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340 REPRESENTATIVE SAMPLING VERIFICATION TANK SAMPLING AND ANALYSIS PLAN

A.R. Olander

Westinghouse Hanford Company Richland, WA 99352
U.S. Department of Energy Contract DE-AC06-87RL10930

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Characterization.

Abstract: This Sampling and Analysis Plan contains requirements for characterizing the 340 vault tank 1. The objective of the sampling and characterization is to determine if the tank is homogeneous when agitated and which sampling method provides the most representative sample. A secondary objective is to collect and characterize solid samples.

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James R. Bishop
Release Approval

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Approved for Public Release

**340 Representative Sampling Verification
Tank Sampling and Analysis Plan**

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1.0 INTRODUCTION

Concerns have been raised about possible accumulation of fissile material in the vault tanks and whether or not sampling methods are representative of tank contents. This characterization effort will be designed to collect samples from various locations in the tank for comparison.

This Sampling and Analysis Plan (SAP) describes the field activities and methods associated with collection of radioactive wastewater samples from the 340 vault tanks. Sampling location and number are specified in this SAP, as are work plans and procedures for packaging the samples and transporting them to the 325 Building for analysis.

The remaining sections of this SAP include the following:

- o Section 2.0--Sampling Objectives
- o Section 3.0--Responsibilities
- o Section 4.0--Sample Location and Frequency
- o Section 5.0--Sample Identification
- o Section 6.0--Sampling Equipment and Procedures
- o Section 7.0--Sample Handling and Analysis
- o Section 8.0--Quality Assurance Project Plan
- o Section 9.0--References

The Quality Assurance Project Plan (QAPP) provides the guidelines and requirements enhance the quality of the radioactive liquid effluent sampling activities.

System Description The vault tanks are 14' diameter 13'1" high stainless steel accumulation tanks. The tanks are sloped 1/8" per foot towards a 3" drain pipe with a blind flange. The drain pipe is at the periphery of the tank near the vault sump. The vault sump is at the center of the vault between the tanks. Each tank has 3 equally spaced baffles that are 3/8" thick, 10" wide and 10'6" tall. The bottoms of the baffles are 9" from the bottom of the tank. The baffles are attached to the tank with 5 stiffeners leaving a 1" gap between the baffle plates and the tank wall along most of the length. Instrumentation lines are installed in a stilling chamber in each tank. The stilling chamber is a 6" line with 1/2" holes. In vault tank 1, a manometer line in the stilling chamber has been converted to a sample line. The tanks are also equipped with cooling jackets and immersion heaters that are no longer in service.

Vault tank equipment includes sump pumps, a backup transfer/sample pump, and mixers. Each tank has one sump pump that is used to transfer waste between vault tanks, to the above ground storage tanks, or to the railcar. The sump pumps bell housings are 12" from the bottom of the tank. The pumps are rated at 100 gpm with 53' Total Discharge Head (TDH). The backup pump is a centrifugal pump rated at 150 gpm at 60' TDH. The suction leg for the pump is a 4" line that is 4" from the bottom of the tank. Each tank has a 15 horse power mixer. The impeller has 6 blades that are 14" from the bottom of the tank and are designed to turn at 68 rpm.

The tank mixers are located in the center of tank. The sump pumps are 4'8" from the center. The suction leg for the backup transfer/sample pump is 6'6" from the center of the tank on the opposite side of the tank from the sump pumps.

2.0 OBJECTIVES

Overall objectives for the SAP are to provide data that will identify reliable and repeatable methods for collecting representative samples from different locations in the vault tanks. Solid samples will also be collected from the tank bottom to determine the type of solids that may have accumulated. The sample analytical results will be compared to determine if the waste is homogeneous.

Liquid samples will be collected from the bottom of the tank using two separate systems if possible; sample collection using TP-3 is not reliable. The suction head of the pump is not always adequate to lift the waste for sampling. If functioning properly, more than one sample will be collected using TP-3 and more than one sample will be collected using the alternate method. Samples collected using each method can be compared to determine natural system variation. Samples collected using TP-3 can be compared against each other and then can be compared against the samples collected using the alternate method.

More than one grab sample will be collected from the top 2' of the liquid in the tank. More than one grab sample will also be collected from the vertical mid-point of the waste using a sampling device that can be remotely opened at the correct depth. These results will be compared against each other and samples collected from the bottom of the tank.

All Personnel associated with collection of liquid effluent characterization samples, processing of the samples, processing of the data, and control of records shall comply with the procedures related to their responsibilities. As necessary, personnel shall sign a document verifying that they have read and understand the procedures.

The samples will also be analyzed for radionuclides of concern for fissile tracking and soluble radionuclides that may provide an indication of sampling precision.

3.0 RESPONSIBILITIES

The organizations listed below have the following responsibilities for implementation of this SAP.

Process Engineering

- o Provides Person in Charge (PIC)/operator support as required during liquid effluent characterization sampling including sampler setup.
- o Coordinates Health Physics Technician support.
- o Writes sampling and analysis plans and maintenance work plans for preparing vault tanks for characterization activities.
- o Prepare statement of work and select contract laboratory.
- o Schedule and prioritize sample analyses requests.
- o Coordinate sampling and laboratory analysis schedule.
- o File "chain-of-custody" documentation received from samples.
- o Work Control and Data Management.

OPERATIONS

- o Approve the SAP/QAPP.
- o Sample tanks and control samples until delivered to the laboratory.
- o Package samples for shipment.
- o Transport samples to the analytical laboratory or shipping center.
- o Document sampling activities in a controlled log book.
- o Initiate "chain-of-custody" documentation for samples.
- o Store controlled field logs and other sampling data information.

Health and Safety

- o Provide the Radiation Work Permit instructions for radiation area entry.
- o Verify radiation worker training requirements of sampling personnel.

Quality Assurance (QA)

- o Review and approve this SAP/QAPP.
- o Audit records and procedures.

4.0 SAMPLING LOCATION AND QUANTITY

Vault tank 1 will be sampled at 5 locations. Two sample sets will be collected from different locations at the bottom of the tank using routine sampling procedures. Three sample sets will be collected from different depths out of an access hole at the top of the tank.

TP-3/Primary Sample Location The primary sampling system uses a recirculation loop, centrifugal pump, sample line, and sample hood. After the waste is agitated for 55 minutes, waste is drawn up through a 4" pipe that is 6'6" from the center of the tank. The bottom of the suction line is 4" from the bottom of the tank. When the system is operated, the waste is drawn up through the suction pipe through valve RL-6 into TP-3 out through RL-11 and RL-14 and through RL-8 back into vault tank 1. A 1/2" sample line is connected to the 4" recycle loop between valves RL-11 and RL-14. When RL-13 and RL-13A are opened waste is pushed through the sample loop and back into the vault tank. The sample line is 1/2" stainless steel. From the recycle loop to the sample collection point in the hood, the sample line spans approximately 25' horizontal and 15' vertical distance. A sample is collected by opening valve RL-13B in the decontamination area sample hood.

Alternate Sample Location The alternate sample system was installed as a backup to the primary (TP-3) system. The system was tied into a stilling chamber which is 6'3" from the center of the tank. The stilling chamber is a 6" stainless steel pipe with 1/2" holes on 6" vertical centers. A number of instrumentation lines are inside the stilling chamber. The alternate sample line is tied into a 1/2" line that was formerly used for a manometer. The bottom of the line is 13" from the bottom of the tank. The line from the top of the tank is 1/2" stainless steel and spans approximately 25' horizontal and 10' vertical distance to the sample collection point. After the waste is agitated for 55 minutes, the sample is collected by attaching a vacuum flask and vacuum pump to the sample line.

Upper Grab Sample Location Grab samples will be collected from the top of the tank. The only available access joint is a access hole cut into the top skin of the tank. The hole is approximately 5' from the center of the tank near the transfer pump. A sample bottle will be attached to a rigid pole and then will be submersed in the liquid. The agitator will be run for 55 minutes before sampling and then will be shutdown just prior lowering bottles into the tank. This will ensure the liquid is as well mixed as possible and minimize the chance of the entangling the sampling equipment in the agitator.

Mid Grab Sample Location Grab samples will be collected from the vertical mid-point of the waste using a remote actuated sample cylinder. The cylinder is stainless steel and has plunger that can be opened with a pull string when it has descended to mid-level. Again, the agitator will be run 55 minutes before sampling and then will be shutdown for a few minutes prior to sampling to ensure the sampler does not interfere with the agitator shaft or impeller.

Solid Sample The sample of accumulated bottom solids will be collected from the same access point used for the liquid grab samples. The agitator will not be run prior to sampling for solids. Using a rigid pole, a sample scoop will be moved across the bottom to collect any heavy solid material that has accumulated. The amount of solids will provide a very rough quantitative estimate of solids that have accumulated, but the primary purpose is to determine the type of solids.

Sample Quantity More than one sample should be collected from each sample location. The initial goal should be to collect 2 samples from each location. More can be collected and will be analyzed if a need exists.

Table 1 summarizes the characterization strategy.

5.0 SAMPLE IDENTIFICATION

Sample identification numbers shall be furnished by process engineering. The labels will also require the following information to be recorded by a member from the sampling team: sampler's initials; date and time the sample was collected; the place the sample point; and the analysis to be performed on the sample. Details of the analysis to be performed will be included on the Sampling and Analysis Form (SAF). The sample labels shall reference the appropriate SAF.

6.0 SAMPLING EQUIPMENT AND PROCEDURES

The sampling equipment is described in 2 operating procedures and a maintenance work plan. There are procedures for sampling from the vault tank using TP-3 and the alternate method. A maintenance work plan has been written for collecting grab samples from the top, mid-level, and bottom of the tank. Following are procedure and work plan numbers and titles specific to each sample location:

<u>Document Number</u>	<u>Title</u>
340-OP-007	Sample RLW From Vault Tanks
340-OP-008	Sample Vault Tanks - Alternate Sampling Method
3D-96-0062	Vault TK-1 Sample

Table 1. Characterization Sample Summary

Sample Location/Method	Waste Phase	Sample Quantity	Analysis
Bottom of Tank/TP-3	Mostly liquid with some solids	More than one	Plutonium Isotopic Uranium Isotopic GEA Percent Solids pH SpG
Bottom of Tank/Alternate Method	Mostly liquid with some solids	More than one	Plutonium Isotopic Uranium Isotopic GEA Percent Solids pH SpG
Top of Tank/Grab	Mostly liquid with some solids	More than one	Plutonium Isotopic Uranium Isotopic GEA Percent Solids pH SpG
Mid-Level/Grab	Mostly liquid with some solids	More than one	Plutonium Isotopic Uranium Isotopic GEA Percent Solids pH SpG
Bottom of Tank/Grab	Mostly solids with incidental liquid	More than one	Plutonium Isotopic Uranium Isotopic Fissionable Material GEA SpG

7.0 SAMPLE HANDLING AND ANALYSIS

Once a liquid sample has been drawn, it must be in the physical control or view of the custodian, located in an area where it cannot be tampered with or prepared for shipping with tamper-proof tape applied. If the samples are to be left unattended, physical control will be maintained by placing samples in the sample hood with tamper tape. When more than one person is involved in sampling, one person shall be designated and only that person signs as sampler. This person is the custodian until the samples are transferred to another location or group and shall sign when releasing the samples to the designated receiver.

The samples will be packaged for shipment per procedure 340-OP-021, Package/Transport RLW Samples Using Hedgehog System. After packaging, the samples will be hand carried to the 325 Building for analysis. At the laboratory, the sample custodian or his alternate shall sign and date all appropriate receiving documents at the time of receipt and at the same time initiate an internal Chain of Custody form using documented procedures. A continuous chain of custody will be maintained from the time of sampling until final disposition of all samples.

Each liquid sample will be analyzed for pH, percent solids, plutonium, uranium, and gamma emitting radionuclides. The solids will be dissolved and analyzed with the liquid. The bottom of the tank solids will be separated and analyzed separately from any incidental liquid collected. The SAFs list specific procedures and requirements for the liquid and solids analysis and are shown as Figures 1 and 2.

Certified clean containers will not be necessary for this characterization project; radionuclide contamination is not anticipated on commercially available sample bottles. A nitric acid preservative will not be used in the sample containers. For the liquid samples acidification would invalidate the percent solids analysis. Plastic sample bottles will be used; plutonium sticks more readily to glass containers.

8.0 QUALITY ASSURANCE PROJECT PLAN

This job specific QAPP provides the general framework for sample collection, laboratory analysis, and data reporting. The QAPP covers QA requirements for the characterization of the vault tanks. These QA requirements include sample collection, sample control, data quality objectives (DQOs), laboratory analysis, and data reporting.

In addition to the project plan, there are several upper tier documents applicable to this characterization activity. Activities at the 340 Waste Handling Facility are implemented under an organization specific Quality Assurance Program Plan. The Quality Assurance Program Plan for the 300 Area Liquid Effluent Facilities can be found in WHC-IP-1000, *300 Area Liquid Effluent Facilities Administrative*, Section 1.4, Parts 4.6.1, "Engineering Documents"; Section 4.6.3, "Operating Procedures"; and Section 4.13, "Handling, Storage, and Shipping" provides applicable guidance to this characterization activity.

8.1 QUALITY CONTROL OF FIELD ACTIVITIES

Audits of sampling activities have been periodically performed in the past. Due to the large number of samples and importance of the characterization project QA/Quality Control (QC) field presence will be required. Specifically, QA/QC will be requested at a minimum to verify the following:

- o Sample Piping has been properly purged.
- o Samples have been correctly identified.

8.2 SAMPLING PROCEDURE CONTROL

Operating procedures and maintenance work procedures are controlled according to the requirements contained in the WHC-IP-1000. The requirements of operating procedure control are listed in Section 3.1, "Technical Procedure Control Process". Maintenance work plans control requirements are in Section 4, "Work Control".

8.3 LABORATORY QUALITY CONTROL

The Quality Assurance Plan (QAP) for the Analytical Chemistry Laboratory (325) is MCS-033, *Quality Assurance Plan for Activities Conducted by the Analytical Chemistry Laboratory* Revision 4, Section 9.4, identifies "Radiochemical Quality Control". The QAP was prepared following guidance from Interim Guidelines and Specifications for Preparing QAPP, USEPA Office of Monitoring Systems and Quality Assurance Office of Research and Development (QAMS-005/80). The identifies controls and requirements for all aspects of characterization work.

Two key elements of QA within the 325 Laboratory are the assignment of a Project Manager (PM) and impact level.

L.R. Greenwood is the PM for this characterization project. Some of his responsibilities include acting as a single point of contact, development of appropriate DQOs, and ensuring analytical staff is provided the necessary information to meet data quality requirements.

The impact level designation is a risk-based rating system with Levels I, II, and III. The severest health and safety or technical risk work if predetermined goals are not accomplished is impact Level I. Impact Level II analytical work provides the same rigor as impact Level I, but the QA details are not included in the final report. Even though duplicate test and other data is not in the final report, qualified data would be flagged. Impact Level II has been selected for this project.

Figure 1. Liquid SAF

Sampling Authorization Form				Crit-L
Parameter/ Analysis	Analytical Methods	Container/ Volume	Preservation	Holding Time
Vol % Solids	PNL-ALO-504	Plastic 250 ml (use HDPE or FEP for transport package)	NA	ASAP
pH	PNL-ALO-225			ASAP
SpG	PNL-ALO-535			ASAP
Pu-238, 239/240, 241, 242	PNL-ALO-455			6 Months
GEA	PNL-ALO-450			6 Months
Uranium Isotopic	PNL-ALO-455			6 Months

Analytical Protocols: RCRA

Data Turnaround Requirements: Priority

Quality Assurance: QA MCS 033, PNL Impact Level II

Data Deliverable: Level I

Special Instructions: Handle as a single batch with samples for Crit-S

Figure 2. Solid SAF

Sampling Authorization Form				Crit-S
Parameter/ Analysis	Analytical Methods	Container/ Volume	Preservation	Holding Time
Pu-238, 239/240, 241, 242	PNL-ALO-455	Plastic 250 ml (use HDPE or FEP for transport package)	NA	6 Months
SpG	PNL-ALO-535			ASAP
Am-241	PNL-ALO- 489/422			6 Months
GEA	PNL-ALO-450			6 Months
Uranium Isotopic	PNL-ALO-455			6 Months

Analytical Protocols: RCRA

Data Turnaround Requirements: Standard

Quality Assurance: QA MCS 033, PN. Impact Level II

Data Deliverable: Level I

Special Instructions: Handle as a single batch with samples for Crit-L

8.4 DATA QUALITY OBJECTIVES

To prove samples are homogeneous there should only be statistically insignificant difference between samples collected at various locations. The samples collected will likely contain soluble and insoluble constituents. Separate liquid phases are not anticipated. The analysis results from soluble radionuclides will be compared as will the results from insoluble radionuclides. The laboratory results shall be within a 95% confidence interval.

8.5 QUALITY ASSURANCE OBJECTIVES

The QA standards for the 325 Laboratory are summarized in Table 9.8 of MCS-033. In order to ensure high quality data for this project, the 340 samples shall be treated as a batch. This will ensure proper checks and controls are performed during the analysis of the 340 samples which will provide assurance of high quality data.

8.6 DATA REDUCTION, VALIDATION, AND REPORTING

The standard process for data checking at the 325 Laboratory is peer review. An independent QA review service is available, but is not required for this project. Reporting requirements for the 325 Laboratory are listed in Section 12.0 of MCS-033. For the purposes of this project, Data Deliverable - Level I is adequate.

9.C REFERENCES

- (1) WHC-IP-1000, *300 Area Liquid Effluent Facilities Administration*.
- (2) MCS-033, *Quality Assurance Plan for Activities Conducted by the Analytical Chemistry Laboratory (ACL)*, Revision 4, Issued May 31, 1996.