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7. Abstract

This sampling and analysis plan provides guidance for soil drum sampling and analysis necessary for disposal.

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TANK FARM SOIL DRUM SAMPLING

AND

ANALYSIS PLAN

WHC-SD-WM-EV-069

REV. 0

A. R. Olander

July, 1991

TANK FARM SOIL DRUM SAMPLING AND ANALYSIS PLAN

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TABLES

TANK FARM SOIL DRUM SAMPLING AND ANALYSIS PLAN

1.0 INTRODUCTION

Preliminary soil sampling in the tank farms to determine regulatory status has provided mixed results. Forty-three samples were taken in the fall of 1990; 2 samples from each single and double shell tank farm and 9 from the cross site transfer line contamination area. Disregarding listed waste issues, 8 of the samples would have been TCLP toxic because of barium contamination and 1 for barium and lead. The units listed on the analysis report may have been in error. Most of the samples had quantities of TCLP toxic barium between 120 and 650 ppb. The nine samples with barium levels above the regulatory limit were between 211 and 365 ppm. None of the other samples approached regulatory limits.

Due to laboratory limitations the samples analyzed were not from the most radiologically contaminated locations. Most of the samples were also taken near the surface of the contamination area. There is a strong possibility that chemical contamination of a regulatory concern will increase with radioactive levels and soil depth. Therefore, more sampling is necessary in order to designate the soil.

Some contaminated soil has already been collected and placed in 55-gallon drums to prevent migration and reduce personnel exposure. The drums are located in several tank farm facilities. Most of the drums have been staged in the 241-T and 241-BX tank farms. Others are located near the spill site where contamination is being removed. An inventory of the soil drums has been compiled which will allow the drums to be identified by sample groups. The sample groups will be determined by generation point. Generation points will vary from specific contamination sites to unknown generation points. In all cases the drum or drums with the highest dose rate in the sample group will be sampled.

1.1 Purpose The purpose of this document is to provide guidance for sampling/characterization of soil in drums that have been collected in tank farm facilities. Instructions are provided for the sampling method, required analysis, and documentation requirements necessary to verify quality of the sampling and analysis activities.

1.2 Scope This sampling plan is to provide guidance for soil sampling/characterization for drums of contaminated soil generated in tank farm facilities. Different sampling plans guide the sampling and characterization of in situ contamination. In addition to this plan, some sampling and analysis requirements can be found in the Tank Farm Soil Characterization Quality Assurance Project Plan, WHC-SD-WM-QAPP-007.

2.0 FACILITY DESCRIPTION

The tank farm facilities consist of 12 single shell tank farms, 6 double shell tank farms, evaporators, double contained receiver tanks, cribs and other waste water receiving sites, a waste unloading facility, and ancillary equipment. Most of these facilities and the soils included in their boundaries have been contaminated with tank waste or other slightly radioactive liquid discharges.

Many of the single shell tanks (SST) have failed and large contamination areas exist nearby. The source of the contamination areas may be from leaking tanks, pipes, equipment, or past process upsets. Other contamination areas near SST are the result of cascade discharges to soil. Because of the vast size of the contamination sites, cleanup activities for contamination control have been limited to removing the top layers.

None of the double shell tanks have failed, but some contamination exists on the ground near the tanks due to some operating practices. Equipment is handled remotely due to the high dose rates. Even though equipment is flushed and often coated with a fixant prior to handling some radioactive liquid may drip to the ground. Other reasons for contamination spread may be due to process upsets.

Only one of the existing evaporators is still in an active status. The non-functioning evaporators serve as change facilities and control rooms. All of the evaporators have contamination zones and a potential for releasing contamination to the environment or uncontrolled areas. Some contaminated soil can be found near the evaporators and there have been recent incidents where contamination from the evaporator has reached the nearby soil.

The double contained receiver tanks serve as remote collection/staging facilities. Equipment for DCRTs, like DSTs, is handled remotely due to the high dose rates. Soil contamination can be found within the controlled area surrounding some of the DCRTs.

Cribs ponds and ditches have been receiving mildly radioactive liquid for years. These facilities have not been a major source of spreading surface contamination. Most of the radioactive and chemical contamination is contained in the soil below grade. Soil removal from these facilities has not started and is not necessary to control the spread of surface contamination.

The 204-AR Waste Unloading Facility receives waste shipped in drums, trucks, and rail cars. All of the waste handling operations occur indoors and there has been no release of contamination to the soils near the facility.

Much of the tank farm ancillary equipment or transfer piping has been in service for 40 years. Some of the piping and its secondary containment has failed and allowed contamination to spread outside of tank farm boundaries. The soil from some of these contamination sites has been collected, but most of it is still in place.

2.1 Tank Waste During operation many types of waste were sent into the tank farm. The wastes were generated in different processing plants, evaporators, and laboratories. According to Waste Characterization Plan for the Hanford Site Single-Shell Tanks, WHC-EP-0210, the following wastes were transferred into the tanks and may be encountered in tank farm contamination sites :

B-Plant low-level waste
B-Plant flush
PNL Laboratories waste
Carbonated waste
Complexed waste
REDOX coating waste
Double-shell slurry feed
Evaporator bottoms
Hanford defense residual liquid
Hanford laboratory operations
Laboratory waste
Ion exchange waste
Noncomplexed waste
PUREX high-level waste
PUREX sludge supernatant
REDOX high-level waste
Residual evaporator waste
PUREX ion exchange
Strontium semi-works
Terminal liquid
Second cycle waste
Cell 5 and 6 waste
B-Plant high level waste
B-Plant evaporator bottoms
Cesium feed
Complexant concentrate
PUREX coating waste
Diatomaceous earth
Decontamination waste
Evaporator Feed
Fission product waste
Hot semiworks
Metal waste
N Reactor waste
Organic wash waste
PUREX low-level waste
Partial neutralized waste
REDOX supernatant
REDOX ion exchange waste
Strontium sludge
Tri-butyl phosphate
First cycle waste
224-U waste

Each tank has a unique combination of the wastes and the contents of the waste is not well known. Some core samples have been taken in the tank farm, but the remaining waste in the tanks may no longer be similar to the waste that contaminated the soil.

2.2 Process Knowledge A surface contamination history has not been compiled for most tank farms. No process knowledge has been documented to indicate which of the wastes listed above may be contaminating the soil. The waste streams are the result of several processes used at the plants. These processes used a limited number of chemicals. The waste streams are different mixtures of the chemicals used during these processes.

Some chemicals of regulatory concern have been detected in evaporator effluent streams. These contaminants include 1-butanol, methyl isobutyl ketone, acetone, and methyl ethyl ketone. These contaminants are nonspecific source listed wastes and can cause the soil to be regulated as a mixed waste instead of low level radioactive waste.

3.0 SAMPLING/CHARACTERIZATION

As previously discussed, soil drums will be grouped by site and tank farm. Within the groups the drum(s) with the highest dose rate will be sampled.

Ideally, each contamination site should be treated as a unique waste stream. When some of the drums were filled, soil portions may have come from more than one site. Even though each site may have a slightly varied chemical and radiological constituents, it is not expected that one site would have a greater probability of being regulated over another. The drum with the highest dose rate will likely contain the most regulated chemical contamination. Sampling the highest dose rate drum from any sample group will provide a conservative characterization for proper designation.

3.1 Sampling Technique Sampling activities will be performed by technicians from the WSCF Startup/Sampling & Mobile Laboratories group. The samples will be taken with a hand auger. General instructions for use of the auger are contained in WHC-CM-7-7, Environmental Investigations and Site Characterization Manual, section EII 5.2, Appendix E 4.3. The action of digging up and filling drums homogenized the soil. Because the soil in the drums was homogenized, there is no need to sample the entire height of the drum. The auger will remove soil from below the surface in case some chemicals readily evaporated when the drum is opened. The collected sample will be immediately placed in the sample container and sealed to avoid the loss of any remaining volatile or semi-volatile compounds.

The sampling equipment will be decontaminated between each sampling activity. Equipment will be decontaminated per WHC-CM-7-7, Section 5.5.

3.2 Sample Handling Field logs will be maintained to record all field observations and activities in accordance with EII 1.5, Field Logbooks. Samples will be placed in containers and properly preserved in accordance with Chapter 4.0 of the QAPP#. All samples will be transported under chain of custody in accordance with EII 5.1, Chain of Custody, Chapter 5.0 of the QAPP#, and EII 5.11, Sample Packaging and Shipping. Instructions for sample handling can also be found in Sampling and Mobile Laboratories (S&ML) Desk Instructions, section T032 A-01 450 F.

4.0 SAMPLE ANALYSIS

The samples will be analyzed so that proper waste designations can be made for the soil to be removed from the facility. The tank Part A permit applications list many regulated materials that may also be in the soil. There are also some specific isotopic analyses required in WHC-EP-0063, Hanford Site Radioactive Solid Waste Acceptance Criteria.

4.1 Chemical Table 4.1.1 contains a list of the chemicals found in the preliminary soils samples. Other chemicals listed in Appendix VIII, 40 Code of Federal Regulations Part 261 are not expected contaminants in the soil. The waste generating processes used a limited number of chemicals and the contaminants in the soil are mixtures of these chemicals. The sample analyses requested will provide data necessary for adequate determination of tank constituents contaminating the soil.

Table 4.1.1. Detected Chemicals

Metals	Organics	Other
Arsenic	Fluoranthene	Fluoride
Barium	Benzo(a)anthracene	Ammonia
Cadmium	Chrysene	Chloride
Chromium	Benzo(b)fluoranthene	Nitrate
Lead	Benzo(a)pyrene	Sulfate
Selenium	Pyrene	Sulfide
	1,1,1-Trichloroethane	Phosphate
	Toluene	2,4-D
	Acenaphthylene	
	2,4,5-Trichlorophenol	
	1,1,2,2-Tetrachlorethane	

Some of the analyses showed phthalate compounds that were not listed. The laboratory introduced some phthalate contamination so all phthalate compounds were disregarded in the previous data evaluation.

Table 4.1.2 contains a list of analytes that are suspected as possibly being found in contaminated soil. The list is compiled from the Double Shell Tank (DST) Waste Analysis Plan (WAP), SD-WM-EV-053. Some additional analytes have been added to the list that are suspected soil contaminants not found in the tanks. Those analyses applicable only to liquid wastes have been removed from the table.

TABLE 4.1.2
SOIL CHARACTERIZATION SAMPLE PARAMETER LIST

PARAMETER	SW-846 REFERENCE ANALYTICAL METHOD	RATIONALE
Ag	6010	a,b
Al	6010	a
As	7060	a,b
Ba	6010	a,b
Bi	6010	a
Ca	6010	a
Cd	6010	a,b
Cr	6010	a,b
Cu	6010	a,b
Fe	6010	a
Hg	7470	a,b
Pb	6010,7421	a,b
Mg	6010	a
Mn	6010	a
Mo	6010	a
P	6010	a
K	6010	a
Se	7740	a,b
Si	6010	a
Na	6010	a
Ti	6010	a
Zn	6010	a
Zr	6010	a
F	300.0	a

PARAMETER	SW-846 REFERENCE ANALYTICAL METHOD	RATIONALE
Cl	300.0	a
NO_2	300.0	a
NO_3	300.0	a
PO_4	300.0	a
SO_4	300.0	a
CO_3	NA[c]	a
NH_4	NA[c]	a
Banvel-Dimethylamine Salt of Dicamba	8150	b
Telar-Chlorsulfuron	8150	b
Arsenal-Imazapyr and Isopropylamine	8150	b
Krovar-Bromacil and Diuron	8150	b
Spike-Tebuthiuron	8150	b
2,4-D	8150	b
pH	9045	a
TCLP	1311, 200.7	b
Volatile Organic Analysis (VOA)	8240	b
Semi-VOA	8270	b

NOTE:
a) Characterization parameter
b) Waste designation parameter
c) No specific SW-846 method exists. A water leach procedure will be used.

4.2 Radiological Radiological characterization is necessary to meet disposal and/or storage criteria at the burial grounds and the Central Waste Complex (CWC). The characterization must include all radionuclides that contribute >1% (by Curies) of the total activity of the waste matrix and a selection of radionuclides that contribute greater than class A quantities listed in 10 CFR 61.55. The radionuclides listed in Table 4.2 are those found in radiological assays of tank farm waste and those specifically required for burial/storage.

The detection levels specified in 10 CFR 61.55 may not be achievable for all of the isotopes listed in Table 4.2. In lieu of specific quantitations for each isotope documentation may be included with the data report verifying that the isotopic quantities of a similar group are below the specified level. For example, total beta emissions from a sample may be quantified and then the

known beta emissions subtracted from the total. If the remaining emission from a combined group are below the MQLs, the absence of the unknown beta emitting isotope can be verified.

Alpha emitting isotopes are not suspected in the soil. Nonetheless, a total alpha analysis will be performed to verify that alpha emitting radionuclides are not present above the lower quantification levels specified in WHC-EP-0063. If higher than expected alpha contamination is present isotopic analyses will be performed.

Table 4.2
Radionuclide Characterization

PARAMETER	SW-846 REFERENCE ANALYTICAL METHOD	RATIONALE
^{60}Co	NA	a
^{137}Cs	NA	a
^{106}Ru-Rh	NA	a
^{3}H	NA	a
^{14}C	NA	a
^{59}Ni	NA	a
^{63}Ni	NA	a
^{79}Se	NA	a
^{90}Sr	NA	a
^{94}Nb	NA	a
^{99}Tc	NA	a
^{129}I	NA	a
^{125}Sb	NA	a
^{144}Ce	NA	a
^{134}Cs	NA	a
^{154}Eu	NA	a
^{155}Eu	NA	a
^{241}Pu	NA	a
^{242}Cm	NA	a
Total Alpha	NA	a
Total Beta	NA	a

NOTE: a) Characterization parameter

5.0 DATA EVALUATION

The characterization data will be validated before final disposal decisions are made. Designations will be performed on the validated data to determine if the soil should be handled as low-level or mixed waste.

5.1 Validation Data validation will be performed by the Office of Sample Management. Procedures for contract laboratory data validation are contained WHC-CM-5-3, Sample Management and Administration manual.

5.2 Designation Preliminary designations will be performed by Tank Farm Environmental Engineering using the validated data. Engineering will propose likely chemical compounds to account for elements in the data package. The proposed compounds, preliminary designation, and data package will be submitted to the Site Hazardous Waste Engineering Support Unit for formal designation.

REFERENCES

WHC-SD-WM-QAPP-007, Tank Farm Soil Characterization Quality Assurance Projection Plan.

WHC-EP-0210, Waste Characterization Plans for the Hanford Site Single-Shell Tanks.

WHC-CM-7-7, Environmental Investigation and Site Characterization Manual, section EII 5.2, Appendix E 4.3.

Process Laboratories and Technology (PLT) Desk Instructions, section T032 A-01 450 F.

WHC-EP-0063-2, Hanford Site Radioactive Solid Waste Acceptance Criteria.

Double-Shell Tank (DST) Waste Analysis Plan (WAP), SD-WM-EV-053.

WHC-CM-5-3, Sample Management and Administration.

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