ENGINEERING CHANGE NOTICE

Page 1 of 2

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SDD/DD ☐ Functional Design Criteria ☐ Operating Specification ☐ Criticality Specification ☐ Conceptual Design Report ☐ Equipment Spec. ☐ Const. Spec. ☐ Procurement Spec. ☐ Vendor Information ☐ OM Manual ☐ FSAR/SAR ☐ Safety Equipment List ☐ Radiation Work Permit ☐ Environmental Impact Statement ☐ Environmental Report ☐ Environmental Permit ☐	Seismic/Stress Analysis ☐ Stress/Design Report ☐ Interface Control Drawing ☐ Calibration Procedure ☐ Installation Procedure ☐ Maintenance Procedure ☐ Engineering Procedure ☐ Operating Instruction ☐ Operating Procedure ☐ Operational Safety Requirement ☐ IEPD Drawing ☐ Cell Arrangement Drawing ☐ Essential Material Specification ☐ Fac. Proc. Samp. Schedule ☐ Inspection Plan ☐ Inventory Adjustment Request ☐	Tank Calibration Manual ☐ Health Physics Procedure ☐ Spares Multiple Unit Listing ☐ Test Procedures/Specification ☐ Component Index ☐ ASME Coded Item ☐ Human Factor Consideration ☐ Computer Software ☐ Electric Circuit Schedule ☐ ICRS Procedure ☐ Process Control Manual/Plan ☐ Process Flow Chart ☐ Purchase Requisition ☐ Ticker File ☐																																			
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Tank Farms Solid Waste Characterization Guide With Sampling And Analysis Plan Attachment

J. T. Quigley

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Key Words: Hazardous Chemical Characterization, Solid Waste, Tank Farms, Sampling and Analysis.

Abstract: This document describes methods used, including sampling and analysis, to characterize hazardous chemical constituents in Tank Farms containerized solid waste.

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TANK FARMS SOLID WASTE CHARACTERIZATION GUIDE
WITH
SAMPLING AND ANALYSIS PLAN ATTACHMENT

Prepared by Jean T. Quigley
March, 1997
For Rust Federal Services Hanford (RFSH)

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LIST OF TERMS

ALARA	as low as reasonably achievable
AS	Analytical Services
ASTM	American Society for Testing and Materials
CFR	Code of Federal Regulations
Cs-137	Cesium-137
CWDR	Chemical Waste Designation Request
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
FDH	Fluor Daniel Hanford, Inc.
GS/OF	Generator Services/Operating Facilities
GS/O	Generator Services/Operations
HAZCAT	Hazardous Categorization
HEPA	High-Efficiency Particulate Air (Filter)
HPT	Health Physics Technicians
HSQMP	Hanford Sampling Quality Management Plan
HWDA	Hazardous Waste Designation Analysis Report
LDR	Land Disposal Restrictions
LLW	Low-Level Waste
LMHC	Lockheed Martin Hanford Corporation
MSDS	Material Safety Data Sheet
MW	Mixed Waste
mg/l	milligrams per liter
NHC	Numatec Hanford Corporation
PCBs	Polychlorinated biphenyls
PIN	Package Identification Number
ppm	parts per million
QA	quality assurance
QC	quality control
RCRA	Resource Conservation and Recovery Act
RFSH	Rust Federal Services of Hanford, Inc.
RFSNW	Rust Federal Services Northwest
SAP	Sampling and Analysis Plan
SAS	Special Analytical Support
SDLA	Sample Data and Laboratory Administration
SML	Sampling and Mobile Laboratories
SVOA	semi-volatile organic analysis
TC	Toxicity characteristic
TCLP	Toxicity Characteristic Leaching Procedure
TCRs	Tank Characterization Reports
TCRC	Tank Characterization Resource Center
TF	Tank Farms
TS	Technical Services
TSCA	Toxic Substance Control Act
TWRS	Tank Waste Remediation Systems
VOA	volatile organic analysis
VOC	volatile organic compound
WDOE	Washington State Department of Ecology
WSCF	Waste Sampling and Characterization Facility

LIST OF DEFINITIONS

Carcinogen

Any substance that can cause or contribute to the production of cancer.

Characteristic

Any one of the four categories used in defining hazardous waste: ignitability, corrosivity, reactivity, and toxicity.

Constituent or Dangerous Waste Constituent

A chemically distinct component of a dangerous waste stream or mixture (WHC 173-303-040).

Corrosive Material

A liquid or solid that causes visible destruction or irreversible alterations in human skin tissue at the site of contact, or a liquid that has a severe corrosion rate on steel or aluminum. (49 CFR 171.8)

Curie or Ci

A quantitative measure of radioactivity equal to 3.7×10^{10} disintegrations per second.

Dangerous Waste

Waste that is listed as a dangerous waste, exhibits the characteristic(s) of hazardous waste (i.e., ignitable, corrosive, reactive, and/or toxic), or meets the criteria for dangerous waste (i.e., toxicity, or persistence). The lists, characteristics, and criteria are specified in WAC 173-303.

Detection Limit

Lowest amount that can be distinguished from the normal random "noise" of an analytical instrument or method.

Equivalent Method

Any testing or analytical method other than the U.S. EPA's criteria (40 CFR 53.11, 53.16, 60.2, 61.02, 260.10).

Field Sampling Plan

Provides guidance for all fieldwork by defining in detail the sampling and data-gathering methods to be used on a project.

Halogenated Hydrocarbons

Family of compounds consisting of hydrocarbons bonded to one or more halogen atoms (fluorine, chlorine, bromine, or iodine).

Hazardous Waste

Those solid wastes designated by 40 CFR Part 261, and regulated as hazardous and/or mixed waste by the USEPA. (WAC 173-303-040), (40 CFR 260.10), (10 CFR 61.2), (DOE Order 5820.2A Attachment 2), (49 CFR 171.8)

Heavy Metals

A set of metals which are commonly measured because of their high toxicity. They can damage living things at low concentration and tend to accumulate in the food chain. The series includes: arsenic (As), barium (Ba), cadmium (Cd), chromium (Cr), lead (Pb), mercury (Hg), selenium (Se), and silver (Ag).

Holding Time

The amount of time allowed to elapse from sample collection until laboratory analysis and/or extraction as specified by the contract, statement of work, method, or regulatory requirement.

Ignitability

Identifies a waste that may cause a fire during routine disposal and storage conditions. (WAC 173-303-090 [5]), (WAC 173-303-040)

Listed Waste

Wastes which are designated under WAC 173-303-080 through -082.

Low-Level Waste

Waste that contains radioactivity and is not classified as high-level waste, transuranic (TRU) waste, or spent nuclear fuel or 11E(2) byproduct material as defined by DOE Order 5820.2A.

Material Safety Data Sheet (MSDS)

A compilation of information required under the OSHA Communication Standard on the identity of hazardous chemicals, health, and physical hazards, exposure limits, and precautions.

Mixed Waste

Waste containing both radioactive and hazardous components as defined by the Atomic Energy Act (ATEA) and the Resource Conservation and Recovery Act (RCRA), respectively. (10 CFR 20.1003)

PCBs

A group of toxic, persistent chemicals (polychlorinated biphenyls) used in transformers and capacitors for insulating purposes, and in gas pipeline systems as a lubricant.

Persistence

Refers to the length of time a compound, once introduced into the environment, stays there. A compound may persist for less than a second or indefinitely.

pH

A measure of the acidity or alkalinity of a liquid or solid material.

Process Knowledge

Documented evidence of past or current industrial (including chemical) practices.

Quality Assurance (QA)

An integrated system or program of activities involving planning, quality control, quality assessment, reporting and quality improvement to ensure that a product or service meets the defined standards of quality with a stated level of confidence.

Quality Control (QC)

The overall system of routine technical activities whose purpose is to measure and control the quality of a product or service so that it meets the needs of its users.

Radioactive Material

Any material having a specific activity greater than 0.002 microcuries per gram (uCi/g). (49 CFR 173.403)

Radioactive Waste

Solid, liquid, or gaseous materials, of no commercial value that emits ionizing radiation. Discarded items such as clothing, containers, equipment, rubble, residues, or soils that contain radionuclides.

Reactivity

Identifies wastes that presents a hazard because they are unstable or extremely reactive. (WAC 173-303-090 [7]), (WAC 173-303-040)

Sample

(1) Material or a set of samples drawn from a larger set or population that is taken to represent the larger. A single sample can comprise a sample; however, statistical constraints generally require that a sample be comprised of no less than three samples. (2) A portion or subset of a population selected to be representative of the population.

Sampling

The process of selecting a set of samples from a given population in accord with a preselected scheme for determining which samples to take and when to take them. At some level the selection of samples should be fully randomized.

Split Sample

Samples taken from a single homogenous medium, placed in separate containers and sent to separate laboratories for analysis by the same method/protocol.

Toxicity

The degree of danger posed by a substance to animal or plant life. A solid waste has the characteristic of toxicity if the TCLP test shows that the extract from a representative sample contains specified contaminants at a concentration equal to or greater than that called for by RCRA Regulations.

Toxicity Characteristics Leaching Procedure (TCLP)

The procedure by which a waste is determined to exhibit the toxicity characteristic. If, by using test methods specified in Appendix II of 40 CFR 261, or equivalent methods approved by the EPA Administrator, the extract from a representative sample of a waste contains contaminants listed in Table I of 40 CFR 261.24 at concentrations equal to or greater than the values in that table, the waste exhibits the toxicity characteristic.

Trip Blank

An analyte sample container filled with pre-certified silica sand which is transported to the sampling site, and returned to the laboratory with the samples. Trip blanks are filled in the laboratory and are not to be opened in the field.

Volatile Organic Compound (VOC)

Any organic compound which participates in atmospheric photochemical reactions, except for those designated by the EPA Administrator as having negligible photochemical reactivity. Any component containing carbon and hydrogen or containing carbon and hydrogen in combination with any other element which has a vapor pressure of 1.5 pounds per square inch absolute (77.6 mm. Hg) or greater under actual storage conditions (40 CFR 60.391, 60.461).

Waste Container

The waste, waste package, and any absorbent that are intended for disposal as a unit.

Waste Stream

A waste stream is any consistent set of waste material from a given process or set of closely related processes that does not change in its physical, radionuclide or chemical designation, or in its means of packaging. Waste streams are established to meet the requirements in the Waste Specification System document, WHC-EP-0846.

1.0 INTRODUCTION

1.1 BACKGROUND

Lockheed Martin Hanford Corporation (LMHC) manages the activities of the 200 East and West tank farms. Rust Federal Services Hanford (RFSH), Generator Services/Operating Facilities (GS/OF) manages, for LMHC, all containerized solid waste generated from these activities. Activities that generate waste include, but are not limited to, routine maintenance, clean-up, upgrades, spills, excavations, and removal or repair of equipment.

The containerized solid waste is transported from the point of generation to the 209E facility. GS/OF receives waste which is classified as either Hazardous/Dangerous, Low-Level, Mixed, or Non-Regulated waste. The waste is characterized for proper designation and then prepared for shipment to a disposal, storage, or recycle facility. Hazardous/Dangerous and Mixed waste must be characterized, designated and shipped within a 90-day holding period.

The regulatory drivers which require waste generators to characterize their waste streams are found in 40 CFR, Part 260 - 299, the Washington Administrative Code, Dangerous Waste Regulations, 173-303, and the Department of Energy Directives (DOE Order 5820.2A). The "Hanford Site Solid Waste Acceptance Criteria", WHC-EP-0063-4 and "Waste Specification System", WHC-EP-0846 also gives guidance to waste generators in characterizing waste streams. This document does not apply to high-level radioactive waste.

Hazardous chemical, physical, and radioactive characterization data and information is necessary to properly designate tank farm containerized solid waste for treatment, storage, disposal, and/or recycle. The following methods are presently used to acquire characterization information:

- (1) process knowledge,
- (2) Material Safety Data Sheets (MSDS's),
- (3) Cesium-137 (Cs-137) activity ratios, and
- (4) sampling and analysis of solid waste.

Solid waste is classified as either hazardous/dangerous, low-level, mixed, or non-regulated waste. Solid waste is also categorized into tank farm waste streams (i.e., tank-contacted debris including HEPA filters, soils, low-level debris).

Hazardous/Dangerous Waste

Hazardous waste is characterized by using process knowledge, material safety data sheet (MSDS) information, and when necessary, sampling and analysis data, particularly, for unknown wastes. (Washington State uses the term "Dangerous Waste" to describe hazardous and extremely hazardous waste characteristics and criteria).

Low-Level Waste

Low-level waste is characterized by using process knowledge, MSDS information, and sampling and analysis data.

Mixed Waste

Mixed waste is characterized by using process knowledge, the Cs-137 activity ratios, MSDS information, and sampling and analysis data.

Non-regulated Waste

Non-regulated waste is characterized by using process knowledge, MSDS information, and when necessary, sampling and analysis data.

1.2 PURPOSE

The purpose of this document is to discuss the current methods available and used to characterize hazardous chemicals in tank farm containerized solid waste.

1.3 SCOPE

This plan will discuss methods of waste characterization, with an emphasize on the sampling and analysis methods used to identify hazardous chemicals in waste.

Radiological characterization of tank farms containerized solid waste is addressed in document WHC-SD-WM-PLN-115⁽¹⁾.

1.4 RESPONSIBILITIES

Technical Services (TS)

- Reviews and approves Waste Portfolios submitted by Generating Services/Operating Facilities (GS/OF).
- Issues Hazardous Waste Designation Analysis Report (HWDAR) and reviews Chemical Waste Designation Request (CWDR).

Generating Services/Operating Facilities (GS/OF)

- Defines, confirms, and verifies hazardous chemical characterization of containerized solid waste.
- Identifies solid waste containers in need of sampling and analysis. Requests waste sampling and analyses.
- Interface between GS/O and outside sampling (SML) organizations.
- Requests waste analyses from Special Analytical Support, 222-S laboratory, or the Waste Sampling Characterization Facility (WSCF).
- Performs designation of waste based upon characterization data.

Generator Services/Operations (GS/O)

- Provide support and oversight of outside sampling organizations during sampling activities according to Tank Farm Plant Operating Procedure, TO-100-053.

Sampling and Mobile Laboratories (SML)

- Collects specified samples according to SAF.
- Ships samples to on-site and off-site laboratories.
- Maintains field logbook, prepares chain-of-custody records.

Special Analytical Support (Numatec Hanford Corp.)

- Provides trained scientists/technicians for field sampling and laboratory analysis of specified samples.
- Transports samples to laboratories.
- Documents sampling activities in a controlled logbook, prepares chain-of-custody records.
- Generates data report detailing analytical results, methods used, quality control samples.

2.0 CHARACTERIZATION METHODS

2.1 Process Knowledge

General Use

Documented evidence of past or current industrial practices that use hazardous or non-hazardous chemicals, is used to characterize solid waste streams.

Process knowledge of chemical products used in operating or maintaining tank farm equipment is used in characterizing waste generated from clean-up activities or equipment maintenance and/or failures. Waste streams could include paint wastes, shop clean-out wastes, oil spill wastes, equipment chemical changeouts.

Specific Use - Listed Wastes

Mixed waste streams, in particular, tank-contacted debris and contaminated soil, specifically use process knowledge in defining listed waste issues.

Process knowledge is considered to be documented evidence of past or current industrial practices that use hazardous or "listed" chemicals, and indicates that these chemicals are found in current waste storage tanks. The contents of the waste tanks is presumed to be the primary source of any contamination found in the tank farms.

Past Hanford Site chemical processing operations generated mixed waste. This mixed waste was transferred from the chemical process plants to underground storage tanks on the Hanford Site. The tanks are located in the 200 East and 200 West area tank farms.

There are 149 single-shell tanks with a collective design capacity of 91,880,000 gallons. There are 28 double-shell tanks with a collective design capacity of 43,000,000 gallons. The double-shell tanks are used for the interim storage of mixed waste. These tanks are considered storage units.

In addition to the above tanks, there are numerous smaller capacity single- and double-shell tanks located within the farms, including a variety of waste storage and transfer tanks.

Tank waste hazardous chemical constituents have been determined by reporting 0.01 percent by weight of the net weight of the waste for each of the listed hazardous constituents. This method is consistent with the "derived-from rule", which requires solid waste that comes into contact with a listed waste (tank waste is a listed waste) be managed as a hazardous waste.

"Listed" chemicals used in the extraction processes require that waste codes be assigned to the present waste. Waste codes may be assigned solely on the source of the waste and need not consider waste characteristics or compositions. These codes may be for specific sources, such as wood preservation or for non-specific sources. Hanford tank waste have been assigned the following non-specific, source codes ⁽²⁾: F001, F002, F003, F004, and F005. A further explanation of waste codes may be found in 40 CFR Part 261.

Tank-contacted waste and contaminated soil is assigned the above codes due to the "derived-from" and "mixture" rules ⁽³⁾ and managed as mixed waste. Through process knowledge, it is believed that all the above F-codes apply to tank contacted waste. However, all of the codes may not apply to every individual tank. Accurate documentation is unavailable for every introduction and transfer of listed waste, (i.e., listed solvents). Due to these past practices, the above codes are currently applied to all tank contacted waste.

Process knowledge detailing concentrations of the "listed" chemicals in the tank waste is limited at the present time. As current tank waste core sampling data becomes available, new information concerning "listed" chemicals will be used where appropriate to characterize solid waste. It is conservatively assumed that each of these "F-listed" chemicals is present in tank-contacted debris in concentrations of no more than 0.01% of the weight of the waste. Current data acquired from sampling of tank contacted waste supports this assumption, thus far.

Current sampling data results indicate that the "F-listed" chemicals are present in tank farm contaminated soil waste in the following concentrations:

<u>Constituent</u>	<u>Assumed Concentration in Waste</u>
F001 (1,1,1-Trichloroethane)	< 1.0 mg/kg
F002 (Methylene chloride)	< 1.0 mg/kg
F003 (Acetone)	< 10 mg/kg
F003 (Methyl isobutyl ketone)	< 1.0 mg/kg
F004 (Cresols)	< 10 mg/kg
F005 (Methyl ethyl ketone)	< 1.0 mg/kg

"F-listed" Chemicals Process Sources

The Hanford Site processes which introduced "listed" chemicals to the tanks are:

<u>Waste Code</u>	<u>Organic Listed Chemical Waste</u>
-------------------	--------------------------------------

F001	1,1,1 - Trichloroethane (TCE)
------	-------------------------------

Process: (4)(5)

Process knowledge indicates that a B-Plant activity, prior to 1988, generated the source of 1,1,1 - Trichloroethane (TCE). A spent solvent solution containing TCE was used for crane decontamination activities. The crane was sprayed with TCE, and the TCE residue fluid drained thru the B-Plant process drainage system (cell 21 or cell 16) and then on into the low-level waste collection system.

The low-level waste generated in B-Plant was processed thru the E-23-3 concentrator. The condensed vapor from operating the concentrator was collected in two 13,000 gallon holding tanks which was then transferred to the double-shell tank farms.

<u>Waste Code</u>	<u>Organic Listed Chemical Waste</u>
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F002	Methylene Chloride
------	--------------------

F003	Acetone
------	---------

Process: (4)(6)(7)

T-Plant performs decontamination activities on equipment to reduce or remove smearable radiological contamination. Depending upon the type of equipment and the nature of the contamination, the following decontamination methods have been used in the past: steam cleaning, high-pressure water application, blasting with dry and wet abrasives, acid/base chemical baths, and occasional cleaning by hand using small amounts of solvents and detergents. Waste from these processes goes to Tank 15-1.

Although not currently used at T-Plant, previous operations used acetone and methylene chloride as decontamination agents. Between 1986 and 1988, four commercial decontamination solutions containing greater than 10% methylene chloride were used at T-Plant. About 35 gallons of methylene chloride were used per year at T-Plant. Small amounts of acetone and methylene chloride may still be present in the tank system, thus making T-Plant waste a "listed" waste.

<u>Waste Code</u>	<u>Organic Listed Chemical Waste</u>
F003	Acetone
F003	Methyl isobutyl ketone or (Hexone)

Process: (4)(6)

In addition, to its use at T-Plant, Acetone was used in laboratories to dry glassware and consequently, could have been discharged to the tank farms. Acetone is a volatile organic and probably originates from the evaporation and condensation process in the 242-A Evaporator. The DST waste has been determined to be a listed (F003) source because of the presence of Acetone. Consequently, the 242-A process condensate is also an F003 waste because it is derived from DST waste.

Between 1951 and 1966, the Redox Plant used a distillation process to clean Hexone for reuse in the solvent extraction process. Hexone was first washed with sodium carbonate to remove the radiation-produced degradation products, then distilled to remove the water that had dissolved in it during washing. The water left behind was combined with the high-level waste stream for final steam stripping in the plant's waste concentrator. This step recovered any hexone dissolved in the high-level waste stream or in the water sent over from the distillation process. After steam stripping the concentrated high-level waste was sent to boiling waste SSTs in the 241-S and 241-SX Tank Farms. Steam stripping is a recommended recovery technique for Hexone (40 CFR Part 268).

<u>Waste Code</u>	<u>Organic Listed Chemical Waste</u>
F004	Cresols and Cresylic Acid

Process: (8)(9)

T-Plant documents and nuclear process operators state that the product "CTD-99", also referred to as Chemstrip, was used and stored at T-Plant. Considering the configuration of the liquid waste handling system at T-Plant, it is probable to suspect this source entered the tank system. "CTD-99" contains up to 20% cresylic acid, according to MSDS #10727. "CTD-99" was used as a tank cleaning agent or sprayed directly onto equipment being decontaminated.

Waste Code

Organic Listed Chemical Waste

F005

Methyl ethyl ketone or (2-Butanone)

Process: (4)(6)

Methyl ethyl ketone was used in the Redox analytical (222-S) laboratories and may have been discharged through the drains to the tank farms.

Specific Use - Toxic Substance Control Act (TSCA) Waste

The Backlog Waste Program generated 769 drums and five boxes of tank farm soils to waste storage. During this program, Tank farms had no process knowledge of any Polychlorinated biphenyls (PCBs) contamination or spills within the farms that would designate and regulate the backlog soils for PCBs.

In 1996, additional waste sampling and analysis of the stored backlog soils occurred resulting in the determination that PCBs do exist in some of these soils. The detection of PCBs in these soils was unexpected and the source of the PCB contamination can not be identified in the tank farms.

The Toxic Substance Control Act (TSCA) regulates the management and disposal of Polychlorinated biphenyls (PCBs). At one time, PCBs were used as a heat transfer fluid in Hanford capacitors and transformers. PCBs have also been identified as a component in heavy equipment hydraulic fluid. Electric Utilities has not identified any historical spills or leaks from any transformers located within the tank farms.

Due to this recent backlog soil sampling data information, all newly generated tank farm soil waste should be field screened for PCB contamination. If the field screen result indicates the presence of PCB above 1 ppm and there is no known source of contamination, then the waste should be managed under TSCA as regulated waste.

2.2 Material Safety Data Sheets (MSDSs)

Process knowledge of chemical products used during operations may identify other hazardous chemicals in the waste streams. Information concerning the hazards or non-hazards of these chemical products may be gathered from the Material Safety Data Sheet (MSDS) provided by the product manufacturer.

Information found on a chemical product MSDS may include:

- Product/Manufacturer Chemical Identification
- Precautionary Labeling
- Chemical Components - Hazardous Ingredients
- Physical Data
- Fire and Explosion Hazard Data
- Health Hazard Data - Toxicity Data
- Effects of Overexposure
- Emergency and First Aid Procedures
- Reactivity Data
- Spill and Disposal Procedures
- Industrial Protective Equipment
- Storage and Handling Precautions
- Transportation Data

2.3 Cesium-137 Activity Procedure ⁽¹⁰⁾

Tanks contain certain TCLP metals. Tank-contacted debris waste is not easily sampled for TCLP metals. Therefore, the concentration of the TCLP metals on tank-contacted debris is estimated by relating metals to Cs-137 concentrations. The Cesium(Cs)-137 activity procedure is used to provide a worst-case estimate of toxicity characteristic (TC) metals for tank-contacted debris. This method uses the worst-case ratio of each TC metal to Cs-137 activity from historical tank sampling data. If this method determines that a container may be designated for one of the TC metals, tank specific sampling data may be evaluated to determine more accurately whether a "D-" waste code should be added to the container. Typically, the Cs-137 activity of a container must exceed 0.01 Ci for there to be any possibility of adding waste codes for TC metals using this method.

Cs-137 activity determination in a laboratory or field setting is relatively easy and inexpensive. Cs-137 activity was selected to correlate the composition of individual waste packages to the composition of bulk tank waste.

First, constituent concentrations were compared to the Cs-137 activity for each waste tank using data available from historical tank characterization studies. Ratios of constituent concentration to Cs-137 activity were then derived for each tank and then compared on a tank-to-tank basis. A worst-case ratio for each constituent was utilized to calculate a maximum expected concentration. In this manner a laboratory or field measurement of Cs-137 activity may be used to calculate the amount of all significant tank waste constituents in each waste container.

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Worksheets were developed to simplify and organize the calculations required by the generator.

The following procedure is used to determine composition information on tank-contacted waste:

- Step 1. Obtain the Cs-137 activity (in Ci) of the waste container by nondestructive assay of the container.
- Step 2. Divide the Cs-137 activity by the weight of the waste matrix (in grams). The waste matrix weight is defined as the weight of all waste materials inside the container, but DOES NOT include the weight of the waste container or any void space filler materials. Enter the Cs-137 concentration (in Ci/g) in column 2 of Table 1-1, Attachment A.
- Step 3. Multiply the Cs-137 concentration in column 2 by the ratios in column 3. Multiply that number by 100%. Enter the results in column 5.
- Step 4. Determine whether the worst-case ratio values from Column 5 are potentially above the WAC-173-303 limits.
- Step 5. The TC constituent concentration is compared with the TC metal limits located in WAC-173-303-090(8), normalizing to account for dilution during the TCLP extraction.

If this method results in a waste designation which is considered unnecessarily restrictive, laboratory data for each tank, tank farm, or waste container may be substituted for the values from Table 1-1. A catalog of data is maintained by the Tank Characterization Resource Center (TCRC). The catalog is updated every six months. GS/OF is on the distribution list for this catalog, as well as for the Tank Characterization Reports (TCRs).

The ideal situation for characterization by scaling factors would be to have a complete, high-confidence database available for each tank to ensure that the calculated values of the hazardous and radioactive constituents remain conservative. Los Alamos National Laboratory (LATA) has been tasked with compiling an estimate of the chemical and radionuclide compositions of the 177 Hanford High Level Waste storage tanks. This inventory is entitled the Hanford Defined Waste (HDW) model. The latest HDW Model, Rev. 4 was published in January, 1997, with the final revision due by late 1997. This inventory has been compiled from historical waste transaction records, tank waste addition histories, waste calculations, process knowledge, and tank waste sampling characterization efforts. This final inventory, along with

additional waste sampling and laboratory analysis, will assist in validating the characterization ratios used in this document. As more accurate data become available, the ratios will be updated and the degree of accuracy of waste characterization can be calculated and improved. Through process knowledge waste characterization should be documented and incorporated into a sampling and analysis program.

2.4 Sampling and Analysis of Containerized Solid Waste

Sampling and analysis of containerized solid waste provides information required to properly designate waste for storage, disposal and/or recycle. Sampling and analysis of waste verifies what is known to be true about the waste stream from process knowledge, in addition to providing new information concerning the hazardous or non-hazardous components of the waste. The generator is responsible for providing accurate waste designation in order to safely transport, store, dispose, and/or recycle the waste in compliance with state and federal regulations.

Sampling and analysis of containerized waste is and will continue to be the best means available for characterizing and designating solid waste. Representative sampling and the subsequent analysis of suspected chemical contaminants of a current waste stream, helps determine the true nature of the waste. The more accurate waste streams are characterized, the better generated waste is managed, thus allowing for a more efficient run operation and waste management cost savings.

Sampling and analysis of containerized solid waste is required when one of the following conditions exist:

- (1) limited availability of process knowledge,
- (2) verification needed of process knowledge or Cs-137 ratio,
- (3) suspect chemical contaminants associated with waste,
- (4) limited availability of waste stream data,
- (5) limited availability of specific tank or specific tank farm waste stream data,
- (6) redesignation issue (i.e, change in waste stream),
- (7) all containerized tank farm soil will be field screened for Polychlorinated biphenyls (PCBs) content using the SW-846 immunoassay method 4020. This method identifies the presence of PCBs to a level of 1 ppm. The Toxic

Substance Control Act (TSCA) regulates PCB contaminated media when the PCB source concentration is greater than 50 ppm. If the field screening indicates that the soil has PCB contamination at the 1 ppm level or greater, and there is no known source, then the soil will be regulated under TSCA.

Container sampling selection is made due to any of the above conditions, in addition to appropriate dose rate, and budget constraints. Data acquired through sampling and analysis may result in no change in waste designation or a redesignation of the waste.

See Attachment B: "Tank Farms Containerized Solid Waste Sampling and Analysis Plan", for the steps used to acquire waste samples and analysis data.

3.0 Waste Designation

Upon acquiring sufficient waste characterization information, the following records are prepared for the formal waste designation:

3.1 Hazardous Waste

A Chemical Waste Designation Request (CWDR) is prepared and submitted to Technical Services (TS), accompanied by hazardous chemical characterization information and data. Waste designation is made and a Hazardous Waste Disposal Analysis Record (HWDAR) is issued to the generator. The waste may then be shipped for storage or disposal.

3.2 Low-Level Waste

A Waste Certification Summary is prepared for submittal to TS when sufficient hazardous chemical, radiological, and physical characterization information is collected concerning a waste stream.

Upon approval, these summaries become the guidelines for waste stream designation. If the waste stream should change significantly, characterization must address the change and a new waste summary prepared for TS. The waste may then be shipped for storage or disposal.

The following Waste Certification Summaries have been prepared and submitted to TS:

(1)	Miscellaneous Supercompacted
Low-Level Waste Debris	WSRd #102-02
(2)	Noncompacted Low-Level Waste Debris	WSRd #100-00
(3)	Low-Level Absorbed Organic Waste	WSRd #106-00
(4)	Noncompacted Low-Level Laundry By-Product	WSRd #100-00d
(5)	Supercompacted Low-Level Laundry
By-Product	WSRd #100-02a
(6)	Low-Level Tumbleweeds	WSRd #100-00b
(7)	Low-Level HEPA Filters	WSRd #100-00e

3.3 Mixed Waste

A Waste Certification Summary is prepared for submittal to TS when sufficient hazardous chemical, radiological, and physical characterization information is collected concerning a waste stream.

Once approval is given, these summaries become the guidelines for waste stream designation. If the waste stream should change significantly, characterization must address the change and a new waste summary prepared for TS. Once designated, the waste may be prepared for shipment to storage or disposal.

The following Waste Certification Summaries have been prepared and submitted to TS:

(1)	Tank Farms Contaminated Soil (F-listed)	WSRd #720-00
(2)	Tank Contacted Debris (F-listed)	WSRd #601-01
or
#801-00
(3)	Mercury Contaminated Waste	WSRd #601-01
or
#810-00
(4)	Miscellaneous Lab Packs	WSRd #400-00 or
401-00 or 402-00 or 420-00 or 403-00 or 421-00 or 406-00

(5)	Oily Solid Waste and Absorbed Chemical Products	WSRd #522-00 or #920-00
(6)	Used Respirator Mask Filter Cartridges - MSA GMD-H	WSRd #523-00
(7)	Long-Length Contaminated Equipment (F-listed)	WSRd #601-01a
(8)	Radioactive Lead	WSRd #800-00
(9)	Lead-Acid Battery Spill Waste	WSRd #503-00A
(10)	Nickel-Cadmium (Wet Cell) Battery	WSRd #830-01
(11)	Acid Contaminated Waste	WSRd #605-00
(12)	Alkaline Contaminated Waste	WSRd #606-00 or #626-00

3.4 Non-Regulated Waste

A CWDR is prepared and submitted to TS, accompanied by chemical characterization information and data. Waste designation is made and a Disposal Analysis record is issued to the generator. The waste may then be shipped for disposal or recycle.

4.0 Hazardous Chemical Characterization Program Goals

Hazardous chemical characterization of tank farms containerized solid waste supports Generator Services/Operating Facilities programs. This document will be revised based upon future data and information. The following goals are identified:

- (1) Update process knowledge, as needed, to include current tank characterization data as it becomes available.
- (2) Continue to sample and analyze containerized solid waste to better define specific waste streams from specific farms in relationship to specific tanks.
- (3) Define, trend, and track data collected in support of the Waste Certification Summary program.

REFERENCES

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2. Single-Shell Tanks and Double-Shell Tanks Part A, Part B permits.
3. Washington Administrative Code, Dangerous Waste Regulations, 173-303.
4. WHC Internal Memo 81100-92-026, "Addition of Listed Waste Codes F001 and F002 to Affected Part A Dangerous Waste Permit Applications", March 23, 1992.
5. WHC Internal Memo 85100-92-DMB-007, "Management Strategy for B Plant Aqueous Low-Level Waste", January 17, 1992.
6. WHC-EP-0342, "242-A Evaporator Process Condensate Stream-Specific Report", Addendum 15, August 31, 1990, pgs. 5-18 to 5-20.
7. WHC Letter with Enclosure #9159302D, "T Plant Treatment By Generator Request", January 10, 1992.
8. WHC Internal Memo 88400-93-006, "Addition of Listed Waste Code F004 to Affected Dangerous Waste Part A Permit Applications", February 18, 1993.
9. WHC DSI Attachment 88400-93-006, R.D. Pierce to R.J. Julian, "Listed Waste Codes for T Plant Tank Waste", February 08, 1993.
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11. Core Composite Sample Data (C-104), November 11, 1986.
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13. Internal Letter 65453-85-041, D.R. Bratzel to A.P. Appel, "Characterization of Complexant Concentrate Supernatant", February 28, 1985.
14. DSI, R.L. Weiss to V.C. Boyles, "BX Farm Liquid Analysis", March 16, 1990.

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15. PNL Letter, A.P. Toste to W.G. Richmond, "Selected Physicochemical Properties of Double-Shell Slurry-2 (DSS-2) Waste", September 25, 1987.
16. WHC-SD-WM-DTR-026, Herting, D.L., et al, "Laboratory Characterization of Samples taken in December 1991 (Window E) from Hanford Waste Tanks 241-SY-101, August 20, 1992.
17. WHC-EP-0063-4, Hanford Site Solid Waste Acceptance Criteria.
18. EPA 1986, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", SW-846, 3rd edition, with promulgated Final Update I package dated July, 1992.
19. 40 CFR, Part 261 - Identification and Listing of Hazardous Waste, Subpart C - Characteristics of Hazardous Waste, Subpart D - Lists of Hazardous Wastes, July 01, 1992.
20. WHC-EP-0846, "Waste Specification System", K.L. Kirkpatrick and B.L. Oswald, January, 1995.
21. WHC-SD-WM-PLN-088, "Hanford Sampling Quality Management Plan (HSQMP)", 1995.

ATTACHMENT A

Table 1-1. Hazardous Constituent Worksheet

Col. 1	Col. 2	Col. 3	Col. 4	Col. 5
Constituent	Cs-137 Concentration (Ci/g matrix)	Constituent Ratio (g metal/Ci)	% Conversion	Constituent Concentration (Wt. %)
Ag (D011)		2.79 E-05 ⁽¹¹⁾	x 100%	%
As (D004)		2.70 E-01 ⁽¹²⁾	x 100%	%
Ba (D005)		7.36 E+01 ⁽¹³⁾	x 100%	%
Cd (D006)		3.86 E+01 ⁽¹³⁾	x 100%	%
Cr (D007)		7.20 E+02 ⁽¹⁴⁾	x 100%	%
Hg (D009)		4.17 E+00 ⁽¹⁵⁾	x 100%	%
Pb (D008)		1.19 E+02 ⁽¹³⁾	x 100%	%
Se (D010)		3.65 E-01 ⁽¹⁶⁾	x 100%	%

Table 1-2. Toxicity Characteristics List

WAC 173-303-090(8)(c)

Contaminant/Code	Maximum Conc. (mg/l)	Contaminant Concentration (Wt.%)
Arsenic (D004)	5.0	0.01
Barium (D005)	100.0	0.2
Cadmium (D006)	1.0	0.002
Chromium (D007)	5.0	0.01
Lead (D008)	5.0	0.01
Mercury (D009)	0.2	0.0004
Selenium (D010)	1.0	0.002
Silver (D011)	5.0	0.012

(Toxicity Characteristic Leaching Procedure/TCLP: 20:1 dilution)

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ATTACHMENT B

**TANK FARMS CONTAINERIZED SOLID WASTE
SAMPLING AND ANALYSIS PLAN**

ATTACHMENT B

TANK FARMS CONTAINERIZED SOLID WASTE SAMPLING AND ANALYSIS PLAN

I. INTRODUCTION

Sampling and analysis of containerized solid waste determines or verifies whether or not the waste contains constituents or exhibits a characteristic or criteria that makes it hazardous. For regulatory purposes, hazardous/dangerous solid wastes are defined in terms of characteristics and criteria.

The Resource Conservation Recovery Act (RCRA) authorized the Environmental Protection Agency (EPA) to establish characteristics that make a waste hazardous (40 CFR, Part 261). Washington State has established Dangerous waste characteristics and criteria in WAC 173-303-090 and -100 for solid waste. Containers are sampled and analyzed for one or more of the following characteristics depending upon the nature of and what is known about the waste:

- (1) Characteristic of Ignitability - D001
- (2) Characteristic of Corrosivity - D002
- (3) Characteristic of Reactivity - D003
- (4) Toxicity characteristic - D004 thru D043

This characteristic includes determinations for toxic, heavy metals, volatile organics (VOAs), and semi-volatile organics (SVOAs).

Listed constituents are sampled to, 1) verify listing assumptions, and to, 2) determine if the waste meets Land Disposal Restriction (LDR) concentrations.

Waste may also be analyzed for other hazardous compounds, formulations, and classes of substances, such as Polychlorinated biphenyls (PCBs).

Washington State criteria consist of:

- (1) Toxic dangerous waste,
- (2) Persistent dangerous waste.

These criteria are determined by book designation (NIOSH RTECS) or biological testing for the toxic criteria and identifying halogenated or polycyclic aromatic hydrocarbon constituents in the waste for the persistent criteria.

II. OBJECTIVES

The objective of this sampling and analysis plan is to state the steps and requirements needed in acquiring representative solid waste samples for chemical analysis.

Solid waste samples are collected from containers and analyzed to resolve the following waste characterization issues:

- (1) to determine if hazardous constituents or characteristics are present.
- (2) to determine compliance with existing regulations by identifying contaminants which exceed any criteria or standards.
- (3) to obtain data to classify, treat, recover, recycle, or determine compatibility characteristics of the waste components.

III. RESPONSIBILITIES

Generator Services/Operations (GS/O)

- Provide support and oversight of outside sampling organizations during sampling activities according to Tank Farm Plant Operating Procedure, TO-100-053.

Generator Services/Operating Facilities (GS/OF)

- Defines, confirms, and verifies hazardous chemical characterization of containerized solid waste.
- Identifies solid waste containers in need of sampling and analysis.
- Interface between GS/O and outside sampling organizations.
- Requests waste sampling and analyses from SML, SAS, 222-S laboratory, or WSCF.
- Performs designation of waste based upon characterization data.

Sampling and Mobile Laboratories (SML)

- Collects specified samples.
- Ships samples to on-site and off-site laboratories.
- Maintains field logbook, prepares chain-of-custody records.

Special Analytical Support (SAS)

- Provides trained scientists/technicians for field sampling and laboratory analysis of specified samples.
- Transports samples to laboratories.
- Documents sampling activities in a controlled logbook, prepares chain-of-custody records.
- Generates data report detailing analytical results, methods used, quality control samples.

IV. REQUIREMENTS

SAFETY

ALARA principles must be taken into account when any sampling job is undertaken and in determining the waste containers to be sampled. Prior to beginning a sampling job, GS/OF and GS/O will address any and all safety concerns (i.e., exposure to radiation, organic vapors, asbestos, mercury, or biohazards). When appropriate, Health Physics (HP) and Industrial Health and Safety personnel will be present at the pre-job meeting and during the sampling job to address and monitor any potential safety hazard.

QUALITY ASSURANCE/QUALITY CONTROL

Sampling is the physical collection of a representative portion of the waste. A representative sample must be collected and handled in such a way as to preserve its original physical form and chemical composition, as well as to prevent contamination or changes in the concentration of the constituents to be analyzed. Sample integrity must be ensured and quality assurance standards maintained for a sample to be typical of the waste. QA/QC requirements are guided by the document, "Hanford Sampling Quality Management Plan (HSQMP)", WHC-SD-WM-PLN-088.

The collection, handling, and preparation of samples shall comply with the protocol of "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846". Other documented, verifiable techniques, such as ASTM methods, may be used when appropriate for the waste matrix. Composite samples of the waste matrices will be collected from the container. Field screening techniques may be used when appropriate, but should be verified with laboratory confirmation, if not an approved method.

Sampling personnel must adhere to and use appropriate sampling techniques, sampling equipment, precleaned bottles, chain-of-custody procedures, sample holding times, preservatives, and complete a controlled logbook entry to ensure proper quality control of the sample.

CHAIN-OF-CUSTODY/FIELD LOGBOOK

A chain-of-custody form will be filled out at the time of sampling and shall accompany each waste characterization sample. A sample may consist of several containers. The chain-of-custody will account for the whereabouts and handling of a sample and data from the point of collection to final determination.

All activities associated with the sampling event will be documented in a controlled field logbook. The sampling team shall retain ownership of the field logbook. Photocopies of the field logbook entries shall be forwarded to the GS/OF representative upon completion of the sampling event.

QA/QC SAMPLES

Trip Blanks

Trip blanks shall be collected every twentieth sample event. The trip blank shall be collected by filling a sample bottle with pre-certified silica sand, in order to apply for a solid matrix. Trip blanks should be treated and labeled in the same manner as the samples.

Duplicate Samples

One duplicate sample shall be collected for every 20 actual samples. A duplicate sample will be collected at the same time and from the same sample composite. The duplicate shall be analyzed for the same constituents as the actual sample that it represents. The laboratory analyzing the samples shall not be able to ascertain the existence of a duplicate sample thru any accompanying documentation.

Laboratory Split Samples

At a minimum, 10% of the samples taken shall be collected as split samples to be sent to different laboratories.

V. SAMPLING AND ANALYTICAL ORGANIZATIONS

Presently, two on-site organizations are available and capable of sampling tank farm containerized solid waste.

SPECIAL ANALYTICAL SUPPORT (SAS)

SAS performs the following:

- (1) Samples solid waste containers, transports sample to 222-S or the WSCF laboratory for activity screening, if required, and then performs sample analysis at their on-site laboratory facilities.

- (2) Samples solid waste containers, transports sample to 222-S laboratory for activity screening, if required, and then transports sample for analysis to an off-site laboratory.
- (3) Performs field assessment analytical tests (HAZCAT) on a waste with follow-up verification on-site laboratory analysis.

The SAS group follows sampling procedures outlined in WHC-CM-7-7, "Environmental Investigations and Site Characterization Manual". The SAS group uses analytical methods outlined in WHC-IP-1128, "Special Analytical Services Procedures". GS/OF only requests SAS to perform sampling and analytical methods adhering to SW-846 protocol for waste designations.

SAMPLING AND MOBILE LABORATORIES (SML)/HANFORD SAMPLE DATA AND LABORATORY ADMINISTRATION (SDLA)/ANALYTICAL SERVICES (AS)

SML samples containers and transports the samples for analysis to on-site laboratories or an off-site laboratory. SML uses sampling procedures outlined in WHC-CM-7-7, "Environmental Investigations and Site Characterization Manual" and WHC-IP-1127, "Sample Mobile Laboratories Procedures Manual". GS/OF requests SML to perform sampling methods adhering to SW-846 protocol.

AS coordinates the requested analyses of the samples with the off-site laboratories. AS verifies that the requested analytical methods adhere to SW-846 protocol.

VI. SAMPLING AND ANALYSIS COURSE OF ACTION

The steps GS/OF follows for acquiring characterization data thru sampling and analysis of solid waste are:

- (1) Review the Package Identification Number (PIN) file associated with the waste container. The review should be done as soon as possible after the container arrives at the GS facility.
- (2) Determine the number and identity of waste containers to be sampled.
- (3) Determine the analytes of interest to be requested for sampling. Determine the analytical method needed to be performed on the sample.
- (4) Choose the on-site sampling organization for the job.
- (5) Make the job request to the sampling and laboratory organization by using the "Sampling and Analysis Request Form - GS/OF". (See Attachment C).

- (6) GS/OF schedules date and time of sample job. GS/O must approve scheduled sample date. GS/O supports and oversees the sampling team personnel during the job. GS/O arranges any required HP or Industrial Safety and Health support for the job.

On the day of sampling the following course of action occurs:

- (7) A pre-job occurs with the sampling team, GS/O, GS/OF, and if required HPs, and ISH personnel. Any and all safety concerns should be discussed at the pre-job. Additional information concerning the waste is provided to the sampling team, if requested.
- (8) Sample team takes the samples. The sample team completes the field logbook entries, chain-of-custody form, labels and seals the sample bottles, and packages the samples for transport to the laboratory. The sample team transports the samples to the laboratory.

Upon completion of the sampling job, the following course of action occurs:

- (9) Sample activity data for mixed or low-level waste is received from the lab by GS/OF.
- (10) Chemical analytical data is received from the laboratory. The data is received from the laboratory according to set priority. (One to six weeks)
- (11) Review and summary of data is made by GS/OF personnel.
- (12) Place data summary, data package, chain-of custody form, sample request, in PIN file for documentation.
- (13) Sample waste may be returned to GS/OF or prior arrangements may be made with analytical lab to dispose of sample waste.

ATTACHMENT C

SAMPLING AND ANALYSIS REQUEST FORM - GS/OF

ID No./Project Title:		Date:	
Org Code/Charge Code:	Contact:	Phone #:	FAX #:
MSIN:			
Work Order No.:		Sample Matrix:	
Radioactive:			
Pre-Job Location/Time:	Sampling Location:	No. of Samples:	
Job Description/Job No.:			

ANALYSIS REQUIREMENTS (check requested analyses)					
TEST	METHODS	TEST	METHODS	TESTS	METHODS
☐ Total Alpha		☐ TCLP Extract		☐ Selenium	
☐ Total Beta		☐ TCLP Metals		☐ Mercury	
☐ GEA		☐ Arsenic		☐ TCLP VOAs	
☐ Strontium 90		☐ Barium		☐ TCLP Semi-VOAs	
☐ Plutonium 239/240		☐ Cadmium		☐ Flashpoint	
☐ pH		☐ Chromium		☐ Total Metals	
☐ Sulfide		☐ Lead			
☐ Cyanide		☐ Silver			

Data Required by:	Protocol Required:
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Additional Information:

DISTRIBUTION SHEET

To	From	Page 1 of 1
Distribution	Generator Services/Operating Facilities	Date 3/31/97
Project Title/Work Order		EDT No.
Tank Farms Solid Waste Characterization Guide With Sampling and Analysis Plan Attachment		ECN No. 635186

Name	MSIN	Text With All Attach.	Text Only	Attach./Appendix Only	EDT/ECN Only
P. A. Gagnon	S6-31	X			
K. A. George	S6-30	X			
D. C. Hetzer	S6-31	X			
M. E. Lakes	S6-31	X			
J. T. Quigley	S6-30	X			
B. E. Salazar	S6-30	X			
F. C. Schmidt	S6-30	X			
Y. M. Shehadeh	S6-30	X			