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To Solid Waste Management	From Process Chemistry and Statistics	Page 1 of 1 Date May 18, 1995			
Project Title/Work Order ANALYSIS AND STABILIZATION OF LAWRENCE BERKELEY LABORATORY'S MULTIPHASE MIXED WASTE.		EDT No. 601945 601944 ECN No.			

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LIST OF TERMS

CFR	<i>Code of Federal Regulations</i>
CWC	Central Waste Complex
DSC	Differential scanning calorimetry
FTIR	Fourier transform infrared analysis
FT	Fourier transform
GC	Gas chromatography
GEA	Gamma energy analysis
IMS	Indicating molecular sieves
LBL	Lawrence Berkeley Laboratories
MS	Mass spectroscopy
PNL	Pacific Northwest Laboratory
RTR	Real-time radiography
SWITS	Solid waste inventory tracking system
SWM	Solid Waste Management
TA	Total alpha
TB	Total beta
TGA	Thermal gravimetric analysis
TOC	Total organic carbon
TOMES	Toxicology, Occupational Medicine, and Environmental Series (Micromedex Inc. database)
WHC	Westinghouse Hanford Company
XRD	X-ray diffraction

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ANALYSIS AND STABILIZATION OF LAWRENCE BERKELEY LABORATORY'S MULTIPHASE MIXED WASTE

1.0 INTRODUCTION

Mixed waste (containing both low-level radioactive materials and chemically hazardous materials) are stored on the Hanford Site at the Mixed Waste Facility at the Central Waste Complex (CWC) in the 200 West Area. Five drums of waste accepted from Lawrence Berkeley Laboratories (LBL) during fiscal year 1994 are of concern because of incompatible waste mixtures and the potential for gas-generating reactions or reactions that form explosive, shock-sensitive compounds. In addition, the *Code of Federal Regulations* (CFR) (40 CFR 264.17) governing the storage of mixed wastes does not permit the presence of "incompatible" materials within an individual waste drum, whether or not the incompatible materials are mixed within the individual storage containers held in the waste drum.

The 55-gal drums each have inner liners which contain several inner containers, or "Lab Packs." These Lab Packs are constructed of polypropylene, Teflon¹, or glass and are packed in absorbent packing material.

According to the documentation supplied by LBL, mineral acids, including both hydrochloric and nitric acids, are contained in two of the drums; the various acid types (e.g., nitric, hydrofluoric, perchloric and hydrochloric) are reportedly stored separately from each other within the inner containers of one of these drums, while the other drum has the various acid types stored blended together in liter-sized inner containers. It is known that concentrated nitric and hydrochloric acid mixtures (aqua regia) react to form chlorine gas and nitrosyl chloride (ClNO). Concerns arise because the production of gas may lead to inner container pressurization and rupture, resulting in leakage of the corrosive liquid to the metal drum Lab Pack, and release of toxic gases (Camioni 1995). Furthermore, inner containers hold tritium and various other transuranic elements including ²³⁸U and ²³²Th, ²⁴¹Am.

Mixtures of inorganic and organic reagents are contained in three of the other drums as reported by LBL. The inorganic chemical contents of these three drums include the mineral acids nitric acid, hydrofluoric acid (HF) and inorganic chloride salts. Organic contents include methyl ethyl ketone (MEK), acetone, isopropyl alcohol, toluene, hexane, diethyl ether, and tetrahydrofuran (THF). These three drums also contain specific radioactive components at nanocurie per gram levels: tritium (³H), depleted uranium (²³⁸U), and natural thorium (²³²Th). The presence of the radioactive materials with hazardous chemicals causes the contents of these drums to be mixed waste.

¹Teflon is a trademark of E. I. duPont de Nemours and Company.

Initial concerns regarding the organic-containing drums are based on the possible formation of shock-sensitive organic peroxides from the ethers (diethyl ether and THF) and nitrate esters, and the (possibly self-accelerating) oxidations of organic compounds by the nitric acid that give gaseous products (e.g., NO_x, CO₂) which can pressurize the inner containers. Other unstable chemical conditions may also be present.

The concentrations of the various materials are given in an inexact way in the manifests that were sent to Westinghouse Hanford Company (WHC) from LBL. Thus, it is impossible, *a priori*, to know the concentrations of any component. Similarly, the ratios of organic to oxidizer (nitric acid) are not known with certainty. In addition, the drums are stored in uninsulated metal sheds in the 200 West Area. Therefore, storage temperatures are equivalent to ambient outside temperatures that may range from -20°C to +45°C. Both heat and aging may promote formation of peroxide and nitrate esters and affect the concentration of the various liquids in the waste containers. Therefore, it is necessary to characterize the waste in order to determine whether stabilization is necessary and to segregate the waste by what is currently present.

2.0 OBJECTIVES

This work plan describes the process for treating and analyzing the wastes contained in three of the five drums received by LBL. The objectives are as follows:

1. Separate aqueous and organic phases in individual containers to eliminate reaction between incompatible solvents.
2. Characterize the specific hazards and reactivities of the separated phases.
3. Perform stabilization to eliminate hazards recognized and ensure safe storage as chemically compatible fractions at the CWC.

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3.0 SCOPE

The scope of this test plan is to provide a protocol for analysis and stabilization of mixed acid and acid/organic liquids containing low-level radioactive materials from packages in drums received from LBL.

This test plan addresses specific analysis requirements and outlines handling methods that will result in stabilizing potentially reactive organic and acid/organic mixtures. Only those wastes shown to have significant exothermicity will be treated for peroxides. The work described in this test plan is based on the assumption that all permitting and regulatory requirements and waste packaging protocols will be handled in procedures developed by the Solid Waste Management (SWM) division of WHC.

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4.0 STABILIZATION METHODS SUMMARY

The following suggested stabilization methods are based on information obtained from the literature on work related to pure solvents:

1. **PHASE SEPARATION.** Based on visual phase determination, multiple phases will be separated by separatory funnel. It is anticipated that many of the organic constituents like MEK and tetrahydrofuran (THF) will be found in the aqueous phase.
2. **AQUEOUS PEROXIDE SCRUB.** Indicating molecular sieves (IMS) will be used to break down peroxides. This will be accomplished by bubbling nitrogen gas through a 5 vol% bed of sieves over a 3-day period or until peroxide tests are negative (Burfield 1982).
3. **THF/ORGANIC SCRUB.** Liquid/liquid extraction in toluene will be performed to remove organics that form peroxides over time. The organics will be stabilized for long-term storage at CWC (DuPont 1991).
4. **NEUTRALIZATION.** Neutralization will be performed by titration with 1.5 M Na_2CO_3 , which breaks down nitrate esters to alcohols, olefins, and aldehydes (Boschan et. al. 1955 and Bretherick 1985).
5. **ORGANIC PEROXIDE SCRUB.** Like aqueous peroxides, the organic peroxides will be destroyed by sparging the solution in a 5-vol% bed of IMS (Burfield 1982).

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5.0 DESCRIPTION OF TEST

The work described in this test plan is represented in a flowsheet in Figure 5-1.

5.1 SUSPECTED SAMPLE COMPOSITION

Based on LBL shipping information and the solid waste inventory tracking system (SWITS) database, five drums are suspected to contain incompatible and/or unstable substances within the same inner container or drum. Concentration and packaging information as provided by LBL is presented in Appendix A. Reactivity information was obtained online from the Micromedex Toxicology, Occupational Medicine, and Environmental Series (TOMES) PLUS (R) System (1974 through 1995) through the Pacific Northwest Laboratory (PNL) Technical Library. This information is presented in Tables 5-1 through 5-3.

Drums RFC0000194, RFC0294, and RFL0794 contain organic/acid which may and pose the greatest hazard. These drums contain mixtures of wastes which may form shock-sensitive peroxides and/or nitrate-esters. These peroxides may form on storage of this waste over time under ambient conditions.

Drum RAL0394 contains corrosive materials that have the potential to produce gases and overpressurize inner containers (see Appendix A). If the majority of these containers were vented for overpressurization, the primary hazard would be eliminated. The materials in these drums will be stabilized at the T Plant facility under protocol described in *Remediation Process for Incompatible LBL Containers*, WHC-IP-0845, Rev. 0 (WHC 1995a); however, in the event discrepancies are found in the containers of this drum, (such as the presence of organic phases or solids) they will be handled according to the same protocol established for drums RFC0000194, RFC0294, and RFL0794. All treatment protocol that will be performed at T-Plant for these drums are included in Appendix A of this document.

5.2 STABILIZATION FACILITY AND MATERIALS REQUIRED

The 222-S laboratory facility will be used to perform the stabilization work described in this work plan. The facility is equipped with adequate ventilation and storage for the containers as preparation for the work progresses. The waste must be stored under refrigeration in a dark cabinet. The work will be accomplished in a hood equipped with bottled nitrogen gas for sparging solutions. The hood is also equipped with explosion shields and will be posted to preclude exposure to personnel during waste stabilization. Other equipment needed includes: shakers or stirrers, polyethylene and glass separatory funnels and labware (1-L beakers, Teflon stir bars, tubing, and sampling vials), reagents such as IMS, and 1.5 M Na_2CO_3 .

Figure 5-1. Waste Stabilization Flowsheet.

29504011.1

Table 5-1. Perceived Hazards and Recommended Actions for Drum RFC0000194.
(4 sheets)

Sub-container ID	Contents as reported by LBL	Perceived hazard	Method of stabilization ^a	Comment
R010877	HF, isopropanol, MEK, water (20%), acetone, toluene, phosphine residue ^b	Explosive peroxides; extremely corrosive; flammable	Peroxide scrub	MEK enhances peroxide formation in isopropanol; HF is extremely corrosive
R010879	HF, isopropanol, MEK, water (32%), methylene chloride, toluene	Explosive peroxides; extremely corrosive; flammable	Peroxide scrub	MEK enhances peroxide formation in isopropanol; HF is extremely corrosive
R010881	HNO ₃ , MEK, THF, NaCl, LiCl, TMSCP, MCP, hexane, water (15%), acetone, toluene	Explosive peroxides; explosion potential among 3 or more components; flammable mixture	Phase separation, neutralization, peroxide scrub, organic removal, and stabilization	THF and MEK form peroxides; explosion potential combinations: HNO ₃ -acetone HNO ₃ -CP
R010882	HF, isopropanol, MEK, water (29%), acetone, methylene chloride, toluene	Explosive peroxides; flammable; extremely corrosive	Peroxide scrub	MEK enhances peroxide formation in isopropanol; HF is extremely corrosive
R010876	MEK, THF, toluene, HNO ₃ , bis-TMSCP water (23%), acetone, 1,1,1-TCE	Explosive peroxides; explosion potential among 3 or more components; flammable;	Phase separation, peroxide scrub, organic scrub, neutralization, organic removal and stabilization	THF and MEK form peroxides; explosion potential combinations: HNO ₃ -acetone HNO ₃ -CP
R010880	MEK, HF, pyridine, PMCP, CP, KI water (10%), acetone, methylene chloride, toluene	Explosive peroxides; extremely corrosive; flammable	Phase separation, peroxide scrub, and neutralization	MEK forms peroxides; HF is extremely corrosive
R009304	acetone, HNO ₃ , diethyl ether, hexane, toluene, THF, water (12%)	Explosive peroxides; explosion potential among three or more components; flammable	Phase separation, peroxide scrub, neutralization, organic removal and stabilization	THF and diethyl ether form peroxides; explosion potential with HNO ₃ -acetone; HF is extremely corrosive

Table 5-1. Perceived Hazards and Recommended Actions for Drum RFC0000194.
(4 sheets)

Sub-container ID	Contents as reported by LBL	Perceived hazard	Method of stabilization*	Comment
R008741	THF, diethyl ether, HNO ₃ , acetone, hexane, toluene, water (9%)	Explosion peroxides; explosion potential among three or more components; flammable	Phase separation, peroxide scrub, neutralization, organic removal and stabilization	THF and diethyl ether form peroxides; explosion potential with HNO ₃ -acetone; HF is extremely corrosive
R007264	diethyl ether, hexane, acetone, HNO ₃ , THF water (10%)	Explosive peroxides; explosion potential among three or more components; flammable	Phase separation, peroxide scrub, neutralization, organic removal and stabilization	THF and diethyl ether form peroxides; explosion potential with HNO ₃ -acetone
R008747	THF, HNO ₃ , acetone, hexane, toluene, water (29%)	Explosive peroxides; flammable	Phase separation, peroxide scrub, neutralization, organic removal and stabilization	THF forms peroxides; explosion potential with HNO ₃ -acetone
R010883	HNO ₃ , MEK THF, NaCl, LiCl, TMSCP, water (13%), acetone, methylene chloride, toluene, MCP, mercury, zinc	Explosive peroxides; explosion potential among three or more components; flammable; contains HNO ₃ , LiCl; toxic	Phase separation, peroxide scrub, neutralization, organic scrub, organic removal and stabilization	MEK and THF form peroxides; explosive combinations: HNO ₃ -CP HNO ₃ -acetone
R010886	HNO ₃ , MEK, THF, NaCl, LiCl, TMSCP, MCP, hexane, water (34%), acetone, methylene chloride, toluene, mercury, zinc	Explosive peroxides; explosion potential among three or more components; flammable; contains reactive HNO ₃ /LiCl NaCl	Phase separation, peroxide scrub, organic scrub, neutralization, organic removal and stabilization	MEK and THF form peroxides; explosive combinations: HNO ₃ -CP HNO ₃ -acetone
R010889	HNO ₃ , MEK, THF, NaCl, LiCl, DCP, MCP, hexane, water (65%), acetone, methylene chloride, mercury	Explosive peroxides; explosion potential among three or more components; flammable; contains reactive toxic HNO ₃ /LiCl NaCl	Phase separation, peroxide scrub, organic scrub, neutralization, organic removal and stabilization	MEK and THF form peroxides; explosive combinations: HNO ₃ -CP and HNO ₃ -acetone; solution is dilute
R010890	HNO ₃ , MEK, NaCl, CP, TMSCP, hexane, water (39%), acetone, methylene chloride, toluene, mercury	Explosive peroxides; explosion potential among three or more components; flammable; toxic HNO ₃ /LiCl NaCl	Phase separation, peroxide scrub, neutralization	MEK forms peroxides; explosive combinations: HNO ₃ -CP HNO ₃ -acetone

Table 5-1. Perceived Hazards and Recommended Actions for Drum RFC0000194.
(4 sheets)

Sub-container ID	Contents as reported by LBL	Perceived hazard	Method of stabilization*	Comment
R010902	HF, isopropanol, MEK, water (27%), methylene chloride, toluene, mercury	Explosive peroxides; flammable; extremely corrosive; toxic	Peroxide scrub	MEK enhances peroxide formation in isopropanol; HF is extremely corrosive
R010903	HF, MEK, toluene, THF, pyridine, KI, bisTMSCP, PMCP, water (26%), methylene chloride, mercury	Explosive peroxides; flammable; extremely corrosive; toxic	Phase separation, peroxide scrub, neutralization, organic removal and stabilization	MEK forms peroxides; HF is extremely corrosive
R010904	HF, HNO ₃ , MEK, NaCl, LiCl, DCP, water (65%) acetone, barium, beryllium, chromium, cobalt, copper, mercury, molybdenum, nickel, vanadium, zinc	Explosive peroxides; explosive potential among three or more components flammable; contains reactive HNO ₃ /LiCl NaCl; toxic	Phase separation, peroxide scrub, and neutralization	MEK forms peroxides; explosive combinations: HNO ₃ -acetone HNO ₃ -CP; solution is dilute
R010905	HNO ₃ , MEK, THF, KCl, bisTBCP, bisTMSCP, LiCl, water (64%), beryllium, chromium, copper, lead, mercury, zinc	Explosive peroxides; explosive potential among three or more components flammable; contains reactive HNO ₃ /KCl LiCl	Phase separation, peroxide scrub, neutralization, organic removal and stabilization	THF and MEK form peroxides; explosive combinations: HNO ₃ -CP; solution is dilute
R010906	HNO ₃ , MEK, hexane, CP, TMSCP, diethylene glycol, water (43%), arsenic, mercury	Explosive peroxides; explosion potential among 3 or more components; flammable; toxic	Phase separation and peroxide scrub	MEK forms peroxides; explosive combinations HNO ₃ -CP HNO ₃ -glycol
R010907	HNO ₃ , MEK, hexane, CP, TMSCP, MCP, NaCl, LiCl, water (59%), acetone, methylene chloride, toluene, xylenes mercury	Explosive peroxides; explosion potential among 3 or more components; flammable; toxic	Phase separation and peroxide scrub	MEK forms peroxides; explosive combinations: HNO ₃ -CP HNO ₃ -acetone; solution is dilute

Table 5-1. Perceived Hazards and Recommended Actions for Drum RFC0000194.
(4 sheets)

Sub-container ID	Contents as reported by LBL	Perceived hazard	Method of stabilization ^a	Comment
R010908	HF, isopropanol, MEK, water (25%), methylene chloride, toluene, mercury	Explosive peroxides; HF is extremely corrosive; toxic	Peroxide scrub	MEK enhances peroxide formation in isopropylalcohol
RO08746	THF, hexane, acetone, toluene, HNO ₃ , water (2.5%)	Explosive peroxides; flammable	Phase separation, peroxide scrub, organic scrub, organic removal and stabilization	THF forms peroxides; explosive combinations: HNO ₃ -acetone

Notes:

CP = cyclopentadiene
 DCP = dicyclopentadiene
 HF = hydrofluoric acid
 HNO₃ = nitric acid
 KCl = potassium chloride
 KI = potassium iodide
 LiCl = lithium chloride
 MCP = methylcyclopentadiene
 MEK = methyl ethyl ketone
 NaCl = sodium chloride
 PMCP = pentamethylcyclopentadiene
 TCE = 1,1,1-trichloroethane
 THF = tetrahydrofuran
 TMSCP = trimethylsilylcyclopentadiene

^aThe stabilization methods provided in this table are based on shipping information (manifests) supplied by LBL, SWITS information, and stabilization methods for pure reagents. These plans may change if characterization results reveal that the waste is not like that which is expected (see flowsheet in Figure 5-1).

^bThe following trace quantities of phosphines are contained in this container: 1,2-Bis(dimethoxyphosphoryl) benzene; 1,2-Bis(dimethoxyphosphoryl) benzene; 1,2-Bis(dimethylphosphoryl) benzene.

Table 5-2. Perceived Hazards and Recommended Actions for Drum RFC0294.

Sub-container ID	Contents as reported by LBL	Perceived Hazard	Methods for stabilization ^a	Comments
RO11377	Acetone, HNO ₃ , hexane, toluene, THF, water (12%)	Explosive peroxides; flammable	Phase separation, peroxide scrub, organic scrub, neutralization, organic removal and stabilization	THF forms peroxides; explosive combinations; HNO ₃ -acetone
RO08741	Acetone, HNO ₃ , hexane, toluene, THF, diethyl ether, water (9%)	Explosive peroxides; explosion potential among three or more components; extremely flammable	Phase separation, peroxide scrub, organic scrub, neutralization, organic removal and stabilization	THF and diethyl ether form peroxides; explosion combinations; HNO ₃ -acetone; diethyl ether may ignite from static electricity
RO07267	Acetone, HNO ₃ , hexane, THF, thallium chloride, water (10%)	Explosive peroxides; flammable	Phase separation, peroxide scrub, organic scrub, neutralization, organic removal and stabilization	THF forms peroxides; HNO ₃ -acetone form nitrate esters
RO07287	Acetone, HNO ₃ , hexane, THF, thallium chloride, toluene, water (9%)	Explosive peroxides; flammable	Phase separation, peroxide scrub, organic scrub, neutralization, organic removal and stabilization	THF forms peroxides; HNO ₃ + acetone
RO07268	Acetone, HNO ₃ , hexane, THF, thallium chloride, diethyl ether, water (9%)	Explosive peroxides; explosion potential among three or more components; flammable	Phase separation, peroxide scrub, organic scrub, neutralization, organic removal and stabilization	THF and diethyl ether form peroxides; HNO ₃ + acetone forms nitrate esters
RO08749	HNO ₃ , hexane, THF, thallium chloride, acetone, water (9%)	Explosive peroxides; flammable	Phase separation, peroxide scrub, organic scrub, neutralization, organic removal and stabilization	THF forms peroxides; HNO ₃ -acetone forms nitrate esters

Notes:

HNO₃ = nitric acid
 THF = tetrahydrofuran

^aThe stabilization methods provided in this table are the expected stabilization methods. However, these plans may deviate based on characterization results obtained while stabilization is performed (see flowsheet in Figure 5-1).

Table 5-3. Perceived Hazards and Recommended Actions for Drum RFL0794. (2 sheets)

Sub-container ID	Contents as reported by LBL	Perceived Hazard	Stabilization method	Comments
R011147	Acetone, hexane, toluene, THF, diethyl ether, water (21 %)	Explosive peroxides; extremely flammable	Phase separation, peroxide scrub, organic removal and stabilization	THF and diethyl ether forms peroxides
R011148	Acetone, hexane, toluene, diethyl ether, isopropanol, magnesium chloride	Explosive peroxides; flammable	Peroxide scrub and organic stabilization	Diethyl ether forms peroxides
R010373	Acetone, hexane, toluene, diethyl ether, isopropanol, magnesium chloride, lithium chloride, alkylcyclopentadienes	Explosive peroxides; flammable	Peroxide scrub, organic removal and stabilization	Diethyl ether and alkylcyclopentadienes form peroxides
R010388	Acetone, toluene, diethyl cyclopentadienes, THF, hexane, water (23 %)	Explosive peroxides; flammable	Phase separation, peroxide scrub, organic (ether) removal and stabilization	Diethyl cyclopentadienes and THF form peroxides
R011150	Acetone, toluene, diethyl ether, hexane, isopropanol, magnesium chloride, alkylcyclopentadienes	Explosive peroxides; flammable	Peroxide scrub, organic removal and stabilization	Diethyl ether and cyclopentadienes form peroxides
R010389	Acetone, hexane, THF, cyclopentadiene, toluene, water (23 %)	Explosive peroxides; flammable	Phase separation, peroxide scrub, organic removal	THF and cyclopentadienes form peroxides
R010365	Acetone, hexane, THF, diethyl ether, alkylcyclopentadienes	Explosive peroxides; flammable	Peroxide scrub, organic removal and stabilization	THF, diethyl ether and alkylcyclopentadienes form peroxides
R010367	Acetone, hexane, magnesium salts, diethyl ether, alkylcyclopentadiene	Explosive peroxides; flammable	Peroxide scrub, organic removal and stabilization	Diethyl ether and alkylcyclopentadienes form peroxides
R010386	Acetone, hexane, toluene, THF, diethyl ether, isopropanol, magnesium salts, alkylcyclopentadiene	Explosive peroxides; flammable	Peroxide scrub, organic removal and stabilization	THF, diethyl ether and alkylcyclopentadienes form peroxides

Table 5-3. Perceived Hazards and Recommended Actions for Drum RFL0794. (2 sheets)

Sub-container ID	Contents as reported by LBL	Perceived Hazard	Stabilization method	Comments
RO10366	Acetone, hexane, toluene, diethyl ether, toluidine, lithium chloride, alkylcyclopentadiene	Explosive peroxides; flammable	Peroxide scrub, organic removal and stabilization	Diethyl ether and alkylcyclopentadienes form peroxides
RO09349	Acetone, hexane, diethyl ether, isopropanol, lithium salts, magnesium salts, alkylcyclopentadiene	Explosive peroxides; flammable	Peroxide scrub, organic removal and stabilization	Diethyl ether and alkylcyclopentadienes form peroxides
RO09350	Acetone, hexane, toluene, diethyl ether, isopropanol, lithium chloride, alkylcyclopentadiene	Explosive peroxides; flammable	Peroxide scrub, organic removal and stabilization	Diethyl ether and alkylcyclopentadienes form peroxides
RO00300	Isopropanol, MEK, hexane, methanol	Peroxides, flammable	Peroxide scrub	MEK enhances peroxide formation in Isopropanol
RO00347	Isopropanol	Peroxides	Peroxide scrub	

Notes:

THF: = tetrahydrofuran

*The stabilization methods provided in this table are the expected stabilization methods. However, these plans may deviate based on characterization results obtained while stabilization is performed (see flowsheet in Figure 5-1).

5.3 ANALYSES REQUIRED

Analyses will be accomplished in two arenas: the field and the laboratory. Field analyses will be performed at the retrieval site and includes pH and peroxide strip tests, fourier transform infrared (FTIR) analysis for organics, X-ray diffraction (XRD) for metals, and fourier transform (FT) Raman for all phases as required. Field analyses will be performed on selected samples. Calorimetry is the primary laboratory analysis method required to understand the impact of long-term (15 years or longer) storage of the wastes and the stability of the waste mixtures. Differential scanning calorimetry (DSC) requires small samples and defines exotherms over various temperature ranges. When coupled with thermal gravimetric analysis (TGA), FTIR analysis (or mass spectrometry [MS]) provides additional information related to the breakdown components and also determines reaction constituents for mixtures found to produce significant exotherms. Additional analyses will be performed to determine organic content in the aqueous phase and speciation of organics being returned to the Central Waste Complex. After stabilization, containers will be surveyed for total alpha (TA) and total beta (TB) concentration, and gamma energy analysis (GEA) will be performed to determine concentration of gamma emitters (see Table 5-4).

Table 5-4. Analytical Procedures Required.

Procedure number	Title	Analysis
LA-344-105, Rev. B-3	<i>Determination of Carbon in Solutions by Combustion and Calorimetry</i>	TOC
LA-514-114, Rev. B-0	<i>Operation of Perkin-Elmer DSC 7 and TGA 7</i>	DSC/TGA
LA-523-402, Rev. A-1	<i>Semivolatile Organics by Gas Chromatography/Mass Spectroscopy</i>	Organic Screening
LA-548-121, Rev. D-1	<i>Preparation of Sample Mounts for Gamma Energy Analysis</i>	GEA
LA-508-101, Rev. D-2	<i>Alpha and Beta in Liquid Samples</i>	TA and TB

Notes:

TOC = Total organic carbon
 DSC = Differential scanning calorimetry
 TGA = Thermal gravimetric analysis
 GEA = Gamma energy analysis
 TA = Total alpha
 TB = Total beta

5.4 PROCEDURE

The following proposed general procedure for material receipt and lab screening is included in the remediation plan for the containers (WHC 1995a).

1. The inner containers will be opened and vented in the field before shipping.
2. The inner containers will be received in shipping packages that contain no more than five containers. This will allow the safest handling and the least amount of exposure to personnel. Packaging and shipping will be performed by SWM.
3. The corrosive nature of HF-containing wastes requires that these wastes be handled in polyethylene separatory funnels, beakers, and labware in well-ventilated areas.
4. Until there is confirmation that no reaction will likely occur, there is the potential for EXPLOSION when handling inner containers because of potential peroxide and nitrate ester formation.
5. Real-time radiography (RTR) has shown that solids are in some of the waste. Crystals from reagents other than peroxides may form during stabilization of the waste. If this occurs, work shall immediately stop and the cognizant chemist must be notified before proceeding.
6. All samples that show reactivity (i.e., as determined by calorimetry experts) shall be subjected to adiabatic calorimetry, especially samples analyzed by open-pan DSC where an exotherm is noticed above the normally expected endotherms associated with evaporation of samples. The adiabatic calorimetry analysis will provide thermal, pressure, and reaction rate information. This data will be used as a basis for discussion of how to proceed with the waste handling in the event that the potential for extreme hazard is indicated.
7. For wastes with high potential reactivity hazard, as determined by DSC and adiabatic calorimetry, an investigation will be initiated to determine the most appropriate means for chemically stabilizing the material. This determination will be based on the chemical and physical characteristics of the material and performed on a case-by-case basis.

5.4.1 Pretest for Peroxide Removal

A pretest will be performed to determine the detection limit for peroxides in acids and the viability of using molecular sieves for destruction of peroxide as described by Burfield (Burfield 1982).

1. Test peroxide EM Quant Peroxide Test Strips² in 1 M HCl and 1 M HNO₃. Obtain pH readings at the same time using litmus paper.
2. Prepare 0.06% H₂O₂ in 1 M HNO₃.
[Add 1.0 mL 3.0% H₂O₂ to 50 mL 1 M HNO₃ and label as follows:
"1 M HNO₃ + 0.06% H₂O₂."]
 3. Test pH and peroxide strip response.
[Test solution with peroxide test strip and litmus strip and paste all strips in notebook.]
4. Prepare 0.06% H₂O₂ in 1 M HCl.
[Add 1.0 mL 3.0% H₂O₂ to 50 mL 1 M HCl and label as follows:
"1 M HCl + 0.06% H₂O₂."]
 5. Test pH and litmus response.
[Test solution with peroxide test strip and litmus strip and paste all strips in notebook.]
6. Add ~5 vol% of IMS to each acid and peroxide solution and observe results (e.g., color changes, bubbling). Record observations in notebook.
7. Test each solution for peroxide beginning 1 day after addition of IMS to solution and continue testing until a negative test is obtained. It is possible that IMS will be adversely affected by acids rendering them inert, in which case testing for peroxide with sodium metabisulfite shall be accomplished, according to Hamstead (1964), by performing the following actions:
 - a. Begin by testing sample solutions of 50-mL HCl and 50-mL HNO₃ solutions for peroxide.
 - b. Stir 1 part 5% sodium metabisulfite to 3 parts sample for 30 minutes.

²EM Quant is a trademark of the EM Science Corporation.

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- c. Retest for peroxide content and repeat steps 11.a and 11.b every 30 minutes for 3 hours. Record any color changes, bubbling, or crystal formation.

5.4.2 Acid Drums RAL0394 and RAL1294

Drums RAL0394 and RAL1294 contain potentially reactive acids. Inner containers R006203, R006210, and R006211 will be neutralized with 1 M Na_2CO_3 at the T Plant facility. The method for neutralization of these wastes has been described in a memorandum to the facility (Triner 1995). In the event that discrepancies are found in the contents of these drums, additional characterization and treatment of drum contents will be performed depending on the discrepancies found. These wastes will be treated in the same manner as the organic/acid drums in the worst case scenario.

5.4.3 Organic/Acid Drums RFC0000194 and RFC0294

Drums RFC0000194, RFC0294, and RFL0794 each have containers of multiple-phase liquids requiring separation and analysis for organic content before neutralization can be performed. The following protocol should be followed:

1. Obtain and review peroxide test and field screening results.
2. If multiple phases are observed, separate the phases into individual containers and label the containers using the original container number and adding an alpha character extension to indicate the appropriate phase: The "-A" extension indicates the aqueous phase, The "-R" extension indicates the organic phase, and the "-S" extension indicates the solid phase.
3. If peroxides are present in solution treat for peroxides (see Section 5.4.4), otherwise proceed with Section 5.4.3, Step 4.
4. Obtain a 10-mL sample of the aqueous phase for total organic carbon (TOC) laboratory analyses and radionuclear assay. Obtain a 1-mL sample for DSC/TGA analysis.
5. Obtain a 5-mL sample of the organic phase for DSC/TGA laboratory analyses. Perform FT-Raman analysis on the sample before submitting for organic screening.

6. If there are solids present, perform DSC/TGA on a 1-g sample. Also, on a separate 1-g sample, submit for Radionuclear Assay, perform FTRaman characterization and obtain XRD verification.
7. Store all phases separately under refrigeration until laboratory results are received.
8. If the organic phase of the waste shows no reactivity (i.e., determined by DSC/TGA), return the organic phase to SWM for repackaging. Organic screening shall be performed and include gas chromatography (GC)/MS and TA, TB, and GEA before the sample is shipped. Document contents after screening and submit contents information to SWM.
9. If no organic is found in the aqueous phase, proceed with titration with 1.5 M Na_2CO_3 to pH 7.0 for all acids except HF.
10. If organic carbon is found in the aqueous phase, request GC/MS screening for THF and other organics.
11. If THF or other organics are found, extract in an amount of toluene equal to the sample volume using a separatory funnel (DuPont 1991).
12. Separate the aqueous from the organic layer and retest a 10-mL (maximum) sample following Step 4 and Steps 8 through 11. Proceed with extraction until the aqueous organic content is less than detectable (i.e., ppm levels).
13. Transfer toluene extractant to a brown glass container.
14. Sparge organic extractant for 3 hours with nitrogen to remove oxygen from the solution.
15. Add butylated hydroxytoluene to 400 ppm as stabilizer to the extractant (Dupont 1991)
16. Cap and ship back to SWM with original waste number and extension -R.
17. When all analyses are complete, return remaining samples to the original waste container as marked by identical number before the phase extension.

5.4.4 Peroxide Removal from Aqueous or Organic Waste

If peroxides are present, proceed with the following tasks in accordance with methodology developed by Burfield (1982) as follows:

1. Determine the volume of solution to be treated.
2. Set up a nitrogen bottle with refluxing line through 5 vol% IMS.
3. Sparge for 1 to 3 days.
4. Test for peroxides every 24 hours. When a negative result is obtained, continue with stabilization according to Section 5.4.3 (Steps 3 through 15).
5. Test the IMS beads for peroxides by running DSC/TGA.
6. Discard IMS with remaining waste.
7. Proceed to Section 5.4.3, Step 4.

5.4.5 Acid Neutralization

All nitric acid containing mixtures shall be neutralized to decompose nitrate esters if present in solution (Autry 1995).

1. Determine the volume of solution to be neutralized and obtain a container approximately two to three times the solution volume.
2. Transfer the solution to this container and label with original container number.
3. Neutralize solution to pH 7.0 with 1.5M Na_2CO_3 .
4. Record volume of material added and observations in laboratory notebook.
5. Submit 1mL of neutralized material to DSC to check for reactivity.
6. If no reactivity is reported, ship neutralized solution back to solid waste management and provide concentration weight and volume of material added to original solution.

5.4.6 Additional Stabilization

Subsequent to adiabatic calorimetry analysis a plan for stabilization shall be developed for the material on a case-by-case basis. This stabilization will ensure that waste is acceptable for long term storage. The development of this plan will require additional investigation based on thermodynamic and characterization results.

5.5 REQUIRED DATA

Reactivity of wastes will be checked by DSC and TGA, and organic content in aqueous solutions will be determined by TOC analysis and GC/MS. All speciation results as taken by XRD, GC/MS, and FT Raman will be provided to SWM for all organic phases found and radiological data will be provided for all separated phases. Tetrahydrofuran content is of specific concern and will be reported to the detection limit of instruments used for screening (i.e., in ppm levels). All data obtained from organic speciation and radionuclear assay will be provided to SWM for drum inventory and tracking. Under ideal conditions this data should not vary from the species described on the original manifest. However, because of waste aging other hydrolysis or oxidation products may be found.

5.6 DATA QUALITY

Data Quality will follow the guidelines provided in the *222-S Laboratory Quality Assurance Plan* (WHC 1995b). While waste is being treated, all procedures will be documented in controlled laboratory notebooks in accordance with guidelines provided in WHC-CM-5-4, *Laboratory Administration*, Section 5.4, "Laboratory Test Plans." All off-normal conditions must be documented by the scientist and reported with the results so that conditions are considered in the final analysis of the data.

6.0 SAFETY

Hazards associated with this waste include:

- Potential for explosion based on formation of shock-sensitive peroxides and nitrate esters.
- Radiological contamination
- Elemental poisoning from mercury and thallium compounds.

Personal protective clothing will be worn while processing the waste when the presence of toxic elements (e.g., thallium and mercury) has been listed (i.e., in containers RO10883, RO10886, RO10889, RO10890, RO10902, RO10903, RO10905, RO10906, RO10907, RO10908, RO07267, RO072787, RO07268, and RO08749). The required clothing will consist of disposable sleeves and aprons and rubber outer gloves. All personal protective clothing materials will have the maximum chemical resistance possible without impairing manual flexibility.

Methods have been developed after a thorough review of literature (see Appendix B) for associated hazards and are aimed at elimination of all known chemical incompatibility problems. This and handling of the waste shall proceed in isolated hoods and/or gloveboxes. In addition, samples shall be obtained in the field for use in determining appropriate safe practices for waste handling before the waste is received at the laboratory. While these peroxide and litmus strip tests are not definitive, conservative handling based on results from these tests will aid in later analytical characterization and stabilization. Specifically, pH measurements and peroxide analysis will be performed before samples are separated or further analyses begin. All waste and handling will proceed according to the guidelines provided below. In addition, a maximum of 16 containers will be stored under refrigeration at any one time.

The wastes will be returned to the Mixed Waste Storage Facility. Therefore, the stabilization method(s) have been selected to ensure that the treated materials will be stable for years at the temperature extremes of the facility (i.e., -20°C to +45°C). Analyses have been selected which will verify the stability of the material and radioactive content of the separated phases as they are returned to the facility.

6.1 RADIOLOGICAL SAFETY

All inner containers and their associated radionuclides are listed in Appendix A. The predominant radioactive species found in these wastes are transuranic elements. However,

radioactive bismuth and tritium have been reported for containers R006203 (see Appendix A), R010877, R010879, R010882, R010902, R010903 and R010880 (see Tables 6-1, 6-2, 6-3).

6.2 CHEMICAL SAFETY

Types of chemical reactions generally expected in handling this waste include, but are not limited to, those associated with chemical compatibility (e.g., nitric acid and organics) and that form shock-sensitive materials (e.g., autoxidation of ethers to form organic peroxides). The following list represents some chemical reactions that have been cited (Camioni 1995 and Autrey 1995):

- Nitric acid combined with pyridine produces cyanides (TOMES database).
- Both nitrate esters and peroxides form shock-sensitive crystals and solutions that may explode when dried or handled (TOMES database).
- Many organic and metallic peroxides are shock-sensitive.
- Nitric acid combined with alcohol forms nitrate esters (Boschan et. al. 1955).
- Nitric acid combined with diethyl ether or alcohols in stored solutions have been reported to explode (solutions exceeding 5 percent nitric acid should not be stored with alcohols [Bretherick 1985]).
- Isopropanol mixtures may form peroxides (Camioni 1995).
- MEK may enhance formation of peroxides in isopropanol alcohol (Camioni 1995).
- Alkyl ethers are reported to form polymeric peroxides on stabilization with acids (Kirk-Othmer 1978).
- Solid residues of cyclopentadiene may contain organic peroxides (Kirk-Othmer 1978).
- Thallium chloride, a toxic compound, is reported in waste concentrations to 2.7 wt%.
- Some acid mixtures may produce overpressurization in containers. Therefore, use extreme caution when open bulging containers in hoods.

Table 6-1. Radionuclides Reported in Drum
RFC0000194 Inner Containers.*

Inner container number	Isotopes present	Activity reported (nCi/g)
R010877	^3H	0.86
R010879	^3H	0.67
R010881	^{232}Th	0.19
R010882	^3H	0.57
R010883	^{238}U	0.190
R010886	^{232}Th	0.038
R010889	^{238}U	0.190
R010890	^{232}Th	0.086
R010902	^3H	0.029
R010903	^3H	0.019
R010904	^{238}U	3.5
R010905	^{238}U	1.4
R010906	^{238}U	0.20
R010907	^{238}U	0.380
R010908	^{238}U	0.019
R010876	^{238}U	0.143
R010880	^3H	0.86
R009304	^{238}U	1.66
R008741	^{238}U	1.66
R007264	^{238}U	1.66
R008747	^{238}U	0.99
R008746	^{238}U	1.66
R011377	^{238}U	3.32
R008741	^{238}U	1.66
R007267	^{238}U	0.66
R007287	^{238}U	0.99
R007268	^{238}U	1.66
R008749	^{238}U	1.66

*All information presented was obtained from the Solid Waste Inventory Tracking System.

Table 6-2. Radionuclides Reported in Drum RFC0294
Inner Containers.

Inner container number	Isotopes present	Activity reported (nCi/g)
R011377	^{238}U	1.70
R008741	^{238}U	1.74
R007267	^{238}U	0.71
R007287	^{238}U	0.99
R007268	^{238}U	1.78
R008749	^{238}U	1.73

Table 6-3. Radionuclides Reported in Drum RFL0794
Inner Containers.*

Inner container number	Isotopes present	Activity reported (nCi/g)
R011147	^{238}U	2.80
R010382	^{238}U	1.39
R011148	^{238}U	0.16
R010473	^{238}U	0.99
R010388	^{238}U	1.33
R011150	^{238}U	1.16
R010389	^{238}U	1.33
R010365	^{238}U	0.50
R010367	^{238}U	0.99
R010386	^{238}U	1.32
R010366	^{238}U	0.84
R009349	^{238}U	0.66
R009350	^{238}U	0.99
R000300	^{238}U	1.43
	^{232}Th	0.86
R000347	^{238}U	25

*All information presented was obtained from the Solid Waste Inventory Tracking System.

6.3 SAMPLE HANDLING

Remediation of the drum Lab Packs which contain the incompatible mixed waste will require personnel to handle (retrieve, open, and transport) the individual containers. As this project is planned (see WHC-IP-0845), the greatest hazard potential associated with sample handling is assumed in the field where the Hanford Fire Department will open the containers in full bomb squad clothing (WHC 1995a). Possible detonation, fire, pressure, and fume hazards have been identified, and appropriate personnel protective equipment and procedures have been developed.

In general, all procedures will be performed in ventilated hoods or isolated gloveboxes and protective disposable clothing will be used when handling solutions. Work must be stopped at any point crystals are observed and the cognizant scientist must be notified. Gas release is expected when molecular sieves are added to peroxide-containing solutions. Neutralization and introduction of molecular sieves will be performed slowly, in increments of < 1 vol%, with continuous stirring and temperature monitoring. Whenever possible, increments of < 10 mL will be tested for reagent compatibility before additions are made to the solutions. The wastes will be stored in the dark and refrigerated as a means to inhibit peroxide formation. If crystals are noted after a sample is refrigerated or if sample volume changes are noted, the affected sample will be returned to ambient temperature and the cognizant scientist contacted.

Workers shall observe and record any color changes, crystal formation, or container deterioration while working with these solutions. These changes shall be reported promptly to the cognizant scientist.

All labware and containers must be free of metal contamination and be composed of only polyethylene or Teflon when working with hydrofluoric acid wastes.

Thallium and mercury are toxic elements which must be handled in well-ventilated and marked areas where access limits prevent entry by employees unfamiliar with the hazards associated with these elements. Extra dress requirements include disposable water resistant sleeves, rubber aprons, and two pair of gloves with the outside pair composed of chemically impervious material (i.e. Silver Shield). All labware that has been used to process thallium-containing mixtures must be discarded after work is complete. The discarded materials will be placed in laboratory solid waste packs which will be included with the remaining LBL solid waste.

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7.0 ORGANIZATION AND FUNCTION RESPONSIBILITIES

Table 7-1 lists organizations and functions affected by this plan, and also lists the responsibilities of the listed organizations and functions.

Table 7-1. Organization and Function Group Responsibilities.

Organization or function group	Responsibility
Analytical Operations	Receive and store containers
	Analyze samples
Process Chemistry and Development	Write work plan for characterization and stabilization
	Treat waste and perform sample breakdown
	Report data received after analysis
	Provide summary and notes obtained from processing waste to Solid Waste Management
Environmental Compliance Officer and Safety Officer	Review workplan
	Approve final workplan
Hazardous Material Control Group	Segregate all solid waste associated with LBL analysis
	Package waste
	Ship waste back to T Plant with appropriate documentation
T Plant Operations	Shipping and repacking drums
Field Analytical Services	Review workplan and perform field screening analysis
Solid Waste Management	Administration of project budget and schedule reporting

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8.0 REFERENCES

- 40 CFR 264.17, 1992, "General Requirements for Ignitable, Reactive or Incompatible Wastes," *Code of Federal Regulations*, as amended.
- Autrey, S. T., 1995, *LBL Waste Literature Review* (internal electronic correspondence to G. C. Triner and B. A. Crawford, March 23), Pacific Northwest Laboratory, Richland, Washington.
- Boschan, R., R. T. Merrow, and R. W. Van Dolah, 1955, "The Chemistry of Nitrate Esters," *Chemical Reviews*, Vol. 55, page 485, City, State.
- Bretherick, 1985, *Handbook of Reactive Chemical Hazards*, Butterworths, London, England.
- Burfield, D. R., 1982, "Deperoxidation of Ethers. A Novel Application of Self-Indicating Molecular Sieves," *Journal of Organic Chemistry*, Vol. 47, page 3821, Kuala Lumpur, West Malaysia.
- Camioni, D., 1995, *Progress Report, LBL Waste Literature Review* (internal electronic correspondence to G. C. Triner, B. A. Crawford, and R. D. Pierce, March 3), Pacific Northwest Laboratory, Richland, Washington.
- DuPont, 1991, *Tetrahydrofuran: Properties, Uses, Storage, and Handling*, Brochure H-23411, DuPont Chemicals, Wilmington, Delaware.
- Hamstead, A. C., 1964, "Destroying Peroxides of Isopropyl Ether," *Industrial and Engineering Chemistry*, Vol. 56 No. 6, page 37, South Charleston, West Virginia.
- Kirk-Othmer, 1978, *Encyclopedia of Technology*, John Wiley and Sons, New York, New York.
- Triner, G. C., 1995, *Instructions for T Plant Pertaining to LBL Drum RAL 0394, Rev. 1*, (internal letter to P. J. Crane, April 4) Westinghouse Hanford Company, Richland, Washington.
- WHC, 1995a, *Remediation for Incompatible LBL Containers*, WHC-IP-0845, Rev. 0, Richland, Washington.
- WHC, 1995b, *222-S Laboratory Quality Assurance Plan*, WHC-SD-QAPP-016, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

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APPENDIX A
DRUM LABORATORY PACK CONTENTS

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Westinghouse Hanford Company

From: G. C. Triner
Phone: 372-0734 T3-04
Date: April 4, 1995
Subject: INSTRUCTIONS FOR T PLANT PERTAINING TO LBL DRUM RAL0394 (REV. 1)

Project: LBL CONTAINER TREATMENT AND SEGREGATION PROJECT

To: P. J. Crane T3-28

cc: C.K. Girres	T3-05	R.D. Pierce	T3-04
M.D. Aichele	T4-04	N.P. Emerson	T4-03
R.J. Giroir	T4-05	M.S. Wright	T3-28

This document provides general information and instructions concerning the work required of T Plant in support of the Lawrence Berkeley Laboratory (LBL) drum treatment and segregation project.

LBL drum RAL0394 contains nine polyethylene jars ranging in size from 500 ml to 5 gallons of acid mixtures. Three of the inner containers require neutralization. The table which is attached to the end of these instructions denotes the materials and quantities of each container.

The three internal containers identified as requiring neutralization may be pressurized, due to the fact that they contain a mixture of hydrochloric and nitric acids. The mixture of nitric acid and hydrochloric acid is known as "aqua regia", which can produce chlorine gas. Also nitric acid is known to cause polyethylene containers to become brittle. Solid Waste Disposal has chosen to conservatively manage these containers. Therefore, extreme caution should be taken when managing these containers. T Plant should prevent bumping, dropping, or shaking the containers and movement of the containers should be held to a minimum.

These containers were packaged in 1993 and received at the Central Waste Complex (CWC) in early 1994. At the time of packaging, no peroxides or other problems were evident.

The following sections contain the general instructions for performing the activities required of T Plant in support of this program:

INSTRUCTIONS FOR OPENING THE INNER CONTAINERS:

- 1) Upon receipt of the container, T Plant shall input the new drum location in SWITS.
- 2) Perform the activity in accordance with an approved work plan, and all other applicable requirements.

Westinghouse Hanford Company

- 3) RAL0394 will be opened, the following internal containers will be removed and vented by the Hanford Fire Department (HFD), repackaged in glass containers, neutralized by SWAT, and placed in a separate drum:
 - R006203, R006210, & R006211
- 4) T Plant will package the containers in accordance with an approved SDAR supplied by Generator and Waste Acceptance Services (GWAS). The following inner containers will be segregated in the following manner to comply with department of transportation requirements.
 - GROUP 1 (RAL0394): R008404 & R008411.
 - GROUP 2 (RAL0394-2): R000966.
 - GROUP 3 (RAL0394-3): R006203, R006210, & R006211.
 - GROUP 4 (RAL1294): R006752
 - GROUP 5 (RAL0394-5): R007299
 - GROUP 6 (RAL1294-2): R007300.
- 5) Generate new burial records, Uniform Hazardous Waste Manifest, RSR, and container summary.
- 6) Return the containers to the CWC.

Should T Plant have any questions concerning these instructions, please contact Mr. G. C. Triner at 372-0734 or pager 85-9488. Should the above instructions or associated summary sheet require revision the revision number will be changed, Mr. P.J. Crane will be notified by phone, and the material will be transmitted to Mr. P.J. Crane in hardcopy signed and dated accordingly.

G.C. Triner
Segregation and Treatment Team Leader

Attachment 1

ATTACHMENT 1
SUMMARY TABLE FOR DRUM #RAL0394 (Rev. 4/3/95)

CONTAINER # & ISOTOPES	CONSTITUENT CAS #	CONSTITUENT NAME	WEIGHT %	RGN	GENERAL INFORMATION
R008404 ISOTOPES: Cm-248 = 0.01 uCi	10035-10-6	Hydrobromic Acid	1	1	TOTAL MATERIAL WEIGHT: 20 kg TOTAL MATERIAL VOLUME: 5 gallon CONTAINER: This waste is packaged in a 5 gallon polyethylene acid carboy. POSS. HAZARDS: Extremely corrosive TREATMENT: None
	7726-95-6	Bromine	0.1	104	
	7647-01-0	Hydrochloric Acid	0.1	1	
	N/A	Water	99	N/A	
R008411 ISOTOPES: Cm-248 = 0.01 uCi	10035-10-6	Hydrobromic Acid	1	1	TOTAL MATERIAL WEIGHT: 20 kg TOTAL MATERIAL VOLUME: 5 gallon CONTAINER: This waste is packaged in a 5 gallon polyethylene acid carboy. POSS. HAZARDS: Extremely corrosive TREATMENT: None
	7782-50-5	Chlorine	0.1	104	
	7647-01-0	Hydrochloric Acid	0.1	1	
	N/A	Water	99	N/A	
R000966 ISOTOPES: Z-95 = 5 uCi Hf-172 = 10 uCi U-235 = 0.001 uCi	7664-38-3	Hydrofluoric Acid	0.02	1	TOTAL MATERIAL WEIGHT: 1 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter polyethylene container. POSS. HAZARDS: Extremely corrosive TREATMENT: None
	7647-01-0	Hydrochloric Acid	1	1	
	N/A	Water	99	N/A	
R006203 ISOTOPES: Bi-207 & 208 = 0.1 uCi	7697-37-2	Nitric Acid	40	2	TOTAL MATERIAL WEIGHT: 1 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter polyethylene container. Possible container compatibility problems, embrittlement. POSS. HAZARDS: Extremely corrosive and overpressurization TREATMENT: Neutralization, package in glass container after treatment.
	7647-01-0	Hydrochloric Acid	20	1	
	N/A	Water	40	N/A	
R006210 ISOTOPES: Th-228 = 10 uCi Th-229 = 100 uCi	7697-37-2	Nitric Acid	40	2	TOTAL MATERIAL WEIGHT: 1 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter polyethylene container. Possible container compatibility problems, embrittlement. POSS. HAZARDS: Extremely corrosive and overpressurization TREATMENT: Neutralization, package in glass container after treatment.
	7647-01-0	Hydrochloric Acid	20	1	
	N/A	Water	40	N/A	

ATTACHMENT 1
SUMMARY TABLE FOR DRUM #RAL0394 (Rev. 4/3/95)

CONTAINER # & ISOTOPES	CONSTITUENT CAS #	CONSTITUENT NAME	WEIGHT %	RGN	GENERAL INFORMATION
R006211 ISOTOPES: Am-241 = 1 uCi Cl-249 = 1 uCi	7697-37-2	Nitric Acid	17	2	TOTAL MATERIAL WEIGHT: 0.2 kg TOTAL MATERIAL VOLUME: 200 ml CONTAINER: This waste is packaged in a 1 liter or 500 ml polyethylene container. Possible container compatibility problems, embrittlement. POSS. HAZARDS: Extremely corrosive and overpressurization TREATMENT: Neutralization, package in glass container after treatment.
	7647-01-0	Hydrochloric Acid	56	1	
	N/A	Water	28	N/A	
R006752 ISOTOPES: Np-237 = 0.1 uCi Pu-239 = 0.1 uCi	7647-01-0	Hydrochloric Acid	0.36	1	TOTAL MATERIAL WEIGHT: 1 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter polyethylene container. POSS. HAZARDS: Extremely corrosive TREATMENT: None
	N/A	Water	99.64	N/A	
R007299 ISOTOPES: Np-237 = 0.1 uCi Pu-239 = 0.1 uCi	7647-01-0	Hydrochloric Acid	0.36	1	TOTAL MATERIAL WEIGHT: 1 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter polyethylene container. POSS. HAZARDS: Extremely corrosive TREATMENT: None
	7647-14-5	Sodium Chloride	6	Not Listed	
	7601-90-3	Perchloric Acid	0.1	2	
	N/A	Water	94	N/A	
R007300 ISOTOPES: Np-237 = 0.1 uCi Pu-239 = 0.1 uCi	7647-01-0	Hydrochloric Acid	0.36	1	TOTAL MATERIAL WEIGHT: 1 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter polyethylene container. POSS. HAZARDS: Extremely corrosive TREATMENT: None
	7647-14-5	Sodium Chloride	30	Not Listed	
	N/A	Water	70	N/A	

A-6

WHC-SD-WM-TP-336, Rev. 0

**Westinghouse
Hanford Company**

From: G. C. Triner
Phone: 372-0734 T3-04
Date: April 4, 1995
Subject: INSTRUCTIONS FOR T PLANT PERTAINING TO LBL DRUM RFC0000194(REV.0)

Project: LBL CONTAINER STABILIZATION AND SEGREGATION PROJECT

To: P. J. Crane T3-28

cc: C.K. Girres	T3-05	R.D. Pierce	T3-04
M.D. Aichele	T4-04	N.P. Emerson	T4-03
R.J. Giroir	T4-05	M.S. Wright	T3-28

This document provides general information and instructions concerning the work required of T Plant in support of the Lawrence Berkeley Laboratory (LBL) drum stabilization and segregation project.

Lawrence Berkeley Laboratory (LBL) drum RFC0000194 contains twenty-two glass and polyethylene jars ranging in size from 500 ml to 1 liter of organic and acid mixtures. The following four containers will be tested for peroxides and treated in accordance with the stabilization scheme denoted for the other eighteen containers if there are any indications of peroxide formation:

- R010877, R010879, R010902, & R010908.

The remaining eighteen containers require stabilization consisting of phase separation, peroxide scrubbing, organic removal, and neutralization of the aqueous phase. The table which is attached to the end of these instructions denotes the materials and quantities of each container.

NOTE: Currently DOE-RL has determined to treat this container at Hanford. However, the last section of these instructions is provided should that decision be reversed at some point and T Plant is asked to package the containers for shipment to LBL prior to stabilization.

The internal containers identified as requiring stabilization have a remote possibility of containing peroxides and are extremely flammable, due to the fact they contain a tetrahydrofuran and/or diethyl ether. All information obtained from the generator as well as other experts suggest that peroxides will not be present. However Solid Waste Disposal has chosen to conservatively manage these containers. Therefore, extreme caution should be taken when managing these containers. T Plant should prevent bumping, dropping, or shaking the containers and movement of the containers should be held to a minimum.

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Upon stabilization, T Plant will receive a minimum of two containers for each container shipped. These will consist of 1) those organics not requiring destruction containing and 2) the neutralized aqueous phase. T Plant may also receive debris generated during the stabilization activity. However, T Plant must assure that each container received is accompanied by a completed summary identifying the radioactive and hazardous constituents including any analysis, new PIN, and PIN(s) of original containers which contributed to the container (if debris).

NOTE: IF THIS INFORMATION IS NOT SUPPLIED, CONTACT GENERATOR AND WASTE ACCEPTANCE SERVICES (GWAS) IMMEDIATELY. SINCE GWAS CANNOT FORESEE THE EXACT TYPE OF CONSTITUENTS WHICH WILL BE RETURNED, THE ACTUAL SEGREGATION OF CONTAINERS INTO DRUMS WILL BE PERFORMED UPON RECEIPT OF THE TREATED CONTAINERS.

These containers were packaged in 1993 and received at the Central Waste Complex (CWC) in early 1994. At the time of packaging, no peroxides or other problems were evident.

The following sections contain the general instructions for performing the activities required of T Plant in support of this program:

INSTRUCTIONS FOR OPENING THE INNER CONTAINERS:

- 1) Upon receipt of the container, T Plant shall input the new drum location in SWITS.
- 2) Container opening will be performed in accordance with an approved work plan, and all other applicable requirements. The activity will be conducted in the following general manner:

WARNING: IF AT ANYTIME CRYSTALS ARE IDENTIFIED, WORK IS TO STOP, FACILITY MANAGEMENT, GWAS, AND THE HANFORD FIRE DEPARTMENT (HFD) NOTIFIED. WORK WILL NOT BE RE-STARTED WITHOUT AUTHORIZATION OF THE FACILITY MANAGER.

- A) RFC0000194 will be opened and the internal containers will be removed and vented by HFD.
- B) The organic upper phase of the internal container will then be tested for peroxides by SWAT.

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- C) If the test is POSITIVE for peroxides in the upper organic phase, and
 - a) The container is denoted as requiring stabilization, no further testing is required, GO TO STEP I).
 - b) Container is denoted as requiring testing to determine stabilization, no further testing is required, GO TO STEP K).
- D) If the test is NEGATIVE for peroxides in the upper organic phase, HFD or T Plant operations support will obtain a sample of the aqueous phase under the supervision of SWAT.
- E) SWAT will test the aqueous phase for peroxides.
- F) If the test is NEGATIVE for peroxides in the aqueous phase, and
 - a) Container denoted as requiring stabilization, GO TO STEP H).
 - b) Container is denoted as requiring testing to determine stabilization, GO TO STEP J).
- G) If the test is POSITIVE for peroxides in the aqueous phase, and
 - a) The container is denoted as requiring stabilization, GO TO STEP I).
 - b) Container is denoted as requiring testing to determine stabilization, GO TO STEP K).

NOTE: AT NO TIME ARE CONTAINERS WITH NITRIC ACID TO BE STORED IN THE SAME SECONDARY CONTAINMENT BASIN AS CONTAINERS WITH ALCOHOL. IF THE INSTRUCTIONS PROVIDED ARE UNCLEAR OR QUESTIONABLE, PLEASE CONTACT MR. G.C. TRINER.

- H) T Plant operations support will re-seal the inner container, wrap the container in a conwed pad, package the container in a plastic bag, label the bag with the internal container number, and place the container in the secondary containment basin marked "CG 1, Stabilization - No peroxides - No Alcohols", GO TO STEP 3).

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- I) T Plant operations support will re-seal the inner container, wrap the container in a conwed pad, package the container in a plastic bag, label the bag with the internal container number, and place the container in the secondary containment basin marked "CG 2, Stabilization - Peroxides - No Alcohols", GO TO STEP 3).
 - J) T Plant operations support will re-seal the inner container, wrap the container in a conwed pad, package the container in a plastic bag, label the bag with the internal container number, and place the container in the secondary containment basin marked "CG 3, No Stabilization - Peroxides - Alcohols", GO TO STEP 7).
 - K) T Plant operations support will re-seal the inner container, wrap the container in a conwed pad, package the container in a plastic bag, label the bag with the internal container number, and place the container in the secondary containment basin marked "CG 4, Stabilization - Peroxides - Alcohols", GO TO STEP 3).
- 3) Containers will then be stored in a suitable location to await shipment of the containers to the stabilization facility by GWAS.

**INSTRUCTIONS FOR THE SHIPMENT OF INNER
CONTAINERS:**

- 4) T Plant will assist GWAS in further segregation and possibly packaging of the containers for shipment, releasing containers for shipment, and completing the Chain-of-Custody and Uniform Hazardous Waste Manifest (as required).
- 5) Upon shipment of the containers to the stabilization facility, T Plant will enter the new container location in SWITS.

**INSTRUCTIONS FOR RECEIPT, RE-PACKAGING,
AND SHIPMENT OF CONTAINERS:**

- 6) Upon receipt of the treated containers from the stabilization facility, T Plant will assure all documentation is in order and enter the new container location in SWITS.
- 7) T Plant will package the containers in accordance with the an approved SDAR supplied by GWAS. However, containers GWAS will assist T Plant in determining the correct segregation of containers for shipment to the CWC.

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- 8) Generate new burial records, Uniform Hazardous Waste Manifest, RSR, and container summary.
- 9) Return the containers to the CWC.

**INSTRUCTIONS FOR RE-PACKAGING, AND
SHIPMENT OF CONTAINERS TO LBL (if
applicable):**

- 1) Remove the containers from the applicable secondary containment basins and place them in the following drums:

NOTE: The internal containers from RFC0294 and RFC0000194 will be intermingled to minimize the number of drums. Therefore, the generic identifiers for these containers are the same for the segregation instructions which accompany those containers.

- Drum - 1 (NAT): R008747 & R008746.
- Drum - 2 (NATD): R009304, R008741, & R007264.
- Drum - 3 (HFAL): R010877, R010879, R010882, R010902 & R010908.
- Drum - 4 (HFCY): R010880.
- Drum - 5 (NATCY): R010876, R010881, R010883, R010886, R010889, R010890, & R010905.
- Drum - 6 (HFTCY): R010903.
- Drum - 7 (NACY): R010906 & R010907.
- Drum - 8 (HFNACY): R010904.

Should T Plant have any questions concerning these instructions, please contact Mr. G. C. Triner at 372-0734 or pager 85-9488. Should the above instructions or associated summary sheet require revision the revision number will be changed, Mr. P.J. Crane will be notified by phone, and the material will be transmitted to Mr. P.J. Crane in hardcopy signed and dated accordingly.

G.C. Triner
Segregation and Stabilization Team Leader

Attachment 1

ATTACHMENT 1
SUMMARY TABLE FOR DRUM #RFC0000194 (Rev. 4/5/95)

CONTAINER # & ISOTOPES	CONSTITUENT CAS #	CONSTITUENT NAME	WEIGHT %	RGN	GENERAL INFORMATION
R010877 ISOTOPES: H-3 = 900 pCi/ml	67-64-1	Acetone	.25	19	TOTAL MATERIAL WEIGHT: 1.05 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter polyethylene container. POSS. HAZARDS: Flammable and extremely corrosive. STABILIZATION: Stabilization required if indications of peroxide formation.
	7664-39-3	Hydrofluoric Acid	24.5	1	
	67-63-0	Isopropanol	44.5	13	
	108-88-3	Toluene	0.4	16	
	78-93-3	Methyl Ethyl Ketone	10.2	19	
		Phosphine residue	0.37	?	
	N/A	Water	20	N/A	
R010879 ISOTOPES: H-3 = 700 pCi/ml	75-06-2	Methylene Chloride	1.4	17	TOTAL MATERIAL WEIGHT: 1.05 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter polyethylene container. POSS. HAZARDS: Flammable and extremely corrosive. Stabilization: Stabilization required if indications of peroxide formation.
	7664-39-3	Hydrofluoric Acid	30	1	
	67-63-0	Isopropanol	30	13	
	108-88-3	Toluene	0.61	16	
	78-93-3	Methyl Ethyl Ketone	6.3	19	
	N/A	Water	31.7	N/A	

¹ The following trace quantities of phosphines are contained in this container:
 1,2-Bis(dimethoxyphosphoryl)benzene, cas 15104-46-8;
 1,2-Bis(dimethoxyphosphoryl)benzene, No Cas;
 1,2-Bis(dimethylphosphoryl)ethane, cas 18724-97-5;
 2-Chloro(dimethoxyphosphoryl)benzene, 15104-43-5.

ATTACHMENT 1
SUMMARY TABLE FOR DRUM #RFC0000194 (Rev. 4/5/95)

CONTAINER # & ISOTOPES	CONSTITUENT CAS #	CONSTITUENT NAME	WEIGHT %	RGN	GENERAL INFORMATION
R010881 ISOTOPES: Th-232 = 200 pCi/ml	67-64-1	Acetone	0.14	19	TOTAL MATERIAL WEIGHT: 1.05 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter glass container. POSS. HAZARDS: Explosive peroxides and polyperoxides, explosion potential among 3 or more components, and flammable mixture. STABILIZATION: Phase separation - peroxide scrub - organic removal - neutralization
	7697-37-2	Nitric Acid	12.6	2	
	108-88-3	Toluene	0.19	16	
	110-54-3	Hexane	5	29	
	109-99-9	Tetrahydrofuran	10	14	
	78-93-3	Methyl Ethyl Ketone	52	19	
	26472-00-4	methylcyclopentadiene	0.5	Not Listed	
	3559-74-8	Trimethylsilylcyclopentadiene	2	14	
	7447-41-8	Lithium Chloride	0.5	Not Listed	
	7647-14-5	Sodium Chloride	2	Not Listed	
	N/A	Water	15	106	
R010882 ISOTOPES: H-3 = 600 pCi/ml	67-64-1	Acetone	0.89	19	TOTAL MATERIAL WEIGHT: 1.05 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter polyethylene container. POSS. HAZARDS: Extremely flammable, and flammable mixture. STABILIZATION: Phase separation - peroxide scrub - organic removal - neutralization
	7664-39-3	Hydrofluoric Acid	20	1	
	67-63-0	Isopropanol	40	13	
	108-88-3	Toluene	1.4	16	
	78-93-3	Methyl Ethyl Ketone	4.7	19	
	75-09-2	Methylene Chloride	3.7	17	
	N/A	Water	29.3	106	

ATTACHMENT 1
SUMMARY TABLE FOR DRUM #RFC0000194 (Rev. 4/5/95)

CONTAINER # & ISOTOPES	CONSTITUENT CAS #	CONSTITUENT NAME	WEIGHT %	RGN	GENERAL INFORMATION
R010883 ISOTOPES: U-238 = 200 pCi/ml	67-64-1	Acetone	0.13	19	TOTAL MATERIAL WEIGHT: 1.05 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter glass container. POSS. HAZARDS: Explosive peroxides and polyperoxides, explosion potential among 3 or more components, and flammable mixture. STABILIZATION: Phase separation - peroxide scrub - organic removal - neutralization
	7697-37-2	Nitric Acid	12.6	2	
	108-88-3	Toluene	0.11	16	
	109-99-9	Tetrahydrofuran	5	14	
	75-09-2	Methylene Chloride	0.07	17	
	78-93-3	Methyl Ethyl Ketone	64	19	
	26472-00-4	methylcyclopentadiene	2.5	Not Listed	
	3559-74-8	Trimethylsilylcyclopentadiene	1	14	
	7447-41-8	Lithium Chloride	1	Not Listed	
	7647-14-5	Sodium Chloride	0.5	Not Listed	
	7439-97-6	Mercury	0.002	24	
	7440-66-6	Zinc	0.0007	24	
	N/A	Water	13.2	106	

ATTACHMENT 1
SUMMARY TABLE FOR DRUM #RFC0000194 (Rev. 4/5/95)

CONTAINER # & ISOTOPES	CONSTITUENT CAS #	CONSTITUENT NAME	WEIGHT %	RGN	GENERAL INFORMATION
R010886 ISOTOPES: Th-232 = 40 pCi/ml	67-64-1	Acetone	0.16	19	TOTAL MATERIAL WEIGHT: 1.05 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter glass container. POSS. HAZARDS: Explosive peroxides and polyperoxides, explosion potential among 3 or more components, and flammable mixture. STABILIZATION: Phase separation - peroxide scrub - organic removal - neutralization
	7697-37-2	Nitric Acid	10	2	
	108-88-3	Toluene	0.36	16	
	109-99-9	Tetrahydrofuran	10	14	
	75-09-2	Methylene Chloride	0.07	17	
	78-93-3	Methyl Ethyl Ketone	40	19	
	110-54-3	Hexane	0.5	29	
	26472-00-4	methylcyclopentadiene	1	Not Listed	
	3559-74-8	Trimethylsilylcyclopentadiene	1.5	14	
	7447-41-8	Lithium Chloride	1	Not Listed	
	7647-14-5	Sodium Chloride	1.5	Not Listed	
	7430-97-6	Mercury	0.0002	24	
	7440-66-6	Zinc	0.0009	24	
	N/A	Water	34	106	
R010889 ISOTOPES: U-238 = 200 pCi/ml	67-64-1	Acetone	0.41	19	TOTAL MATERIAL WEIGHT: 1.05 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter glass container. POSS. HAZARDS: Explosive peroxides and polyperoxides, explosion potential among 3 or more components, and flammable mixture. STABILIZATION: Phase separation - peroxide scrub - organic removal - neutralization
	7697-37-2	Nitric Acid	10	2	
	109-99-9	Tetrahydrofuran	10	14	
	75-09-2	Methylene Chloride	0.09	17	
	78-93-3	Methyl Ethyl Ketone	5.6	19	
	110-54-3	Hexane	5	29	
	77-73-6	Dimethylcyclopentadiene	1	28	
	26472-00-4	Methylcyclopentadiene	1	Not Listed	
	7447-41-8	Lithium Chloride	0.5	Not Listed	
	7647-14-5	Sodium Chloride	1	Not Listed	
	7430-97-6	Mercury	0.00003	24	
	N/A	Water	65.5	106	

ATTACHMENT 1
SUMMARY TABLE FOR DRUM #RFC0000194 (Rev. 4/5/95)

CONTAINER # & ISOTOPES	CONSTITUENT CAS #	CONSTITUENT NAME	WEIGHT %	RGN	GENERAL INFORMATION
R010890 ISOTOPES: Th-232 = 90 pCi/ml	67-64-1	Acetone	0.18	19	TOTAL MATERIAL WEIGHT: 1.05 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter glass container. POSS. HAZARDS: Explosive polyperoxides, explosion potential among 3 or more components, and flammable mixture. STABILIZATION: Phase separation - peroxide scrub - organic removal - neutralization
	7697-37-2	Nitric Acid	10	2	
	75-09-2	Methylene Chloride	0.068	17	
	78-93-3	Methyl Ethyl Ketone	39	19	
	110-54-3	Hexane	10	29	
	108-88-3	Toluene	0.18	16	
	542-92-7	1,3-Cyclopentadiene	0.5	Not Listed	
	3559-74-8	Trimethylsilylcyclopentadiene	1	14	
	7647-14-5	Sodium Chloride	0.35	Not Listed	
	7430-97-6	Mercury	0.00009	24	
	N/A	Water	38.79	106	
R010902 ISOTOPES: H-3 = 30 pCi/ml	7664-39-3	Hydrofluoric Acid	10	1	TOTAL MATERIAL WEIGHT: 1.05 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter polyethylene container. POSS. HAZARDS: Extremely corrosive, and flammable mixture. STABILIZATION: Stabilization required if indications of peroxide formation.
	67-63-0	Isopropanol	40	13	
	108-88-3	Toluene	0.42	16	
	78-93-3	Methyl Ethyl Ketone	11	19	
	75-09-2	Methylene Chloride	12	17	
	7430-97-6	Mercury	0.00002	24	
	N/A	Water	26.6	N/A	

ATTACHMENT 1
SUMMARY TABLE FOR DRUM #RFC0000194 (Rev. 4/5/95)

CONTAINER # & ISOTOPES	CONSTITUENT CAS #	CONSTITUENT NAME	WEIGHT %	RGN	GENERAL INFORMATION
R010903 ISOTOPES: H-3 = 20 pCi/ml	7664-39-3	Hydrofluoric Acid	10	1	TOTAL MATERIAL WEIGHT: 1.05 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter polyethylene container. POSS. HAZARDS: Explosive peroxides and polyperoxides, extremely corrosive, and flammable mixture. STABILIZATION: Phase separation - peroxide scrub - organic removal - neutralization
	110-86-1	Pyridine	0.2	31	
	109-99-9	Tetrahydrofuran	1.5	14	
	108-88-3	Toluene	1.1	16	
	78-93-3	Methyl Ethyl Ketone	60	19	
	75-09-2	Methylene Chloride	0.00002	17	
	38927-85-4	Bis(trimethylsilyl)cyclopentadiene	0.5	Not Listed	
	4045-44-7	Pentamethylcyclopentadiene	0.5	Not Listed	
	7681-11-0	Potassium Iodide	0.5	Not Listed	
	7430-97-6	Mercury	0.00003	24	
	N/A	Water	25.5	106	

ATTACHMENT 1
SUMMARY TABLE FOR DRUM #RFC0000194 (Rev. 4/5/95)

CONTAINER # & ISOTOPES	CONSTITUENT CAS #	CONSTITUENT NAME	WEIGHT %	RGN	GENERAL INFORMATION
R010904 ISOTOPES: U-238 = 3500 pCi/ml	7664-39-3	Hydrofluoric Acid	10	1	TOTAL MATERIAL WEIGHT: 0.58 kg TOTAL MATERIAL VOLUME: 580 ml CONTAINER: This waste is packaged in a 1 liter polyethylene container. POSS. HAZARDS: Explosive polyperoxides, explosion potential among 3 or more components, and flammable mixture. STABILIZATION: Phase separation - peroxide scrub - organic removal - neutralization
	7697-37-2	Nitric Acid	10	2	
	78-93-3	Methyl Ethyl Ketone	2.9	19	
	77-73-6	Dicyclopentadiene	2	287	
	7647-14-5	Sodium Chloride	5	Not Listed	
	7447-41-8	Lithium Chloride	5	Not Listed	
	67-64-1	Acetone	0.18	19	
	7440-30-3	Barium	0.0007	24	
	7440-41-7	Beryllium	0.0002	24	
	7440-47-3	Chromium	0.0086	24	
	7440-48-4	Cobalt	0.0006	24	
	7440-50-8	Copper	0.002	24	
	7430-97-6	Mercury	0.00422	24	
	7439-96-7	Molybdenum	0.001	24	
	7440-02-0	Nickel	0.0027	24	
	7440-62-2	Vanadium	0.0016	24	
	7440-66-6	Zinc	0.0622	24	
	N/A	Water	65	106	

ATTACHMENT 1
SUMMARY TABLE FOR DRUM #RFC0000194 (Rev. 4/5/95)

CONTAINER # & ISOTOPES	CONSTITUENT CAS #	CONSTITUENT NAME	WEIGHT %	RGN	GENERAL INFORMATION
R010905 ISOTOPES: U-238 = 1400 pCi/ml	7697-37-2	Nitric Acid	10	2	TOTAL MATERIAL WEIGHT: 0.8 kg TOTAL MATERIAL VOLUME: 800 ml CONTAINER: This waste is packaged in a 1 liter glass container. POSS. HAZARDS: Explosive polyperoxides, explosion potential among 3 or more components, and flammable mixture. STABILIZATION: Phase separation - peroxide scrub - organic removal - neutralization
	78-93-3	Methyl Ethyl Ketone	18	19	
	109-99-9	Tetrahydrofuran	5	14	
	7447-40-7	Potassium Chloride	0.5	Not Listed	
	7447-41-8	Lithium Chloride	0.5	Not Listed	
	73046-16-9	Bis(t-butyl)cyclopentadiene	1	Not Listed	
	38927-85-4	Bis(trimethylsilyl)cyclopentadiene	1	Not Listed	
	7440-41-7	Beryllium	0.0034	24	
	7440-47-3	Chromium	0.0003	24	
	7440-50-8	Copper	0.018	24	
	7439-92-1	Lead	0.0015	24	
	7430-97-6	Mercury	0.00005	24	
	7440-66-6	Zinc	0.001	24	
R010906 ISOTOPES: U-238 = 200 pCi/ml	N/A	Water	64	106	
	7697-37-2	Nitric Acid	10	2	TOTAL MATERIAL WEIGHT: 0.8 kg TOTAL MATERIAL VOLUME: 800 ml CONTAINER: This waste is packaged in a 1 liter glass container. POSS. HAZARDS: Explosive polyperoxides, explosion potential among 3 or more components, and flammable mixture. STABILIZATION: Phase separation - peroxide scrub - organic removal - neutralization
	78-93-3	Methyl Ethyl Ketone	30	19	
	110-54-3	Hexane	10	29	
	542-92-7	1,3-Cyclopentadiene	1	Not Listed	
	3559-74-8	Trimethylsilylcyclopentadiene	1	14	
	111-46-6	Diethylene Glycol	5	14	
	7440-38-2	Arsenic	0.0133	24	
	7439-97-6	Mercury	0.00032	24	
	N/A	Water	43	106	

ATTACHMENT 1
SUMMARY TABLE FOR DRUM #RFC0000194 (Rev. 4/5/95)

CONTAINER # & ISOTOPES	CONSTITUENT CAS #	CONSTITUENT NAME	WEIGHT %	RGN	GENERAL INFORMATION
R010907 ISOTOPES: U-238 = 400 pCi/ml	7697-37-2	Nitric Acid	10	2	TOTAL MATERIAL WEIGHT: 1.05 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter glass container. POSS. HAZARDS: Explosive polyperoxides, explosion potential among 3 or more components, and flammable mixture. STABILIZATION: Phase separation - peroxide scrub - organic removal - neutralization
	78-93-3	Methyl Ethyl Ketone	15	19	
	110-54-3	Hexane	5	29	
	67-64-1	Acetone	0.049	19	
	75-09-2	Methylene Chloride	0.035	17	
	108-88-3	Toluene	0.093	16	
	1330-20-7	Xylene	0.011	16	
	7647-14-5	Sodium Chloride	5	Not Listed	
	7447-41-8	Lithium Chloride	1	Not Listed	
	542-92-7	1,3-Cyclopentadiene	1	Not Listed	
	3559-74-8	Trimethylsilylcyclopentadiene	1	14	
	26472-00-4	Methylcyclopentadiene	2.5	Not Listed	
	7439-97-2	Mercury	0.00037	24	
	N/A	Water	59.4	106	
R010908 ISOTOPES: U-238 = 20 pCi/ml	7664-39-3	Hydrofluoric Acid	30	1	TOTAL MATERIAL WEIGHT: 1.05 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter polyethylene container. POSS. HAZARDS: Extremely corrosive, and flammable mixture. STABILIZATION: Stabilization required if indications of peroxide formation.
	67-63-0	Isopropanol	30	13	
	75-09-2	Methylene Chloride	0.29	17	
	108-88-3	Toluene	0.12	16	
	78-93-3	Methyl Ethyl Ketone	15	19	
	7439-97-2	Mercury	0.000013	24	
	N/A	Water	24.6	106	

ATTACHMENT 1
SUMMARY TABLE FOR DRUM #RFC0000194 (Rev. 4/5/95)

CONTAINER # & ISOTOPES	CONSTITUENT CAS #	CONSTITUENT NAME	WEIGHT %	RGN	GENERAL INFORMATION
R010876 ISOTOPES: U-238 = 150 pCi/ml	7697-37-2	Nitric Acid	1	2	TOTAL MATERIAL WEIGHT: 1.05 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter glass container. POSS. HAZARDS: Explosive peroxides and polyperoxides, explosion potential among 3 or more components, and flammable mixture. STABILIZATION: Phase separation - peroxide scrub - organic removal - neutralization
	109-99-9	Tetrahydrofuran	5	14	
	71-55-6	1,1,1-Trichloroethane	1.2	17	
	108-88-3	Toluene	0.21	16	
	67-64-1	Acetone	0.29	19	
	78-93-3	Methyl Ethyl Ketone	68	19	
	38927-85-4	Bis(trimethylsilyl)cyclopentadiene	1	Not Listed	
	N/A	Water	23.3	106	
R010880 ISOTOPES: H-3 = 900 pCi/ml	7664-39-3	Hydrofluoric Acid	5	1	TOTAL MATERIAL WEIGHT: 1.05 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter glass container. POSS. HAZARDS: Explosive polyperoxides, extremely corrosive, and flammable mixture. STABILIZATION: Phase separation - peroxide scrub - organic removal - neutralization
	78-93-3	Methyl ethyl ketone	83	19	
	110-86-1	Pyridine	0.1	31	
	108-88-3	Toluene	0.69	16	
	67-64-1	Acetone	0.18	19	
	4045-44-7	Pentamethylcyclopentadiene	0.2	Not Listed	
	542-92-7	1,3-Cyclopentadiene	0.2	Not Listed	
	75-09-2	Methylene Chloride	0.12	17	
	7681-11-0	Potassium Iodide	0.1	Not Listed	
	N/A	Water	10.4	106	
R009304 ISOTOPES: U-238 = 1.66 uCi	7697-37-2	Nitric Acid	1.6	2	TOTAL MATERIAL WEIGHT: 0.95 kg TOTAL MATERIAL VOLUME: 950 ml CONTAINER: This waste is packaged in a 1 liter glass container. POSS. HAZARDS: Explosive peroxides, explosion potential among 3 or more components, and flammable mixture. CONTAINS DIETHYL ETHER MAY IGNITE FROM STATIC ELECTRICITY, ASSURE GROUNDING. STABILIZATION: Phase separation - peroxide scrub - organic removal - neutralization
	60-29-7	Diethyl ether	21	14	
	67-64-1	Acetone	22	19	
	109-99-9	Tetrahydrofuran	11	14	
	108-88-3	Toluene	11	16	
	110-54-3	Hexane	21	29	
	N/A	Water	18.4	N/A	

ATTACHMENT 1
SUMMARY TABLE FOR DRUM #RFC0000194 (Rev. 4/5/95)

CONTAINER # & ISOTOPES	CONSTITUENT CAS #	CONSTITUENT NAME	WEIGHT %	RGN	GENERAL INFORMATION
R008741 ISOTOPES: U-238 = 1.66 uCi	7697-37-2	Nitric Acid	1	2	TOTAL MATERIAL WEIGHT: 0.95 kg TOTAL MATERIAL VOLUME: 950 ml CONTAINER: This waste is packaged in a 1 liter glass container. POSS. HAZARDS: Explosive peroxides, explosion potential among 3 or more components, and flammable mixture. CONTAINS DIETHYL ETHER MAY IGNITE FROM STATIC ELECTRICITY, ASSURE GROUNDING. STABILIZATION: Phase separation - peroxide scrub - organic removal - neutralization
	60-29-7	Diethyl ether	11	14	
	67-64-1	Acetone	20	19	
	109-99-9	Tetrahydrofuran	21	14	
	108-88-3	Toluene	16	16	
	110-54-3	Hexane	21	29	
	N/A	Water	9	106	
R007264 ISOTOPES: U-238 = 1.66 uCi	7697-37-2	Nitric Acid	1	2	TOTAL MATERIAL WEIGHT: 0.95 kg TOTAL MATERIAL VOLUME: 950 ml CONTAINER: This waste is packaged in a 1 liter glass container. POSS. HAZARDS: Explosive peroxides, explosion potential among 3 or more components, and flammable mixture. CONTAINS DIETHYL ETHER MAY IGNITE FROM STATIC ELECTRICITY, ASSURE GROUNDING. STABILIZATION: Phase separation - peroxide scrub - organic removal - neutralization
	60-29-7	Diethyl ether	16	14	
	67-64-1	Acetone	63	19	
	109-99-9	Tetrahydrofuran	5	14	
	110-54-3	Hexane	5	29	
	N/A	Water	10	106	
R008747 ISOTOPES: U-238 = 0.99 uCi	7697-37-2	Nitric Acid	3	2	TOTAL MATERIAL WEIGHT: 0.95 kg TOTAL MATERIAL VOLUME: 950 ml CONTAINER: This waste is packaged in a 1 liter glass container. POSS. HAZARDS: Explosive peroxides and flammable mixture. STABILIZATION: Phase separation - peroxide scrub - organic removal - neutralization
	67-64-1	Acetone	21	19	
	109-99-9	Tetrahydrofuran	32	14	
	108-88-3	Toluene	5	16	
	110-54-3	Hexane	10	29	
	N/A	Water	29	106	
R008746 ISOTOPES: U-238 = 1.66 uCi	7697-37-2	Nitric Acid	0.5	2	TOTAL MATERIAL WEIGHT: 0.95 kg TOTAL MATERIAL VOLUME: 950 ml CONTAINER: This waste is packaged in a 1 liter glass container. POSS. HAZARDS: Explosive peroxides and flammable mixture. STABILIZATION: Phase separation - peroxide scrub - organic removal - neutralization
	67-64-1	Acetone	22	19	
	109-99-9	Tetrahydrofuran	53	14	
	108-88-3	Toluene	11	16	
	110-54-3	Hexane	11	29	
	N/A	Water	4.5	106	

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From: G. C. Triner
Phone: 372-0734 T3-04
Date: April 4, 1995
Subject: INSTRUCTIONS FOR T PLANT PERTAINING TO LBL DRUM RFC0294 (REV. 0)

Project: LBL CONTAINER STABILIZATION AND SEGREGATION PROJECT

To: P. J. Crane T3-28

cc: C.K. Girres T3-05 R.D. Pierce T3-04
M.D. Aichele T4-04 N.P. Emerson T4-03
R.J. Giroir T4-05 M.S. Wright T3-28

This document provides general information and instructions concerning the work required of T Plant in support of the Lawrence Berkeley Laboratory (LBL) drum stabilization and segregation project.

Lawrence Berkeley Laboratory (LBL) drum RFC0294 contains six glass jars ranging in size from 1 liter to 2 liters of organic and acid mixtures all of which require stabilization consisting of phase separation, peroxide scrubbing, organic removal, and neutralization of the aqueous phase. The table which is attached to the end of these instructions denotes the materials and quantities of each container.

NOTE: Currently DOE-RL has determined to treat this container at Hanford. However, the last section of these instructions is provided should that decision be reversed at some point and T Plant is asked to package the containers for shipment to LBL prior to stabilization.

The internal containers identified as requiring stabilization have a remote possibility of containing peroxides and are extremely flammable, due to the fact they contain a tetrahydrofuran and/or diethyl ether. All information obtained from the generator as well as other experts suggest that peroxides will not be present. However, Solid Waste Disposal has chosen to conservatively manage these containers. Therefore, extreme caution should be taken when managing these containers. T Plant should prevent bumping, dropping, or shaking the containers and movement of the containers should be held to a minimum.

Upon stabilization, T Plant will receive a minimum of two containers for each container shipped. These will consist of 1) those organics not requiring destruction and 2) the neutralized aqueous phase. T Plant may also receive debris generated during the stabilization activity. However, T Plant must assure that each container received is accompanied by a completed summary identifying the radioactive and hazardous constituents including any analysis, new PIN, and PIN(s) of original containers which contributed to the container (if debris).

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NOTE: IF THIS INFORMATION IS NOT SUPPLIED, CONTACT GENERATOR AND WASTE ACCEPTANCE SERVICES (GWAS) IMMEDIATELY. SINCE GWAS CANNOT FORESEE THE EXACT TYPE OF CONSTITUENTS WHICH WILL BE RETURNED, THE ACTUAL SEGREGATION OF CONTAINERS INTO DRUMS WILL BE PERFORMED UPON RECEIPT OF THE TREATED CONTAINERS.

These containers were packaged in 1993 and received at the Central Waste Complex (CWC) in early 1994. At the time of packaging, no peroxides or other problems were evident.

The following sections contain the general instructions for performing the activities required of T Plant in support of this program:

INSTRUCTIONS FOR OPENING THE INNER CONTAINERS:

- 1) Upon receipt of the container, T Plant shall input the new drum location in SWITS.
- 2) Container opening will be performed in accordance with an approved work plan, and all other applicable requirements. The activity will be conducted in the following general manner:

WARNING: IF AT ANYTIME CRYSTALS ARE IDENTIFIED, WORK IS TO STOP, FACILITY MANAGEMENT, GWAS, AND THE HANFORD FIRE DEPARTMENT (HFD) NOTIFIED. WORK WILL NOT BE RE-STARTED WITHOUT AUTHORIZATION OF THE FACILITY MANAGER.

- A) RFC0294 will be opened and the internal containers will be removed and vented by HFD.
- B) The organic upper phase of the internal container will then be tested for peroxides by SWAT.
- C) If the test is POSITIVE for peroxides in the upper organic phase, no further testing is required, GO TO STEP I).
- D) If the test is NEGATIVE for peroxides in the upper organic phase, HFD or T Plant operations support will obtain a sample of the aqueous phase under the supervision of SWAT.
- E) SWAT will test the aqueous phase peroxides.
- F) If the test is NEGATIVE for peroxides in the aqueous phase, GO TO STEP H).
- G) If the test is POSITIVE for peroxides in the aqueous phase, GO TO STEP I).

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- H) T Plant operations support will re-seal the inner container, wrap the container in a conwed pad, package the container in a plastic bag, label the bag with the internal container number, and place the container in the secondary containment basin marked "CG 1, Stabilization - No peroxides - No Alcohols", GO TO STEP 3).
- I) T Plant operations support will re-seal the inner container, wrap the container in a conwed pad, package the container in a plastic bag, label the bag with the internal container number, and place the container in the secondary containment basin marked "CG 2, Stabilization - Peroxides - No Alcohols", GO TO STEP 3).
- 3) Containers will then be stored in a suitable location to await shipment of the containers to the stabilization facility by GWAS.

**INSTRUCTIONS FOR THE SHIPMENT OF INNER
CONTAINERS:**

- 4) T Plant will assist GWAS in further segregation and possibly packaging of the containers for shipment, releasing containers for shipment, and completing the Chain-of-Custody and Uniform Hazardous Waste Manifest (as required).
- 5) Upon shipment of the containers to the stabilization facility, T Plant will enter the new container location in SWITS.

**INSTRUCTIONS FOR RECEIPT, RE-PACKAGING,
AND SHIPMENT OF CONTAINERS:**

- 6) Upon receipt of the treated containers from the stabilization facility, T Plant will assure all documentation is in order and enter the new container location in SWITS.
- 7) T Plant will package the containers in accordance with the an approved SDAR supplied by GWAS. However, containers GWAS will assist T Plant in determining the correct segregation of containers for shipment to the CWC.
- 8) Generate new burial records, Uniform Hazardous Waste Manifest, RSR, and container summary.
- 9) Return the containers to the CWC.

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**INSTRUCTIONS FOR RE-PACKAGING, AND
SHIPMENT OF CONTAINERS TO LBL (if
applicable):**

- 1) Remove the containers from the applicable secondary containment basins and place them in the following drums:

NOTE: The internal containers from RFC0294 and RFC0000194 will be intermingled to minimize the number of drums. Therefore, the generic identifiers for these containers are the same for the segregation instructions which accompany those containers.

- Drum - 1 (NAT): R007287, R008749, R007267, & R011377.
- Drum - 2 (NATD): R008741, & R007268.

Should T Plant have any questions concerning these instructions, please contact Mr. G. C. Triner at 372-0734 or pager 85-9488. Should the above instructions or associated summary sheet require revision the revision number will be changed, Mr. P.J. Crane will be notified by phone, and the material will be transmitted to Mr. P.J. Crane in hardcopy signed and dated accordingly.

G.C. Triner
Segregation and Stabilization Team Leader

Attachment 1

ATTACHMENT 1
SUMMARY TABLE FOR DRUM #RFC0294 (Rev. 4/3/94)

CONTAINER # & ISOTOPES	CONSTITUENT CAS #	CONSTITUENT NAME	WEIGHT %	RGN	GENERAL INFORMATION
R011377 ISOTOPES: U-238 = 3.32 uCi	67-64-1	Acetone	15	19	TOTAL MATERIAL WIEGHT: 1.95 kg TOTAL MATERIAL VOLUME: 1950 ml GENERAL: Rad Tags R007263 and R007282 were combined into this container. CONTAINER: This waste is packaged in a 2 liter glass container. There appear to be no container compatibility problems. POSS. HAZARDS: Explosive peroxides and flammable mixture. STABILIZATION: Phase separation - peroxide scrub - organic removal - neutralization
	7697-37-2	Nitric Acid	1.3	2	
	110-54-3	Hexane	36	29	
	108-88-3	Toluene	15	16	
	109-99-9	Tetrahydrofuran	21	14	
	N/A	Water	11.7	N/A	
R008741 ISOTOPES: U-238 = 1.66 uCi	67-64-1	Acetone	21	19	TOTAL MATERIAL WIEGHT: 0.95 kg TOTAL MATERIAL VOLUME: 950 ml CONTAINER: This waste is packaged in a 1 liter glass container. There appear to be no container compatibility problems. POSS. HAZARDS: Explosive peroxides, explosion potential among 3 or more components, and flammable mixture. CONTAINS DIETHYL ETHER MAY IGNITE FROM STATIC ELECTRICITY, ASSURE GROUNDING. STABILIZATION: Phase separation - peroxide scrub - organic removal - neutralization
	7697-37-2	Nitric Acid	1	2	
	110-54-3	Hexane	21	29	
	108-88-3	Toluene	16	16	
	109-99-9	Tetrahydrofuran	21	14	
	60-29-7	Diethyl Ether	11	14	
R007267 ISOTOPES: U-238 = 0.66 uCi	67-64-1	Acetone	43	19	TOTAL MATERIAL WIEGHT: 0.93 kg TOTAL MATERIAL VOLUME: 925 ml CONTAINER: This waste is packaged in a 1 liter glass container. There appear to be no container compatibility problems. POSS. HAZARDS: Explosive peroxides and flammable mixture. STABILIZATION: Phase separation - peroxide scrub - organic removal - neutralization
	7697-37-2	Nitric Acid	1.1	2	
	110-54-3	Hexane	11	29	
	109-99-9	Tetrahydrofuran	32	14	
	7791-12-0	Thallium Chloride	2.7	Not Listed	
	N/A	Water	10.9	N/A	
R007287 ISOTOPES: U-238 = 0.99 uCi	67-64-1	Acetone	10	19	TOTAL MATERIAL WIEGHT: 1 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter glass container. There appear to be no container compatibility problems. POSS. HAZARDS: Explosive peroxides and flammable mixture. STABILIZATION: Phase separation - peroxide scrub - organic removal - neutralization
	7697-37-2	Nitric Acid	1	2	
	110-54-3	Hexane	50	29	
	109-99-9	Tetrahydrofuran	20	14	
	108-88-3	Toluene	10	16	
	7791-12-0	Thallium Chloride	0.5	Not Listed	
	N/A	Water	9	N/A	

ATTACHMENT 1
SUMMARY TABLE FOR DRUM #RFC0294 (Rev. 4/3/94)

CONTAINER # & ISOTOPES	CONSTITUENT CAS #	CONSTITUENT NAME	WEIGHT %	RGN	GENERAL INFORMATION
R007268 ISOTOPES: U-238 = 1.66 uCi	67-64-1	Acetone	39	19	TOTAL MATERIAL WIEGHT: 0.93 kg TOTAL MATERIAL VOLUME: 925 ml CONTAINER: This waste is packaged in a 1 liter glass container. There appear to be no container compatibility problems. POSS. HAZARDS: Explosive peroxides, explosion potential among 3 or more components, and flammable mixture. CONTAINS DIETHYL ETHER MAY IGNITE FROM STATIC ELECTIRICITY, ASSURE GROUNDING. STABILIZATION: Phase separation - peroxide scrub - organic removal - neutralization
	7697-37-2	Nitric Acid	1	2	
	110-54-3	Hexane	19	29	
	109-99-9	Tetrahydrofuran	19	14	
	60-29-7	Diethyl Ether	10.7	14	
	7791-12-0	Thallium Chloride	2.3	Not Listed	
	N/A	Water	9	N/A	
R008749 ISOTOPES: U-238 = 1.66 uCi	67-64-1	Acetone	5	19	TOTAL MATERIAL WIEGHT: 0.96 kg TOTAL MATERIAL VOLUME: 950 ml CONTAINER: This waste is packaged in a 1 liter glass container. There appear to be no container compatibility problems. POSS. HAZARDS: Explosive peroxides and flammable mixture. STABILIZATION: Phase separation - peroxide scrub - organic removal - neutralization
	7697-37-2	Nitric Acid	3.15	2	
	110-54-3	Hexane	31.5	29	
	109-99-9	Tetrahydrofuran	31.5	14	
	7791-12-0	Thallium Chloride	.5	Not Listed	
	N/A	Water	28.35	N/A	

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From: G. C. Triner
Phone: 372-0734 T3-04
Date: April 4, 1995
Subject: INSTRUCTIONS FOR T PLANT PERTAINING TO LBL DRUM RFL0794 (REV. 0)

Project: LBL CONTAINER STABILIZATION AND SEGREGATION PROJECT

To: P. J. Crane T3-28

cc: C.K. Girres	T3-05	R.D. Pierce	T3-04
M.D. Aichele	T4-04	N.P. Emerson	T4-03
R.J. Giroir	T4-05	M.S. Wright	T3-28

This document provides general information and instructions concerning the work required of T Plant in support of the Lawrence Berkeley Laboratory (LBL) drum stabilization and segregation project.

Lawrence Berkeley Laboratory (LBL) drum RFL0794 contains twenty-one glass jars ranging in size from 500 ml to 20 liters of organic and acid mixtures. The following seven containers require no stabilization and may be segregated in to the 5 drums as instructed and return to the Central Waste Complex (CWC) in accordance with a valid SDAR:

- R010771, R001283, R012930, R012929, R008918, R008745, & R000347.

The following two containers will be tested for peroxides and treated in accordance with the stabilization scheme denoted for possible peroxide containers, if there are any indications of peroxide formation:

- R010382 & R000300.

The remaining twelve containers require stabilization consisting of possible phase separation, peroxide scrubbing, and organic removal. The table which is attached to the end of these instructions denotes the materials and quantities of each container.

NOTE: Currently DOE-RL has determined to treat this container at Hanford. However, the last section of these instructions is provided should that decision be reversed at some point and T Plant is asked to package the containers for shipment to LBL prior to stabilization.

The internal containers identified as requiring stabilization have a remote possibility of containing peroxides and are extremely flammable, due to the fact they contain a tetrahydrofuran and/or diethyl ether. All information obtained from the generator as well as other experts suggest that peroxides will not be present. However Solid Waste Disposal has chosen to conservatively manage these containers. Therefore, extreme caution should be taken when managing these containers. T Plant should prevent bumping, dropping, or shaking the containers and movement of the containers should be held to a minimum.

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Upon stabilization, T Plant may receive two containers for each container shipped. These will consist of 1) those organics not requiring destruction and 2) the aqueous phase (if applicable, see attached table). T Plant may also receive debris generated during the stabilization activity. However, T Plant must assure that each container received is accompanied by a completed summary identifying the radioactive and hazardous constituents including any analysis, new PIN, and PIN(s) of original containers which contributed to the container (if debris).

NOTE: IF THIS INFORMATION IS NOT SUPPLIED, CONTACT GENERATOR AND WASTE ACCEPTANCE SERVICES (GWAS) IMMEDIATELY. SINCE GWAS CANNOT FORESEE THE EXACT TYPE OF CONSTITUENTS WHICH WILL BE RETURNED, THE ACTUAL SEGREGATION OF CONTAINERS INTO DRUMS WILL BE PERFORMED UPON RECEIPT OF THE TREATED CONTAINERS.

These containers were package in 1993 and received at the CWC in early 1994. No peroxides or other problems were evident at the time they were packaged.

The following sections contain the general instructions for performing the activities required of T Plant in support of this program:

INSTRUCTIONS FOR OPENING THE INNER CONTAINERS:

- 1) Upon receipt of the container, T Plant shall input the new drum location in SWITS.
- 2) Container opening will be performed in accordance with an approved work plan, and all other applicable requirements. The activity will be conducted in the following general manner:

WARNING: IF AT ANYTIME CRYSTALS ARE IDENTIFIED, WORK IS TO STOP, FACILITY MANAGEMENT, GWAS, AND THE HANFORD FFIRE DEPARTMENT (HFD) NOTIFIED. WORK WILL NOT BE RE-STARTED WITHOUT AUTHORIZATION OF THE FACILITY MANAGER.

- A) RL0794 will be opened and the internal containers will be removed.
- B) Read the container label and,
 - a) If the container is listed as not requiring stabilization, GO TO STEP L).
 - b) Or the containers will be vented by HFD.

NOTE: IF THERE IS ONLY ONE PHASE IN THE CONTAINER SKIP TO STEP F).

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- C) The upper phase of the internal container will then be tested for peroxides by SWAT.
- D) If the test is POSITIVE for peroxides in the upper phase, no further testing is required, GO TO STEP J).
- E) If the test is NEGATIVE for peroxides in the upper organic phase, HFD or T Plant operations support will obtain a sample of the aqueous phase under the supervision of SWAT.
- F) SWAT will test the lower or single phase for peroxides.
- G) If the test is NEGATIVE for peroxides in the lower or single phase and
 - a) The container is denoted as requiring stabilization, GO TO STEP K).
 - b) The container is denoted as requiring testing to determine stabilization, GO TO STEP I).
- H) If the test is POSITIVE for peroxides in the aqueous phase, GO TO STEP J).

NOTE: AT NO TIME ARE CONTAINERS WITH NITRIC ACID TO BE STORED IN THE SAME SECONDARY CONTAINMENT BASIN AS CONTAINERS WITH ALCOHOL. IF THE INSTRUCTIONS PROVIDED ARE UNCLEAR OR QUESTIONABLE, PLEASE CONTACT MR. G.C. TRINER.

- I) T Plant operations support will re-seal the inner container, wrap the container in a conwed pad, package the container in a plastic bag, label the bag with the internal container number, and place the container in the secondary containment basin marked "CG 3, No Stabilization - No Peroxides - Alcohols", GO TO STEP 7).
- J) T Plant operations support will re-seal the inner container, wrap the container in a conwed pad, package the container in a plastic bag, label the bag with the internal container number, and place the container in the secondary containment basin marked "CG 4, Stabilization - Peroxides - Alcohols", GO TO STEP 3).
- K) T Plant operations support will re-seal the inner container, wrap the container in a conwed pad, package the container in a plastic bag, label the bag with the internal container number, and place the container in the secondary containment basin marked "CG 5, Stabilization - No Peroxides - Alcohols" GO TO STEP 3).

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- L) Package containers into the following generic drums in accordance with an applicable SDAR and then GO TO STEP 8):

- Drum - 9 (METAL): R010771.
- Drum - 10 (MTAA): R001283, R012930, & R012929.
- Drum - 11 (ETH): R008918.
- Drum - 12 (HEX): R008745.
- Drum - 13 (ISO): R000347.

- 3) Containers will then be stored in a suitable location to await shipment of the containers to the stabilization facility by GWAS.

**INSTRUCTIONS FOR THE SHIPMENT OF INNER
CONTAINERS:**

- 4) T Plant will assist GWAS in further segregation and possibly packaging of the containers for shipment, releasing containers for shipment, and completing the Chain-of-Custody and Uniform Hazardous Waste Manifest (as required).
- 5) Upon shipment of the containers to the stabilization facility, T Plant will enter the new container location in SWITS.

**INSTRUCTIONS FOR RECEIPT, RE-PACKAGING,
AND SHIPMENT OF CONTAINERS:**

- 6) Upon receipt of the containers from the stabilization facility, T Plant will assure all documentation is in order and enter the new container location in SWITS.
- 7) T Plant will package the containers in accordance with the an approved SDAR supplied by GWAS. However, GWAS will assist T Plant in determining the correct segregation of containers for shipment to the CWC.
- 8) Generate new burial records, Uniform Hazardous Waste Manifest, RSR, and container summary.
- 9) Return the containers to the CWC.

**INSTRUCTIONS FOR RE-PACKAGING, AND
SHIPMENT OF CONTAINERS TO LBL (if
applicable):**

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- 1) Remove the containers from the applicable secondary containment basins and place them in the following drums:

NOTE: The contents of the internal containers from RFL0794 will not be intermingled with RFC0294 and RFC0000194. This is due to the fact, that RFL contains very different constituents and we must comply with transportation requirements.

- Drum - 14 (TD): R011147.
- Drum - 15 (ISOAL): R010382 & R000300.
- Drum - 16 (DEALCY): R011150, R009349 & R009350.
- Drum - 17 (DEAL): R011148.
- Drum - 18 (DECY): R010373, R010366, & R010367.
- Drum - 19 (THCY): R010388 & R010389.
- Drum - 20 (TDCY): R010365.
- Drum - 21 (TDALCY): R010386.

Should T Plant have any questions concerning these instructions, please contact Mr. G. C. Triner at 372-0734 or pager 85-9488. Should the above instructions or associated summary sheet require revision the revision number will be changed, Mr. P.J. Crane will be notified by phone, and the material will be transmitted to Mr. P.J. Crane in hardcopy signed and dated accordingly.

G.C. Triner
Segregation and Stabilization Team Leader

Attachment 1

ATTACHMENT 1 SUMMARY TABLE FOR DRUM #RFL0794 (Rev. 4/5/95)					
CONTAINER # & ISOTOPES	CONSTITUENT CAS #	CONSTITUENT NAME	WEIGHT %	RGN	GENERAL INFORMATION
R010771 ISOTOPES: C-14 = 1.6 uCi	***	Methanol	45	**	TOTAL MATERIAL WEIGHT: 4 kg TOTAL MATERIAL VOLUME: 4000 ml CONTAINER: This waste is packaged in a 4 liter glass container. POSS. HAZARDS: Possible flammable mixture STABILIZATION: None Required
	***	Acetonitrile	4	**	
	***	Ethyl Acetate	1	**	
	N/A	Water	50	N/A	
R011147 ISOTOPES: U-238 = 2.66 uCi	67-64-1	Acetone	21	19	TOTAL MATERIAL WEIGHT: 0.95 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter glass container. POSS. HAZARDS: Explosive peroxides and extremely flammable. STABILIZATION: Phase Separation - peroxide scrub - organic removal
	110-54-3	Hexane	21	29	
	108-88-3	Toluene	16	16	
	109-99-9	Tetrahydrofuran	11	14	
	60-29-7	Diethyl Ether	11	14	
	N/A	Water	21	N/A	
R010382 ISOTOPES: U-238 = 1.32 uCi	67-64-1	Acetone	61	19	TOTAL MATERIAL WEIGHT: 0.95 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter glass container. POSS. HAZARDS: Flammable mixture STABILIZATION: Stabilization required if indications of peroxide formation.
	108-88-3	Toluene	6	16	
	110-54-3	Hexane	28	29	
	67-63-0	Isopropanol	5	13	
	N/A	Magnesium Salts	0.2	**	
R012930 ISOTOPES: P-32 = 50 uCi	***	Methanol	50	13	TOTAL MATERIAL WEIGHT: 0.50 kg TOTAL MATERIAL VOLUME: 500 ml CONTAINER: This waste is packaged in a 1 liter or 500 ml glass container. POSS. HAZARDS: Possible flammable mixture. STABILIZATION: None Required
	***	0.1N Acetic Acid Solution	50	**	
R008918 ISOTOPES: H-3 = 10 uCi	***	Ethanol	70	13	TOTAL MATERIAL WEIGHT: 0.50 kg TOTAL MATERIAL VOLUME: 500 ml CONTAINER: This waste is packaged in a 1 liter or 500 ml glass container. POSS. HAZARDS: Possible flammable mixture. STABILIZATION: None Required
	N/A	Water	30	106	

ATTACHMENT 1
SUMMARY TABLE FOR DRUM #RFL0794 (Rev. 4/5/95)

CONTAINER # & ISOTOPES	CONSTITUENT CAS #	CONSTITUENT NAME	WEIGHT %	RGN	GENERAL INFORMATION
R001283 ISOTOPES: H-3 = 60 uCi I-125 = 500 uCi Rb-86 = 200 uCi	***	Methanol	2	13	TOTAL MATERIAL WEIGHT: 20.0 kg TOTAL MATERIAL VOLUME: 20,000 ml CONTAINER: This waste is packaged in a 20 liter glass container. POSS. HAZARDS: Toxic STABILIZATION: None Required
	***	Tris Buffer	0.6	**	
	N/A	Water	97.4	106	
R011148 ISOTOPES: U-238 = 0.16 uCi	67-64-1	Acetone	39	19	TOTAL MATERIAL WEIGHT: 1.00 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter glass container. POSS. HAZARDS: Explosive peroxides and flammable mixture. STABILIZATION: Peroxide scrub - organic removal
	110-54-3	Hexane	33	29	
	60-29-7	Diethyl Ether	22	14	
	67-63-0	Isopropanol	6	13	
	***	Magnesium Chloride	0.2	**	
R010373 ISOTOPES: U-238 = 0.99 uCi	67-64-1	Acetone	35	19	TOTAL MATERIAL WEIGHT: 1.00 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter glass container. POSS. HAZARDS: Explosive peroxides and flammable mixture. STABILIZATION: Peroxide scrub - organic removal
	110-54-3	Hexane	20	29	
	108-88-3	Toluene	10	16	
	60-29-7	Diethyl Ether	25	14	
	67-63-0	Isopropanol	10	13	
	***	Magnesium Chloride	0.2	**	
	***	Lithium Chloride	0.1	**	
	***	Alkylcyclopentadienes	0.3	**	
R010388 ISOTOPES: U-238 = 1.33 uCi	67-64-1	Acetone	23	19	TOTAL MATERIAL WEIGHT: 1.00 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter glass container. POSS. HAZARDS: Explosive peroxides and flammable mixture. STABILIZATION: Phase separation - peroxide scrub - organic removal
	108-88-3	Toluene	16	16	
	***	Cyclopentadienes	0.2	**	
	109-99-9	Tetrahydrofuran	11	14	
	110-54-3	Hexane	27	29	
	N/A	Water	23	N/A	

ATTACHMENT 1
SUMMARY TABLE FOR DRUM #RFL0794 (Rev. 4/5/95)

CONTAINER # & ISOTOPES	CONSTITUENT CAS #	CONSTITUENT NAME	WEIGHT %	RGN	GENERAL INFORMATION
R011150 ISOTOPES: U-238 = 1.16 uCi	67-64-1	Acetone	33	19	TOTAL MATERIAL WEIGHT: 1.00 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter glass container. POSS. HAZARDS: Explosive peroxides and flammable mixture. STABILIZATION: Peroxide scrub - organic removal
	60-29-7	Diethyl Ether	15	14	
	108-88-3	Toluene	15	16	
	110-54-3	Hexane	22	29	
	67-63-0	Isopropanol	15	13	
	***	Alkylcyclopentadiene	0.3	**	
	***	Magnesium Chloride	0.1	**	
R010389 ISOTOPES: U-238 = 1.33 uCi	67-64-1	Acetone	23	19	TOTAL MATERIAL WEIGHT: 1.00 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter glass container. POSS. HAZARDS: Explosive peroxides and flammable mixture. STABILIZATION: Phase separation - peroxide scrub - organic removal
	110-54-3	Hexane	27	29	
	109-9-9	Tetrahydrofuran	11	14	
	***	cyclopentadiene	0.2	**	
	108-88-3	Toluene	16	16	
	N/A	Water	23	106	
R010365 ISOTOPES: U-238 = 0.50 uCi	67-64-1	Acetone	60	19	TOTAL MATERIAL WEIGHT: 1.00 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter glass container. POSS. HAZARDS: Explosive peroxides and flammable mixture. STABILIZATION: Peroxide scrub - organic removal
	110-54-3	Hexane	30	29	
	109-99-9	Tetrahydrofuran	5	14	
	60-29-7	Diethyl Ether	5	14	
	***	Alkyl Substituted Cyclopentadienyl	0.3	**	
R010367 ISOTOPES: U-238 = 0.99 uCi	67-64-1	Acetone	31	19	TOTAL MATERIAL WEIGHT: 1.00 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter glass container. POSS. HAZARDS: Explosive peroxides and flammable mixture. STABILIZATION: Peroxide scrub - organic removal
	110-54-3	Hexane	24	29	
	***	Magnesium Salts	0.2	**	
	60-29-7	Diethyl Ether	45	14	
	***	Alkyl Substituted Cyclopentadienyl	0.2	**	

ATTACHMENT 1
SUMMARY TABLE FOR DRUM #RFL0794 (Rev. 4/5/95)

CONTAINER # & ISOTOPES	CONSTITUENT CAS #	CONSTITUENT NAME	WEIGHT %	RGN	GENERAL INFORMATION
R010386 ISOTOPES: U-238 = 1.32 uCi	67-64-1	Acetone	46	19	TOTAL MATERIAL WEIGHT: 1.00 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter glass container. POSS. HAZARDS: Explosive peroxides and flammable mixture. STABILIZATION: Peroxide scrub - organic removal
	110-54-3	Hexane	15	29	
	108-88-3	Toluene	9	16	
	109-99-9	Tetrahydrofuran	5	14	
	60-29-7	Diethyl Ether	20	14	
	67-63-0	Isopropanol	5	13	
	***	Magnesium Salts	0.3	**	
	***	Alkyl Substituted Cyclopentadienyl	0.3	**	
R010366 ISOTOPES: U-238 = 0.84 uCi	67-64-1	Acetone	67	19	TOTAL MATERIAL WEIGHT: 1.00 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter glass container. POSS. HAZARDS: Explosive peroxides and flammable mixture. STABILIZATION: Peroxide scrub - organic removal
	110-54-3	Hexane	11	29	
	108-88-3	Toluene	10	16	
	60-29-7	Diethyl Ether	11	14	
	***	Toluidene	0.1	**	
	***	Lithium Chloride	0.3	**	
	***	Alkyl Substituted Cyclopentadienyl	0.3	**	
R009349 ISOTOPES: U-238 = 0.66 uCi	67-64-1	Acetone	32.5	19	TOTAL MATERIAL WEIGHT: 1.00 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter glass container. POSS. HAZARDS: Explosive peroxides and flammable mixture. STABILIZATION: Peroxide scrub - organic removal
	110-54-3	Hexane	35	29	
	60-29-7	Diethyl Ether	30	14	
	67-63-0	Isopropanol	2.5	13	
	***	U-238 Salts	0.2	**	
	***	Lithium Salts	0.1	**	
	***	Magnesium Salts	0.2	**	
	***	Alkylcyclopentadienyls	0.2	**	

ATTACHMENT 1
SUMMARY TABLE FOR DRUM #RFL0794 (Rev. 4/5/95)

CONTAINER # & ISOTOPES	CONSTITUENT CAS #	CONSTITUENT NAME	WEIGHT %	RGN	GENERAL INFORMATION
R009350 ISOTOPES: U-238 = 0.99 uCi	67-64-1	Acetone	60	19	TOTAL MATERIAL WEIGHT: 1.00 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter glass container. POSS. HAZARDS: Explosive peroxides and flammable mixture. STABILIZATION: Peroxide scrub - organic removal
	110-54-3	Hexane	20	29	
	108-88-3	Toluene	10	16	
	60-29-7	Diethyl Ether	5	14	
	67-63-0	Isopropanol	5	13	
	***	Lithium Chloride	0.1	**	
	***	Alkylcyclopentadienyls	0.3	**	
R000300 ISOTOPES: U-238 = 1.0 uCi Th-232 = 0.6 uCi	67-63-0	Isopropanol	29	13	TOTAL MATERIAL WEIGHT: 0.7 kg TOTAL MATERIAL VOLUME: 700 ml CONTAINER: This waste is packaged in a 1 liter glass container. POSS. HAZARDS: Flammable mixture. STABILIZATION: Stabilization required if indications of peroxide formation.
	78-93-3	Methyl Ethyl Ketone	14	19	
	110-54-3	Hexane	43	29	
	***	Methanol	14	**	
	***	UCl	0.1	**	
R008745 ISOTOPES: U-238 = 0.33 uCi	110-54-3	Hexane	100	29	TOTAL MATERIAL WEIGHT: 0.95 kg TOTAL MATERIAL VOLUME: 950 ml CONTAINER: This waste is packaged in a 1 liter glass container. POSS. HAZARDS: Flammable material STABILIZATION: None Required
R000347 ISOTOPES: U-238 = 25 uCi	67-63-0	Isopropanol	100	13	TOTAL MATERIAL WEIGHT: 1.00 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter glass container. POSS. HAZARDS: Flammable material STABILIZATION: None Required
R012929 ISOTOPES: H-3 = 883 uCi	***	Methanol	100	13	TOTAL MATERIAL WEIGHT: 0.50 kg TOTAL MATERIAL VOLUME: 500 ml CONTAINER: This waste is packaged in a 1 liter or 500 ml glass container. POSS. HAZARDS: Flammable material STABILIZATION: None Required

Westinghouse Hanford Company

From: G. C. Triner
Phone: 372-0734 T3-04
Date: April 4, 1995
Subject: INSTRUCTIONS FOR T PLANT PERTAINING TO LBL DRUM RAL1294 (REV. 2)

Project: LBL CONTAINER TREATMENT AND SEGREGATION PROJECT

To: P. J. Crane T3-28

cc: C.K. Girres	T3-05	R.D. Pierce	T3-04
M.D. Aichele	T4-04	N.P. Emerson	T4-03
R.J. Giroir	T4-05	M.S. Wright	T3-28

This document provides general information and instructions concerning the work required of T Plant in support of the Lawrence Berkeley Laboratory (LBL) drum treatment and segregation project.

LBL drum RAL1294 contains forty-two polyethylene jars ranging in size from 500 ml to 1 liter of acids which may require segregation. The table which is attached to the end of these instructions denotes the materials and quantities of each container.

No internal containers are expected to contain a hazard by itself, however several internal containers hold nitric acid and others hydrochloric acid. The mixture of nitric acid and hydrochloric acid is known as "aqua regia", which can produce chlorine gas when mixed. Also nitric acid and perchloric acid is known to degrade polyethylene containers. For this reason, Solid Waste Disposal has chosen to conservatively manage these containers. Therefore, extreme caution should be taken when managing these containers. T Plant should prevent bumping, dropping, or shaking the containers and movement of the containers should be held to a minimum.

These containers were packaged in 1993 and received at the Central Waste Complex (CWC) in early 1994. At the time of packaging, no peroxides or other problems were evident.

The following sections contain the general instructions for performing the activities required of T Plant in support of this program:

INSTRUCTIONS FOR OPENING THE INNER CONTAINERS:

- 1) Upon receipt of the container, T Plant shall input the new drum location in SWITS.
- 2) Perform the activity in accordance with an approved work plan, and all other applicable requirements.

Westinghouse Hanford Company

- 3) RAL1294 will be opened, the following internal containers will be removed, repackaged in glass containers, and placed in a separate drum:
 - R008040, R008036, R008035, R008034, R009145, R009147, R009146, & R007299.
- 4) T Plant will package the containers in accordance with an approved SDAR supplied by Generator and Waste Acceptance Services (GWAS). The following inner containers will be segregated in the following manner to comply with department of transportation requirements.
 - GROUP 1 (RAL1294): R008250, R009128, R009129, R009127, R009121, R009136, R008041, R009132, R009138, R009130, R009137, R009140, R008244, R009120, R009133, R001274, R009135, R009125, R009139, R008039, R008246, R008245, & R009131.
 - GROUP 2 (RAL1294-2): R008232, R008233, R008231, R008236, R008235, R008234, R009124, R009123, R008237, R008238, R009134, & R009126.
 - GROUP 3 (RAL1294-3): R009145.
 - GROUP 4 (RAL1294-4): R009147.
 - GROUP 5 (RAL1294-5): R009146.
 - GROUP 6 (RAL1294-6): R008040, R008036, R008035, & R008034.
- 5) Generate new burial records, Uniform Hazardous Waste Manifest, RSR, and container summary.
- 6) Return the containers to the CWC.

Should T Plant have any questions concerning these instructions, please contact Mr. G. C. Triner at 372-0734 or pager 85-9488. Should the above instructions or associated summary sheet require revision the revision number will be changed, Mr. P.J. Crane will be notified by phone, and the material will be transmitted to Mr. P.J. Crane in hardcopy signed and dated accordingly.

G.C. Triner
Segregation and Treatment Team Leader

Attachment 1

ATTACHMENT 1
SUMMARY TABLE FOR DRUM #RAL1294 (Rev. 4/5/95)

CONTAINER # & ISOTOPES	CONSTITUENT CAS #	CONSTITUENT NAME	WEIGHT %	RGN	GENERAL INFORMATION
R008250 ISOTOPES: Am-241 & 243 = 0.001 uCi	7647-01-0	Hydrochloric Acid	4	1	TOTAL MATERIAL WEIGHT: 1 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter polyethylene container. POSS. HAZARDS: Extremely corrosive TREATMENT: None
	N/A	Water	96	N/A	
R009128 ISOTOPES: Pu-239 = 0.5 uCi	7647-01-0	Hydrochloric Acid	4	1	TOTAL MATERIAL WEIGHT: 1 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter polyethylene container. POSS. HAZARDS: Extremely corrosive TREATMENT: None
	N/A	Water	96	N/A	
R009129 ISOTOPES: Np-237 = 0.17 uCi Pu-239 = 0.17 uCi Am-241 = 0.17 uCi	7647-01-0	Hydrochloric Acid	4	1	TOTAL MATERIAL WEIGHT: 1 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter polyethylene container. POSS. HAZARDS: Extremely corrosive TREATMENT: None
	N/A	Water	96	N/A	
R009127 ISOTOPES: Np-237 = 0.17 uCi Pu-239 = 0.17 uCi Am-241 = 0.17 uCi	7647-01-0	Hydrochloric Acid	4	1	TOTAL MATERIAL WEIGHT: 1 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter polyethylene container. POSS. HAZARDS: Extremely corrosive TREATMENT: None
	N/A	Water	96	N/A	
R009121 ISOTOPES: Pu-239 = 0.5 uCi	7647-01-0	Hydrochloric Acid	4	1	TOTAL MATERIAL WEIGHT: 1 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter polyethylene container. POSS. HAZARDS: Extremely corrosive TREATMENT: None
	N/A	Water	96	N/A	
R009136 ISOTOPES: Np-237 = 0.17 uCi Pu-239 = 0.17 uCi Am-241 = 0.17 uCi	7647-01-0	Hydrochloric Acid	4	1	TOTAL MATERIAL WEIGHT: 1 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter polyethylene container. POSS. HAZARDS: Extremely corrosive TREATMENT: None
	N/A	Water	96	N/A	

ATTACHMENT 1
SUMMARY TABLE FOR DRUM #RAL1294 (Rev. 4/5/95)

CONTAINER # & ISOTOPES	CONSTITUENT CAS #	CONSTITUENT NAME	WEIGHT %	RGN	GENERAL INFORMATION
R008041 ISOTOPES: Np-237 = 0.5 uCi	7647-01-0	Hydrochloric Acid	4	1	TOTAL MATERIAL WEIGHT: 1 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter polyethylene container. POSS. HAZARDS: Extremely corrosive TREATMENT: None
	N/A	Water	96	N/A	
R009132 ISOTOPES: Pu-239 = 0.5 uCi	7647-01-0	Hydrochloric Acid	4	1	TOTAL MATERIAL WEIGHT: 1 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter polyethylene container. POSS. HAZARDS: Extremely corrosive TREATMENT: None
	N/A	Water	96	N/A	
R009138 ISOTOPES: Np-237 = 0.17 uCi Pu-239 = 0.17 uCi Am-241 = 0.17 uCi	7647-01-0	Hydrochloric Acid	4	1	TOTAL MATERIAL WEIGHT: 1 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter polyethylene container. POSS. HAZARDS: Extremely corrosive TREATMENT: None
	N/A	Water	96	N/A	
R009130 ISOTOPES: Np-237 = 0.17 uCi Pu-239 = 0.17 uCi Am-241 = 0.17 uCi	7647-01-0	Hydrochloric Acid	4	1	TOTAL MATERIAL WEIGHT: 1 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter polyethylene container. POSS. HAZARDS: Extremely corrosive TREATMENT: None
	N/A	Water	96	N/A	
R009137 ISOTOPES: Np-237 = 0.17 uCi Pu-239 = 0.17 uCi Am-241 = 0.17 uCi	7647-01-0	Hydrochloric Acid	4	1	TOTAL MATERIAL WEIGHT: 1 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter polyethylene container. POSS. HAZARDS: Extremely corrosive TREATMENT: None
	N/A	Water	96	N/A	
R009140 ISOTOPES: Np-237 = 0.17 uCi Pu-239 = 0.17 uCi Am-241 = 0.17 uCi	7647-01-0	Hydrochloric Acid	4	1	TOTAL MATERIAL WEIGHT: 1 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter polyethylene container. POSS. HAZARDS: Extremely corrosive TREATMENT: None
	N/A	Water	96	N/A	

ATTACHMENT 1
SUMMARY TABLE FOR DRUM #RAL1294 (Rev. 4/5/95)

CONTAINER # & ISOTOPES	CONSTITUENT CAS #	CONSTITUENT NAME	WEIGHT %	RGN	GENERAL INFORMATION
R008244 ISOTOPES: Np-237 = 0.0125 uCi Pu-239 = 0.0125 uCi Am-241 & 243 = 0.0125 uCi U-235 & 238 = 0.0125 uCi	7647-01-0	Hydrochloric Acid	4	1	TOTAL MATERIAL WEIGHT: 0.4 kg TOTAL MATERIAL VOLUME: 400 ml CONTAINER: This waste is packaged in a 1 liter or 500 ml polyethylene container.
	N/A	Water	96	N/A	POSS. HAZARDS: Extremely corrosive TREATMENT: None
R009120 ISOTOPES: Np-237 = 0.17 uCi Pu-239 = 0.17 uCi Am-241 = 0.17 uCi	7647-01-0	Hydrochloric Acid	4	1	TOTAL MATERIAL WEIGHT: 1 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter polyethylene container.
	N/A	Water	96	N/A	POSS. HAZARDS: Extremely corrosive TREATMENT: None
R009133 ISOTOPES: Pu-239 = 0.5 uCi	7647-01-0	Hydrochloric Acid	4	1	TOTAL MATERIAL WEIGHT: 1 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter polyethylene container.
	N/A	Water	96	N/A	POSS. HAZARDS: Extremely corrosive TREATMENT: None
R001274 ISOTOPES: Np-237 = 17 uCi Pu-239 = 17 uCi Am-241 = 17 uCi	7647-01-0	Hydrochloric Acid	3	1	TOTAL MATERIAL WEIGHT: 0.5 kg TOTAL MATERIAL VOLUME: 500 ml CONTAINER: This waste is packaged in a 1 liter or 500 ml polyethylene container.
	N/A	Water	97	N/A	POSS. HAZARDS: Extremely corrosive TREATMENT: None
R009135 ISOTOPES: Np-237 = 0.17 uCi Pu-239 = 0.17 uCi Am-241 = 0.17 uCi	7647-01-0	Hydrochloric Acid	11	1	TOTAL MATERIAL WEIGHT: 1 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter polyethylene container.
	N/A	Water	89	N/A	POSS. HAZARDS: Extremely corrosive TREATMENT: None

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WHC-SD-WM-TP-336, Rev. 0

**ATTACHMENT 1
SUMMARY TABLE FOR DRUM #RAL1294 (Rev. 4/5/95)**

CONTAINER # & ISOTOPES	CONSTITUENT CAS #	CONSTITUENT NAME	WEIGHT %	RGN	GENERAL INFORMATION
R009125 ISOTOPES: Np-237 = 0.25 uCi Pu-239 = 0.25 uCi	7647-01-0	Hydrochloric Acid	11	1	TOTAL MATERIAL WEIGHT: 1 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter polyethylene container.
	N/A	Water	89	N/A	POSS. HAZARDS: Extremely corrosive TREATMENT: None

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WHC-SD-WM-TP-336, Rev. 0

ATTACHMENT 1
SUMMARY TABLE FOR DRUM #RAL1294 (Rev. 4/5/95)

CONTAINER # & ISOTOPES	CONSTITUENT CAS #	CONSTITUENT NAME	WEIGHT %	RGN	GENERAL INFORMATION
R009139 ISOTOPES: Np-237 = 0.17 uCi Pu-239 = 0.17 uCi Am-241 = 0.17 uCi	7647-01-0	Hydrochloric Acid	11	1	TOTAL MATERIAL WEIGHT: 1 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter polyethylene container. POSS. HAZARDS: Extremely corrosive TREATMENT: None
	N/A	Water	89	N/A	
R008039 ISOTOPES: Np-237 = 0.5 uCi	7647-01-0	Hydrochloric Acid	11	1	TOTAL MATERIAL WEIGHT: 1 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter polyethylene container. POSS. HAZARDS: Extremely corrosive TREATMENT: None
	N/A	Water	89	N/A	
R008246 ISOTOPES: Pu-239 = 0.5 uCi	7647-01-0	Hydrochloric Acid	22	1	TOTAL MATERIAL WEIGHT: 0.5 kg TOTAL MATERIAL VOLUME: 500 ml CONTAINER: This waste is packaged in a 1 liter or 500 ml polyethylene container. POSS. HAZARDS: Extremely corrosive TREATMENT: None
	N/A	Water	78	N/A	
R008245 ISOTOPES: Np-237 = 0.25 uCi Pu-239 = 0.25 uCi	7647-01-0	Hydrochloric Acid	22	1	TOTAL MATERIAL WEIGHT: 1 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter polyethylene container. POSS. HAZARDS: Extremely corrosive TREATMENT: None
	N/A	Water	78	N/A	
R009131 ISOTOPES: Pu-239 = 0.5 uCi	7647-01-0	Hydrochloric Acid	22	1	TOTAL MATERIAL WEIGHT: 1 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter polyethylene container. POSS. HAZARDS: Extremely corrosive TREATMENT: None
	N/A	Water	78	N/A	
R008232 ISOTOPES: Np-237 = 26 uCi	7647-01-0	Hydrochloric Acid	4	1	TOTAL MATERIAL WEIGHT: 1 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter polyethylene container. POSS. HAZARDS: Extremely corrosive TREATMENT: None
	7647-14-5	Sodium Chloride	15	Not Listed	
	N/A	Water	81	N/A	

WHC-SD-WM-TP-336, Rev. 0

ATTACHMENT 1
SUMMARY TABLE FOR DRUM #RAL1294 (Rev. 4/5/95)

CONTAINER # & ISOTOPES	CONSTITUENT CAS #	CONSTITUENT NAME	WEIGHT %	RGN	GENERAL INFORMATION
R008233 ISOTOPES: Np-237 = 13 uCi	7647-01-0	Hydrochloric Acid	4	1	TOTAL MATERIAL WEIGHT: 1 kg TOTAL MATERIAL VOLUME: 1000 ml
	7647-14-5	Sodium Chloride	15	Not Listed	CONTAINER: This waste is packaged in a 1 liter polyethylene container.
	N/A	Water	81	N/A	POSS. HAZARDS: Extremely corrosive TREATMENT: None
R008231 ISOTOPES: Np-237 = 0.3 uCi	7647-01-0	Hydrochloric Acid	4	1	TOTAL MATERIAL WEIGHT: 1 kg TOTAL MATERIAL VOLUME: 1000 ml
	7647-14-5	Sodium Chloride	15	Not Listed	CONTAINER: This waste is packaged in a 1 liter polyethylene container.
	N/A	Water	81	N/A	POSS. HAZARDS: Extremely corrosive TREATMENT: None
R008236 ISOTOPES: Np-237 = 2.2 uCi	7647-01-0	Hydrochloric Acid	4	1	TOTAL MATERIAL WEIGHT: 1 kg TOTAL MATERIAL VOLUME: 1000 ml
	7647-14-5	Sodium Chloride	15	Not Listed	CONTAINER: This waste is packaged in a 1 liter polyethylene container.
	N/A	Water	81	N/A	POSS. HAZARDS: Extremely corrosive TREATMENT: None
R008235 ISOTOPES: Np-237 = 11.1 uCi	7647-01-0	Hydrochloric Acid	4	1	TOTAL MATERIAL WEIGHT: 1 kg TOTAL MATERIAL VOLUME: 1000 ml
	7647-14-5	Sodium Chloride	15	Not Listed	CONTAINER: This waste is packaged in a 1 liter polyethylene container.
	N/A	Water	81	N/A	POSS. HAZARDS: Extremely corrosive TREATMENT: None
R008234 ISOTOPES: Np-237 = 5.2 uCi	7647-01-0	Hydrochloric Acid	4	1	TOTAL MATERIAL WEIGHT: 1 kg TOTAL MATERIAL VOLUME: 1000 ml
	7647-14-5	Sodium Chloride	15	Not Listed	CONTAINER: This waste is packaged in a 1 liter polyethylene container.
	N/A	Water	81	N/A	POSS. HAZARDS: Extremely corrosive TREATMENT: None
R009124 ISOTOPES: Np-237 = 0.017 uCi Pu-239 = 0.017 uCi Am-241 = 0.017 uCi	7647-01-0	Hydrochloric Acid	4	1	TOTAL MATERIAL WEIGHT: 1 kg TOTAL MATERIAL VOLUME: 1000 ml
	7647-14-5	Sodium Chloride	18	Not Listed	CONTAINER: This waste is packaged in a 1 liter polyethylene container.
	N/A	Water	78	N/A	POSS. HAZARDS: Extremely corrosive TREATMENT: None

ATTACHMENT 1
SUMMARY TABLE FOR DRUM #RAL1294 (Rev. 4/5/95)

CONTAINER # & ISOTOPES	CONSTITUENT CAS #	CONSTITUENT NAME	WEIGHT %	RGN	GENERAL INFORMATION
R009123 ISOTOPES: Np-237 = 0.5 uCi	7647-01-0	Hydrochloric Acid	4	1	TOTAL MATERIAL WEIGHT: 1 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter polyethylene container. POSS. HAZARDS: Extremely corrosive TREATMENT: None
	7647-14-5	Sodium Chloride	18	Not Listed	
	N/A	Water	78	N/A	
R008237 ISOTOPES: Np-237 = 0.2 uCi	7647-01-0	Hydrochloric Acid	4	1	TOTAL MATERIAL WEIGHT: 0.5 kg TOTAL MATERIAL VOLUME: 500 ml CONTAINER: This waste is packaged in a 1 liter or 500 ml polyethylene container. POSS. HAZARDS: Extremely corrosive TREATMENT: None
	7647-14-5	Sodium Chloride	15	Not Listed	
	N/A	Water	81	N/A	
R008238 ISOTOPES: Np-237 = 0.049 uCi	7647-01-0	Hydrochloric Acid	4	1	TOTAL MATERIAL WEIGHT: 0.5 kg TOTAL MATERIAL VOLUME: 500 ml CONTAINER: This waste is packaged in a 1 liter or 500 ml polyethylene container. POSS. HAZARDS: Extremely corrosive TREATMENT: None
	7647-14-5	Sodium Chloride	15	Not Listed	
	N/A	Water	81	N/A	
R009134 ISOTOPES: Np-237 = 0.17 uCi Pu-239 = 0.17 uCi Am-241 = 0.17 uCi	7647-01-0	Hydrochloric Acid	4	1	TOTAL MATERIAL WEIGHT: 1 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter polyethylene container. POSS. HAZARDS: Extremely corrosive TREATMENT: None
	7647-14-5	Sodium Chloride	12	Not Listed	
	N/A	Water	84	N/A	
R009126 ISOTOPES: Np-237 = 0.5 uCi	7647-01-0	Hydrochloric Acid	4	1	TOTAL MATERIAL WEIGHT: 1 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter polyethylene container. POSS. HAZARDS: Extremely corrosive TREATMENT: None
	7647-14-5	Sodium Chloride	25	Not Listed	
	N/A	Water	61	N/A	
R009145 ISOTOPES: Pu-239 = 5 uCi	7647-01-0	Hydrochloric Acid	4	1	TOTAL MATERIAL WEIGHT: 1 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter polyethylene container. POSS. HAZARDS: Extremely corrosive TREATMENT: None
	7601-90-3	Perchloric Acid	1	2	
	N/A	Water	95	N/A	

ATTACHMENT 1
SUMMARY TABLE FOR DRUM #RAL1294 (Rev. 4/5/95)

CONTAINER # & ISOTOPES	CONSTITUENT CAS #	CONSTITUENT NAME	WEIGHT %	RGN	GENERAL INFORMATION
R009147 ISOTOPES: Pu-239 = 0.5 uCi	7601-90-3	Perchloric Acid	12	2	TOTAL MATERIAL WEIGHT: 1 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter polyethylene container. POSS. HAZARDS: Extremely corrosive TREATMENT: None
	7647-14-5	Sodium Chloride	10	Not Listed	
	N/A	Water	78	N/A	
R009146 ISOTOPES: Pu-239 = 0.5 uCi	7601-90-3	Perchloric Acid	10	2	TOTAL MATERIAL WEIGHT: 1 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter polyethylene container. POSS. HAZARDS: Extremely corrosive TREATMENT: None
	N/A	Water	90	N/A	
R008040 ISOTOPES: Am-241, 242, & 243 = 0.005 uCi	7697-37-2	Nitric Acid	19	2	TOTAL MATERIAL WEIGHT: 0.5 kg TOTAL MATERIAL VOLUME: 500 ml CONTAINER: This waste is packaged in a 1 liter or 500 ml polyethylene container. Possible container compatibility problems, embrittlement. POSS. HAZARDS: Extremely corrosive TREATMENT: Segregate into a separate drum and overpack in one gallon glass container.
	N/A	Water	81	N/A	
R008036 ISOTOPES: Np-237 = 0.001 uCi Pu-239 Am-241	7697-37-2	Nitric Acid	19	2	TOTAL MATERIAL WEIGHT: 1 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter or 500 ml polyethylene container. Possible container compatibility problems, embrittlement. POSS. HAZARDS: Extremely corrosive TREATMENT: Segregate into a separate drum and overpack in one gallon glass container.
	N/A	Water	81	N/A	
R008035 ISOTOPES: Am-241 & 243 = 0.005 uCi	7697-37-2	Nitric Acid	19	2	TOTAL MATERIAL WEIGHT: 1 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter or 500 ml polyethylene container. Possible container compatibility problems, embrittlement. POSS. HAZARDS: Extremely corrosive TREATMENT: Segregate into a separate drum and overpack in one gallon glass container.
	N/A	Water	81	N/A	

ATTACHMENT 1
SUMMARY TABLE FOR DRUM #RAL1294 (Rev. 4/5/95)

CONTAINER # & ISOTOPES	CONSTITUENT CAS #	CONSTITUENT NAME	WEIGHT %	RGN	GENERAL INFORMATION
R008034 ISOTOPES: Am-241 & 243 = 0.005 uCi	7697-37-2	Nitric Acid	19	2	TOTAL MATERIAL WEIGHT: 1 kg TOTAL MATERIAL VOLUME: 1000 ml CONTAINER: This waste is packaged in a 1 liter or 500 ml polyethylene container. Possible container compatibility problems, embrittlement.
	N/A	Water	81	N/A	POSS. HAZARDS: Extremely corrosive TREATMENT: Segregate into a separate drum and overpack in one gallon glass container.

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APPENDIX B
PACIFIC NORTHWEST LABORATORY LITERATURE SEARCH

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[65] From: Donald M Camaioni at -PNL51 3/3/95 6:24PM (20563 bytes: 1 ln, 3 fl)
 To: Beverly A Crawford at -WHC167, Glen C Triner at -WHC212, Richard D Pierce at -WHC212
 cc: Harry Babad at -WHC142, Roger M Bean at -PNL95, S Thomas Autrey at -PNL19, Wendy J Shaw at -PNL19, David W Koppenaal at -PNL40
 Subject: Progress Report, LBL Waste Literature Review
 ----- Message Contents -----

Text item 1:

our literature survey of the chemical hazards associated with the LBL wastes searched (1) the CA, CIN and CAPLUS databases that include information published from 1972 to the present, (2) the MSDS data base and (3) the TOMES databases at the Hanford Tech Library. We followed the citations from the TOMES data base back to the original documents to look for more specific information. We searched for (1) specifics on the incompatibilities of nitric acid with the organics listed in the LBL waste logs and (2) information regarding the formation of peroxides with the organics listed in the LBL waste logs. The attached EXCEL file lists pertinent findings and gives bibliographic references for the organic compounds listed in on the LBL waste log sheets.

PEROXIDES

As has been pointed out by Beverly Crawford, peroxides are known to form upon prolonged storage of alkyl alcohols and ethers (diethyl ether, THF, isopropanol (IPA), ethanol). In general the peroxide formation is increased in the presence of air and/or light. We have found citations that show traces of MEK (2-butanone) increase the rate of formation of peroxides in IPA (Bretherick, 1985, pg 379). Peroxides of IPA are formed in the dark, however at a slower rate than when exposed to full light (Redemann, C. E. JACS, 1942, 64, 3049).

Alkyl ethers have been reported to yield explosive polymeric peroxides on treatment with acids and many ethers autooxidize readily to peroxides in non-airtight containers (Kirk-Othmer Encyc. of Chem Tech, pg 48).

Cyclopentadiene monomer is reported to react spontaneously with oxygen to form "brown - gummy peroxide-containing products" (Kirk-Othmer Encyc. of Chem Tech, pg 424).

NITRIC ACID

An online search of the Chemical Abstracts (1972 to present) found that 364 articles were indexed under the terms "safety" or "hazard" for nitric acid. Of these articles, 26 were review articles. Bibliographic references and abstracts were downloaded.

One citation recommended that nitric acid not be stored in polypropylene bottles, because of gradual embrittlement (one LBL bottle has both nitric and hydrofluoric acid). Other citations indicated that nitrate esters of alcohols are used as industrial high explosives. Thus, a search on nitrate esters gave a query with 412 hits that, when linked to the safety INDEX term yielded 7 hits. References and abstracts to these articles were downloaded.

An early review entitled, "The Chemistry of Nitrate Esters" (Chem Reviews 1955, 55, 485) was found in our personal files. It discusses preparations, solvolytic decomposition and physical and chemical properties

- They can be formed from alcohols and nitric acid.

- They are decomposed under basic conditions to alcohols, olefins and aldehydes.
- They have characteristic IR bands, (6.1, 7.8 and 11.8 microns)

A general search of nitric acid in the Hazardous Materials data base (TOMES) reveals that nitric acid is incompatible with several organic solvents present in the LBL wastes. A search of the cited reference (Brethenick 1985) pertinent to the LBL waste made two recommendations. (1) Concentrated nitric acid solutions containing diethyl ether or alcohols should be diluted or neutralized and (2) mixtures of containing over 5% nitric acid and alcohols should not be stored (Fromm 1949). It was suggested that these precautions would have prevented reported explosions of nitric acid diethyl ether solutions (Holt 1981) and (Fischer 1902). Some work suggests that formation of ethyl nitrate, not peroxides were responsible for the reported explosions (Anon. 1981).

There are a series of French language review articles (Cah. Notes Doc.) that reportedly discuss the reactivity of nitric acid with a series of organic and inorganic components.

Nitric acid with:

Hydrocarbons	Cah. Notes Doc. 1979, 95, 293-305.
Ethers	Cah. Notes Doc. 1976, 82, 127-9.
Alcohols	Cah. Notes Doc. 1976, 82, 121-5.

These may contain useful information. They would have to be ordered from a document delivery service and translated.

ALKYLPEROXIDES AND NITRIC ACID

No information regarding the stability of organic peroxides in the presence of nitric acid were found in an online search of the Chemical Abstracts.

A cross reference search of alkyl peroxides and nitric acid yielded 0 hits, while a broad search with alkylperoxide and acid yielded 2 hits with no directly useful information.

No evidence has yet been found to indicate that alkyl peroxides hydrolyze in the presence of nitric acid. Polymeric peroxides are said to be formed from ethers under acidic conditions.

In addition to risks of peroxide formation, the formation of nitrate esters should be considered a possibility. An exotherm from the DSC/TGA could result from nitrate esters as well as peroxides. Infrared analysis might indicate the presence of nitrate esters.

SIGNIFICANT FINDINGS

- nitric acid solutions above 5% should not be stored for prolonged periods.
- nitric acid solutions should not be stored in plastic bottles.
- nitric acid and primary alcohols can form explosive nitrate esters
- observation of solid crystals in the containers may be due to the formation of polymeric peroxides, in which case, "bomb squad" techniques should be considered in manipulating suspect containers.

We recommend further literature work to: 1) obtain more information on the other products and their associated hazards produced from nitric acid and the other organic components, 2) recommend methods to scrub peroxides, especially under heterogeneous or acidic conditions, and 3) recommend methods to scrub nitrate ester and the other nitric acid products.

Chemical	Reading Reference	Comment	Supporting References
Nitric Acid	4	Reacts violently with alcohol	**1, pg 943
	4	Explodes on contact with many reducing agents	**2, pg 2002
	4	Can react with alcohols to form nitrate esters	*Kononova, SD et al: Genetika 1972; *Kononova SD: Teor Dkim Matageneza Mater Vses Soveshch 4th: 1971, p 34-38
	Anal.Chem (1976), 48(13), 2048	Conc. nitric acid should not be stored in polypropylene bo	None
	3	Can react violently with alcohol	*ITI, 1985; ** Windholz, 1983
	3	Can react violently with: Acetic acid, cyclic ketones, Ethanol, Fluorine, Hydrogen Peroxide and Ketones + Hydrogen Peroxides	**2; **NFPA. Fire Protection Guide on Hazardous Materials. 9th ed. Boston, MA: NFPA, 1986., p. 491M-8
	2	Mixtures of over 5% nitric acid should not be stored	**Fromm, F. et al., Chem. Eng. News. 1949, 27, 1956 **Fawcett, H.H., Chem. Eng. News, 1949, 27, 1396
Methylene Chloride bp 39.8-40 C	4	Mixtures with N2O4 are explosive when subjected to a shock of 25 g TNT equivalents or less.	Bretherick, L. Handbook of Reactive Chemical Hazards. 3rd ed. Boston, MA: Butterworths, 1985. 1297 -cited Turley, RE Chem. and Eng. News. 1964, 42(47) 53
	4	Dissolves endothermically in con HNO3 to give detonable	** ibid. 1110
	3	Nothing critical	
Dicyclopentadiene bp 170 C	4	Mixtures with peroxides could cause explosion	**Kirk-Othmer Encyclopedia of Chemical Technology. 3rd ed., vol. 1-26. New York, NY: John Wiley and Sons, 1978-1984., p. V7 417 (1979)
Pyridine bp 115 C	3	Reacts violently with nitric acid	4, 1993; *Reed, RL: Pyridine In: Buhler DR & Reed DJ (Eds): Ethel Browning's Toxicity and Metabolism of Industrial Solvents, Elsevier Publishers, London, 1990
	4	Reacts violently with nitric acid	*National Research Council. Prudent Practices for Handling Hazardous Chemicals in Laboratories. Washington, DC: National Academy Press, 1981. 145
Diethylene Glycol bp 245 C	4	Nothing critical	
Xylene bp 137-144 C	3	Nothing critical	
p-xylene			

bp 156 C/12mm	3	p-xylene is explosive in vapor form	**Lewis, 1992
	3	Forms a potentially explosive reaction with nitric acid and pressure	**Lewis, 1992
1,1,1-trichloroethane bp 74-76 C	3	Can undergo explosive reactions with heavy metals or N ₂	**Sax and Lewis, 1989; **Bretherick, 1990
	4	Reacts slowly with water, releasing corrosive HCl	US Coast Guard, Dept. of Trans. CHRIS-Hazardous Chemical Data. Volume II. Washington, D.C.: US Government Printing Office, 1984-85
	4	Reacts violently with N ₂ O ₄	**2, pg. 2620.
	4		
Ethyl Ether bp 34.6 C	3	Peroxide formation may occur and can be detonated by impact or heating.	NFPA, 1991
	3	Reacts violently or ignites on contact with nitric acid	**Sax and Lewis, 1989
	4	May explode when it contacts anhydrous nitric acid	**1, pg 551.
	4	Should be tested and separated from peroxidic products distillation or evaporation	**Kirk-Othmer Encyclopedia of Chemical Technology. 3rd ed., Vol. 1-26. New York, NY John Wiley and sons, 1978-1984., p. V17 48(1982)
	4		
Toluene bp 111 C	3	Forms explosive reactions with N ₂ O ₄ or con. nitric acid	**Sax and Lewis, 1989
Acetone bp 56 C	3	Forms potentially explosive reactions with a combination nitric acid and sulfuric acid	**Sax and Lewis, 1989
	4	May form explosive mixtures with nitric acid	NFPA. Fire Protection Guide on Hazardous Materials. 9th ed. Boston, MA: NFPA, 1986., p. 491M-8
	4		
Hexane bp 69 C	3	Mixtures with N ₂ O ₄ may explode at 28 C	**Sax and Lewis, 1989
Isopropanol bp 82 C	3	Nothing critical	
	4	0.36M peroxide reported in a 99.5% pure sample of isopr stored for several months in a partially full clear glass b strong daylight	Bretherick, L. 1985. p. 379 -cited *Renfrew, M.M. J. Chem. Ed., 1983, 60(9), A229 -cited *Redemann, C.E. JACS 1942, 64 3049 Provided information on peroxide formation
	4		
	4		
Methyl Ethyl Ketone bp 80 C	3	Nothing critical	
	4	Keep away from oxidizing agents, organic peroxides and radioactive materials.	*ITI. Toxic and Hazardous Industrial Chemicals Safety Manual. Tokyo, Japan: The International Technical Information Institute, 1982. 336
	4	Avoid strong oxidizers and inorganic acids	

			*DLA/DOD; Hazardous Materials Info System #6810-00-K00-0330 (1982)	
Tetrahydrofuran bp 67 C	3	Forms peroxides upon exposure to air or light. If accumu above 1% it will become thermally explosive	4, 1992	
Hydrogen fluoride	3	Reacts violently with a combination of lactic acid and nitri	**Sax and Lewis, 1989	
	4	Nothing critical		
Methylcyclopentadiene	3	No information		
	4	No information		
Pentamethylcyclopentadie	3	No information		
	4	No information		
bis(tributyl)cyclopentadien	3	No information		
	4	No information		
References:				
1 The Merck Index. 10th ed. Rahway, New Jersey: merck Co., Inc., 1983.				
2 Sax, N.I. Dangerous Properties of Industrial Materials. 6th ed. New York, NY: Van Nostrand Reinhold, 1984.				
3 Tomes data base Hazard Management				
4 Tomes data base Hazardous Substances Data Base				
* Not available in the Hanford Technical Library				
**Provided no additional information than the original reference and gave no further references				

To: Glen Triner, Beverly Crawford
From: Tom Autrey, Wendy Shaw, Don Camaioni
Date: March 14, 1994

The following letter report summarizes our literature survey results regarding the LBL waste. We have searched for (1) specifics on the incompatibilities of nitric acid with the organics listed in the LBL waste logs and (2) information regarding the formation of peroxides with the organics listed in the LBL waste logs.

Sources of Information.

The TOMES database at the Hanford Technical Library gave information on the Hazards of chemicals and lists of incompatible mixtures. Only brief information is available with references to the primary literature and four catalogs of chemical safety information in (1) Sax, Dangerous Properties of Industrial Materials, (2) Kirk-Othmer Encyclopedia of Chemical Technology, (3) Bretherick, Handbook of Reactive Chemical Hazards and (4) The Merck Index.

Issues dealing with safety in computer online searching of the STN databases are limited to information published after 1972. We found little information on the hazards of mixed wastes in chemical abstracts.

We attempted to locate the primary literature citations to obtain specific information regarding the hazards listed in the TOMES databases and summarize our findings below. A list of specific references to each chemical is listed in the Appendix.

When specific data was lacking we investigated the possible chemical reactions; in March -- Advanced Organic Chemistry, Fieser and Fieser -- Reagents for Organic Synthesis, and the Collective Volumes of Organic Synthesis. For information on polyperoxide hazards we utilized the references cited in the auto-oxidation chapters in Walling -- Free Radicals in Solution and Kochi -- Free Radicals.

Incompatibility of Nitric Acid.

An online search of the Chemical Abstracts (1972 to present) found that 364 articles were indexed under the terms "safety" or "hazard" for nitric acid. Of these articles, 26 were review articles. Bibliographic references and abstracts were downloaded. A general search of nitric acid in the Hazardous Materials data base (TOMES) reveals that nitric acid is incompatible with several organic solvents present in the LBL wastes.

General Reactions of Nitric Acid with Organics.

Nitration. The active nitrating reagent in nitric acid is believed to be (NO_2^+). An equilibrium (eq 1) is proposed to lie to the left with ca. 4% NO_2^+ in concentrated nitric acid. Addition of water will shift the equilibrium to the right.

Activated aromatics are more easily nitrated. However addition of a nitro group to an aromatic ring deactivates the ring and subsequent nitration steps become less favorable.

Nitration of Aliphatic compounds (e.g. hexane) is suggest to occur only at very high temperatures (400 °C).

Oxidation. In addition to nitration pathways nitric acid is a potent oxidizing reagent. There were no specific references to hazardous products formed from the nitric acid oxidation of cyclic alcohols and ketones in TOMES references. A survey of Fieser and Fieser listed a number of Organic Synthesis references, both cyclohexanol and cyclohexanone are oxidized to *adipic acid*. A cyclic ether was oxidized to an organic acid, and nicotine (a derivative of pyridine) is oxidized to nicotinic acid. Nitric acid oxidation of xylene yields *toluic acid*. As far as we understand these oxidation products pose no additional hazards.

Nitric acid and zinc is listed as incompatible in TOMES database. We did not find specific products to be aware of, however addition of nitric acid to zinc metal can generate hydrogen gas.

The low concentration of zinc in the LBL waste should pose little concern for hydrogen formation. For example Feiser and Feiser suggest activating Zn by washing with a solution of concentrated sulfuric acid with a few drops of concentrated nitric acid, to decant acid and dilute with water. They note that "A vigorous reaction with the dilute acid was allowed to proceed for a few minutes and the metal was collected", probable due to hydrogen gas formation.

Nitric acid and pyridine. The original reference to the TOMES database citation regarding the incompatibility of nitric acid with pyridine is in "Prudent Practices for Handling Hazardous Chemicals in the Laboratory" published by NAP. In the original citation a caution is listed that "pyridine reacts violently with ... nitric acid.... On decomposition, *cyanides* can be liberated."

Ethers/Alcohols. Nitrate esters are industrial high explosives. An early review entitled, "The Chemistry of Nitrate Esters" (Chem Reviews 1955, 55, 485) was found in our personal files. It discusses preparations, solvolytic decomposition and physical and chemical properties

- They can be formed from alcohols and nitric acid.
- They are decomposed under basic conditions to alcohols, olefins and aldehydes.

-
- They have characteristic IR bands, (6.1, 7.8 and 11.8 microns)

Storage of Nitric Acid.

One citation recommended that **nitric acid not be stored in polypropylene bottles**, because of gradual embrittlement (one LBL bottle has both nitric and hydrofluoric acid R010904).

A search of the cited reference (Brethenick 1985) pertinent to the LBL waste made two recommendations:

- (1) Concentrated nitric acid solutions containing **diethyl ether** or alcohols should be diluted or neutralized and
- (2) Mixtures of containing over 5% nitric acid and alcohols should not be stored (Fromm 1949).

It was suggested that these precautions would have prevented reported explosions of nitric acid diethyl ether solutions (Holt 1981) and (Fischer 1902). Some work suggests that formation of ethyl nitrate, not peroxides were responsible for the reported explosions (Anon. 1981). **Ethanol** may have been a commercial impurity or may have formed acid catalyzed hydrolysis of diethyl ether.

Additional References.

There are a series of French language review articles (Cah. Notes Doc.) that reportedly discuss the reactivity of nitric acid with a series of organic and inorganic components.

Nitric acid with:

Hydrocarbons	Cah. Notes Doc. 1979, 95, 293-305.
Ethers	Cah. Notes Doc. 1976, 82, 127-9.
Alcohols	Cah. Notes Doc. 1976, 82, 121-5.

These may contain useful information. They would have to be ordered from a document delivery service and translated.

PEROXIDES

As has been pointed out by Beverly Crawford, peroxides are known to form upon prolonged storage of alkyl alcohols and ethers (**diethyl ether, THF, isopropanol**). In general the peroxide formation is increased in the presence of air and/or light. We have found citations that show traces of **MEK** (2-butanone) increase the rate of formation of peroxides in **IPA** (Bretherick, 1985, pg 379). Peroxides of **IPA** are formed in the dark, however at a slower rate than when exposed to full light (Redemann, C. E. JACS, 1942, 64, 3049).

Alkyl ethers have been reported to yield explosive polymeric peroxides on treatment with acids and many ethers auto-oxidize readily to yield peroxides in non-airtight containers (Kirk-Othmer Encyc. of Chem Tech, pg 48).

Cyclopentadiene monomer is reported to react spontaneously with oxygen to form "brown - gummy peroxide-containing products" (Kirk-Othmer Encyc. of Chem Tech, pg 424).

Formation of polyperoxides from olefins (e.g. cyclopentadiene) requires a 1:1 equivalent of olefin to oxygen. Addition of substituents to cyclopentadienes that can stabilize the resulting 6-peroxyalkyl radical can increase the rate of polyperoxide formation. There is a 1951 citation in Chem Ber, vol 84 pg 349 by Hock and Depke (in German) regarding the chemistry of the polyperoxide formed by oxidative polymerization of cyclopentadiene.

Polyperoxides. Polyperoxides can be formed by either the copolymerization of olefins and oxygen or by acid catalyzed polymerization of organic ethers. The Hanford Technical Library had one text, Organic Peroxides published in 1954. There were reference citations to the explosive nature of the polymer peroxides formed from cyclohexadiene and styrene. A search of CA online (1972 to present), NTIS reports from 1985 to present, and DOE reports since 1978 did not reveal any additional information on the hazards of polyperoxides.

FR Mayo published work on polyperoxides (Accounts Chem. Research 1961, JACS 1956). A review of these papers are references cited within suggested that the polyperoxides explosions are less probable when solvents are present. *Polyperoxides are also reported to react poorly to peroxide tests* (Mayo, Russel JACS 1957)

Summary

Extreme care should be exercised when handling the LBL waste. The "reaction conditions" for the above mixtures may have generated either peroxides and or nitrate esters. If any of the storage containers are not air-tight peroxide formation should be assumed.

The above references recommend:

- . that nitric acid solutions above 5% not be stored for prolonged periods.
- . that nitric acid solutions not be stored in plastic bottles.
- . nitric acid and primary alcohols (present in ether) can form explosive nitrate esters
- . observation of solid crystals may be due to the formation of polymeric peroxides and that "bomb squad" techniques be considered
- . isopropyl alcohol, diethyl ether and the cyclopentadienyl derivatives auto-oxidize to form peroxides

Addendum. (3/15/95)

Regarding the effect of aqueous solvents on polyperoxide stability as per request.

I did not find any specific information regarding the stability or decomposition of polyperoxides in aqueous media in my search of CA (1972 to present) or in the papers we found published on the subject (of polyperoxides).

The closest information that we found regarding the decomposition of polyperoxides was in a 1956 paper by Mayo and Miller. The authors discussed the decomposition of styrene polyperoxide under a variety of conditions. The polyperoxides are decomposed efficiently by organic amines, however organic acids "exhibited little catalytic effect on decomposition". Perchloric acid at 60 °C lead to a 40 % decomposition after 6 hours. There was no information regarding nitric acid decomposition.

There was little information regarding the decomposition at ambient temperatures, most of the decomposition experiments were performed at temperatures between 80 - 100 °C. They did report the hydrolysis of the styrene polyperoxide was > 80 % after 11 hours of steam distillation (100 °C)

Treatment Considerations. 3/20/95

Nitric Acid. From what we gathered in our literature review, nitric acid solutions should not be stored in concentrations above 5%. Therefore neutralization or dilution to nitric acid concentration below 5% is recommended.

Nitrate esters are hydrolyzed to alcohols, alkenes or aldehydes and nitrate ion (NO₃⁻) under alkaline and neutral hydrolysis conditions. Thus neutralization should additionally decrease the concentration of any nitrate esters and their associated hazards.

Peroxides. The presence of polyperoxides should be handled with extreme caution. As stated in our literature survey, "any sign of crystals ... and bomb squad techniques should be used". They are especially troublesome since they are reported to not give accurate results to normal peroxide tests. Polyperoxides are reported (Mayo and Miller) to decompose under basic conditions. Organic bases were better than aqueous alkaline bases because of immiscibility of base and peroxide.

Organic peroxides are decomposed by reducing agents, ferric salts, potassium iodide and sodium hydrogen sulfite. The reducing agents may not be effective under acidic conditions therefore neutralization would improve the reaction conditions.

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