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HLW TANK FARM

SOLID WASTE RADIONUCLIDE

SMEAR SAMPLE and ANALYSIS PLAN (U)

Revision 0

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DISCLAIMER

HLW TANK FARM

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SMEAR SAMPLE and ANALYSIS PLAN

Peter L. Gray

Introduction

The HLW Tank Farm Low-Level Solid Waste Radionuclide Smear Sample And Analysis Plan has been written to describe the three methods by which the HLW Tank Farm facilities will obtain analytical data of radionuclide distribution in, and activities of, solid waste generated in the Tank Farms for waste certification and delivery to the Low Activity Waste Vaults (LAWV) in E Area. Results will be used as a possible confirmatory supplement to process knowledge as contained in the document, WSRC-TR-94-0290, "High-Level Waste Characterization In Support Of Low-Level Waste Certification, I. HLW Supernate Radionuclide Characterization."

The purpose of collecting samples is to obtain analytical data to supplement the validation data from WSRC-TR-94-0290 that gives radionuclide distributions for low-level job control waste characterization. It is expected that the results received from the laboratory will not enable quantification within the existing WAC limits but will be used only to possibly supplement the validation of years of determinations made based on process knowledge and sampling the High Level Waste (HLW). This occurs because several of the nuclides in the WAC 3.10 list (table 2) are either expected to be present in such low abundance and/or have such a soft radiation (e.g., low energy beta) that even the most sensitive laboratory techniques cannot detect their presence and measure their abundance.

This document has been formatted according to the suggested outline as contained in Attachment A of WSRC 1S Manual WAC 2.01, May 21, 1994.

Caution

This smear sampling document is not to be confused with another sampling document being prepared for the Tank Farms that deals with samples of HLW taken from HLW Tanks for process control and other operational purposes. That document is "Tank Farm Sampling And Analysis Plan (U)," P. D. d'Entremont, WSRC-TR-94-0304, draft.

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Project/Facility Description

The history of materials coming into and being separated, mixed and processed in the tank farms ensures that a variety of wastes exists within the farms. A knowledge of the different facilities and processes, as well as of waste streams entering the farms, is necessary to understand the variety of the wastes that may give rise to low-level job control wastes in the tank farms.

In this section, there is a description of the facilities and systems. In the next section, there is a description of the types of waste entering the farms, as well as those found after separation, mixing and processing occurs.

Originally , the HLW tank farms had only one function: namely, to receive and temporarily store liquid wastes generated in the chemical processing canyons (221-F and 221-H). Neutralized waste was sent to tanks where insoluble fractions precipitated; this material is called sludge. The soluble fraction (after about one year of settling) was pumped off and is called supernate. Supersaturated supernate also produces a precipitate called salt. Sludge, salt and supernate are the main wastes in the tank farms.

Later, additional functions were added to include:

- Evaporation of supernate liquid to produce salt and to conserve storage tank space,
- In Tank Precipitation (ITP) to prepare feed for Saltstone and DWPF,
- Extended Sludge Processing (ESP) to prepare feed for DWPF, and
- Effluent Treatment Facility (ETF) to replace previously-used seepage basins (now closed).

Finally, because storage in tanks is only an interim step, Waste Removal (WR) activities will be directed at removing waste from all 51 HLW storage tanks and sending it for final disposition.

Some of these facilities will be in essentially constant use for the next 20 or more years; others will be used intermittently or will be (have been) placed in standby awaiting D&D.

To obtain typical and analyzable smear samples, locations in the HLW tank farms have been selected where the majority of RadCon work occurs. They are not limited to only those locations where supernate contamination is expected. The eight listed locations are typical sites of major HLW tank farm activity. Three smear samples will be taken at each. They are:

- ESP (tank 51),
- ITP before filtration (tank 48) and after filtration (tank 50),
- Evaporation in F (2F - tank 26) and in H (2H - tanks 43 & 38)
- Excavation for tie-ins to new facilities (tank 37),
- Waste Removal (tank 29), and
- ETF. plus
- 299-H Decon Facility per MCC 7/27/94 gRH.

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Types Of Waste

The tank farms at SRS have collected over the past 40 years a variety of wastes from the different chemical separations processes used for the many products SRS has produced. However, there are two basic characteristics for most of these wastes that will influence where they are found. One is the fission products that arise from the use of fissile uranium and plutonium in the SRS Production Reactors. The other is the solubility of the fission product nuclides. The first determines the abundance of the nuclides that will be found in tank farm waste. The second determines where, in our general waste types, a particular nuclide (and its abundance) is liable to be found.

Different fuels have slightly different mixtures of fission products. Studies have developed in great detail the quantities of each nuclide present in each of the fuel types. The results of these studies are given in WSRC-TR-94-0290.

Additionally, the several activities being conducted in the tank farms alter these distributions and result in various distributions of nuclides at different locations. Thus samples from these locations are expected to vary accordingly. The influence of solubility is one of the factors that governs distributions of various nuclides among these locations.

The sample results are expected to indicate that the Cs and Sr isotopes are above the minimum level of detection (MLD). The other nuclides are expected to be below the MLD. Attachment 1 describes the MLDs which HLW tank farms will need to supplement or confirm the process knowledge analysis of the waste. For those cases in which the MLD cannot be attained, confirmation of the process knowledge of the wastes will not be invalidated by the inability to obtain quantitative data from these smears.

In some cases, it is expected that the smear effort will not be successful in collecting enough contamination for confirmation of any nuclides other than Cs or Sr. In those cases, the smear data will not be available as a confirmatory technique. Reliance will have to be placed on process knowledge.

Low level waste streams come from all of the above listed job sites in the HLW tank farms. The form is mainly job control waste. It is both compactable and non-compactable.

Data Quality Objectives (DQO)

To obtain typical and analyzable smear samples, locations which have active work with significant contamination potential will be used. Samples will be prescreened according to WSRC Manual 5Q 1.2 procedure 133 (attachment 3). This will be done to ensure that:

- the maximum feasible contamination level is acquired on smears to enhance counting of the lower level nuclides,
- the smears taken have comparable levels of activity (amounts of nuclides to be counted),
- the laboratory can accept the smears without exceeding the laboratory's license limits.

After prescreening the samples, the data will be evaluated by the Generator Certification Officer (GCO) to ensure that all the above provisions have been met. If this is not the case, additional samples may be taken. Sample analysis and precision, and data quality control, of the two off-site laboratories described in the Analysis Of Waste Samples section, have been evaluated by WSRC Samples Management Program personnel and have been found to be adequate.

After the samples have been analyzed and results reported to WSRC, these results will be compared with the expected results. It is expected that the laboratory results from the smears will corroborate and be consistent with the various tank farm waste stream characterizations based on process knowledge. Any discrepancies will be studied and resolved by analysis of a second smear or other reassessments of the particular waste site and constituents contributing to contamination at that work site. The results will be documented and placed in file by the GCO and HLWE.

Site Selection and Sampling Procedures

To obtain typical smears within the tank farms, samples will be taken at the facilities discussed earlier and at active job sites where low level waste is generated and where high enough contamination levels exist. This will be done to obtain a sufficient amount of radioactive material on the smears to lead to accurate results. However, as discussed above in the section on Waste Types it must be recognized that it may not be possible to collect, in some cases, smears with enough activity to represent all or even some of the nuclides. Representative, or typical, areas that will be smeared are listed on page 3 in the Project/Facility Description section.

Although some sites now active may be retired (for D&D) and others now dormant may become active in the future, it is believed that the list represents the full spectrum of waste types to be found in the HLW tank farms. It is, therefore, anticipated, at this time, that no further sampling will be needed from a "scope of activities" standpoint. The need for future samples for validation will be reassessed as work in the tank farms continues. Locations and timing for further validation or confirmatory samples will be developed in the future.

The sampling procedure to be used is: WSRC Manual 5Q 1.2 procedure 133 and WSRC Manual 5Q 1.2 procedure 107.

Selection of Sampling Equipment

WSRC 5Q 1.2 procedure 133 will be used to obtain smears for sample analysis. This procedure describes the method for obtaining a sample as well as the equipment that is needed for the sample. WSRC 5Q 1.2 procedure 107 will be used to document the survey smears taken for sample analysis.

Sample Handling

Three types of smears will be used in the plan to supplement process knowledge. These are shown schematically in figure 1. The three types are:

- smears sent off-site through the SMP group to an approved laboratory,
- smears analyzed on-site by appropriate HP and RadCon laboratories, and
- a survey of recent RadCon smears from jobs in HLWM facilities.

Each of the three major categories is planned to be done for a specific purpose as discussed below.

Off-Site Smears This is the top of the triangle shown in figure 1.

This route is the established one for all waste generators wishing to have their plans certified by Solid Waste. The Sample Management Program (SMP) group is in charge of handling these samples through their contracted off-site laboratories. Once samples are taken by approved WSRC

5Q Manual procedures, they will be transferred to SMP. HLWM Division will follow the 5Q and SMP procedures and receive the laboratory results for inclusion in the HLWM certification effort.

Locations for these samples are given in table 2. These locations are inclusive of all HLWM sites and waste types. Early emphasis will be placed on those sites that represent supernate wastes and will provide the link to job control waste. Later, the other sites will be included.

The schedule for the initial supernate sample smears is to obtain these samples for transfer to SMP by July 15, 1994.

On-Site Smears This is the middle of the triangle shown in figure 1.

This route, although not called for in WAC 2.01, will be used to procure an early reading of the distribution of nuclides in typical HLWM facilities. The handling of the samples will be according to approved WSRC procedures throughout. HLWM Division will receive the laboratory results for inclusion in the HLWM certification effort.

Locations for these samples are given in table 2. These locations are inclusive of all HLWM sites and waste types. A request was made to HP Technology on June 23, 1994 to obtain smears from all of these sites.

The schedule for results from the sample smear is to receive them by July 15, 1994.

RadCon Smears This is the bottom of the triangle shown in figure 1.

A compilation of data from RadCon radiation field surveys is being made to learn the typical quantitative distribution of activities (gross alpha, beta, gamma) from many HLWM work sites. The data record compiled so far has in excess of 600 records and current work is adding to that library. These data will be summarized into ranges to assist in characterizing amounts of waste expected to be sent to the E Area LAWV. They may also be used to assist in demonstrating compliance with the WAC 3.10 vault acceptance criteria.

These smear data are typical for locations throughout the HLWM Division facilities.

The schedule for analysis of these data is July 15, 1994.

This rest of this section pertains only to the off-site samples. The on-site samples will be handled according to WSRC Manual 5Q. The RadCon surveys are merely data collection activities for data already acquired from the field.

Only trained RCHP inspectors will be used to take smears. The samples will be handled so as to prevent cross contamination. After an inspector has smeared the sample location as described in WSRC 5Q 1.2 procedure 133, the smear will be placed in an appropriate package and then prescreened. The reasons for prescreening are discussed above in the section on DQO.

Attachment 2 shows a sample chain of custody form which will be used to document the identity of the person who obtained the smear and to correlate the sample location with the sample number.

The samples will be transported in DOT approved packages. Shipment preparation and transportation will meet all applicable DOT regulations and requirements. Regulations and requirements of WSRC 19Q, as determined by a Hazardous Material Transportation Representative (HMTR), will be complied with.

Sample Handling (cont'd)

After the sample has been properly packaged for transportation, a seal to indicate tampering will be attached to the package by the HLW Tank Farm GCO.

The GCO will then contact the Sample Management Program (SMP) Group. The SMP Group, with assistance from the HMTR, will assist in shipping the sample to the contract laboratory for analysis. The HLW tank farm GCO will have a copy of the off-site laboratory's license for handling the material and will keep a copy of the license on file.

Field Quality Control

A total of three smears will be taken from each area selected as described in table 2 in the Project/Facility Description section. Two smears from each area will be sent off-site for analysis. The other sample will be stored by HLW RCHP personnel for analysis in the event that the first sample results are not credible and additional analyses are required. Three more smears will be taken for the on-site analysis work and handled as above.

Available contract laboratories to which the off-site samples will be sent have been determined by WSRC representatives from Procurement, SMP, and Environmental Monitoring Services (EMS) Quality Control to meet SRS QA requirements.

Documentation and Sample Custody

Areas which are to be sampled in the HLW tank farms will be surveyed according to WSRC 5Q 1.2 procedure 133, Radiological Survey Techniques. The procedure for documentation of the radiation surveys is in WSRC 5Q 1.2 procedure 107, Documenting Radiation Surveys. RCHP personnel will complete a radiation survey for each area sampled. A Radiation Survey Logsheet (RSLS), OSR 4-17, will be completed and stored on file according to the RCHP record retention schedule. Sample tracking will be accomplished by the chain of custody form in attachment 2.

Analysis of Waste Samples

At present, only two off-site laboratories have approved procurement packages meeting the WAC needs. Both of these laboratories have been determined by WSRC representatives, including Procurement, Sample Management Program (SMP), and Environmental Monitoring Services (EMS) Quality Control, to meet SRS QA requirements.

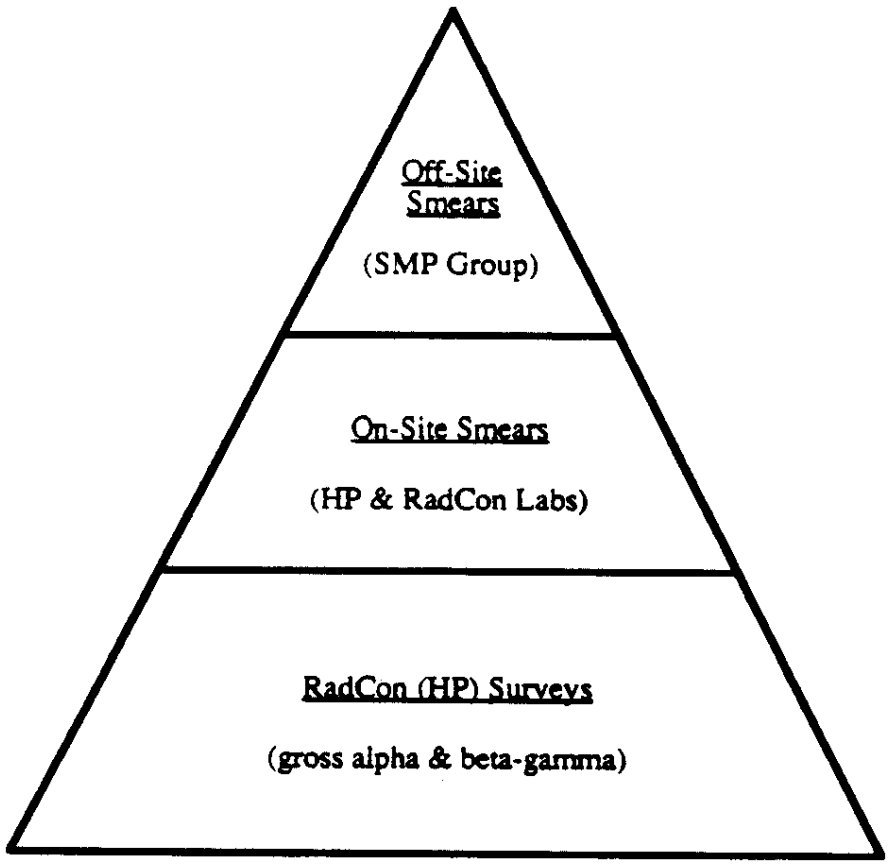
WSRC has contracts with these two laboratories that can provide the requested sampling analysis needed for possible confirmation, by smears, of process knowledge of the HLW tank farm waste types. General Engineering Laboratory (GEL) in Charleston, South Carolina, has been identified as one laboratory with which WSRC has a contract that can provide an analysis of the 22 nuclides and gross alpha and gross beta-gamma counts as identified in WSRC 1S WAC 3.10 rev. 1, 5/21/94, table 2. The other laboratory is Roy F. Weston in Lionville, Pa. Weston does not specifically do radioactive analyses but subcontracts that type of work to TMA/Norcal in Richmond California. The contract is with Weston.

Results shall be reported to the generator in the normal contract agreement form, but shall include as a minimum sample identification numbers, laboratory MDA, results, analysis method used, date and time of analysis, and all quality control results as well as a description of the quality control methods.

Analytical Quality Control

Both of these laboratories have been determined by WSRC representatives, including Procurement, Sample Management Program (SMP), and Environmental Monitoring Services (EMS) Quality Control, to meet SRS QA requirements. A scope of work, number E14593, describing necessary laboratory qualifications is included as attachment 5. Performance reviews of the two selected (by SMP) analytical techniques and practices have been completed and are on file with the Quality Control Manager of EMS of the Environmental Protection Department. These documents are available for review. Also, analytical procedures used by the laboratories are on file in EMS.

Figure 1



Sources Of Smear Data For HLW Characterization

Attachment 1

Nuclide	Rel Activity (sum=1) (b)	MLD (microCi/smear) (a), (c)	Notes:
H-3	9.7e-04	9.7e-04	
C-14	6.3e-11	6.3e-11	
Co-60	1.2e-06	1.2e-06	
Ni-59	2.6e-06	2.6e-06	
Se-79	4.7e-07	4.7e-07	
Sr-90	2.6e-04	2.6e-04	
Tc-99	1.2e-04	1.2e-04	(d)
Sn-126	1.7e-07	1.7e-07	
I-129	1.4e-07	1.4e-07	(d)
Cs-137	1.0e+00	1.0e+00	
U-233	8.3e-11	8.3e-11	
U-234	6.3e-11	6.3e-11	
U-235	5.8e-13	5.8e-13	
U-236	1.7e-11	1.7e-11	
U-238	3.5e-14	3.5e-14	
Np-237	1.0e-07	1.0e-07	(d)
Pu-238	1.2e-08	1.2e-08	
Pu-239	9.3e-08	9.3e-08	
Pu-240	6.9e-08	6.9e-08	
Pu-241	1.3e-08	1.3e-08	
Pu-242	9.6e-08	9.6e-08	
Am-241	1.2e-09	1.2e-09	

Notes:

(a) MLDs above are calculated assuming a smear contains 1.0 microcuries.

(b) The radionuclide distribution was calculated for HLW supernate using the Mark 16B (5-yr decay) table in WSRC-TR-94-0290, appendix A attachment.

(c) For those cases in which the MLD cannot be attained, the lowest MLD attainable by the laboratory doing the analysis will be acceptable.

(d) These nuclides are corrected to agree with table D.1 in WSRC-TR-94-0290, rev. 0