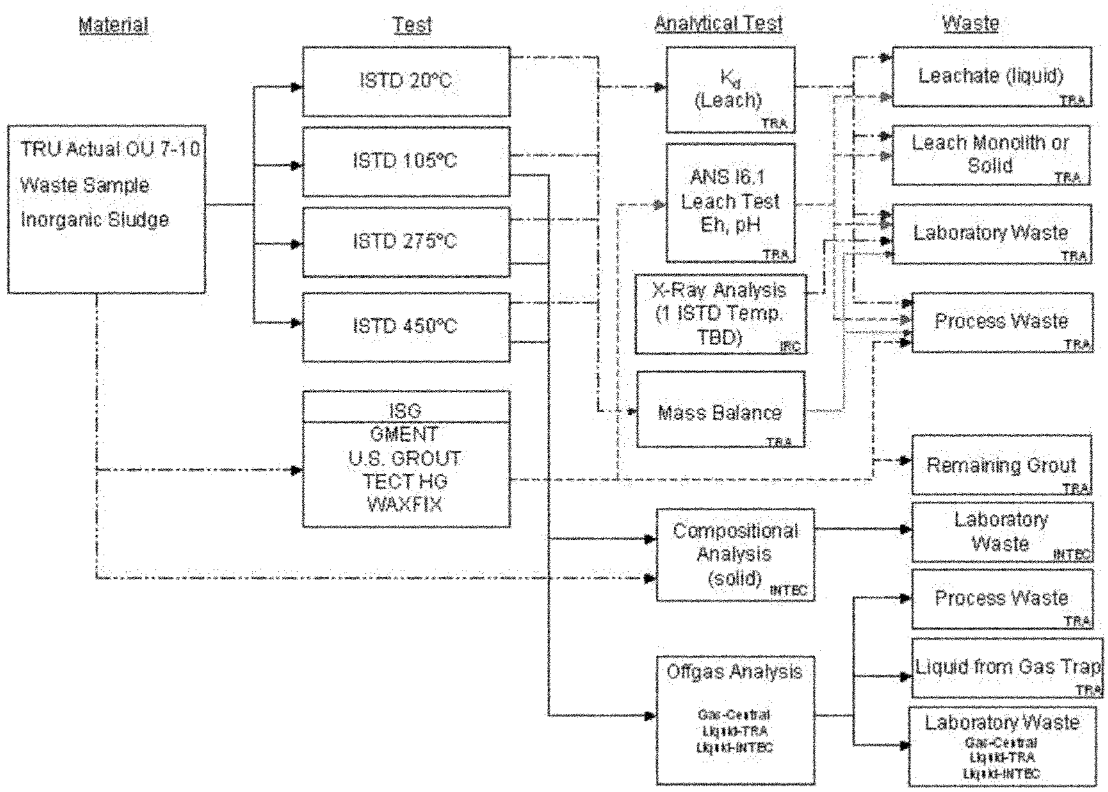

Figure C-12. Expected waste streams for excavated waste samples – inorganic sludge tests.

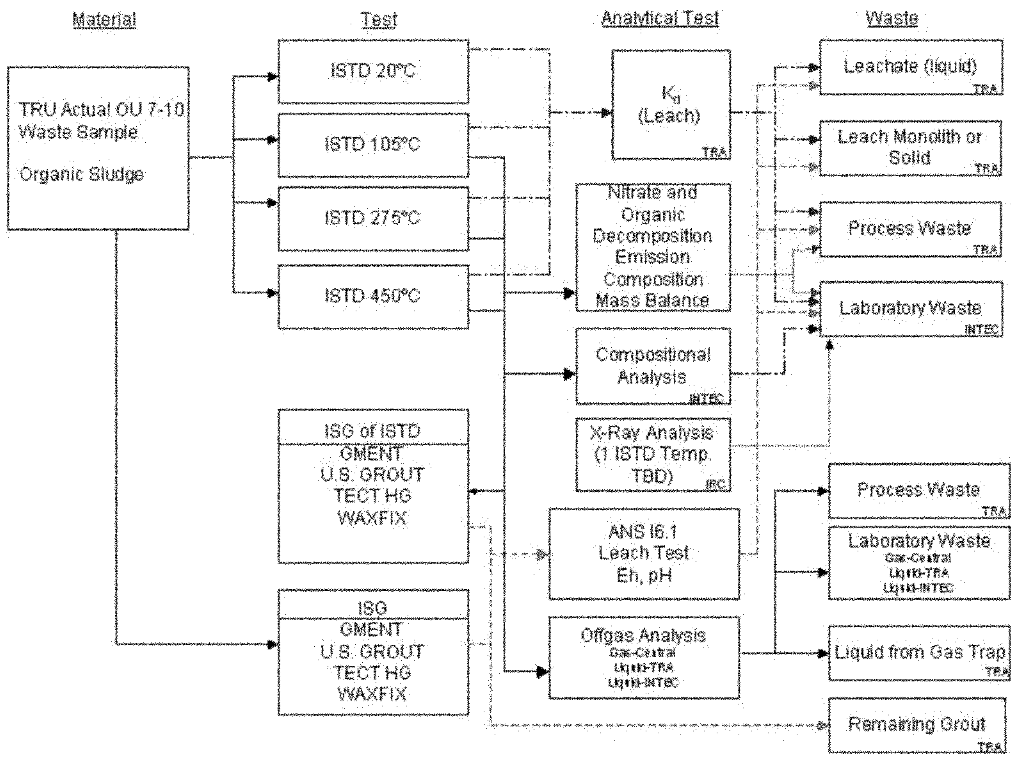

Figure C-13. Expected waste streams for excavated waste samples – organic sludge tests.

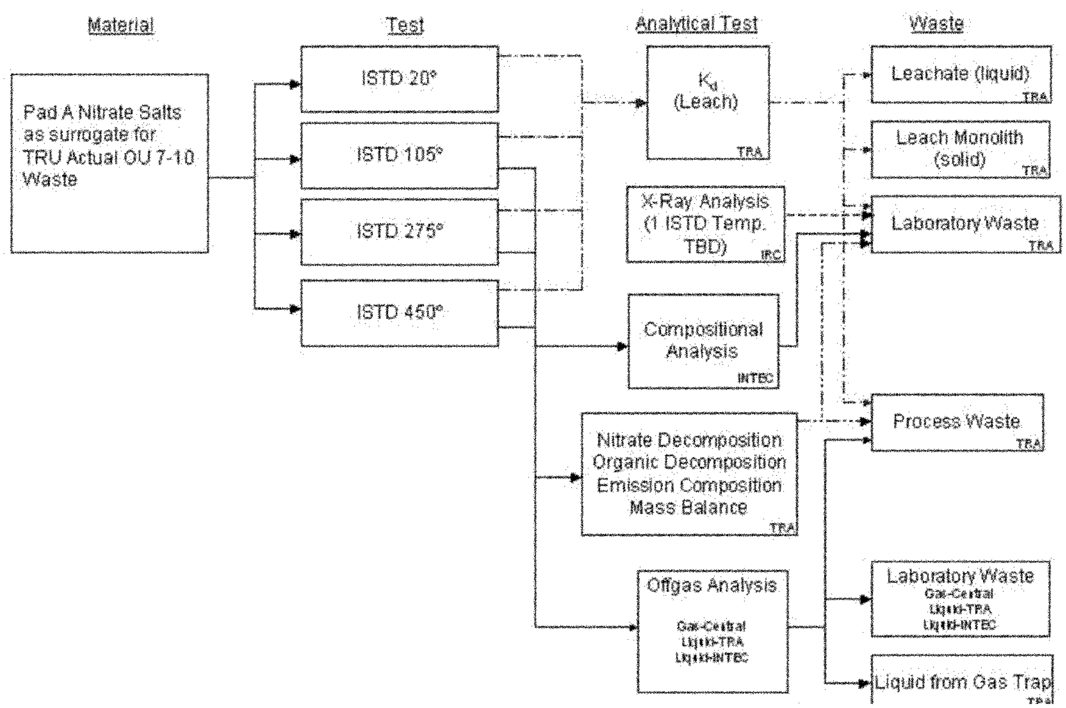

Figure C-14. Expected waste streams for surrogate – Pad **A** nitrate salt sludge tests

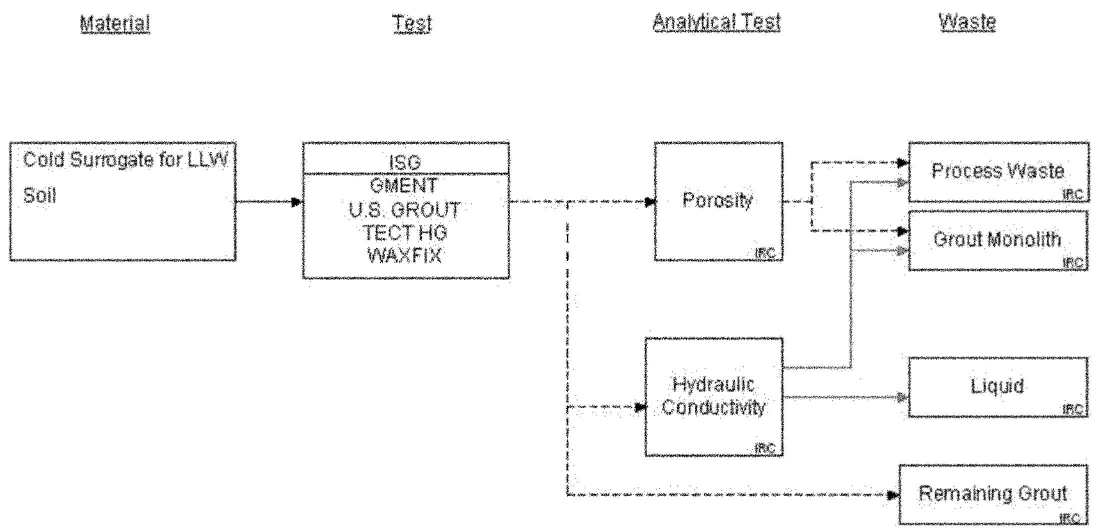

Figure C-15. Expected waste streams for cold waste surrogate – soil sludge tests.

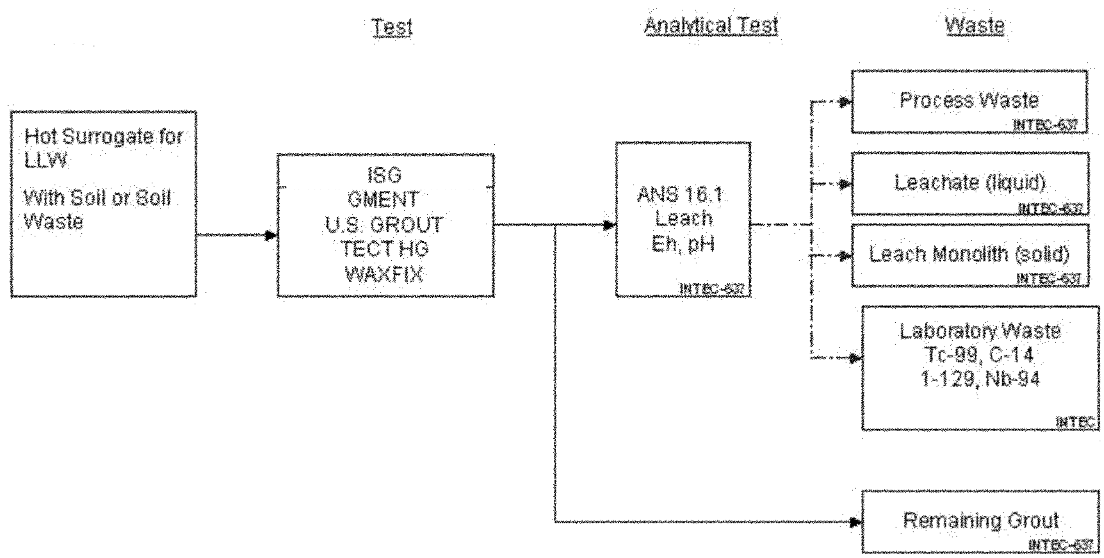

Figure C-16. Expected waste streams for cold waste surrogate – soil sludge tests.

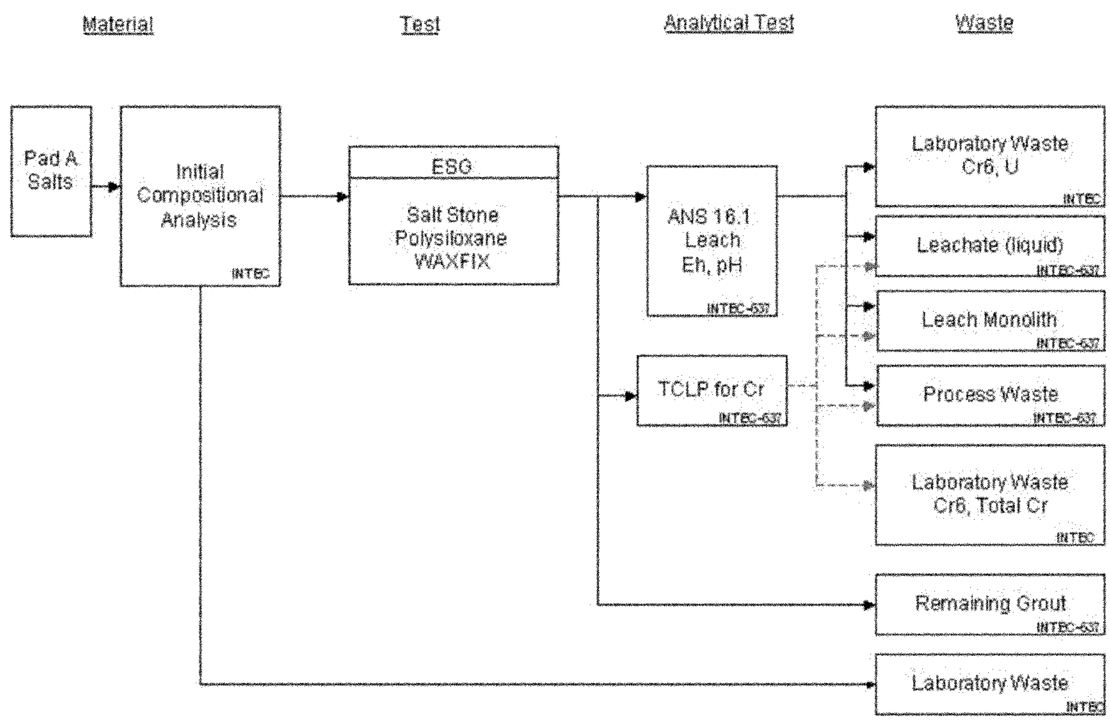

Figure C-17. Expected waste streams for Pad **A** salts ESG tests.

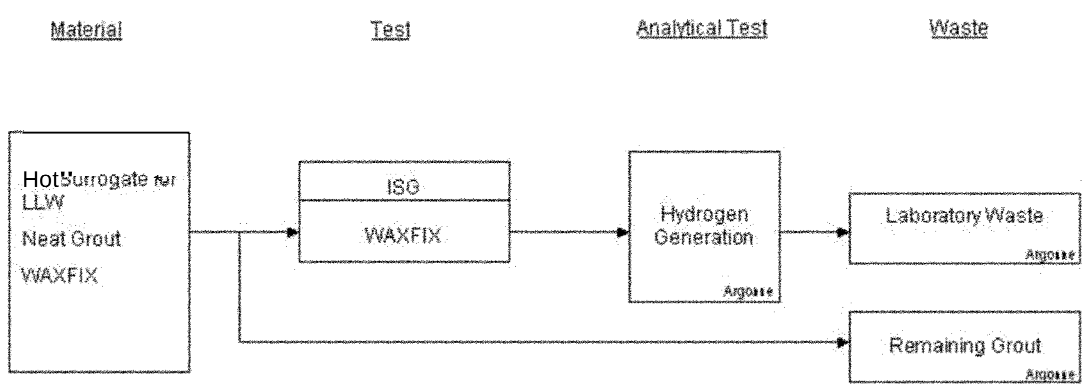

Figure C-18. Expected waste types for hot surrogate for LLW – neat grout tests.

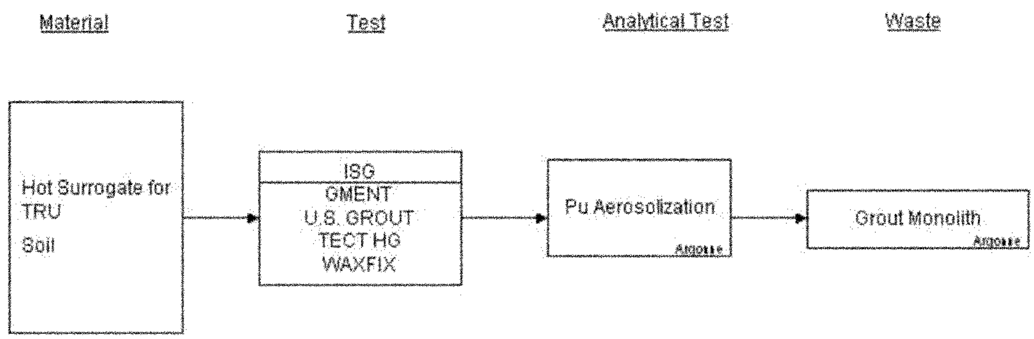

Figure C-19. Expected waste types for hot surrogate for TRU – soil sludge tests

Appendix D

Waste Stream Summary for the RWSC and EMSP Tests

Appendix D

Waste Stream Summary for the RWSC and EMSP Tests

This appendix presents a set of diagrams for the RWSC and EMSP tests that visually links the initial material, the waste produced from the various analytical tests and the disposal location. The following information is presented:

- Material: the input sample material on which the tests are being performed
- Test: the general category of tests being performed on the material.
- Waste stream: the waste generated from the tests, including an estimate of the volumes from the individual streams.
- Disposal: an indication of how the waste will be managed.

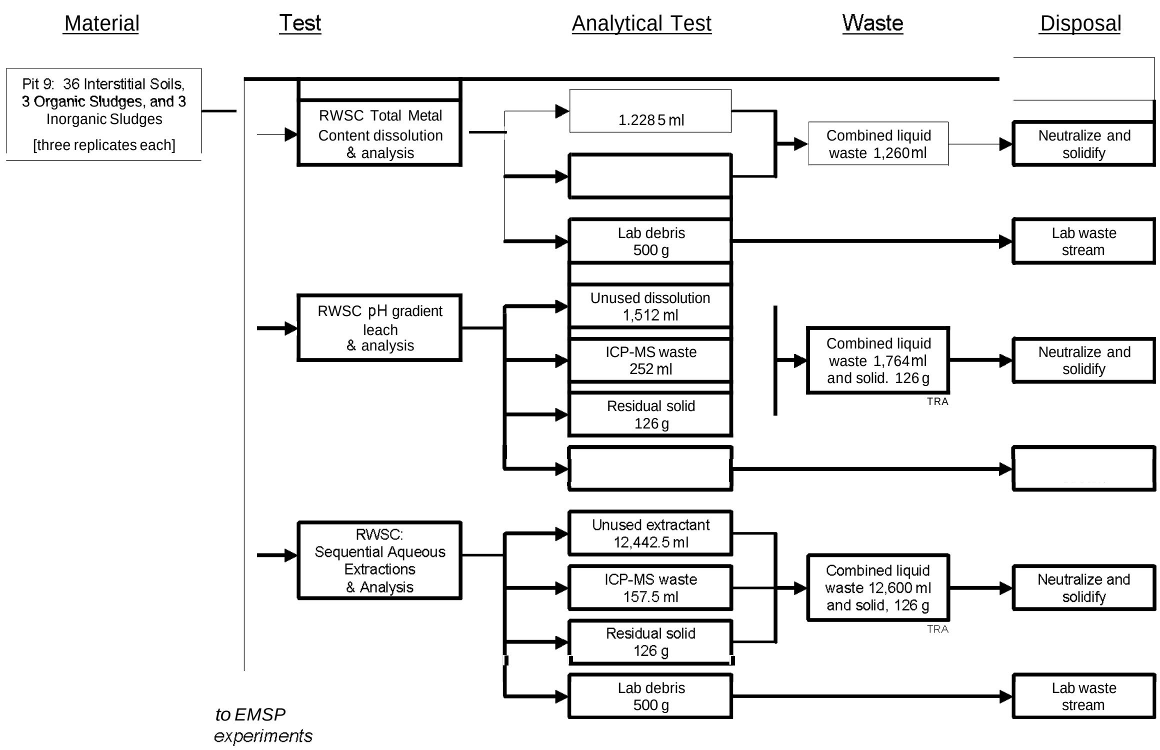

Figure D-1. Expected waste streams from RWSC Tests; disposal for the streams is planned at ICDF or RWMC low-level waste (LLW) Pit, in the event it is not hazardous.

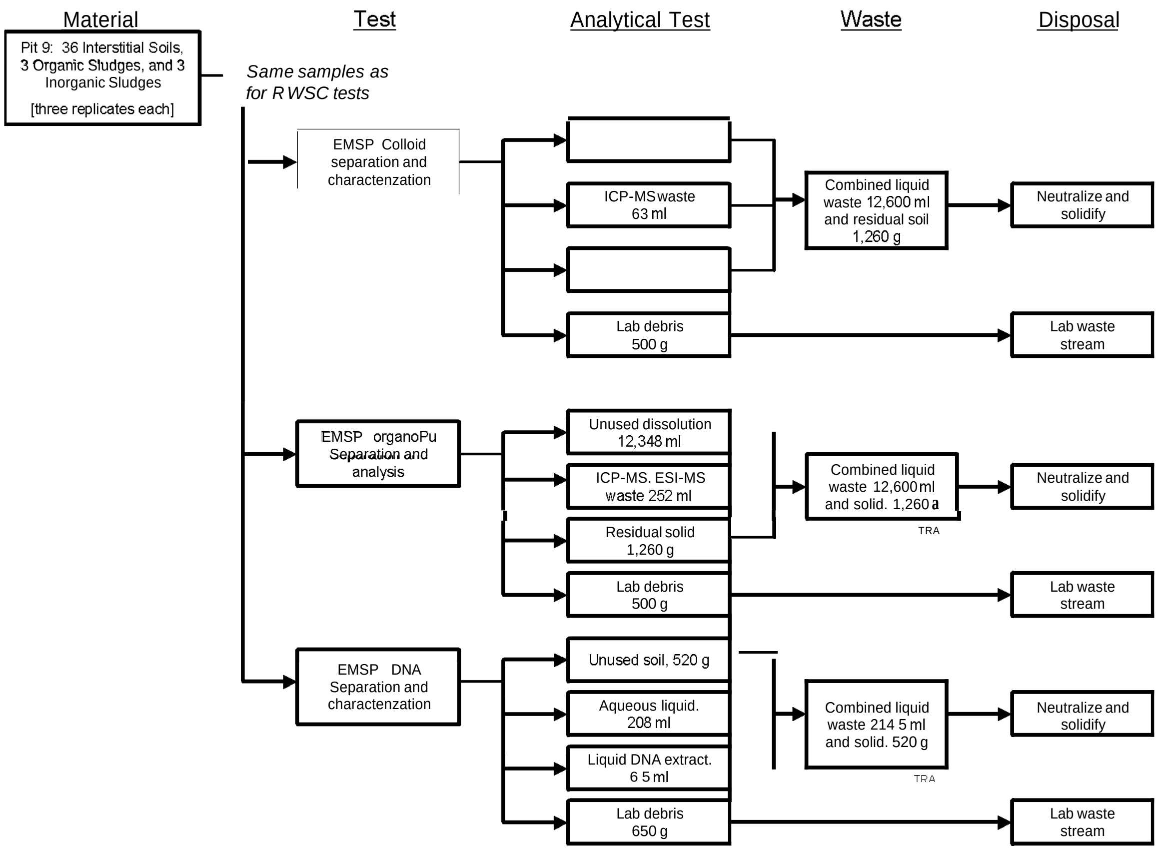

Figure D-2. Expected waste streams from EMSP Tests; disposal for the streams is planned at ICDF or RWMC low-level waste (LLW) Pit, in the event it is not hazardous.

Appendix E

RWSC and EMSP Tests: Estimated Waste Volume and Mass

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RWSC and EMSP Tests: Estimated Waste Volume and Mass

The waste streams expected to form during the previously described RWSC and EMSP tests are identified in this section. Appendix E contains a set of summary diagrams that show the relationship between the input sample material, the tests, the expected waste streams, and the waste type. Since OU 7-10 excavated sample material is used in both test programs, there is some uncertainty in the waste types that will be generated. It is expected that all wastes will be either LLW or MLLW, and that they will be managed by WAG-7 OU 13/14.

Unused Sample from Subsampling

It is assumed that the interstitial soil samples will contain 300–400 g of material (corresponding to 250 cm^3 sample volume). It is expected that the RWSC and EMSP investigations will consume *ut most* 200 g of sample (see the summary below), which will be handled by subsampling. Therefore, there will be *ut least* 100–200 g of unused sample material leftover. The unused sample will remain in the shipping container, and will be returned to INTEC for return to Glovebox Excavator Method for disposal, per section 4.2.2.

The mass of each sample required for the different analytical protocols is:

- 3 x 0.1 g for measurement of total Ac content (RWSC)
- 3 x 1 g for the pH gradient leaching (RWSC)
- 3 x 1 g for the sequential aqueous extractions (RWSC)
- 3 x 10 g for colloid extractions (EMSP)
- 3 x 10 g for measuring organoPu complexes (EMSP)
- 1 x 250 g for the DNA extractions (EMSP).

Retrieved Waste and Soil Characterization (RWSC) Tests

Waste from Total Ac content**.** Volume of solution from fusion dissolution of a typical 0.1 g sample will be approximately 10 mL. Of this, about 250 µl will be used for ICP-MS analysis. The remaining 9.75 mL will be low pH, Ac-containing solution that will become waste. There are expected to be three replicates from each of the 42 samples treated in this manner. The total dissolution volume will be (42 samples)(3 subsamples/sample)(10 mL/subsample) = 1,260 mL.

The ICP-MS waste will be collected in a waste jug, and analyzed at the conclusion of the RWSC sample analysis time period. It is anticipated that the concentrations of hazardous metals will be < RCRA limits, and that the concentrations of radionuclides will be < radiological waste limits (< 10 nCi g^{-1}); however, since the waste "carries" hazardous waste codes with it, it will require neutralization and stabilization at the laboratory, and will require storage at the Waste Management Facility 628. The total volume of the ICP-MS waste is estimated to be (42 samples)(3 replicates)(250 µl per replicate) = 31.5 mL.

The leftover dissolution volume (unanalyzed) will also constitute a waste stream. It will be aggregated in a storage container, and analyzed at the end of the project to ascertain the concentration of radionuclides. It will be neutralized and stabilized subsequent to analysis. The total volume is estimated to be (42 samples)(3 replicates)(9.75 mL per replicate) = 1228.5 mL.

In addition, approximately 500 g of lab debris waste is expected to be generated.

Waste from Ac leachability as a function of pH. This activity will involve:

- Three 1 g subsamples from each of the 36 interstitial soils;
- Three 1 g subsamples from each of the organic sludges; and
- Three 1 g subsamples from each of the three inorganic sludges.

Each individual subsample will be immersed in 10 mL of a leaching solution at pH 10. 250 μl will be analyzed using ICP-MS. The pH will then be adjusted to 9, and analyzed again. This process will be repeated until pH reaches 2, and thus the metal concentration will be measured at 9 different pH values. We estimate that the total volume of leachate will increase by 0.3 mL for each step, and hence should reach (10 mL)+(9 pH steps)(0.3 mL step.') = 12.7 mL per subsample. For the total of 42 x 3 subsamples, the total volume of leachate should be about 1600.2 mL.

The ICP-MS waste will be handled as described above. The total volume will be on the order of (42 samples)(3 replicates)(9 pH levels)(250 μl per level) = 283.5 mL.

The material remaining at the conclusion of the pH gradient leach will consist of approximately 1 g of residual soil immersed in approximately 10 mL of liquid leachate at pH = 2. This mixture will be neutralized and stabilized for storage. The total volume of unanalyzed leachate will be about (1600.2 – 283.5) = 1316.7 mL. The total residual mass of soil in the waste mixture from the pH gradient leach experiment will be (42 samples)(3 replicates)(1 g per replicate) = 126 g.

It is expected that the unanalyzed leachate, the ICP-MS waste and the residual soil mass constitute separate waste streams, and will be subjected to neutralization and stabilization in the laboratory.

In addition, the pH gradient leach is expected to generate 500 g of lab debris waste.

Waste from the Sequential Aqueous Extractions (SAE). This activity will involve:

- Three 1 g subsamples from each of the 36 interstitial soils
- Three 1 g subsamples from each of the organic sludges
- Three 1 g subsamples from each of the three inorganic sludges.

The sequential aqueous extraction scheme involves five steps:

1. Each subsample will be immersed in 10 mL of distilled/deionized water, which will function as a mild leaching solution. 250 μl of the leachate will be analyzed using the ICP-MS. The remaining 9.75 mL will be decanted and will constitute a separate waste stream.

2. Each subsample will be immersed in 10 mL of a $MgCl_2$ leaching solution. 250 μl of the leachate will be analyzed using the ICP-MS. The remaining 9.75 mL will be decanted and combined with the previous SAE leachate waste stream.

3. The residual subsamples will be washed with 10 mL of deionized water. The wash water will be combined with the previous SAE leachate waste stream. The washed sample will then be leached using an acetic acid/sodium acetate buffer. 250 μl of the leachate will be analyzed using the ICP-MS. The remaining 9.75 mL will be decanted and combined with the previous SAE leachate waste stream.

4. The residual subsamples will be washed with 10 mL of deionized water. The wash water will be combined with the previous SAE leachate waste stream. The washed sample will then be leached using a hydrogen peroxide solution. 250 μl of the leachate will be analyzed using the ICP-MS. The remaining 9.75 mL will be decanted and combined with the previous SAE leachate waste stream.

5. The residual subsamples will be washed with 10 mL of deionized water. The wash water will be combined with the previous SAE leachate waste stream. The washed sample will then be leached using a hydroxylamine or dithionite buffer. 250 μl of the leachate will be analyzed using the ICP-MS. The remaining 9.75 mL will be decanted and combined with the previous SAE leachate waste stream.

The ICP-MS waste will be handled as described above. The total volume will be on the order of (42 samples)(3 replicates)(5 extraction steps)(250 μl per level) = 157.5 mL

The excess SAE leachate will be analyzed using the ICP-MS, and if the concentrations of the RCRA metals and the radionuclides are below limits, the leachate will be pH-neutralized and solidified. The total volume of leachate will be (42 samples)(3 subsamples $sample^{-1}$)(5 extraction steps) (9.75 mL/subsample + 10 mL wash water) = 12,442.5mL.

The remaining solid at the end of the SAE process will have been leached more aggressively than if it had undergone a TCLP procedure, and hence will not have any substantial extractable metal remaining. It will be solidified and disposed of using the existing rad waste stream for TRA, which is covered under the existing waste management plan. The mass will be (42 samples)(3 replicates)(1 g per replicate) = 126 g.

Total Quantities from RWSC Tests. The total volume of ICP-MS waste is estimated at 472.5 mL. It will likely have a low pH (1–2). The total volume of unused dissolution, pH gradient leach solution, and SAE solution is estimated at 14,987.7mL, and again is expected to have a low pH. The volume of base required to neutralize these volumes will likely be on the order of several L. The total mass of residual soil is estimated at 252 g.

EMSP Tests

Waste from Colloid Extractions. This project will isolate colloids from the 36 interstitial soil samples and the six waste samples. 10 g sub-samples will be generated. The total soil mass for the colloid measurement will thus be 1,260 g.

Each 10 g subsample will be immersed in 100 mL of deionized water in order to suspend the colloids. The total volume of water used will be approximately 12,600 mL, and most of this will be waste.

The colloidal fraction that suspends will be separated using filtration and centrifugation. The total mass of the colloid fraction is assumed to be 50 mg per subsample. The total mass of separated colloids from all subsamples would thus be 6.3 g. The residual soil will thus be approximately 1,253.7 g.

The separated colloids will be characterized using a suite of nondestructive analytical characterizations including secondary ion mass spectrometry and X-ray diffraction. Small aliquots of the separated colloids will be dissolved and analyzed using ICP-MS.

In addition to the analysis of the separable colloids, soluble or nm-sized neo-colloids will be sought by analyzing small aliquots of the suspension solution using electrospray ion ionization mass spectrometry. This analysis, together with the ICP-MS, should require a total of no more than 0.5 mL per subsample; thus, the total amount of liquid for ESI-MS and ICP-MS should be approximately 63 mL.

The total waste generated from the colloid task will be approximately 12,600 mL of very dilute aqueous solution with near neutral pH and very low concentrations of all metals (including the actinides). In addition there will be about 1,260 g of residual soil, plus laboratory paper debris estimated at 500 g additional.

Waste Generated from Measuring Organo-Pu Complexes. This task will be addressed by performing extractions of the samples, followed by analysis for organic ligands and ligand-actinide complexes. 10 g subsamples of the interstitial soils and wastes will be extracted; therefore, the total mass for the organo-Pu complexes will be 1,260 g. Most of this will remain as residual waste after the extractions.

Each subsample will be extracted using 100 mL of aqueous solutions modified with percent additions of hydrophilic organic solvents such as acetonitrile and ethanol. Extraction of 3 subsamples of each of the 42 samples will produce 12,600 mL of solvent.

The mixed solvent systems have improved ability to extract the organic ligands and ligand complexes, and are amenable to liquid chromatographic (LC) and electrospray ionization mass spectrometric (ESI-MS) analyses. The resultant extracts will be analyzed using LC employing ESI-MS and ICP-MS detection. Both ICP-MS and ESI-MS use about 1 mL per analysis, therefore, the total volume for analysis will be about 252 mL.

The unanalyzed fraction of the extracts will thus be 12,600 mL – 252 mL = 12,348 mL which will be waste.

Waste Generation from DNA Extraction. Work activities will use DNA isolation for characterizing the activity of microorganisms from environmental samples. For DNA isolation, the commercial kit MoBio UltraClean Soil DNA Kit will be used. Within these reagents, the primary active ingredients guanidine thiocyanate (CAS # 593-84-0) and guanidine HCl (CAS # 50-01-1) are not considered RCRA- or sewer-regulated wastes.

1. <u>Waste stream per gram of soil</u>. (5 g) Solids include tubes, soil, guanidine isothiocyanate, glass beads, and cellular debris. Most of the nuclides will be associated with this waste. Liquid waste will include liquid guanidine HCl (1300 μl), liquid Tris- HCl, EDTA, NaCl, and ethyl alcohol (300 μl).

2. Summary of sample residuals produced by microbiological analyses of TM waste materials. Total sample quantity expected to be collected for microbiological analyses is **650** g. The accounting of sample residuals resulting from our proposed analyses is shown below:

   a. **520 g** of the solid waste materials would be unaltered by our procedures.

   b. **650 g** of solids include tubes, soil, guanidine isothiocyanate, glass beads, and cellular debris Most of the nuclides may be associated with this waste.

   c. **208 mL** of liquid waste containing guanidine HCl, Tris- HCl, EDTA, NaCl, and ethyl alcohol.

   d. **130 micrograms** of nucleic acids in **6.5 mL** of Tris-HCl buffer

   The total amount of materials **(1170 g and 215 mL**) could fit in a coffee can or two.

Total Quantities from EMSP Tests. The total liquid waste, originating from unanalyzed extraction solutions and analysis waste, is estimated at 25,415 mL. In addition, there will be 3,040 g of soil material. Finally, 1,650 g of laboratory debris are anticipated.