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VAPOR AND GAS SAMPLING OF SINGLE-SHELL TANK 241-B-102 USING the in Situ Vapor Sampling System

G.S. Caprio

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Abstract: THIS DOCUMENT PRESENTS SAMPLING DATA RESULTING FROM THE APRIL 18, 1996 SAMPLING OF SST 241-B-102

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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
NH ₃	Ammonia
NO ₂	Nitrogen Dioxide
NO	Nitric Oxide
H ₂ O	Water Vapor
OPC	Offsite Property Control
OVN	Organic Vapor Meter
PNNL	Pacific Northwest National Laboratory
SAS	Special Analytical Studies
SML	Sampling and Mobile Laboratories
SST	Single-Shell Tank
TCP	Tank Characterization Plan
team	Vapor Team
TOC	Total Organic Carbon
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-B-102 USING THE VAPOR SAMPLING SYSTEM

1.0 SCOPE

The Vapor Issue Resolution Program tasked the Vapor Team (the team) to collect representative headspace samples from Hanford Site single-shell tank (SST) 241-B-102. This document presents sampling data resulting from the April 18, 1996 sampling of SST 241-B-102. Analytical results will be presented in a separate report issued by Pacific Northwest National Laboratory (PNNL), which supplied and analyzed the sampling media.

2.0 SAMPLING EQUIPMENT DESCRIPTION

2.1 VAPOR SAMPLING SYSTEM

The team, consisting of Sampling and Mobile Laboratories (SML) and Special Analytical Studies (SAS) personnel, used the vapor sampling system (VSS) to collect representative samples of the air, gases, and vapors from the headspace of SST 241-B-102 with sorbent traps and SUMMA¹ canisters on April 18, 1996. Mahon et al. (1994) describes in detail the VSS, its performance, and its operation.

The VSS comprises a mobile laboratory connected to the vapor space of the waste tank by stainless steel transfer tubing. A vacuum pump draws sample vapor from the tank headspace through the transfer tubing and into 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 vapor mass flow, and monitors total organic carbon (TOC) content of 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 at an elevated and controlled 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.

Highly accurate mass flow controllers control the sample vapor flow rate through the sorbent traps at the sorbent trap station. The controllers FICV-1 through FICV-9 are mounted on top of the sorbent station between the inlet and outlet valves of their respective sampling ports. While controllers FICV-10 and FICV-11 are located downstream of the sorbent trap station and the in-line driers, which remove moisture from the sample vapor before it is metered. Errors associated with the mass flow controllers were determined by the Westinghouse Hanford Company (WHC) Standards Laboratory before the SST 241-B-102 sampling event (see Table 1).

The VSS is equipped with a Hewlett Packard 5890 Series II gas chromatograph (GC) which is equipped with a flame-ionization detector (FID), 1 mL sample loop, 10 port injection valve, 2 meter chromatographic column, programmable

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

oven, and a portable computer loaded with the HP-Chemstation² software providing computer control. The oven is programmed to heat from 50°C to 270°C at a rate of 70°C per minute. Helium is the carrier gas, air and hydrogen the combustion gases, and nitrogen the make-up gas. The GC is plumbed to accept 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 by the operator from the computer. HP-Chemstation software activates the 10 port valve which transfers a sample from the sample loop to the HP-5 column. The column is 2m long and has an inside diameter of 0.25mm and is coated with a chemically bonded phenyl methyl silicone layer to minimize sample interference. The sample passes through the column to the FID which generates a TOC signal for that sample. The data is then transmitted to the computer where it is stored for future retrieval and analysis. The GC/FID is configured to quantitatively estimate concentrations of TOC. The GC/FID is configured to confirm sampling system cleanliness, and to quantitatively estimate TOC concentration in ambient air and tank vapor samples in real time.

Table 1. Flow Control Calibration.

Flow-indicating Control valve	Typically used Flow (stdcm ³ /min)	% Change from 647 to Actual	% Change from Datalogger to Actual
1	200	-0.7	-0.85
2	200	0.05	-0.10
3	200	-0.45	-0.60
4	200	0.05	-0.10
5	200	0.55	0.35
6	200	0.25	0.05
7	200	0.4	0.20
8	200	0.25	-1.81
9	50	-0.128	-0.27
10	200	-1.1	-1.20
11	5000	0.332	0.17

The system is multi-point calibrated at the weather station on an as available basis and last performed January 1995. The GC/FID has displayed a high degree of stability over a period of months. For further details, see Section 3.6, Field GC/FID Results.

Sorbent trap samples, pencil-size stainless steel or glass tubes containing vapor-adsorbing media, are collected at the sorbent trap station of the sampling manifold. The rate and the duration of flow are specified by the analytical laboratory providing the sample media, determines the total volume of vapor to be passed through the tube. Virtually all the target analytes are then trapped in the tube by the adsorbing media. Analyte concentration in the tank vapor can then be ascertained from the sorbent media analysis knowing the total volume of vapor which passed through the sorbent trap.

²HP-CHEMSTATION is a Registered Trademark of the Hewlett Packard Company, Avondale, Pennsylvania.

SUMMA[™] canisters, stainless steel vessels with their internal surfaces chemically passivated by the SUMMA[™] process to minimize adsorption of gases and vapors, are used to sample tank vapor from the SUMMA[™] sampling station on the sampling manifold. The precleaned and evacuated SUMMA[™] canisters are filled with sample vapor by opening a manually operated valve, which is then shut after pressure equilibration to seal the sample inside. SUMMA[™] canisters allow a 6 liter sample to be transported to an analytical laboratory.

3.0 SAMPLING EVENT DESCRIPTION

3.1 SPECIFICATIONS

The Vapor Issue Resolution Program specifies sampling requirements in WHC-SD-WM-TP-335 Rev 2, *Vapor Sampling and Analysis Plan* (Homi 1996). The Sampling and Analysis Plan 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. The team retains these documents in the project file. This sample event's project-specific number is S6-044.

3.2 OPERATIONS AND SAMPLING PERSONNEL

Steve Carter was the Tank Farm Operations person-in-charge. The team members included:

G. S. Caprio, Field Scientist
R. D. Mahon, Vapor Sampling Lead
T. B. Utecht, VSS Technician.

The VSS was set up at SST 241-B-102 on April 17, 1996 and was allowed to warm up overnight. Sampling began shortly after 9:00 a.m. on April 18, 1996, and was completed by 11:30 a.m. the same day.

3.3 INDUSTRIAL HYGIENE FIELD RESULTS

Prior to hooking up to SST 241-B-102, an industrial hygiene technician field tested tank vapors. The technician purged the instrument/vent header for 5 minutes and then field measured vapor stream contents using a combustible gas indicator (CGI) and an organic vapor meter (OVM). The measurements were verbally reported, LEL 0%, NH₃ 5ppm, O₂ 20.9%, and TOC 0.0ppm.

3.4 AMBIENT CONDITIONS

The weather the day of the sampling event, April 18, 1996 was cool and sunny with winds from the west at about 5-10 miles per hour. Graphs of ambient temperatures and pressures taken at the Hanford Meteorological Station, which is about 5 miles west of B-Farm, are provided in Appendix B.

3.5 SAMPLE COLLECTION

The hot-water-jacketed sampling probe was located in Riser 7 of SST 241-B-102. The probe length, from the sample inlet to the top of the riser flange, was 6.1 meters.

All zones of the VSS were heated to 60 °C during setup of the VSS at SST 241-B-102 on April 17, 1996. The team stabilized the VSS temperature zones by 9:00 a.m. on April 18, 1996, and the system was ready to collect samples. Measured according to the VSS operating procedure, the pressure and temperature of SST 241-B-102 were 989 mbar (741.6 torr) and 16 °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.

Approximately 23 hours before the first samples were collected, the team began heating the VSS transfer tubing and sampling manifold. During this warmup period, the team began a purge of all vapor transfer tubing and the sampling manifold with ambient air. Prior to sampling tank vapors on April 18, 1996, the team collected two SUMMA[®] canister samples of ambient air, one manually 10 meters upwind of the VSS connection with SST 241-B-102, and the other 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 was performed. The system was evacuated to 292 mbar (219.2 torr) and leakage of ambient air into the system was observed by monitoring system pressure for 15 minutes. Leakage resulted in an increase of 2.8 mbar (2.1 torr) in system pressure during the 15 minute test. Given a system volume of not more than 10 L, this pressure increase corresponds to a leak rate of approximately 6.38 ml/min. This leak rate was then estimated for average SUMMA[®], Triple Sorbent Trap (TST), and sorbent sampling pressures. It was found that for the SUMMA[®] canisters, dilution by ambient air was approximately 0.1%, for TST traps sampled at 100 mL/min was 0.5%, and for sorbent traps the dilution was approximately 0.2%.

The sampling valve was opened and the VSS was purged with sample vapor from SST 241-B-102 for 30 minutes at a total flow rate of 5.46 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.

One analytical laboratory provided sample media. PNNL provided SUMMA[®] canisters, sorbent traps for organic vapors, ammonia (NH₃), NO_x, and water vapor (H₂O), and TST sorbent traps.

3.6 FIELD GC/FID RESULTS

The GC was single point calibrated on the day of sampling using 6.0 ppmC Propane standard by Scott Specialty Gas. The standard is an E.P.A. Protocol Gas that is ± 2% NIST traceable.

Table 2 displays the Field GC/FID results from the sampling of 241-B-102.

Table 2. TOC Results.

Number of Runs	Description	Average TOC Concentration (ppmC)	% Standard Deviation
3	Propane	6.00	0.88
4	Ambient	3.52	0.22
3	Tank Vapor	5.96	1.50

3.7 RADIATION SCREENING

Samples are unconditionally released from the SST farm in accordance with 1995-33300-RSP-03, *Release of Vapor Sampling Equipment* (WHC 1995c). 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 2000 combined pCi/g of beta-gamma activity and alpha activity. Samples exceeding these DOT limits may be shipped as radioactive material if the samples do not exceed the following laboratory acceptance criteria:

PNNL: Beta-gamma activity <400 pCi/g of sample media.
Alpha activity <100 pCi/g of sample media.

To protect the sampling manifold and sampling devices from radioactive particulates, all sample vapor for the April 18, 1996, SST 241-B-102 vapor sampling event was drawn through a series of four filters placed upstream of the sampling manifold. These four filters were in place any time tank vapors were flowing through the system. When sampling was complete, the filters were removed and assigned unique sample identifiers. All four filters were submitted to Laboratory 222-S for total alpha, total beta, and gamma energy analysis (GEA). The filter closest to the sampling manifold was analyzed to determine if the samples met DOT shipping criteria and laboratory acceptance criteria. Moisture from the tank vapors was collected in a silica gel trap through one of the sorbent station ports and analyzed for tritiated water.

Table 3. Radionuclide Analysis Results.

Filter	Sample Identifier	Activity Results ^a (pCi/sample)	Activity ^b (pCi/L of tank gas)
Upstream filter (box)	S6044-A21.OU1	Total Alpha = <0.003 Total Beta = 25.80 GEA = 48.0 (¹³⁷ Cs)	= <detectable = 0.09 = 0.17
Downstream filter (box)	S6044-A22.OD1	Total Alpha = <0.003 Total Beta = 41.7 GEA = 140.0 (¹³⁷ Cs)	= <detectable = 0.01 = 0.51
Upstream filter (VSS)	S6044-A23.OU2	Total Alpha = 1.83 Total Beta = 291.00 GEA = 3100.0 (¹³⁷ Cs)	= 0.01 = 1.06 = 11.26
Downstream filter (VSS)	S6044-A24.OD2	Total Alpha = 1.46 Total Beta = 516 GEA = 1000.0 (¹³⁷ Cs)	= 0.01 = 1.88 = 3.63
Tritium trap	S6044-A03.OT1	Total activity = <5.60	= <5.60 ^c

NOTES:

The samples are nonradioactive. These results were evaluated against laboratory acceptance criteria and DOT limits.

^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 filters. Appendix A and the sample checksheets were used to estimate a total flow through the VSS of 275.2 L.

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

The filter media was transported to 222-S Laboratory for analysis. The analysis was considered "non-typical" based on the previous tanks sampled.

Somewhere in the analytical process the downstream filters were incorrectly numbered or placed in an incorrect planchets. The filters were analyzed several times and the last reported results can be found in Table 3. The vapor team scientists use the activity results in Table 3 to calculate pCi/g of sample media. Even though the result were considered "non-typical" they did meet the laboratory acceptance criteria and the DOT definition of a nonradioactive shipment. For further details on these radiation results please refer to the 241-B-102 project-specific file maintained by the vapor team.

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

All sorbent trains, TSTs, and SUMMA™ canisters received from PNNL are kept in a custody locked storage area maintained by SML. Sorbent trains, tubes and traps were maintained at 4 ± 2 °C in a refrigeration unit. SUMMA™ canisters were stored in the same locked storage area, but were not refrigerated. The sample media was picked up from PNNL by SML and transported in a government vehicle to a custody locked storage area.

Table 4. Pacific Northwest National Laboratory Samples.

Sample Identifier	Sample Type	COC Number
S6044-A01.015	Ambient upwind SUMMA™	100072
S6044-A02.016	Ambient SUMMA™ (VSS)	100072
S6044-A04.018	SUMMA™	100072
S6044-A05.119	SUMMA™	100072
S6044-A06.252	SUMMA™	100072
S6044-A07.S55	NH ₃ /NO _x /H ₂ O sorbent	100074
S6044-A08.S56	NH ₃ /NO _x /H ₂ O sorbent	100074
S6044-A09.S57	NH ₃ /NO _x /H ₂ O sorbent	100074
S6044-A10.S58	NH ₃ /NO _x /H ₂ O sorbent	100074
S6044-A15.S59	NH ₃ /NO _x /H ₂ O field blank	100074
S6044-A16.S60	NH ₃ /NO _x /H ₂ O field blank	100074
S6044-A11.935	TST	100073
S6044-A12.936	TST	100073
S6044-A13.937	TST	100073
S6044-A14.939	TST	100073
S6044-A17.940	TST Field Blank	100073
S6044-A18.941	TST Field Blank	100073
S6044-A19.942	TST Trip Blank	100073
S6044-A20.943	TST Trip Blank	100073

After sampling, the PNNL sorbent tubes, TSTs, and SUMMA™ canisters were transported by government vehicle directly to PNNL and delivered to J. A. Edwards on May 15, 1996. Table 4 lists the sample identifiers, sample types, and COC form numbers for all PNNL samples.

From the time that samples are received by SML until they are shipped back to the analytical laboratory, all COCs are maintained by SML in accordance with WHC-IP-1127-1.3, *Chain-of-Custody/Special Analysis Request for RCRA and CERCLA Protocol Samples* (WHC 1995a). Copies of the completed COC forms for this sampling event are included in Appendix C.

5.0 QUALITY ASSURANCE AND CONTROLS

5.1 VAPOR SAMPLING SYSTEM CLEANING

Immediately prior to sampling of SST 241-B-102, the VSS manifold and vapor sample transfer tubing was heated to 60 °C and ambient air was purged through the system for 1334 minutes. Also, 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. A second ambient air GC/FID run confirmed that the VSS manifold and transfer tubing was free of organic remnant residue down to ambient levels. A SUMMA™ canister ambient air sample was then collected to confirm by laboratory analysis that the VSS sampling manifold was free of trace organic contaminants (or to determine which contaminants were present and at what concentration), as discussed in Section 3.5. For further details, refer to Appendix E of WHC-IP-1127-4.10 (WHC 1995b) and the project-specific file located with the team.

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 the team, are summarized in Table 5. According to the calibration schedule shown in Table 5, all instrumentation was within its calibration period during the SST 241-B-102 sampling event.

Due to calibration discrepancies, the mass flow measurements for this sampling event may have an error of 6% to 14%. A detailed description of this discrepancy can be found in internal memo 75820-96-028.

5.3 BLANK SAMPLES

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

Field blanks are sampling devices similar to trip blanks. They are prepared and handled in the same manner as the sampling media, but no tank vapors are drawn through them.

Spiked blanks are prepared as regular sampling media but also contain a known amount of special analyte. Tank vapors are drawn through these blanks and they are handled and analyzed just like any other sample. 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 or in the transfer tubing or sampling manifold of the VSS immediately prior to sampling operations.

Table 4 lists sample blanks used during the sampling of SST 241-B-102.

Table 5. Calibration Data.

Element	Calibration Date	Expiration Date	WHC Standards Laboratory Code
FICV-1	5/08/95	5/08/96	518-28-03-012
FICV-2	5/08/95	5/08/96	518-28-03-008
FICV-3	5/08/95	5/08/96	518-28-03-004
FICV-4	5/08/95	5/08/96	518-28-03-006
FICV-5	5/08/95	5/08/96	518-28-03-011
FICV-6	5/08/95	5/08/96	518-28-03-009
FICV-7	5/08/95	5/08/96	518-28-03-014
FICV-8	5/08/95	5/08/96	518-28-03-013
FICV-9	5/08/95	5/08/96	518-28-03-007
FICV-10	5/08/95	5/08/96	518-28-03-010
FICV-11	5/08/95	5/08/96	518-28-03-005
PE-1	5/04/95	5/04/96	518-80-02-005
PE-2	5/04/95	5/04/96	518-80-02-006
PE-3	5/04/95	5/04/96	518-80-02-008
PE-4	5/04/95	5/04/96	518-80-02-007
PD-1	5/04/95	5/04/96	518-80-02-004
PD-2	5/04/95	5/04/96	518-80-02-003
Temperature Control System	08/25/95	08/25/96	804-67-74-009

6.0 ANOMALIES

All samples were collected in accordance with the TCP and WHC-IP-1127-4.5, *Collection of SUMMA Canisters and Sorbent Tube Samples Using the Vapor Sampling System* (1995b). There were no anomalies during the VSS sampling event.

7.0 REFERENCES

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- WHC, 1995c, *Release of Vapor Sampling Equipment*, Procedure 1995-33300-RSP-03, Westinghouse Hanford Company, Richland, Washington.

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APPENDIX A
SAMPLE LOG SHEETS

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VSS Sampling of
B-102

Date: 4/18/96

VSS Personnel: Glenn Caprio and Rick Mahon

Trailer Personnel: Tim Utecht

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

Ensure HEPA filters are installed

Ensure connection to sample probe

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

Tank Temperature 16 C

GC Standard Runs

GC Ambient Air Runs through port 10

WHC Sample ID	ORNL/PNL Sample ID	Port Valve #	Description	Desired Flow Rate SCCM	Desired Duration (min.)	Desired Total Flow SCCM	Actual Flow Rate SCCM	Actual Start Time	Actual End Time	Actual Total Time (min.)	Actual Total Flow Liters
Purge with ambient air for 30 min.				5500	30	165000	5500	4/17/96 1040	4/18/96 0854	1334	
S6044- A01. 015	015	Upwind	AMBIENT #1		1			0914	0915	1	
GC Run #1	Ambient air/Cleanliness check										0919
S6044- A02 016	016	15	AMBIENT #2		1			0924	0925	1	
GC RUN#2	Ambient air										0927
LEAK CHECK(APPENDIX A)	Leak Rate: <u>8.4 Torr/Hr</u>										
Purge with tank air for 30 min				5500	30	165000	5500	1002	1032	30	165.00
Measure tank pressure	PE-1 = 741.6 Torr										1034
GCRUN #3 (Tank run #1)											1036
S6044- A03 OT1	S96WV0045	5	Tritium Trap	200	5	1000	200.00	1040	1045	5	1.00
S6044- A04 018	018	11	SUMMA #3		1			1050	1051	1	6.00
S6044- A05 119	119	13	SUMMA #4		1			1054	1055	1	6.00
S6044- A06 252	252	15	SUMMA #5		1			1058	1059	1	6.00
GCRUN #4 (Tank run # 2)											1100

VSS Sampling of B-102											
WHC Sample ID	ORNL/PNL	Port	Description	Desired	Desired	Desired	Actual	Actual	Actual	Actual	Actual
	Sample ID	Valve #		Flow	Duration	Total	Flow	Start	End	Total	Total
				Rate	(min.)	Flow	Rate	Time	Time	Time	Flow
				SCCM		SCCM	SCCM			(min.)	Liters
S6044- A07 S55	#S55	1	NH3/NOx/H2O (#1)	200	10	2000	200.00	1104	1114	10	2.00
S6044- A08 S56	#S56	2	NH3/NOx/H2O (#2)	200	10	2000	200.00	1104	1114	10	2.00
S6044- A09 S57	#S57	3	NH3/NOx/H2O (#3)	200	10	2000	200.00	1104	1114	10	2.00
S6044- A10 S58	#S58	4	NH3/NOx/H2O (#4)	200	10	2000	200.00	1104	1114	10	2.00
S6044- A11 935	#935	5	TST #1	100	2	200	100.00	1104	1106	2	0.20
S6044- A12 936	#936	6	TST #2	100	2	200	100.00	1104	1106	2	0.20
S6044- A13 937	#937	7	TST #3	100	2	200	100.00	1104	1106	2	0.20
S6044- A14 939	#939	8	TST #4	100	2	200	100.00	1104	1106	2	0.20
S6044- A17 940	#940		TST FIELD BLANK #1					1110	1112	2	
S6044- A18 941	#941		TST FIELD BLANK #2					1112	1114	2	
S6044- A15 S59	#S59		NH3/NOx/H2O FIELD BLANK #1					1127	1129	2	
S6044- A16 S60	#S60		NH3/NOx/H2O FIELD BLANK #2					1127	1129	2	
GCRUN #5	(Tank run #3)							1116			
TOTAL TANK GAS USED DURING SAMPLING RUNS											27.80

WHC Sample ID	ORNL/PNL Sample ID	Port Valve #	Description	VSS Sampling of B-102		Desired Total Flow SCCM	Actual Flow Rate SCCM	Actual Start Time	Actual End Time	Actual Total Time (min.)	Actual Total Flow Liters
				Desired	Desired						
				Flow	Duration						
				Rate	(min.)						

S6044-	A21	OU1	S96WV0041	Upstream HEPA(box)							
S6044-	A22	OD1	S96WV0042	Downstream HEPA(box)							
S6044	A23	OU2	S96WV0043	Upstream HEPA(VSS)							
S6044-	A24	OD2	S96WV0044	Downstream HEPA (VSS)							

Trip Blanks (DO NOT EXPOSE)

S6044-	A19	942	TST#942	TST TRIP #1							
S6044-	A20	943	TST#943	TST TRIP #2							

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B-102
TOTAL TANK VAPOR USED

	NUMBER	TIME	VOLUME	TOTAL	
	OF	IN	IN	VOLUME,	
	EVENTS	MINUTES	SCCM	LITERS	
LEAK CHECKS	1	15	5600	5.60	
TANK PURGE PUMP DOWNS	3	1	5600	16.80	
TANK PURGE TIME (From Spreadsheet)	1	30	5500	165.00	
GC PURGES	3	2	5000	30.00	
SUMMA PURGES	3	2	5000	30.00	
ALL SAMPLES COLLECTED				27.80	
TOTAL FOR TANK SAMPLING RUN				275.20	

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VSS SAMPLING RADIOLOGICAL SCREENING RESULTS
B-102

Note: #VALUE! = <Detectable

S6044-A21.OU1 / S96WV0041
FILTER BOX UPSTREAM FILTER

	Liters	pCi / liter	pCi / liter
TOTAL VOLUME	275.20		
ALPHA		<0.003	#VALUE!
BETA		25.80	0.09
GEA - Co-60		<2.1	< Detectable
Cs-134		<1.8	< Detectable
Cs-137		48.00	0.17
Eu-152		<2.9	< Detectable
Eu-154		<5.1	< Detectable
Eu-155		<4.5	< Detectable
Ru-106		<14.0	< Detectable
Sb-125		<4.5	< Detectable
Sr-113		<1.9	< Detectable
Zn-65		<3.5	< Detectable

S6044-A22.OU1 / S96WV0042

	Liters	pCi / liter	pCi / liter
FILTER BOX DOWNSTREAM FILTER	275.20		
TOTAL VOLUME		<0.003	#VALUE!
ALPHA		41.70	0.15
BETA		<1.6	< Detectable
GEA - Co-60		<1.5	< Detectable
Cs-134		140.00	0.51
Cs-137		<2.5	< Detectable
Eu-152		<4.6	< Detectable
Eu-154		<4.0	< Detectable
Eu-155		<4.5	< Detectable
Ru-106		<4.6	< Detectable
Sb-125		<1.7	< Detectable
Sr-113		<3.2	< Detectable
Zn-65			

S6044-A23.OU2 / S96WV0043

	Liters	pCi / liter	pCi / liter
VSS UPSTREAM FILTER	275.20		
TOTAL VOLUME		1.83	0.01
ALPHA		291.00	1.08
BETA		<2.4	< Detectable
GEA - Co-60		<2.7	< Detectable
Cs-134		3100.00	11.26
Cs-137		<10.4	< Detectable
Eu-152		<10.7	< Detectable
Eu-154		<17	< Detectable
Eu-155		<50	< Detectable
Ru-106		<2.4	< Detectable
Sb-125		<8.8	< Detectable
Sr-113		<5.5	< Detectable
Zn-65			

S6044-A24.OU2 / S96WV0044

	Liters	pCi / liter	pCi / liter
VSS DOWNSTREAM FILTER	275.20		
TOTAL FLOW		1.46	0.01
ALPHA		516.00	1.88
BETA		<2.8	< Detectable
GEA - Co-60		<2.7	< Detectable
Cs-134		1000.00	3.63
Cs-137		<7.8	< Detectable
Eu-152		<7.2	< Detectable
Eu-154		<11.0	< Detectable
Eu-155		<34.0	< Detectable
Ru-106		<15.0	< Detectable
Sb-125		<6.3	< Detectable
Sr-113		<5.9	< Detectable
Zn-65			

S6044-A03.OT1 / S96WV0045

	Liters	pCi / liter	pCi / liter
TRITIUM TRAP	1		
TOTAL VOLUME		<5.60	#VALUE!
TOTAL ACTIVITY			

SORBENT SAMPLING Used 5 g for sorbent mass

	2.00 Liters	
TOTAL VOLUME PER SAMPLE		
Tritium per SAMPLE		
NH3 (5 gram)	#VALUE!	pCi per gram
H2O (5 gram)	#VALUE!	pCi per gram
ALPHA per SAMPLE		
NH3 (5 gram)	0.00	pCi per gram
H2O (5 gram)	0.00	pCi per gram
BETA per SAMPLE		
NH3 (5 gram)	0.75	pCi per gram
H2O (5 gram)	0.75	pCi per gram
GEA per SAMPLE (Cs-137)		
NH3 (5 gram)	1.45	pCi per gram
H2O (5 gram)	1.45	pCi per gram

SAMPLE EXPOSURE ANALYSIS, USING VSS DOWNSTREAM FILTER ANALYSIS AS POSSIBLE EXPOSURE LEVEL
= BETA and ALPHA Less than DOT shipping limits

TST SAMPLING Used 4.5 g for TST mass

	0.20 Liter	
TOTAL VOLUME PER SAMPLE		
Tritium per Sample		
TST (4.5 gram)	#VALUE!	pCi per gram
ALPHA per Sample		
TST (4.5 gram)	0.00	pCi per gram
BETA per Sample		
TST (4.5 gram)	0.42	pCi per gram
GEA per Sample (Cs-137)		
TST (4.5 gram)	0.81	pCi per gram

SUMMA SAMPLING

	8 Liters (air at 300K, 1 bar = 1.161 g/L)	
TOTAL VOLUME PER CANISTER		
Tritium per SAMPLE	#VALUE!	pCi per gram
BETA PER SAMPLE	1.61	pCi per gram
ALPHA PER SAMPLE	0.00	pCi per gram
GEA PER SAMPLE (Cs-137)	3.13	pCi per gram

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APPENDIX B
AMBIENT CONDITIONS

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WEATHER DURING VSS SAMPLING OF 241-B-102

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APPENDIX C
CHAIN-OF-CUSTODY FORMS

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Battelle Pacific National Northwest Lab	CHAIN OF CUSTODY	WHC 100072
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Custody Form Initiator J. A. Edwards - PNNL Telephone (509) 373-0141
Page 85-3009 / FAX 376-0418

Company Contact R. D. Mahon - WHC Telephone (509) 373-2891
Page 85-9858 / FAX 373-3793

Project Designation/Sampling Locations 200 West Tank Farm
241-B-102 Tank Vapor Sample SAF S6044
(VSS Truck)
Collection date 04 - 18 - 96
Preparation date 04 - 16 - 96

Ice Chest No. Field Logbook No. WHC- N-64710

Bill of Lading/Airbill No. N/A Offsite Property No. N/A

Method of Shipment Government Truck

Shipped to PNNL

Possible Sample Hazards/Remarks Unknown at time of sampling

Sample Identification

S6044 - A01 . 015' Collect Ambient Air Sample SUMMA #1 Upwind of Tank
S6044 - A02 . 016' Collect Ambient Air Sample SUMMA #2 Through VSS

S6044 - A04 . 018' Collect SUMMA #3
S6044 - A05 . 119' Collect SUMMA #4
S6044 - A06 . 252' Collect SUMMA #5

[] Field Transfer of Custody		[X] Chain of Possession		(Sign and Print Names)	
Relinquished By	Date	Time	Received By	Date	Time
J.A. Edwards	04-16-96	1000	J.L. Tulpe	04-16-96	1000
J.A. Edwards	4-17-96	1400	T. Bute	4-17-96	1400
T. Bute	04-18-96	0730	R.D. Mahon	04-18-96	0730
R.D. Mahon	05-15-96	1316	GS CAO-101/MS CD	05-15-96	1316
GS CAO-101/MS CD	5-15-96	1425	J.A. Edwards	5-15-96	1425

Final Sample Disposition

Comments:

PNNL (only) Checklist: Pick-up / Delivery Comments:

Media labeled and checked? ☒ Y/N

Letter of instruction? ☒ Y/N

Media in good condition? ☒ Y/N

COC info/signatures complete? ☒ Y/N

Rad release stickers on samples? ☒ Y/N

Activity report from 222S? ☒ Y/N

RSR/copy? (a ≤100/8 ≤400 pCi/g) ☒ Y/N

COC copy for LRB, RIDS filed? ☒ Y/N

POC ☒ POC ☒

(Revised 11/30/95 PNNL)

Page	85-3009 / P8-08 / FAX 376-0418
Telephone	(509) 373-7437
Page	85-9656 / S3-27 / FAX 373-7076
Collection date	04-18-96
Preparation date	04-15-96
Field Logbook No.	WHC-N-6572

Custody Form Indicator	J. A. Edwards - PNL
Company Contact	R. D. Mahon - WHC
Project Designation/Sampling Location	200 West Tank Farm
241-B-102 Tank	Vapor Sample SAF S8044 (VSS Truck)
Ice Chest No.	
Error HI/LQ thermometer No.	PNL-T-003 ²
Bill of Lading/Airbill No.	N/A
Method of Shipment	Government Truck
Shipped to	WHC
Possible Sample Hazard/Remarks	Unknown at time of sampling

Sample Identification

S6044 - A17	.940	Open, close & store TST Field Blank # 1
S6044 - A18	.941	Open, close & store TST Field Blank # 2
S6044 - A19	.942	Store TST Trip Blank #1
S6044 - A20	.943	Store TST Trip Blank #2
S6044 - A14	.939	PNL TST Sample # 4
S6044 - A13	.937	PNL TST Sample # 3
S6044 - A12	.936	PNL TST Sample # 2
S6044 - A11	.935	PNL Sample Sorbent Trap (TST) Sample # 1

[illegible]

Comments: PNL (only) Checklist Pick-up / Deliver Comments:

Media labeled and checked?	0
Letter of instruction?	0
Media in good condition?	0
COC info/signatures complete?	0
Sorbents shipped on ice? (<5°C)	0
Hi/L0 thermometer - Keep upright!	0
Hi/L0 thermometer	0
Hi/L0 thermometer	0
Ad release stickers on samples?	0
Activity report from 2225?	0
COC copy for LRB, RIDS filed?	0

[illegible]

Cooler Temperature Status	
HHH	-15 °C / Lo -15 °C (pick up at PNL to WHC)
HHH	___ °C / Lo ___ °C (delivery at WHC from PNL)
HHH	___ °C / Lo ___ °C (a return to PNL from WHC)
HHH	+5 °C / Lo -17 °C (at delivery from WHC to PNL)

(Revised 06/21/95 PNL)

Battelle Pacific National Northwest Lab	CHAIN OF CUSTODY	WHC 100074
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Custody Form Initiator J. A. Edwards - PNNL

Telephone (509) 373-0141

Page 85-3009 / FAX 376-0418

Company Contact R. D. Mahon - WHC

Telephone (509) 373-7437

Page 85-9656 / FAX 373-3793

Project Designation/Sampling Locations 200 West Tank Farm
 241-B-102 Tank Vapor Sample SAF S6044
 VSS

Collection date 04-18-96

Preparation date 04-16-96

Ice Chest No.

Field Logbook No. WHC-N-647-10

Bill of Lading/Airbill No.

N/A

Offsite Property No. N/A

Method of Shipment

Government Truck

Shipped to

PNNL

Possible Sample Hazards/Remarks Unknown at time of sampling

Sample Identification

S6044 - A07 . S55 -

Collect NH₃/NO_x/H₂O Sorbent Trap

S6044 - A08 . S56 -

Collect NH₃/NO_x/H₂O Sorbent Trap

S6044 - A09 . S57 -

Collect NH₃/NO_x/H₂O Sorbent Trap

S6044 - A10 . S58 -

Collect NH₃/NO_x/H₂O Sorbent Trap

S6044 - A15 . S59 -

Open, close and store NH₃/NO_x/H₂O field blank #1

S6044 - A16 . S60 -

Open, close and store NH₃/NO_x/H₂O field blank #2

[] Field Transfer of Custody		[X] Chain of Possession		(Sign and Print Names)		
Relinquished By	Date	Time	Received By	Date	Time	
G W Dennis / J. A. Edwards	04-17-96	1030	J A Edwards / J A Edwards	04-17-96	1030	
J A Edwards / J A Edwards	04-17-96	1400	T. B. L. / T. B. L. / T. B. L.	04-17-96	1400	
T. B. L. / T. B. L. / T. B. L.	04-18-96	0730	R D Mahon / R D Mahon	04-18-96	0730	
R D Mahon / R D Mahon	05-15-96	1315	CS Carpio / J. A. Edwards	05-15-96	1316	
CS Carpio / J. A. Edwards	05-15-96	1400	J A Edwards / J A Edwards	05-15-96	1400	

Final Sample Disposition

Comments:

PNNL (only) Checklist

- ☐ Media labeled and checked?
- ☐ Letter of instruction?
- ☐ Media in good condition?
- ☐ COC info/signatures complete?
- ☐ Rad release stickers on samples?
- ☐ Activity report from 2225?
- ☐ RSR/copy? (a ≤100/B ≤400 pCi/g)
- ☐ COC copy for LRB, RIDS filed?

Pick-up / Delivery

- ☒ N
- ☒ N
- ☒ N / ☒ N
- ☒ N / ☒ N
- ☒ N / ☒ N
- ☒ N / ☒ N
- ☒ N / ☒ N
- ☒ N / ☒ N

Comments:

POC

POC

(Revised 11/30/95 PNNL)

Westinghouse Hanford Company		CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST				C.O.C# 100131	
						Page 1 of 1	
Collector(s) Glenn Caprio/Rick Mahon				Contact/Requestor Rick Mahon		Tel. No. 373-7437 MSIN S3-27 FAX 373-7076	
SAP Number S6144 + S6141 (Petri dish)				Sample Origin B-1C2		Purchase Order/Charge Code E29937/75745	
Project Title Vapor Sampling				Logbook # N/A		Ice Chest # N/A Temp. N/A	
Shipped To (Lab) 222-S				Method of Shipment Government Vehicle		Bill of Lading/Air Bill No. N/A	
Protocol None				Data Turnaround 24 hr		Offsite Property No. N/A	
Sample No.	Lab. ID	A	Date	Time	No/Type Container	Sample Analysis	Perservative
S6144-A21 (Petri dish)	S96WV0041	X			(1) petri dish	AT/TB/GEA	N/A
S6144-A22 (Petri dish)	S96WV0042	X			(1) petri dish	AT/TB/GEA	N/A
S6144-A23 (Petri dish)	S96WV0043	X			(1) petri dish	AT/TB/GEA	N/A
S6144-A24 (Petri dish)	S96WV0044	X			(1) petri dish	AT/TB/GEA	N/A
S6144-A25 (Petri dish)	S96WV0045	X			(1) silica gel	Total Activity - Disposed of on 18 APR 96 Rick Mahon	N/A
S6144-A26 (Petri dish)	S96WV0046	X			(1) Petri dish	AT/TB/GEA (Petri dish cleaning - Filter)	N/A
S6144-A27 (Petri dish)	S96WV0047	X			(1) Petri dish	AT/TB/GEA (Petri dish cleaning - Filter)	N/A
					()		
					()		
					()		
					()		
					()		
POSSIBLE SAMPLE HAZARDS/REMARKS List all known wastes.					MSDS Yes ☐ No ☒		
					SPECIAL INSTRUCTIONS Please fax the report to Rick Mahon at 373-7076 once the analysis is completed. The date and time of each analysis should be included in the report. Thanks.		
					Hold Time		
Relinquished By	Print	Sign	Date/Time	Received By	Print	Sign	Date/Time
Glenn S. CAPRIO		Glenn S. Caprio	4/18/96 1515	Rick Mahon		Rick Mahon	4/18/96 1515
Relinquished By			Date/Time	Received By			Date/Time
Rick Mahon			5-1-96	Rick Mahon			1 MAY 96 / 1336
Relinquished By			Date/Time	Received By			Date/Time
Rick Mahon			1 MAY 96 / 1350	Mark Grant			5-1-96 1350
Relinquished By			Date/Time	Received By			Date/Time
FINAL SAMPLE DISPOSITION				Disposal Method e.g. Return to customer, per lab procedure, used in process.			
Sample S96WV0045 (silica gel) used in process, All others returned				Date/Time 4/18/96 5-1-96			

All samples containing hazardous materials shall be picked up by requestor and returned to parent container or site of origin.

A-6001-500 (07/95)

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DISTRIBUTION SHEET

To Distribution	From Special Analytical Support, Numatec Hanford	Page 1 of 1 Date 8/7/97
Project Title/Work Order VAPOR AND GAS SAMPLING USING THE IN SITU VAPOR SAMPLING SYSTEM		EDT No. <i>621262</i> ECN No.

Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
<u>Lockheed Martin Hanford Company</u>					
L. L. Buckley	R2-12	X			
<u>Lockheed Martin Services, Inc.</u>					
Central Files	A3-88	X			
<u>SGN Eurisys Services Corporation</u>					
E. S. Mast	S3-90	X			
<u>PNNL</u>					
J. L. Huckaby	K6-80	X			