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VAPOR & GAS SAMPLING OF SST 241BY112 USING VAPOR
SAMPLING SYSTEM

SEP 20 1995

ENGINEERING DATA TRANSMITTAL

Page 1 of 1

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VAPOR AND GAS SAMPLING OF SINGLE-SHELL TANK 241-BY-112 USING THE VAPOR SAMPLING SYSTEM

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7. Abstract

THIS DOCUMENT PRESENTS SAMPLING DATA RESULTING FROM THE NOVEMBER 18, 1994, SAMPLING OF SST 241-BY-112 USING THE VAPOR SAMPLING SYSTEM.

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LIST OF TERMS

CGI	Combustible Gas Indicator
COC	Chain Of Custody
DOT	U.S. Department of Transportation
GC/FID	Gas Chromatograph/Flame Ionization Detector
GEA	Gamma Energy Analysis
HEPA	High-Efficiency Particulate Air (filter)
NH ₃	Ammonia
NO ₂	Nitrogen Dioxide
NO	Nitric Oxide
H ₂ O	Water Vapor
OGIST	Oregon Graduate Institute of Science and Technology
OPC	Offsite Property Control
ORNL	Oak Ridge National Laboratory
PNL	Pacific Northwest Laboratory
SML	Sampling and Mobile Laboratories
SST	Single-Shell Tank
TCP	Tank Characterization Plan
team	SML Vapor Team
TST	Triple Sorbent Trap
VSS	Vapor Sampling System
WHC	Westinghouse Hanford Company

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VAPOR AND GAS SAMPLING OF SINGLE-SHELL TANK 241-BY-112 USING THE VAPOR SAMPLING SYSTEM

1.0 SCOPE

The Vapor Issue Resolution Program tasked the Sampling and Mobile Laboratories (SML) to collect representative headspace samples from Hanford Site single-shell tank (SST) 241-BY-112. This document presents sampling data resulting from the November 18, 1994, sampling of SST 241-BY-112.

2.0 SAMPLING EQUIPMENT DESCRIPTION

2.1 VAPOR SAMPLING SYSTEM

The SML vapor team (the team) used the vapor sampling system (VSS) to collect representative samples of the air, gases, and vapors from the headspace of SST 241-BY-112 on November 18, 1994. Mahon et al. (1994) describes in detail the VSS, its performance, and its operation. The team used the VSS to collect sorbent traps and SUMMA¹ canister headspace samples from SST 241-BY-112; subsequently, the team sent these samples to analytical laboratories for analysis.

The VSS comprises a mobile laboratory, a hot-water-jacketed stainless steel probe that is inserted into the tank headspace, and stainless steel transfer tubing that connects the mobile laboratory to the probe. A vacuum pump draws sample vapor from the tank headspace and through all transfer tubing and the sampling manifold. Electrically activated, pneumatically actuated valves direct sample flow within the VSS. Instrumentation housed in the mobile laboratory monitors and controls system temperature, monitors absolute and differential system pressure, meters and controls mass flow, and monitors sample vapor using a gas chromatograph/flame ionization detector (GC/FID).

A key feature of the VSS is its use of heated transfer tubing and a heated sampling manifold. Maintaining the system temperature at an electronically controlled elevated temperature prevents vapor condensation and reduces vapor adsorption on surfaces exposed to sample vapor. Mahon et al. (1994) describes various tests and observations that indicate the VSS sample transfer efficiency is consistently high.

Sorbent trap samples are collected at the sorbent trap station of the sampling manifold. Sorbent traps are pencil-size stainless steel or glass tubes that contain vapor-adsorbing media. A known amount of sample vapor is passed through the tube, which traps (by adsorption) virtually all the target

¹SUMMA is a registered trademark of Molectrics, Inc., Cleveland, Ohio.

analytes. The sorbent trap is then sent to an analytical laboratory and analyzed. The concentration of analytes in the vapor sampled is calculated from the quantity of analyte found in the sorbent media and the volume of vapor passed through the sorbent trap.

The sorbent trap station uses highly accurate mass flow controllers to measure and control the flow rate of sample vapor through the sorbent traps. The controllers are located downstream of the sorbent trap station and the in-line driers, which remove water vapor from the vapor before the vapor is metered. Errors associated with the mass flow controllers were determined by the Westinghouse Hanford Company (WHC) Standards Laboratory before the SST 241-BY-112 sampling (see Table 1). Flow rates and the duration of flow are specified by the analytical laboratories that supply and analyze the sorbent traps.

Table 1. Flow Control Calibration.

Flow-indicating Control Valve	Flow (stdcm ³ /min)	Error (%)
1	200	±0.15
3	200	±0.30

The VSS is also equipped with a gas chromatograph (GC). The Hewlett Packard 5890 Series II GC is equipped with a flame-ionization detector (FID), 1 mL sample loop, 10 port injection valve, 2 meter chromatographic column, programmable oven, portable computer, and HP-Chemstation software to control the GC. The GC is plumbed to directly transfer the sample from the VSS manifold to the sample loop. After the sample is transferred into the sample loop and reaches equilibrium, the run is initiated manually. HP-Chemstation software activates the 10 port valve to transfer the sample from the sample loop to the column. The sample passes through the column and the FID generates a signal for total organic carbon (TOC). All the data is then transmitted to the computer where it is stored for further analysis.

The GC is equipped with a HP-5 column which is 2 meters long, 0.25 mm inside diameter, and a 0.25 μ m phenyl methyl silicone phase. The GC oven is programmed to heat from 50 °C to 270 °C at a rate approximately 70 °C per minute. Helium is the carrier gas, air and hydrogen the combustion gases, and nitrogen the make-up gas.

Prior to sampling, a GC/FID is configured to quantitatively estimate concentrations of TOC. The GC/FID confirms sampling system cleanliness, sampling manifold performance, TOC of ambient air background levels during sampling, and TOC of tank vapor samples. The system is multi-point calibrated and has displayed a high degree of stability over a period of months. For further details, see Section 3.6, Field GC/FID Results.

The sampling manifold also has a station for sampling vapor with evacuated SUMMA[™] canisters. SUMMA[™] canisters are stainless steel vessels with internal surfaces that have been prepared by the SUMMA[™] process, which passivates

active sites on the canister walls to minimize adsorption of gases and vapors. An analytical laboratory must clean and evacuate SUMMA™ canisters before use. The evacuated canister is filled with sample vapor through a valve, which is then closed to seal the sample inside. SUMMA™ canisters essentially allow collection and transfer of whole-air samples from location to an analytical laboratory where the sample is analyzed. The standard capacity of each SUMMA™ canister is 6 liters.

A GC/FID confirms that the VSS is free of hydrocarbon contamination, to the limit of detection. The GC/FID is part of the VSS and can be used during a sampling event to periodically monitor organic vapor concentrations in the vapor being sampled.

3.0 SAMPLING EVENT DESCRIPTION

3.1 SPECIFICATIONS

The Vapor Issue Resolution Program specifies sampling requirements in WHC-SD-WM-TP-281 (Homi 1994). The TCP also specifies the types and number of samples to be collected, flow rates, and durations. These key sampling parameters are summarized on the sample log sheets in Appendix A. In addition to the sample log sheets, checksheets for each individual sample help ensure correct sampling procedures. SML retains these documents in the project file. This sample event's project-specific number is S4-084.

3.2 OPERATIONS AND SAMPLING PERSONNEL

D. Dudley was the Tank Farm Operations person-in-charge. The other SML vapor team members included:

- R. A. Westberg, Field Scientist
- E. A. Johnson, Field Scientist
- R. L. Ragan, Field Scientist (Training)
- N. P. Buechler, Trailer Support.

The VSS was set up at SST 241-BY-112 on November 17, 1994 and was allowed to warm up. Sampling began shortly after 9:30 a.m. on November 18, 1994, and was completed by 2:30 p.m. the same day.

3.3 AMBIENT CONDITIONS

The weather the day of the sampling event, November 18, 1994, was cool and clear with light winds from the east. Graphs of ambient temperatures and pressures taken at the Hanford Meteorological Station, which is about 4 miles due west of 241-BY SST farm, are provided in Appendix B.

3.4 INDUSTRIAL HYGIENE FIELD RESULTS

Before connecting to SST 241-BY-112, an industrial hygiene technician field tested the tank vapors. The technician purged the vapor probe sample tube for 5 minutes and then field measured vapor stream contents using a combustible gas indicator (CGI) and an organic vapor meter (OV). Results of this testing were not recorded.

3.5 SAMPLE COLLECTION

The hot-water-jacketed sampling probe was located in Riser 21 of SST 241-BY-112. The probe length, from the sample inlet to the top of the riser flange, was 7.9 m.

All zones of the VSS were heated to 60 °C during setup of the VSS at SST 241-BY-112 on November 17, 1994. The team stabilized the VSS temperature zones by 9:15 a.m. on November 18, 1994, and the system was ready to collect samples. Measured according to the VSS operating procedure, the pressure and temperature of SST 241-BY-112 were 1000 mbar (750 torr) and 23.2 °C, respectively. The sample log sheets (Appendix A) provide a complete chronology of the sample event including start and end times, flow rates, volumes, and specific sample identifiers.

Prior to sampling, the team began heating the VSS transfer tubing and sampling manifold. Also, the team purged the sampling manifold with ambient air. The team collected two SUMMA™ canister samples of ambient air, one manually 10 meters upwind of the VSS connection with SST 241-BY-112, and one using the VSS sampling manifold. The former was collected to establish background levels of trace organic vapors, and the latter was collected to establish the cleanliness of the sampling manifold.

A leak check of the VSS sampling manifold and transfer tubing (up to the connection to the in-tank sampling probe) was performed. Leakage resulted in an increase of 5.87 mbar (6.9 torr) rise in pressure over the 15 minute test. Given a system volume of not more than 10 L, this pressure rise corresponds to a leak rate of approximately 20.9 mL/min at a 293 mbar (220.1 torr) system pressure. This leak rate was estimated for average SUMMA™, TST, and sorbent sampling pressures. It was found that for the SUMMA™ canisters, dilution by ambient air was approximately 0.2%, for TST traps sampled at 50 mL/min the dilution was approximately 0.8%, for TST traps sampled at 100 mL/min the dilution was approximately 0.8%, for TST traps sampled at 100 mL/min the dilution was approximately 0.8%, and for sorbent traps the dilution was approximately 0.8%. These results are "best guess", as the datalogger was not recording pressure nor flow data during sampling of SST 241-BY-112.

The VSS was purged with sample vapor from SST 241-BY-112 for 30 minutes at a total flow rate of 5.45 L/min. This purge was performed to flush ambient air from the system and saturate the system's active adsorption sites. Because the volume of transfer tubing and the sampling manifold upstream of the sampling devices is estimated to be no more than 10 L, this purge provided about 16.4 air turnovers in the system.

Three analytical laboratories provided sample media. Oak Ridge National Laboratory (ORNL) provided triple sorbent traps (TSTs) for organic vapors; Pacific Northwest Laboratory (PNL) provided SUMMA™ canisters and sorbent traps for organic vapors, ammonia (NH₃), nitrogen dioxide (NO₂), nitric oxide (NO), and water vapor (H₂O); and Oregon Graduate Institute of Science and Technology (OGIST) provided SUMMA™ canisters.

3.6 FIELD GC/FID RESULTS

The GC was single point calibrated on the day of sampling using a 19.00 ppmC Ethane standard by Scott Specialty Gas. The standard is an E.P.A. Protocol Gas that is +/- 2% NIST traceable. Table 2 shows the Field GC/FID results from the sampling of 241-BY-112.

Table 2. TOC Results.

Number of Runs	Description	Average TOC Concentration (ppmC)	% Standard Deviation
4	Ethane	19.00	3.97
2	Ambient	2.88	5.72
4	Tank Vapor	8.94	6.25

3.7 RADIATION SCREENING

Samples are unconditionally released from the SST farm in accordance with DI-33300-93-004, *Release of Vapor Sampling Equipment* (WHC 1993b). Radiological screening results are used to determine (1) if the samples must be shipped as radioactive or nonradioactive in accordance with U.S. Department of Transportation (DOT) regulations and (2) if the samples meet the laboratory acceptance criteria.

The DOT limits for shipping a nonradioactive sample are 200 pCi/g of beta-gamma activity and 60 pCi/g of alpha activity. Samples exceeding these DOT limits may be shipped as radioactive material, if the samples do not exceed the following laboratory acceptance criteria:

- OGIST: The laboratory has supplied no acceptance criteria for alpha-beta-gamma activity. Notify the laboratory if radioactive levels exceed the DOT limits specified above, or if >50 pCi/g tritium are found.
- ORNL: Beta-gamma activity <450 pCi/g of sample media. Alpha activity <135 pCi/g.
- PNL: Beta-gamma activity <400 pCi/g of sample media. Alpha activity <100 pCi/g of sample media.

To protect the sampling manifold and all sampling devices from radioactive particulates, all sample vapor for the November 18, 1994, SST 241-BY-112 vapor sampling event was drawn through a series of four glass-fiber high-efficiency particulate air (HEPA) filters placed upstream of the sampling manifold. These four filters were in place any time tank headspace vapor, gases, and vapors were flowing through the system. When sampling was complete, the filters were removed and assigned unique sample identifiers. All four HEPA filters were submitted to Laboratory 222-S for total alpha, total beta, and gamma energy analysis (GEA). The HEPA filter closest to the sampling manifold was analyzed to determine if the samples met DOT shipping criteria and laboratory acceptance criteria. SST 241-BY-112 filter sample results are shown in Table 2. SML scientists use the activity results from Table 3 to calculate pCi/g of sample media. SML maintains this information in the project-specific file.

A water vapor sample was also collected through one of the sorbent station ports and analyzed for tritiated water. SST 241-BY-112 tritium sample results are shown in Table 3. The results in Table 3 indicate that the samples collected from SST 241-BY-112 met the laboratory acceptance criteria and the DOT definition of a nonradioactive shipment.

Table 3. Radionuclide Analysis Results.

Filter	Sample Identifier	Activity Results ^a (pCi/sample)	Activity ^b (pCi/L of tank gas)
Upstream HEPA filter (box)	S4084-A35.OU1	Total Alpha = 144 Total Beta = 192 GEA = <detectable	=.37 =.50 =<detectable
Downstream HEPA filter (box)	S4084-A36.OD1	Total Alpha = Received Empty Total Beta = Received Empty GEA = Received Empty	
Upstream HEPA filter (VSS)	S4084-A37.OU2	Total Alpha = .93 Total Beta = <3.05 GEA = <detectable	=<.002 =<.008 =<detectable
Downstream HEPA filter (VSS)	S4084-A38.OD2	Total Alpha = <0.0007 Total Beta = <2.8 GEA = <detectable	= <0.000002 =<0.007 =<detectable
Tritium trap	S4084-A03.OT1	Total activity = <50.0	=<50.0 ^c

NOTES:

The samples are nonradioactive. These results were evaluated against laboratory acceptance criteria and DOT limits (see Section 3.5).

^aAll less than (<) values represent the minimum detection limits at Laboratory 222-S.

^bNumbers based on an approximation of the total volume of tank vapor through the HEPA filters. Appendix A and the sample checksheets were used to estimate a total flow through the VSS of 387 L.

^cNumber is calculated using a total volume of 1 L passing through the tritium trap.

4.0 SAMPLE CHAIN OF CUSTODY: RECEIPT, STORAGE, AND SHIPMENT

All sorbent trains, sorbent tubes, and SUMMA™ canisters received by SML are stored in a custody locker maintained by SML. Sorbent trains and tubes were maintained at 4 ± 2 °C in a refrigeration unit. SUMMA™ canisters were stored in the same locked storage area, but were not refrigerated.

TSTs are supplied by ORNL. ORNL initiates the chain-of-custody (COC) forms. The sample media is placed in 40-mL volatile organic analysis vials. Evidence

tape is applied to the vials, which are then placed in a shipping container along with the relinquished COC forms and shipped to SML. TSTs are shipped to SML in a cooler containing "blue" ice.

The TSTs were received, inventoried against the COC forms, and the "received by" block on the COC form was signed by SML. They were maintained at 4 ± 2 °C before and after the sampling event in a refrigeration unit.

The TSTs were shipped back to ORNL after the sampling event using offsite property control (OPC W95-0-0019). Table 4 lists the sample identifiers, sample types, and COC form numbers for all ORNL samples. The samples were delivered for transport on November 28, 1994, and shipped by Federal Express for next-day delivery.

Sorbent trains and SUMMA™ canister sampling devices were supplied with COC forms by PNL. Sampling devices were picked up from PNL by SML and transported in a government vehicle to a custody locker.

Table 4. Oak Ridge National Laboratory Samples.

Sample Identifier	Sample Type	COC Number
S4084-A10.639	TST	006746
S4084-A11.659	TST	006746
S4084-A12.668	TST	006746
S4084-A13.605	TST field blank	006746
S4084-A14.669	TST	006746
S4084-A15.667	TST	006746
S4084-A16.852	TST	006746
S4084-A17.643	TST	006746
S4084-A18.782	TST	006746
S4084-A19.801	TST	006746
S4084-A20.606	TST field blank	006746
S4084-A21.809	TST	006746
S4084-A22.666	TST	006746
S4084-A23.664	TST	006746
S4084-A24.745	TST trip blank	006746
S4084-A25.714	TST trip blank	006746

SUMMA™ canisters were also supplied by OGIST. The sample media is shipped to SML without a COC form. The sample media is inventoried at SML, where the COC is initiated.

After sampling, the PNL sorbent traps and SUMMA™ canisters were transported by government vehicle directly to PNL and delivered to J. A. Edwards on November 28, 1994. Table 5 lists the sample identifiers, sample types, and COC form numbers for all PNL samples. The sorbent trains were maintained at 4 ± 2 °C before and after the sampling event in a refrigeration unit.

Table 5. Pacific Northwest Laboratory Samples.

Sample Identifier	Sample Type	COC Number
S4084-A01.250	Ambient upwind SUMMA™	008078
S4084-A02.251	Ambient SUMMA™ (VSS)	008078
S4084-A07.252	SUMMA™	008078
S4084-A08.253	SUMMA™	008078
S4084-A09.254	SUMMA™	008078
S4084-A26.V01	NH ₃ /NO ₂ /NO/H ₂ O sorbent	008079
S4084-A27.V02	NH ₃ /NO ₂ /NO/H ₂ O sorbent	008079
S4084-A28.V03	NH ₃ /NO ₂ /NO/H ₂ O sorbent	008079
S4084-A29.V04	NH ₃ /NO ₂ /NO/H ₂ O sorbent	008079
S4084-A30.V05	NH ₃ /NO ₂ /NO/H ₂ O sorbent	008079
S4084-A31.V06	NH ₃ /NO ₂ /NO/H ₂ O sorbent	008079
S4084-A32.V07	NH ₃ /NO ₂ /NO/H ₂ O trip blank	008079
S4084-A33.V08	NH ₃ /NO ₂ /NO/H ₂ O trip blank	008079
S4084-A34.V09	NH ₃ /NO ₂ /NO/H ₂ O trip blank	008079

Table 6 lists the sample identifiers, sample types, and COC form numbers for all OGIST samples.

Table 6. Oregon Graduate Institute Samples.

Sample Identifier	Sample Type	COC Number
S4084-A04.218	SUMMA™	007931
S4084-A05.219	SUMMA™	007931
S4084-A06.220	SUMMA™	007931

From the time that samples are received by SML until they are shipped back to the analytical laboratory, COC is maintained by SML in accordance with LO-090-443/AO, *Chain-of-Custody for RCRA and CERCLA Protocol Samples* (WHC 1992). The final COCs for this sampling event are in Appendix C.

5.0 QUALITY ASSURANCE AND CONTROLS

5.1 VAPOR SAMPLING SYSTEM CLEANING

Immediately prior to sampling of SST 241-BY-112, the VSS manifold was heated to 60 °C and ambient air was purged through the system. Throughout this purge, all pertinent system valves were actuated to release any contaminants that may have collected in the VSS valves themselves. After this purge, an ambient air sample was drawn through the VSS manifold and a GC/FID run was initiated. No significant level of contaminants was detected by the FID. A second sample confirmed the VSS was free of organic remnants down to ambient levels. Thus, the system was ready to sample 241-BY-112. For further details, refer to Appendix C of LO-080-450/AO (WHC 1993c) and the project-specific file located with SML.

In compliance with the *Vapor Space Probe Cleaning Procedure* (WHC 1993c), the team cleaned the hot-water-jacketed probe before it was installed in SST 241-BY-112. This procedure requires a solvent rinse of all internal probe surfaces with acetone and methanol to clear the sample line of possible contamination remaining from the construction process. The probes are then heated to 90 °C, and dry air is passed through the probe to evaporate the solvents. Before the probes are released, the team ensures, using a hand-held organic vapor meter, that the total organic concentration in the sample line is below 1 ppmv.

SUMMA[™] canister ambient air samples were also collected to confirm that the VSS sampling manifold was free of trace organic contaminants (or to determine what contaminants were present). One SUMMA[™] canister was filled with ambient air upwind of SST 241-BY-112, and a second canister was filled with ambient air via the VSS sampling manifold. The canisters were shipped to PNL for analysis.

5.2 INSTRUMENT CALIBRATION

Instruments located in the VSS are calibrated on an annual basis at the WHC Standards Laboratory. VSS instrumentation calibration data, maintained in files by SML, is summarized in Table 7. According to the calibration schedule shown in Table 7, all instrumentation was within its calibration period during the SST 241-BY-112 sampling event.

Table 7. Calibration Data.

System	Calibration Date	Expiration Date	WHC Standards Laboratory Code
Temperature Control System	04/21/94	04/21/95	804-67-74-009
Mass Flow System	04/29/94	04/29/95	804-28-03-001
Pressure System	05/03/94	05/03/95	804-67-89-001

5.3 BLANK SAMPLES

Trip blanks are samples that accompany the sample media from the point of generation through sample analysis. Analysis of trip blanks is used to assess cross-contamination of the sample media during transport and storage. Trip blanks are transported to the field with the sample collection media but remain unopened throughout the sampling event.

Spiked blanks are samples that are spiked with a known amount of analyte before shipment. These blanks are handled and analyzed with the other samples. Analysis of the spiked blanks is used to evaluate potential sample loss during shipment or storage.

Ambient blanks are samples of ambient air collected at the sampling location. Analysis of ambient blanks is used to assess contamination that may be present in the atmosphere surrounding the sampling system or in the system itself prior to sampling.

Field blanks are sampling devices prepared and handled in the same manner as the sampler, but no tank gases are drawn through them.

Table 8 lists the blank samples collected during the sampling of SST 241-BY-112.

Table 8. Blank Samples.

Sample Identifier	Blank Type	Sample Media
S4084-A01.250	Ambient	SUMMA™
S4084-A02.251	Ambient through VSS	SUMMA™
S4084-A24.754	Trip	TST
S4084-A25.714	Trip	TST
S4084-A20.606	Field	TST
S4084-A13.605	Field	TST
S4084-A32.97V	Trip	NH ₃ /NO ₂ /NO/H ₂ O
S4084-A33.98V	Trip	NH ₃ /NO ₂ /NO/H ₂ O
S4084-A34.99V	Trip	NH ₃ /NO ₂ /NO/H ₂ O

6.0 ANOMALIES

All samples were collected in accordance with the TCP and LO-080-450/A0, *Collection of SUMMA Canisters and Sorbent Tube Samples Using the Vapor Sampling System* (WHC 1993a). PNL sorbents were exposed to a slight temperature rise prior to sampling. ORNL TST 643 sampled by itself because of an inadvertent valve mixup. Both labs were notified. No other anomalies to the TCP or the operating procedure were noted during the sampling of SST 241-BY-112. Further details are available in the project-specific file maintained by SML.

7.0 REFERENCES

- 49 CFR 100-177, 1992, "Transportation," *Code of Federal Regulations*, as amended.
- Homi, C. S., 1994, *Tank Characterization Plan for Vapor and Gas Sampling Tank 241-BY-112 Using the Vapor Sampling System*, WHC-SD-WM-TP-281, Westinghouse Hanford Company, Richland, Washington.
- Mahon, R. D., C. M. Jones, and M. S. Story, 1994 (draft), *Evaluation of the Capabilities and Use of the Vapor Sampling System for Tank Headspace Sampling and Characterization*, SD-WM-RPT-094, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1993a, *Collection of SUMMA Canisters and Sorbent Tube Samples Using the Vapor Sampling System (VSS)*, Procedure LO-080-450/A0, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1993b, *Release of Vapor Sampling Equipment*, Procedure DI-33300-93-004, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1993c, *Vapor Space Probe Cleaning Procedure*, Procedure LO-080-405/A0, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1992, *Chain-of-Custody for RCRA and CERCLA Protocol Samples*, Procedure LO-090-443/A0, Westinghouse Hanford Company, Richland, Washington.

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APPENDIX A
SAMPLE LOG SHEETS

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Set up VSS (Secton A)(Temperature set point = 60C)

Ensure HEPA filters are installed

Ensure connection to sample probe

System status check sheet. (Verify zones are to temp)

Tank Temperature 23.2 C

Date: 18 November, 1994

VSS Personnel: E.A. Johnson

R. Ragan

Trailer Personnel: N. Buechler

PNL		Desired		Desired		Desired		Actual		Actual		Actual	
OGI/ORNL	Port	Description	Flow	Duration	Total	Flow	Rate	Start	End	Total	Flow	Total	
Sample ID	Valve #		Rate	(min.)			SCCM	Time	Time	Time	Time	Time	
Group # 1													
Purge with ambient air for 30 min.													
4084- A01 .250	250	AMBIENT #1 (PNL)	5450	30	163500		SCCM	11/17/94	09:34	09:35			
GC Run #1													
4084- A02 .251	251	AMBIENT #2 (PNL)		1				09:45					
GC Run #2													
Leak check (Appendix A)													
Leak Rate: 27.6 Torr/Hr.													
Purge with tank air for 30 min.													
Measure tank pressure													
4084- A03 .0T1	T1682(222S	8	5450	30	163500	5450		10:31	11:01	30		163.50	
GC Run # 3 (Tank run #1)													
GC Run # 3 (Tank run #1)													
GC Run # 3 (Tank run #1)													
4084- A04 .H218	H218	11		1				11:20	11:21	1		6.00	
4084- A05 .H219	H219	13		1				11:24	11:25	1		6.00	
4084- A06 .H220	H220	15		1				11:28	11:29	1		6.00	
4084- A07 .252	252	12		1				11:32	11:33	1		6.00	
4084- A08 .253	253	14		1				11:36	11:37	1		6.00	
4084- A09 .254	254	16		1				11:40	11:41	1		6.00	
GC Run # 4 (Tank run # 2)													
GC Run # 4 (Tank run # 2)													

Waste Tank
241-8Y-112

WHC Sample ID	PNL		Description	Desired		Desired Total Flow	Desired		Actual Flow Rate	Actual		Actual Total Flow
	OGI/ORNL Sample ID	Port Valve #		Flow Rate	Duration (min.)		Start Time	End Time				
4084- A10 .639	TST# 639	9	TST #1	50	2	100	50.00	11:54	11:56	2	0.10	
4084- A11 .659	TST# 659	10	TST #2	50	2	100	50.00	11:54	11:56	2	0.10	
4084- A12 .668	TST# 668	8	TST #3	50	2	100	50.00	12:02	12:04	2	0.10	
4084- A14 .669	TST# 669	10	TST #4	50	2	100	50.00	12:02	12:04	2	0.10	
4084- A13 .605	TST# 605	TST FIELD BLANK #1										1
4084- A15 .667	TST# 667	9	TST # 5	100	5	500	100.00	12:14	12:19	5	0.50	
4084- A16 .652	TST# 652	10	TST # 6	100	5	500	100.00	12:14	12:19	5	0.50	
4084- A17 .643	TST# 643	8	TST # 7	100	5	500	100.00	12:32	12:37	5	0.50	
4084- A18 .782	TST# 782	10	TST # 8	100	5	500	100.00	12:25	12:30	5	0.50	
4084- A19 .801	TST# 801	9	TST # 9	200	5	1000	200.00	12:42	12:47	5	1.00	
4084- A21 .809	TST# 809	10	TST # 10	200	5	1000	200.00	12:42	12:47	5	1.00	
4084- A20 .606	TST# 606	TST FIELD BLANK #1										1
4084- A22 .666	TST# 666	8	TST # 11	200	5	1000	200.00	12:55	13:00	5	1.00	
4084- A23 .664	TST# 664	10	TST # 12	200	5	1000	200.00	12:55	13:00	5	1.00	
GC Run # 5 (Tank run #3)												13:07
4084- A26 .V01	V01	9	NH3/NOx/H2O #1	200	15	3000	200.30	13:22	13:27	15	3.00	
4084- A27 .V02	V02	10	NH3/NOx/H2O #2	200	15	3000	200.30	13:22	13:27	15	3.00	
4084- A28 .V03	V03	8	NH3/NOx/H2O #3	200	15	3000	200.30	13:43	13:58	15	3.00	
4084- A29 .V04	V04	10	NH3/NOx/H2O #4	200	15	3000	200.30	13:43	13:58	15	3.00	
4084- A30 .V05	V05	9	NH3/NOx/H2O #5	200	15	3000	200.30	14:11	14:26	15	3.00	
4084- A31 .V06	V06	10	NH3/NOx/H2O #6	200	15	3000	200.30	14:11	14:26	15	3.00	
GC Run # 6 (Tank run # 4)												14:06
TOTAL TANK GAS USED DURING SAMPLING RUNS												61.43

Waste Tank
241-BY-112

PNL		OGI/ORNL		Port	Description	Desired Flow	Desired Duration	Desired Total Flow	Actual Flow	Actual Start Time	Actual End Time	Actual Total Time	Actual Total Flow
WHC Sample ID	Sample ID	Sample ID	Valve #			Rate	(min.)	Flow	Rate	Time	Time	Time	Flow
4084- A35 .0U1	T1683(222S	25	Upstream HEPA(box)								14:45		
4084- A36 .0D1	T1684(222S	26	Downstream HEPA(box)								14:45		
4084- A37 .0U2	T1686(222S	27	Upstream HEPA (VSS)								14:45		
4084- A38 .0D2	T1685(222S	28	Downstream HEPA (VSS)								14:45		

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Trip Blanks (DO NOT EXPOSE)

4084- A24 745	TST # 745	15	TST TRIP #1										
4084- A25 714	TST # 714	15	TST TRIP #1										
4084- A32 .97V	97V	22	NH3/NOx/H2O TRIP #1										
4084- A33 .98V	98V	23	NH3/NOx/H2O TRIP #2										
4084- A34 .99V	99V	24	NH3/NOx/H2O TRIP #3										

VSS SAMPLING RADIOLOGICAL SCREENING RESULTS

SAMPLING DATE 16 Nov. '94									
TANK # BY-111									
HEPA BOX UPSTREAM FILTER	Liters	pCi / filter	pCi / liter	HEPA BOX DOWNSTREAM FILTER	Liters	pCi / filter	pCi / liter		
TOTAL VOLUME	387.33			TOTAL VOLUME	(FILTER MISSING)				
BETA		192	0.50	BETA					
ALPHA		144	0.37	ALPHA					
GEA - Am-243		ND		GEA - Am-243					
- Bi-212		ND		- Bi-212					
- Np-237		ND		- Np-237					
- Pb-212		ND		- Pb-212					
- Th-229		ND		- Th-229					
- TL-208		ND		- TL-208					
VSS UPSTREAM FILTER	Liters	pCi / filter	pCi / liter	VSS DOWNSTREAM FILTER	Liters	pCi / filter	pCi / liter		
TOTAL VOLUME	387.33			TOTAL VOLUME	387.33				
BETA		< 3.5		BETA		< 2.8	< Detectable		
ALPHA		93.20	0.24	ALPHA		< 0.0006	< Detectable		
GEA - Am-243		ND		GEA - Am-243		ND	< Detectable		
- Bi-212		ND		- Bi-212		ND	< Detectable		
- Np-237		ND		- Np-237		ND	< Detectable		
- Pb-212		ND		- Pb-212		ND	< Detectable		
- Th-229		ND		- Th-229		ND	< Detectable		
- TL-208		ND		- TL-208		ND	< Detectable		
TRITIUM TRAP		pCi / filter	pCi / liter						
TOTAL VOLUME	1.0								
TOTAL ACTIVITY		< 50.0	< 50.0						
SAMPLE EXPOSURE ANALYSIS, USING VSS DOWNSTREAM FILTER ANALYSIS AS POSSIBLE EXPOSURE LEVEL									
= BETA < 2.8 pCi/Filter, ALPHA < 0.006 pCi/liter, GEA not detected									
SORBENT SAMPLING				TSTS					
TOTAL VOLUME PER SAMPLE	3.00 Liters			TOTAL VOLUME PER SAMPLE	Liters	Alpha/Beta per sample			
ALPHA PER SAMPLE	0.00 pCi			TST 639, 659, 668, 669.	0.1	0 pCi			
INDIVIDUAL SORBENTS				TST 667, 852, 643, 782.	0.5	0 pCi			
NH3 (0.75 gram)	0.00 pCi per gram			TST 801, 809, 666, 664.	1	0 pCi			
NO2 (0.60 gram)	0.00 pCi per gram								
H2O (0.45 gram)	0.00 pCi per gram								
SUMMA SAMPLING									
TOTAL VOLUME PER CANISTE	6 Liters								
ALPHA PER SAMPLE	0.00 pCi								

WIC-SD-MM-RPT-125, Rev. 0

APPENDIX B
AMBIENT CONDITIONS

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WEATHER FOR VSS VAPOR SAMPLING OF BY-112

Time on 11/18/94

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APPENDIX C
CHAIN-OF CUSTODY FORMS

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Westinghouse
Hanford Company

CHAIN OF CUSTODY

ORNL-006746

Custody Form Initiator Amy Dindal

Company Contact Roger Jenkins

Telephone (615) 576-8594

Project Designation/Sampling Locations 241-BY-112 (VSS)

Collection Date

Ice Chest No.

Field Logbook No.

Bill of Lading/Airbill No.

Offsite Property No.

Method of Shipment Federal Express

Shipped to Rick Mahon

Possible Sample Hazards/Remarks NONE

Sample Identification

S4084-A10.639	TST# 639✓	ORNL Triple Sorbent Trap
S4084-A11.659	TST# 659✓	ORNL Triple Sorbent Trap
S4084-A12.668	TST# 668✓	ORNL Triple Sorbent Trap
S4084-A14.669	TST# 669✓	ORNL Triple Sorbent Trap
S4084-A15.667	TST# 667✓	ORNL Triple Sorbent Trap
S4084-A16.852	TST# 852✓	ORNL Triple Sorbent Trap
S4084-A17.843	TST# 843✓	ORNL Triple Sorbent Trap
S4084-A18.782	TST# 782✓	ORNL Triple Sorbent Trap
S4084-A19.801	TST# 801✓	ORNL Triple Sorbent Trap
S4084-A21.809	TST# 809✓	ORNL Triple Sorbent Trap
S4084-A22.666	TST# 666✓	ORNL Triple Sorbent Trap
S4084-A23.664	TST# 664✓	ORNL Triple Sorbent Trap
S4084-A24.745	TST# 745✓	ORNL Trip Blank
S4084-A25.714	TST# 714✓	ORNL Trip Blank
S4084-A13.805	TST# 805✓	ORNL Field Blank
S4084-A20.806	TST# 806✓	ORNL Field Blank

[] Field Transfer of Custody

Chain of Possession

(Sign and Print Names)

Relinquished By	Date	Time	Received By	Date	Time
AB Dindal	11/3/94	10:46am	AB Dindal	11/29/94	1720
AB Dindal	11/29/94	1120	AB Dindal	11/29/94	1720

Did not include
Max/min
Thermometer
11/29/94

Temperature (°C)	Min	Max
When shipped (ORNL)	0	12
When received (WHC)	2	6
When shipped (WHC)		
When received (ORNL)		9.6

Westinghouse Hanford
Company

CHAIN OF CUSTODY

007931

Custody Form Initiator T.B. UtechtCompany Contact R.D. MahonTelephone 373-1101Project Designation/Sampling Locations 241-BY Tank 112Collection Date 11-18-94Ice Chest No. N/AField Logbook No. N/ABill of Lading/Airbill No. N/AOffsite Property No. N/AMethod of Shipment Fed ExShipped to OBIPossible Sample Hazards/Remarks NONE

Sample Identification

S4084 - A04 .218'S4084 - A05 .219'S4084 - A06 .220'☐ Field Transfer of Custody

CHAIN OF POSSESSION

(Sign and Print Name)

Relinquished By	Date	Time	Received By	Date	Time
<u>T.B. Utecht / T.B. Utecht</u>	<u>11-17-94</u>	<u>0800</u>	<u>JP Buechler</u>	<u>11-17-94</u>	<u>0800</u>
<u>JP Buechler</u>	<u>11-28-94</u>	<u>1200</u>	<u>A. Edwards / A. Edwards</u>	<u>11-28-94</u>	<u>1200</u>

Final Sample Disposition

Disposal Method:

Disposed by:

Date/Time:

Comments:

Westinghouse
Hanford Company

CHAIN OF CUSTODY

WHC 008078

Custody Form Initiator

J. A. Edwards-PNL

Telephone (509) 373-0141

Page 85-3009 / FAX 376-0418

Company Contact

H. D. Mahon-WHC

Telephone (509) 373-1101

Page 85-9656 / FAX 373-3193

Project Designation/Sampling Locations 200 East Tank Farm
241-BY-112 Tank Vapor Sample SAF S4084
(VSS Truck)

Collection date 11-__-94

Preparation date 11-1 0-94

Ice Chest No.

Field Logbook No. WHC-____-____-____

Bill of Lading/Airbill No.

N/A

Offsite Property No. N/A

Method of Shipment

Government Truck

Shipped to

PNL

Sample Job # _____

Possible Sample Hazards/Remarks Unknown at time of sampling

Sample Identification

S4084-A01.250^v

Ambient Air #1 Upwind @ VSS (PNL)

S4084-A02.251^v

Ambient Air #2 Through VSS (PNL)

S4084-A07.252^v

Sample #6 (PNL)

S4084-A08.253^v

Sample #7 (PNL)

S4084-A09.254^v

Sample #8 (PNL)

[] Field Transfer of Custody			[] Chain of Possession			(Sign and Print Names)	
Relinquished By	Date	Time	Received By	Date	Time		
J. A. Edwards <i>J. A. Edwards</i>	11-10-94	1400	<i>N. P. Bruch</i>	11-10-94	1400		
<i>N. P. Bruch</i>	11-28-94	1200	<i>J. A. Edwards</i>	11-28-94	1200		

Final Sample Disposition

Comments:

	PNL (only) Checklist	Pick-up / Delivery	Comments:
0	Media labeled and checked?	Y/N	
0	Letter of Instruction?	Y/N	
0	Media in good condition?	Y/N	
0	COC info/signatures complete?	Y/N	
0	Sorbents shipped on ice?	Y/N	
0	Rad release stickers on samples?	Y/N	
0	Activity report from 222S?	Y/N	
0	COC copy for LRB, RIDS filed?	Y/N	
0	COC copy for sorbent follow-on?	Y/N	
	ROC <i>(Signature)</i>	ROC <i>(Signature)</i>	NIA

(Revised 10/17/94 PNL.)

Westinghouse
Hanford Company

CHAIN OF CUSTODY

WHC 008079

Custody Form Initiator J. A. Edwards-PNL

Telephone (509) 373-0141

Page 85-3009 / FAX 376-0418

Company Contact R. D. Mahon-WHC

Telephone (509) 373-1101

Page 85-9656 / FAX 373-3193

Project Designation/Sampling Locations 200 East Tank Farm
241-BY-112 Tank Vapor Sample SAF S4084
(VSS Truck)

Collection date 11-__-94

Preparation date 11-0 7-94

Ice Chest No.

Field Logbook No. WHC-____-____-____

Bill of Lading/Airbill No. N/A

Offsite Property No. N/A

Method of Shipment Government Truck

Shipped to PNL

Sample Job # _____

Possible Sample Hazards/Remarks Unknown at time of sampling

Sample Identification

S4084 - A26 . V01	NH ₃ /NO _x /H ₂ O (Trap # 1) Line # 9
S4084 - A27 . V02	NH ₃ /NO _x /H ₂ O (Trap # 2) Line # 10
S4084 - A28 . V03	NH ₃ /NO _x /H ₂ O (Trap # 3) Line # 8
S4084 - A29 . V04	NH ₃ /NO _x /H ₂ O (Trap # 4) Line # 10
S4084 - A30 . V05	NH ₃ /NO _x /H ₂ O (Trap # 5) Line # 9
S4084 - A31 . V06	NH ₃ /NO _x /H ₂ O (Trap # 6) Line # 10
S4084 - A32 . V07	NH ₃ /NO _x /H ₂ O a-b-c (Trap Trip Blank# 1)
S4084 - A33 . V08	NH ₃ /NO _x /H ₂ O a-b-c (Trap Trip Blank# 2)
S4084 - A34 . V09	NH ₃ /NO _x /H ₂ O a-b-c (Trap Trip Blank# 3)

Field Transfer of Custody			Chain of Possession (Sign and Print Names)		
Relinquished By	Date	Time	Received By	Date	Time
Gary Dennis <i>[Signature]</i>	11-09-94	0900	J. A. Edwards <i>[Signature]</i>	11-09-94	0800
J. A. Edwards <i>[Signature]</i>	11-14-94	1400	T. B. Utter <i>[Signature]</i> / T. B. Utter	11-0-94	1400
T. B. Utter <i>[Signature]</i> / T. B. Utter	11-28-94	1200	J. A. Edwards <i>[Signature]</i> / J. A. Edwards	11-28-94	1200

Final Sample Disposition

Comments:

	PNL (only) Checklist	Pick-up / Delivery	Comments:
0	Media labeled and checked?	Y/N	
0	Letter of instruction?	Y/N	
0	Media in good condition?	Y/N	
0	COC info/signatures complete?	Y/N	
0	Sorbents shipped on ice?	Y/N	
0	Rad release stickers on samples?	Y/N	
0	Activity report from 222S?	Y/N	
0	COC copy for LRB, RIDS filed?	Y/N	
0	COC copy for sorbent follow-on?	Y/N/A	

POC

POC

(Revised 10/17/94 PNL)

Westinghouse
Hanford Company

CHAIN OF CUSTODY

WHC 008083

Custody Form Initiator J. A. Edwards-PNL

Telephone (509) 373-0141

Page 85-3009 / FAX 376-0418

Company Contact R. D. Mahon-WHC

Telephone (509) 373-1101

Page 85-9658 / FAX 373-3193

Project Designation/Sampling Locations 200 East Tank Farm
241-BY-112 Tank Vapor Sample SAF S4084
(VSS Truck)

Collection date 11-__-94

Preparation date 11-0 9-94

Ice Chest No.

Field Logbook No. WHC-____-____-____

Bill of Lading/Airbill No. N/A

Offsite Property No. N/A

Method of Shipment Government Truck

Shipped to PNL

Sample Job # _____

Possible Sample Hazards/Remarks Unknown at time of sampling

Sample Identification

S4084 - A26 . V01 \	H ₂ O-(l) (Trap # 1)	Line # 9
S4084 - A27 . V02 \	H ₂ O-(l) (Trap # 2)	Line #10
S4084 - A28 . V03 \	H ₂ O-(l) (Trap # 3)	Line # 8
S4084 - A29 . V04 \	H ₂ O-(l) (Trap # 4)	Line #10
S4084 - A30 . V05 \	H ₂ O-(l) (Trap # 5)	Line # 9
S4084 - A31 . V06 \	H ₂ O-(l) (Trap # 6)	Line #10

[] Field Transfer of Custody			[] Chain of Possession			(Sign and Print Names)	
Relinquished By	Date	Time	Received By	Date	Time		
Gary Dennis <i>[Signature]</i>	11-10-94	0800	J. A. Edwards <i>[Signature]</i>	11-10-94	0800		
J. A. Edwards <i>[Signature]</i>	11-10-94	1900	T. B. Uhl <i>[Signature]</i>	11-10-94	1900		
T. B. Uhl <i>[Signature]</i>	11-25-94	1200	J. A. Edwards <i>[Signature]</i>	11-28-94	1200		

Final Sample Disposition

Comments:

*** Attach to sorbents on COC 008079 ***

	PNL (only) Checklist	Pick-up / Delivery	Comments:
0	Media labeled and checked?	☒ Y / ☒ N	
0	Letter of Instruction?	☒ Y / ☒ N	
0	Media in good condition?	☒ Y / ☒ N	
0	COC info/signatures complete?	☒ Y / ☒ N	
0	Sorbents shipped on ice?	☒ Y / ☒ N	
0	Rad release stickers on samples?	☒ Y / ☒ N	
0	Activity report from 222S?	☒ Y / ☒ N	
0	COC copy for LRB, RIDS filed?	☒ Y / ☒ N	
0	COC copy for sorbent follow-on?	☒ Y / ☒ N / ☒ A	
	POC <i>[Signature]</i>	POC <i>[Signature]</i>	

(Revised 10/17/94 PNL)

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