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2	1	Cog. Mgr. L.L. Lockrem	<i>[Signature]</i>	7/20/97							
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# VAPOR AND GAS SAMPLING OF SINGLE-SHELL TANK 241-T-104 USING the in Situ Vapor Sampling System

G.S. Caprio

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Abstract: THIS DOCUMENT PRESENTS SAMPLING DATA RESULTING FROM THE FEBURARY 07, 1996 SAMPLING OF SST 241-T-104

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Approved by: \_\_\_\_\_ Date \_\_\_\_\_  
G. S. Caprio, Field Scientist  
Vapor Sampling Project  
Special Analytical Studies

Approved by: \_\_\_\_\_ Date \_\_\_\_\_  
R. D. Mahon, Project Lead  
Vapor Sampling Project  
Special Analytical Studies

Approved by:  \_\_\_\_\_ Date 7/17/97  
L. L. Lockrem, Manager  
Special Analytical Studies

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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 <sub>3</sub>	Ammonia
NO <sub>2</sub>	Nitrogen Dioxide
NO	Nitric Oxide
H <sub>2</sub> O	Water Vapor
OPC	Offsite Property Control
OVM	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-T-104 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-T-104. This document presents sampling data resulting from the February 7, 1996 sampling of SST 241-T-104. Analytical results will be presented in separate reports issued by the laboratories that 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-T-104 with sorbent trap and SUMMA<sup>1</sup> canisters on February 7, 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 head 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-T-104 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, a programmable

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<sup>1</sup>SUMMA is a registered trademark of Molectrics, Inc., Cleveland, Ohio.

oven, and a portable computer loaded with the HP-Chemstation<sup>2</sup> 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 GC 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 which 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 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 <sup>3</sup> /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 displays 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 that contain vapor-adsorbing media, are collected at the sorbent trap station of the sampling manifold. The rates and duration of flow, as 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.

SUMMA<sup>™</sup> canisters, stainless steel vessels with their internal surfaces chemically passivated by the SUMMA<sup>™</sup> process to minimize adsorption of gases and vapors, are used to sample tank vapor from the SUMMA<sup>™</sup> sampling station on

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

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 1D, *Vapor Sampling and Analysis Plan* (Homi 1996), which 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 this event's project-specific file, S6-012.

#### 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  
T. B. Utecht, Sampling Technician.

The VSS was set up at SST 241-T-104 on February 6, 1996 and was allowed to warm up overnight. Sampling began shortly after 8:30 a.m. on February 7, 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-T-104, 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%, NH<sub>3</sub> <2 ppm, O<sub>2</sub> 20.9%, and TOC 0.0 ppm.

#### 3.4 AMBIENT CONDITIONS

The weather the day of the sampling event, February 7, 1996 was cool, raining, and a slight wind from the southwest. Graphs of ambient temperatures and pressures taken at the Hanford Meteorological Station, which is about 2 miles east of T-Farm, are provided in Appendix B.

#### 3.5 SAMPLE COLLECTION

The hot-water-jacketed sampling probe was located in Riser 3 of SST 241-T-104. 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-T-104 on February 6, 1996. The team stabilized the VSS temperature zones by 8:30 a.m. on February 7, 1996, and the system was ready to collect samples. Measured according to the VSS operating procedure, the pressure and temperature of SST 241-T-104 were 987 mbar (740.5 torr) and 14.3 °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 20 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 February 7, 1996, the team collected two SUMMA canister samples of ambient air, one manually 10 meters upwind of the VSS connection with SST 241-T-104, 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 290 mbar (217.5 torr) and leakage of ambient air into the system was observed by monitoring system pressure for 15 minutes. Leakage resulted in an increase of 2.27 mbar (1.7 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 5.2 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 200 mL/min was 0.2%, and for sorbent traps sampled at 200 mL/min the dilution was approximately 0.2%.

The sampling valve was opened and the VSS was purged with sample vapor from SST 241-T-104 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. Pacific Northwest National Laboratory (PNNL) provided SUMMA canisters, sorbent traps for organic vapors, ammonia (NH<sub>3</sub>), water vapor (H<sub>2</sub>O), 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  $\pm 2\%$  NIST traceable.

Table 2 displays the Field GC/FID results from the sampling of 241-T-104.

Table 2. TOC Results.

Number of Runs	Description	Average TOC Concentration (ppmC)	% Standard Deviation
3	Propane	6.00	1.17
4	Ambient	2.80	0.43
3	Tank Vapor	3.39	2.77

### 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 February 7, 1996, SST 241-T-104 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. SST 241-T-104 filter and silica gel analysis results are shown in Table 3. The vapor team scientists use the activity results in Table 3 to calculate pCi/g of sample media. The team maintains this information in the project-specific file. The results in Table 3 indicate that the samples collected from SST 241-T-104 met the laboratory acceptance criteria and the DOT definition of a nonradioactive shipment.

Table 3. Radionuclide Analysis Results.

Filter	Sample Identifier	Activity Results <sup>a</sup> (pCi/sample)	Activity <sup>b</sup> (pCi/L of tank gas)
Upstream filter (box)	S6012-A34.OU1	Total Alpha = 24.1 Total Beta = 108 GEA = <detectable	= 0.07 = 0.32 = <detectable
Downstream filter (box)	S6012-A35.OD1	Total Alpha = <0.548 Total Beta = 2.04 GEA = <detectable	= <detectable = 0.006 = <detectable
Upstream filter (VSS)	S6012-A36.OU2	Total Alpha = <0.378 Total Beta = 9.59 GEA = <detectable	= <detectable = 0.03 = <detectable
Downstream filter (VSS)	S6012-A37.OD2	Total Alpha = 0.781 Total Beta = 1.76 GEA = <detectable	= <detectable = 0.005 = <detectable
Tritium trap	S6012-A21.OT1	Total activity = <50.0	= <50.0 <sup>c</sup>

## NOTES:

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

<sup>a</sup>All less than (<) values represent the minimum detection limits at Laboratory 222-S.

<sup>b</sup>Numbers 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 338 L.

<sup>c</sup>Number 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, 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  $4 \pm 2$  °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.

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 February 8, 1996.

Table 4 lists the sample identifiers, sample types, and COC form numbers for all PNNL samples.

Table 4. Pacific Northwest National Laboratory Samples.

Sample Identifier	Sample Type	COC Number
S6012-A01.020	Ambient upwind SUMMA™	100033
S6012-A02.028	Ambient SUMMA™ (VSS)	100033
S6012-A03.035	SUMMA™	100033
S6012-A12.041	SUMMA™	100033
S6012-A26.060	SUMMA™	100033
S6012-A04.96S	NH <sub>3</sub> /H <sub>2</sub> O sorbent	100035
S6012-A05.97S	NH <sub>3</sub> /H <sub>2</sub> O sorbent	100035
S6012-A06.98S	NO <sub>3</sub> /H <sub>2</sub> O sorbent	100035
S6012-A07.99S	NH <sub>3</sub> /H <sub>2</sub> O sorbent	100035
S6012-A13.S01	NH <sub>3</sub> /H <sub>2</sub> O sorbent	100035
S6012-A14.S02	NH <sub>3</sub> /H <sub>2</sub> O sorbent	100035
S6012-A15.S03	NH <sub>3</sub> /H <sub>2</sub> O sorbent	100035
S6012-A16.S04	NH <sub>3</sub> /H <sub>2</sub> O sorbent	100035
S6012-A31.S05	NH <sub>3</sub> /H <sub>2</sub> O field blank	100035
S6012-A32.S06	NH <sub>3</sub> /H <sub>2</sub> O field blank	100035
S6012-A33.S07	NH <sub>3</sub> /H <sub>2</sub> O field blank	100035
S6012-A08.840	TST	100038
S6012-A09.841	TST	100038
S6012-A10.842	TST	100038
S6012-A17.843	TST	100038
S6012-A18.844	TST	100038
S6012-A19.845	TST	100038
S6012-A29.846	TST Field Blank	100038
S6012-A30.847	TST Field Blank	100038
S6012-A27.848	TST Trip Blank	100038
S6012-A28.849	TST Trip Blank	100038

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 CERCLAProtocol 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-T-104, the VSS manifold and vapor sample transfer tubing was heated to 60 °C and ambient air was purged through the system for 1240 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.

## 5.2 INSTRUMENT CALIBRATION

Instruments located in the VSS are calibrated on an annual basis at the WHC Standards Laboratory. According to the calibration schedule shown in Table 5, all the VSS instrumentation was within its calibration period during the SST 241-T-104 sampling event.

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

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-T-104.

### 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

- 49 CFR 100-177, 1992, "Transportation," *Code of Federal Regulations*, as amended.
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**APPENDIX A**  
**SAMPLE LOG SHEETS**

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VSS Sampling of  
 T-104  
 Date: 2/7/96  
 VSS Personnel: Glenn Caprio, Tim Utecht  
 Trailer Personnel: None  
 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 14.3 C  
 GC Standard Runs  
 GC Ambient Air Runs through port 10

WHC Sample ID	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.											
S6012-A01	020	Upwind	AMBIENT #1	5500	30	165000	5500	1128	0808	1240	
S6012-A01	020	Upwind	AMBIENT #1		1			0831	0832	1	
S6012-A38	MG1	Upwind	WHITEY #1		1			0834	0835	1	
GC Run #1 Ambient air/Cleanliness check											
S6012-A02	028	15	AMBIENT #2		1			0844	0845	1	
GC RUN#2 Ambient air											
LEAK CHECK(APPENDIX A) Leak Rate: 6.8 Torr											
Purge with tank air for 30 min											
				5500	30	165000	5500	0929	0959	30	165.00
Measure tank pressure PE-1 = 740.5 Torr											
S6012-A39	MG2	15	Whitey #2		1			1005	1006	1	0.75
S6012-A40	MG3	14	Whitey #3		1			1010	1011	1	0.75
S6012-A41	MG4	16	Whitey #4		1			1015	1016	1	0.75
GCRUN #3 (Tank run #1)											
								1018			

VSS Sampling of T-104

WHC Sample ID	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
S6012-A03 035	035	11	SUMMA #3		1			1023	1024	1	6.00
S6012-A04 96S	96S	1	NH3/H2O (#1)	200	15	3000	200.00	1027	1042	15	3.00
S6012-A05 97S	97S	2	NH3/H2O (#2)	200	15	3000	200.00	1027	1042	15	3.00
S6012-A06 98S	98S	3	NH3/H2O (#3)	200	15	3000	200.00	1027	1042	15	3.00
S6012-A07 99S	99S	4	NH3/H2O (#4)	200	15	3000	200.00	1027	1042	15	3.00
S6012-A08 840	840	5	PNL TST #1	200	5	1000	195.10	1027	1032	5	0.98
S6012-A09 841	841	6	PNL TST #2	200	5	1000	200.00	1027	1032	5	1.00
S6012-A10 842	842	7	PNL TST #3	200	5	1000	177.30	1027	1032	5	0.89
GCRUN #4 (Tank run # 2 )								1044			
S6012-A12 041	041	13	SUMMA #4		1			1049	1050	1	6.00
S6012-A13 S01	S01	1	NH3/H2O (#5)	200	15	3000	200.00	1054	1109	15	3.00
S6012-A14 S02	S02	2	NH3/H2O (#6)	200	15	3000	200.00	1054	1109	15	3.00
S6012-A15 S03	S03	3	NH3/H2O (#7)	200	15	3000	200.00	1054	1109	15	3.00
S6012-A16 S04	S04	4	NH3/H2O (#8)	200	15	3000	200.00	1054	1109	15	3.00
S6012-A17 843	843	5	PNL TST #4	200	5	1000	199.20	1054	1059	5	1.00
S6012-A18 844	844	6	PNL TST #5	200	5	1000	200.00	1054	1059	5	1.00
S6012-A19 845	845	7	PNL TST #6	200	5	1000	169.00	1054	1059	5	0.85
S6012-A01 011	T-2450(222S)	8	Tritium Trap	200	5	1000	200.00	1054	1059	5	1.00
GCRUN #5 (Tank run # 3 )								1112			
S6012-A26 060	060	15	SUMMA #5		1			1116	1117	1	6.00

A21

VSS Sampling of T-104

WHG Sample ID	PNL Sample ID	Port Valve #	Description	Desired Flow Rate (gpm)	Desired Duration (min.)	Desired Total Flow (gpm)	Actual Flow Rate (gpm)	Actual Start Time	Actual End Time	Actual Total Time (min.)	Actual Total Flow (Liters)
S6012-A29 846	846		NNL TST FIELD BLANK #1	SCCM		SCCM	SCCM	1102	1103		
S6012-A30 847	847		NNL TST FIELD BLANK #2					1102	1103		
S6012-A31 S05	S05		NH3/H2O FIELD BLANK #1					1114	1115		
S6012-A32 S06	S06		NH3/H2O FIELD BLANK #2					1114	1115		
S6012-A33 S07	S07		NH3/H2O FIELD BLANK #3					1114	1115		

TOTAL TANK GAS USED DURING SAMPLING RUNS

50.95

S6012-A34 0U1	T-2448(222S)	Upstream HEPA(box)
S6012-A35 0D1	T-2446(222S)	Downstream HEPA(box)
S6012-A36 0U2	T-2447(222S)	Upstream HEPA(VSS)
S6012-A37 0D2	T-2448(222S)	Downstream HEPA (VSS)

Tip Blanks (DO NOT EXPOSE)

S6012-A27 848	848	PNL TST TRIP #1
S6012-A28 849	849	PNL TST TRIP #2

S-108

TOTAL TANK VAPOR USED

	NUMBER OF EVENTS	TIME IN MINUTES	VOLUME IN SCOM	TOTAL VOLUME, LITERS
LEAK CHECKS	1	0	5600	5.60
TANK PURGE PUMP DOWNS	3	1	5600	16.80
TANK PURGE TIME (From Spreadsheet)	1	30	5500	165.00
GC PURGES	4	2	5000	40.00
SUMMA PURGES	3	2	5000	30.00
WHITEY PURGES	3	2	5000	30.00
ALL SAMPLES COLLECTED				50.95
TOTAL FOR TANK SAMPLING RUN				338.35

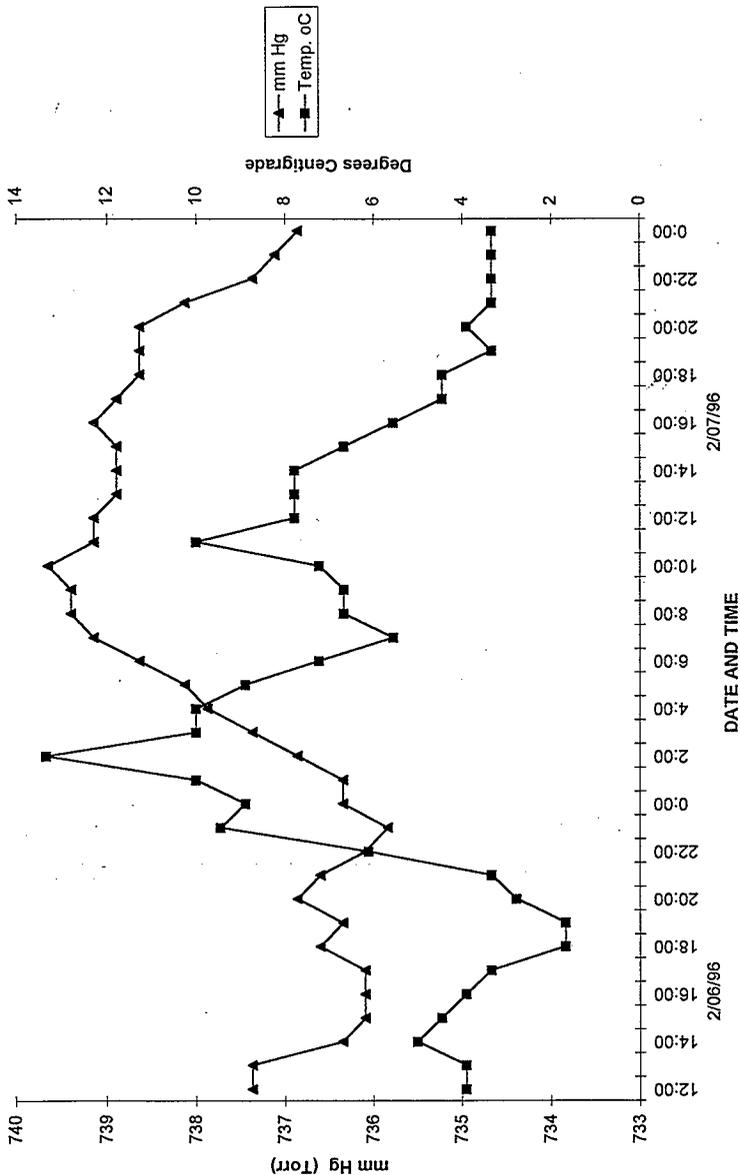
S6012-A34-001	Liters 338.35	pCi / liter 108.00	S6012-A35-001	Liters 338.35	pCi / liter 5.04
HEPA BOX UPSTREAM FILTER (T-2445)			HEPA BOX DOWNSTREAM FILTER (T-2446)		
TOTAL VOLUME	338.35	0.37	TOTAL VOLUME	338.35	0.54
ALPHA	24.10	0.07	ALPHA	<0.54	<0.54
GEA - Am-243	< Detectable	< Detectable	GEA - Am-243	< Detectable	< Detectable
- Bi-212	< Detectable	< Detectable	- Bi-212	< Detectable	< Detectable
- Np-237	< Detectable	< Detectable	- Np-237	< Detectable	< Detectable
- Pb-212	< Detectable	< Detectable	- Pb-212	< Detectable	< Detectable
- Th-229	< Detectable	< Detectable	- Th-229	< Detectable	< Detectable
- Tl-209	< Detectable	< Detectable	- Cd-109	< Detectable	< Detectable
- Cs-137	< Detectable	< Detectable	- Cs-137	< Detectable	< Detectable
S6012-A38-002	Liters 338.35	pCi / liter 9.59	S6012-A37-002	Liters 338.35	pCi / liter 1.76
VSS DOWNSTREAM FILTER (T-2447)			VSS DOWNSTREAM FILTER (T-2448)		
TOTAL VOLUME	338.35	40.378	TOTAL FLOW	1.76	< Detectable
ALPHA	< Detectable	< Detectable	BETA	< Detectable	< Detectable
GEA - Am-243	< Detectable	< Detectable	GEA - Am-243	< Detectable	< Detectable
- Bi-212	< Detectable	< Detectable	- Bi-212	< Detectable	< Detectable
- Np-237	< Detectable	< Detectable	- Np-237	< Detectable	< Detectable
- Pb-212	< Detectable	< Detectable	- Pb-212	< Detectable	< Detectable
- Th-229	< Detectable	< Detectable	- Th-229	< Detectable	< Detectable
- Tl-209	< Detectable	< Detectable	- Tl-209	< Detectable	< Detectable
- Cs-137	< Detectable	< Detectable	- Cs-137	< Detectable	< Detectable
S6012-A03-001	Liters 1.0	pCi / liter < 50.0			
TRITIUM TRAP (T-2383)					
TOTAL VOLUME	1.0	< 50.0			
TOTAL ACTIVITY					
SAMPLE EXPOSURE ANALYSIS USING VSS DOWNSTREAM FILTER ANALYSIS AS POSSIBLE EXPOSURE LEVEL					
= BETA and ALPHA, Less than DDT trapping limits					
SORBENT SAMPLING					
TOTAL VOLUME PER SAMPLE	3.00 Liters		TST SAMPLING	1.00	liter
ALPHA per SAMPLE	< Detectable pCi		TOTAL VOLUME PER SAMPLE	1.00	liter
BETA per SAMPLE	< Detectable pCi		ALL TST'S, BETA	< Detectable	< Detectable
NH3 (0.75 gram)	< Detectable pCi per gram Beta		ALL TST'S, ALPHA	< Detectable	< Detectable
NO2 (0.60 gram)	< Detectable pCi per gram Beta		ALL TST'S, GEA	< Detectable	< Detectable
H2O (0.45 gram)	< Detectable pCi per gram Beta				
GEA per SAMPLE	< Detectable pCi				
SUMMA SAMPLING					
TOTAL VOLUME PER CANISTER	6 Liters				
BETA PER SAMPLE	< Detectable pCi Beta				
ALPHA PER SAMPLE	< Detectable pCi				
GEA PER SAMPLE	< Detectable pCi				

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**APPENDIX B**  
**AMBIENT CONDITIONS**

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WEATHER DURING VSS SAMPLING OF 241-T-104



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**APPENDIX C**  
**CHAIN-OF-CUSTODY FORMS**

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Battelle Pacific Northwest National Laboratory CHAIN OF CUSTODY WHC 100033

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 85-3152 / FAX 373-3793  
 Project Designation/Sampling Locations 200 East Tank Farm Collection date 02 - 07 - 96  
 241-T-104 Tank Vapor Sample SAF S6012 Preparation date 01 - 29 - 96  
 (VSS Truck)  
 Ice Chest No. Field Logbook No. WHC- N-697-10  
 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

S6012 - A01 . 020 Ambient Air SUMMA #1 Upwind of T-104  
 S6012 - A02 . 028 Ambient Air SUMMA #2 Through Port # 15  
 S6012 - A03 . 035 SUMMA #3 Port # 11  
 S6012 - A12 . 041 SUMMA #4 Port # 13  
 S6012 - A26 . 060 SUMMA #5 Port # 15

[ ] Field Transfer of Custody		[ X ] Chain of Possession		(Sign and Print Names)		
Relinquished By	Date	Time	Received By	Date	Time	
J A Edwards / <i>J A Edwards</i>	01-30-96	1435	T B Utter / <i>T B Utter</i>	01-30-96	1435	
T B Utter / <i>T B Utter</i>	2-8-96	1350	J A Edwards / <i>J A Edwards</i>	2-8-96	1350	

Final Sample Disposition

Comments:

PNNL (only) Checklist:	Pick-up / Delivery	Comments:
◊ Media labeled and checked?	Ⓞ/N	
◊ Letter of instruction?	Ⓞ/N	
◊ Media in good condition?	Ⓞ/N / <i>Y</i>	
◊ COC info/signatures complete?	Ⓞ/N / <i>Y</i>	
◊ Rad release stickers on samples?	Ⓞ/N / <i>Y</i>	
◊ Activity report from 222S?	Ⓞ/N / <i>Y</i>	
◊ COC copy for LRB, RIDS filed?	Ⓞ/N / <i>Y</i>	

POC *(Signature)* POC *(Signature)*

(Revised 10/31/95 PNNL)

Battelle Pacific Northwest  
National Laboratory

CHAIN OF CUSTODY

WHC 100035

Custody Form Initiator J. A. Edwards - PNNL  
 Company Contact R. D. Mahon - WHC  
 Project Designation/Sampling Locations 200 East Tank Farm  
 241-T-104 Tank Vapor Sample SAF S6012  
 (VSS Truck)  
 Ice Chest No.  
 Method of Shipment Government Truck  
 Shipped to PNNL  
 Possible Sample Hazards/Remarks Unknown at time of sampling

Telephone (509) 373-0141  
 Page 85-3009 / FAX 376-0418  
 Telephone (509) 373-2891  
 Page 85-3152 / FAX 373-3793  
 Collection date 02 - 07 - 96  
 Preparation date 01 - 26 - 96  
 Field Logbook No. WHC-N-697-10

Sample Identification

S6012 - A04 . 96S *	Collect NH <sub>3</sub> /H <sub>2</sub> O Sorbent Trap #1	Sorbent line 1
S6012 - A05 . 97S *	Collect NH <sub>3</sub> /H <sub>2</sub> O Sorbent Trap #2	Sorbent line 2
S6012 - A06 . 98S *	Collect NH <sub>3</sub> /H <sub>2</sub> O Sorbent Trap #3	Sorbent line 3
S6012 - A07 . 99S *	Collect NH <sub>3</sub> /H <sub>2</sub> O Sorbent Trap #4	Sorbent line 4
S6012 - A13 . S01 *	Collect NH <sub>3</sub> /H <sub>2</sub> O Sorbent Trap #5	Sorbent line 1
S6012 - A14 . S02 *	Collect NH <sub>3</sub> /H <sub>2</sub> O Sorbent Trap #6	Sorbent line 2
S6012 - A15 . S03 *	Collect NH <sub>3</sub> /H <sub>2</sub> O Sorbent Trap #7	Sorbent line 3
S6012 - A16 . S04 *	Collect NH <sub>3</sub> /H <sub>2</sub> O Sorbent Trap #8	Sorbent line 4
S6012 - A31 . S05 *	Open, close & store NH <sub>3</sub> /H <sub>2</sub> O field blank #1	In VSS truck
S6012 - A32 . S06 *	Open, close & store NH <sub>3</sub> /H <sub>2</sub> O field blank #2	In VSS truck
S6012 - A33 . S07 *	Open, close & store NH <sub>3</sub> /H <sub>2</sub> O field blank #3	In VSS truck

[ ] Field Transfer of Custody		[ X ] Chain of Possession		(Sign and Print Names)	
Relinquished By	Date	Time	Received By	Date	Time
G W Dennis <i>G W Dennis</i>	01-30-96	1345	J A Edwards <i>J A Edwards</i>	01-30-96	1345
J A Edwards <i>J A Edwards</i>	01-30-96	1435	T B Utecht <i>T B Utecht</i>	01-30-96	1435
<i>J B Utecht / T B Utecht</i>	<i>2-8-96</i>	<i>1350</i>	<i>J A Edwards / J A Edwards</i>	<i>2-8-96</i>	<i>1350</i>

Final Sample Disposition

Comments:

- |   |   |  |
|---|---|--|
| <ul style="list-style-type: none"> <li><input type="checkbox"/> PNNL (only) Checklist</li> <li><input type="checkbox"/> Media labeled and checked?</li> <li><input type="checkbox"/> Letter of instruction?</li> <li><input type="checkbox"/> Media in good condition?</li> <li><input type="checkbox"/> COC info/signatures complete?</li> <li><input type="checkbox"/> Sorbents shipped on ice? (&lt;10°C)</li> <li><input type="checkbox"/> Rad release stickers on samples?</li> <li><input type="checkbox"/> Activity report from 222S?</li> <li><input type="checkbox"/> COC copy for LRB, RIDS filed?</li> <li><input type="checkbox"/> COC copy for sorbent follow-on?</li> </ul> | <p>Pick-up / Delivery</p> <p>Y/N    Y/N    Y/N    Y/N    Y/N    Y/N    Y/N    Y/N</p> <p>POC <i>(P)</i>    POC <i>(P)</i></p> | <p>Comments:</p> <p>Original COC follows sorbent media</p> |
|---|---|--|

<b>Battelle Pacific Northwest Laboratory</b>	<b>CHAIN OF CUSTODY</b>	<b>WHC 100038</b>
--	-------------------------	-------------------

Custody Form Initiator	J. A. Edwards - PNL	Telephone (509) 373-0141 Page 85-3009 / P8-08 / FAX 376-0418
Company Contact	R. D. Mahon - WHC	Telephone (509) 373-7437 Page 85-9656 / S3-27 / FAX 373-7076
Project Designation/Sampling Locations	200 West Tank Farm 241-T-104 Tank Vapor Sample SAF S8012 (VSS Truck)	Collection date <sup>from</sup> 02-07-96 Preparation date 01-25-96
Ice Chest No.		Field Logbook No. WHC- <u>N-647</u> 10
Ertco Hi/Lo thermometer No.	PNL-T-00__	
Bill of Lading/Airbill No.	N/A	Offsite Property No. N/A
Method of Shipment	Government Truck	
Shipped to	WHC	
Possible Sample Hazards/Remarks	Unknown at time of sampling	

Sample Identification

S6012 - A08 . 840	PNL Triple Sorbent Trap (TST) Sample # 1	
S6012 - A09 . 841	PNL TST Sample # 2	
S6012 - A10 . 842	PNL TST Sample # 3	
S6012 - A17 . 843	PNL TST Sample # 4	
S6012 - A18 . 844	PNL TST Sample # 5	
S6012 - A19 . 845	PNL TST Sample # 6	
S6012 - A20 <sup>2-5-96 09</sup> . 846	Open, close & store PNL TST Field Blank # 1	In VSS truck
S6012 - A21 <sub>30</sub> . 847	Open, close & store PNL TST Field Blank # 2	In VSS truck
S6012 - A27 . 848	Store PNL TST Trip Blank # 1	None
S6012 - A28 . 849	Store PNL TST Trip Blank # 2	None

[ ] Field Transfer of Custody		[ X ] Chain of Possession		(Sign and Print Names)		
Relinquished By	Date	Time	Received By	Date	Time	
JL Julva <i>[Signature]</i>	02-05-96	1410	<i>[Signature]</i>	02-05-96	1410	
<i>[Signature]</i>	02-08-96	1350	J.A. Edwards / J.H. Edwards	02-08-96	1350	

Final Sample Disposition

Comments:				Comments:
PNL (only) Checklist	Pick-up	/	Delivery	
Media labeled and checked?	<input checked="" type="checkbox"/>	N		
Letter of instruction?	<input checked="" type="checkbox"/>	N		
Media in good condition?	<input checked="" type="checkbox"/>	N	/	<input checked="" type="checkbox"/> N
COC info/signatures complete?	<input checked="" type="checkbox"/>	N	/	<input checked="" type="checkbox"/> N
Sorbents shipped on ice? (<5°C)	<input checked="" type="checkbox"/>	N	/	<input checked="" type="checkbox"/> N
Hi/Lo thermometer - <u>Keep upright!</u>	<input checked="" type="checkbox"/>	N		
Hi/Lo thermometer	/		/	<input checked="" type="checkbox"/> N
Rad release stickers on samples?	/		/	<input checked="" type="checkbox"/> N
Activity report from 222S?	/		/	<input checked="" type="checkbox"/> N
COC copy for LRB, RIDS filed?	<input checked="" type="checkbox"/>		/	<input checked="" type="checkbox"/> N

Cooler Temperature Status

Hi	-12 °C / Lo	-12 °C (pick up at PNL to WHC)
Hi	°C / Lo	°C (delivery at WHC from PNL)
Hi	°C / Lo	°C (at return to PNL from WHC)
Hi	5 °C / Lo	-18 °C (at delivery from WHC to PNL)

POC  POC



## 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. <u>614234</u> 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			