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18

VAPOR AND GAS SAMPLING OF SINGLE-SHELL TANK 241-C-107 USING the in Situ Vapor Sampling System

G.S. Caprio

SGN Eurisys Services Company, Richland, WA 99352
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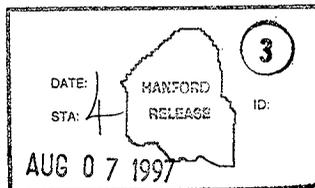
Abstract: THIS DOCUMENT PRESENTS SAMPLING DATA RESULTING FROM THE MARCH 26, 1996 SAMPLING OF SST 241-C-107 (#2)

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(#2) 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
ISVS	In Situ Vapor Sampling System
NH ₃	Ammonia
H ₂ 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-C-107 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-C-107. This document presents sampling data resulting from the March 26, 1996 sampling of SST 241-C-107. Analytical results will be presented in separate reports issued by the Pacific Northwest National Laboratory which supplied and analyzed the sample media.

The team also collected representative headspace samples using the In Situ Vapor Sampling System (ISVS). The ISVS sampling event will be described in a separate report, HNF-SD-WM-RPT-238.

2.0 SAMPLING EQUIPMENT DESCRIPTION

2.1 VAPOR SAMPLING SYSTEM

The team, consisting of Sampling and Mobile Laboratory (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-C-107 with sorbent traps and SUMMA¹ canisters on March 26, 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-C-107 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-Chemstation 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 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 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 a 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 that contain vapor-adsorbing media, are collected at the sorbent trap station of the sampling manifold. The rate 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 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[™] 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-TSAP-073 Rev 1, *Sampling and Analysis Plan for Tank Vapor Sampling Comparison Test* (Buckley 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 S6-019.

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 (VSS)
- R. D. Mahon, VSS Lead Scientist (ISVS)
- L. A. Pingel, Field Scientist (ISVS)
- T. B. Utecht, Sampling Technician (VSS)

The VSS was set up at SST 241-C-107 on March 25, 1996 and was allowed to warm up overnight. Sampling began about 11:30 a.m. on March 26, 1996, and was completed by 2:00 p.m. the same day.

3.3 INDUSTRIAL HYGIENE FIELD RESULTS

Prior to hooking up to SST 241-C-107, 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 40 ppm, O₂ 20.9%, and TOC 3.3 ppm.

3.4 AMBIENT CONDITIONS

The weather the day of the sampling event, March 26, 1996 was cool and sunny, with a mild wind. Graphs of ambient temperatures and pressures taken at the Hanford Meteorological Station, which is about 6 miles west of C-Farm, are provided in Appendix B.

3.5 SAMPLE COLLECTION

The hot-water-jacketed sampling probe was located in Riser 3 of SST 241-C-107. The probe length, from the sample inlet to the top of the riser flange, was 7.9 meters.

All zones of the VSS were heated to 60 °C during setup of the VSS at SST 241-C-107 on March 25, 1996. The team stabilized the VSS temperature zones by 11:00 a.m. on March 26, 1996, and the system was ready to collect samples. Measured according to the VSS operating procedure, the pressure and temperature of SST 241-C-107 were 991 mbar (743.2 torr) and 39.8 °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 21 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 March 26, 1996, the team collected two SUMMA™ canister samples of ambient air, one manually 10 meters upwind of the VSS connection with SST 241-C-107, 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 290.6 mbar (218.0 torr) and leakage of ambient air into the system was observed by monitoring system pressure for 15 minutes. Leakage resulted in an increase of 5.06 mbar (3.80 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 11.6 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 1.0%, and for sorbent traps the dilution was approximately 0.4%.

The sampling valve was opened and the VSS was purged with sample vapor from SST 241-C-107 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) 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-C-107.

Table 2. TOC Results.

Number of Runs	Description	Average TOC Concentration (ppmC)	% Standard Deviation
3	Propane	6.00	2.17
2	Ambient	2.76	6.30
3	Tank Vapor	6.85	0.51

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 March 26, 1996, SST 241-C-107 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-C-107 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-C-107 met the laboratory acceptance criteria and the DOT definition of a nonradioactive shipment.

Table 3. Radionuclide Analysis Results.

Filter	Sample Identifier	Activity Results* (pCi/sample)	Activity ^b (pCi/L of tank gas)
Upstream filter (box)	S6019-A23.OU1	Total Alpha = 368 Total Beta = 2780 GEA = <detectable	= 1.34 = 10.1 = <detectable
Downstream filter (box)	S6019-A24.OD1	Total Alpha = <0.879 Total Beta = 3.84 GEA = <detectable	= <0.879 = 0.01 = <detectable
Upstream filter (VSS)	S6019-A25.OU2	Total Alpha = 0.49 Total Beta = 17.2 GEA = <detectable	= 0.00 = 0.06 = <detectable
Downstream filter (VSS)	S6019-A26.OD2	Total Alpha = <0.524 Total Beta = 3.1 GEA = <detectable	= <0.524 = 0.01 = <detectable
Tritium trap	S6019-A16.OT1	Total activity = 17.3	= 17.3 ^c

NOTES:

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

*All 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 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, TSTs, and SUMMA[™] canisters received from PNNL were transported in a government vehicle to a custody locked storage area

maintained by SML. Sorbent trains, tubes and traps were maintained at 4 ± 2 °C in a refrigeration unit in the locked storage area.

On April 2, 1996 all sorbent tubes, TSTs, and SUMMA™ canisters were transported by government vehicle to PNNL and delivered to J. A. Edwards. Table 4 lists the sample identifiers, types, and COC form numbers.

Table 4. Pacific Northwest National Laboratory Samples.

Sample Identifier	Sample Type	COC Number
S6019-A03.026	Ambient upwind SUMMA™	100049
S6019-A04.031	Ambient SUMMA™ (VSS)	100049
S6019-A05.032	SUMMA™	100049
S6019-A06.057	SUMMA™	100049
S6019-A07.059	SUMMA™	100049
S6019-A17.S16	NH ₃ /H ₂ O sorbent	100045
S6019-A18.S17	NH ₃ /H ₂ O sorbent	100045
S6019-A19.S18	NO ₃ /H ₂ O sorbent	100045
S6019-A20.S19	NH ₃ /H ₂ O sorbent	100045
S6019-A21.S20	NH ₃ /H ₂ O Field Blank	100045
S6019-A22.S21	NH ₃ /H ₂ O Field Blank	100045
S6019-A08.800	TST	100041
S6019-A09.801	TST	100041
S6019-A10.802	TST	100041
S6019-A11.803	TST	100041
S6019-A12.805	TST Field Blank	100041
S6019-A13.812	TST Field Blank	100041
S6019-A14.813	TST Trip Blank	100041
S6019-A15.815	TST Trip Blank	100041

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-C-107, the VSS manifold and vapor sample transfer tubing was heated to 60 °C and ambient air was purged through the system for 1146 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-C-107 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

The flow measurements for this sampling event may have an error of 6 percent to 14 percent due to the mass flow measuring devices recalibration discrepancies. A detailed Description of this discrepancy can be found in internal memo 75-820-96-028 (Trible 1996c).

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-C-107.

6.0 ANOMALIES

All samples were collected in accordance with the TCP and WHC-IP-1127-4.10, *Collection of Parallel Sorbent Tube & SUMMA Canister Samples Using the Vapor Sampling System* (1995b). There were no anomalies during the sampling activity.

7.0 REFERENCES

- 49 CFR 100-177, 1992, "Transportation," Code of Federal Regulations, as amended.
- Buckley, L. L., 1996, *Sampling and Analysis Plan for Tank Vapor Sampling Comparison Test*, WHC-SD-WM-TSAP-073 Rev. 1, 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.
- Trible, T. C., Viswanath, R. S., 1996c, *Recommendation concerning the ISVS/VSS comparison study data with respect to calibration errors in Mass flow monitors and controllers*, (internal memo 75820-96-028 to L.D. Pennington, August 28), Westinghouse Hanford Company, Richland, Washington.
- WHC, 1995a, *Chain-of-Custody/Special Analysis Request for RCRA and CERCLA Protocol Samples*, Procedure WHC-IP-1127-1.3, Rev. 1, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1995b, *Collection of SUMMA Canisters and Sorbent Tube Samples Using the Vapor Sampling System (VSS)*, Procedure WHC-IP-1127-4.10, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1996, *Release Survey of Vapor Sampling Equipment*, Procedure 1996-3E100-RSP-02 Rev 01, Westinghouse Hanford Company, Richland, Washington.

APPENDIX A
SAMPLE LOG SHEETS

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YSS Sampling of
 C-107 in parallel with the ISVS
 Date: 3/26/96
 VSS Personnel: Glenn Caprio and 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 39.8 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.											
S6019- A03. 026	026	Upwind	AMBIENT #1	5500	30	165000	5500	1544	1050	1142	1
GC Run #1 Ambient air/Cleanliness check											
S6019- A04. 031	031	15	AMBIENT #2	5500	1	5500	5500	1146	1147	1	1
GC RUN#2 Ambient air											
LEAK CHECK(APPENDIX A) Leak Rate: 15.2 Torr/Hr											
Purge with tank air for 30 min											
				5500	30	165000	5500	1219	1249	30	165.00
Measure tank pressure PE-1 = 743.2											

GC RUN #3 (Tank run #1)	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
S6019- A05. 032	032	11	SUMMA #3	5500	1	5500	5500	1252	1259	1	6.00
S6019- A06. 057	057	13	SUMMA #4	5500	1	5500	5500	1303	1304	1	6.00
S6019- A07. 059	059	15	SUMMA #5	5500	1	5500	5500	1308	1309	1	6.00

VSS Sampling of
C-107 in parallel with the ISYS

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
S6019- A08 800	#800	5	TST #1	100	2	200	100.00	1312	1314	2	0.20
S6019- A09 801	#801	6	TST #2	100	2	200	100.00	1312	1314	2	0.20
S6019- A10 802	#802	7	TST #3	100	2	200	100.00	1312	1314	2	0.20
S6019- A11 803	#803	8	TST #4	100	2	200	100.00	1312	1314	2	0.20
GCRUN #4 (Tank run # 2)								1316			
S6019- A12 805	#805		TST FIELD BLANK #1					1317	1318	1	
S6019- A13 812	#812		TST FIELD BLANK #2					1317	1318	1	
S6019- A16 0T1	S96WV0013	2	Tritium Trap	200	5	1000	200.00	1329	1334	5	1.00
S6019- A17 S16	#S16	3	NH3/H2O (#1)	200	10	2000	200.00	1329	1339	10	2.00
S6019- A18 S17	#S17	4	NH3/H2O (#2)	200	10	2000	200.00	1329	1339	10	2.00
S6019- A19 S18	#S18	5	NH3/H2O (#3)	200	10	2000	200.00	1329	1339	10	2.00
S6019- A20 S19	#S19	6	NH3/H2O (#4)	200	10	2000	200.00	1329	1339	10	2.00
S6019- A21 S20	#S20		NH3/NOx/H2O FIELD BLANK #1					1342	1343	1	
S6019- A22 S21	#S21		NH3/NOx/H2O FIELD BLANK #2					1342	1343	1	
GCRUN #5 (Tank run #3)								1341			

TOTAL TANK GAS USED DURING SAMPLING RUNS 27.80

VSS Sampling of
C-107 in parallel with the ISYS

WHC Sample ID	ORNL/PNL Sample ID	Port Valve #	Description	Desired Flow Rate	Desired Duration (min.)	Desired Total Flow	Actual Flow Rate	Actual Start Time	Actual End Time	Actual Total Time (min.)	Actual Total Flow	Actual Total Liters
				SCCM		SCCM	SCCM					
S6019- A23 0U1	S96WV0007		Upstream HEPA(box)									
S6019- A24 0D1	S96WV0008		Downstream HEPA(box)									
S6019 A25 0U2	S96WV0009		Upstream HEPA(VSS)									
S6019- A26 0D2	S96WV0010		Downstream HEPA (VSS)									

Trip Blanks (DO NOT EXPOSE)

S6019- A14 813	TST#813		TST TRIP #1									
S6019- A15 815	TST#815		TST TRIP #2									

VSS SAMPLING RADIOLOGICAL SCREENING RESULTS
C-107

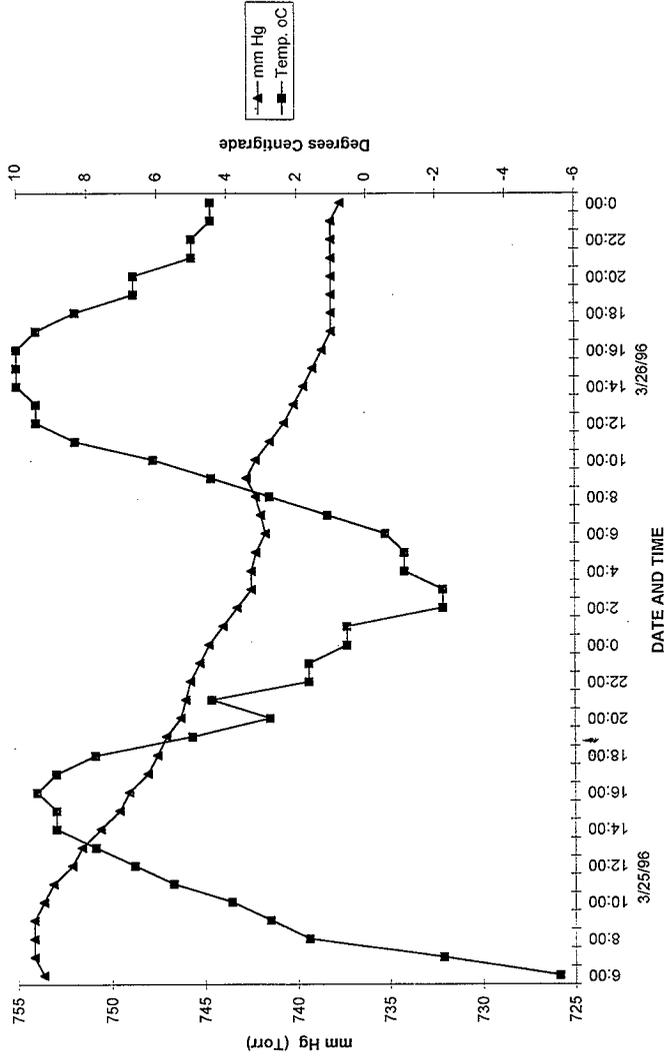
S6019-A23-Q01 / S86W0007 FILTER BOX UPSTREAM FILTER	Liters 275.20	PCI / liter 2780.00	PCI / liter 10.10	S6019-A24-Q01 / S86W0008 FILTER BOX DOWNSTREAM FILTER	Liters 275.20	PCI / liter 3.94	PCI / liter 0.01
BETA	< Detectable	< Detectable	< Detectable	BETA	< Detectable	< Detectable	< Detectable
ALPHA	< Detectable	< Detectable	< Detectable	ALPHA	< Detectable	< Detectable	< Detectable
GEA - Am-243	< Detectable	< Detectable	< Detectable	GEA - Am-243	< Detectable	< Detectable	< Detectable
BI-212	< Detectable	< Detectable	< Detectable	BI-212	< Detectable	< Detectable	< Detectable
Np-237	< Detectable	< Detectable	< Detectable	Np-237	< Detectable	< Detectable	< Detectable
Pb-212	< Detectable	< Detectable	< Detectable	Pb-212	< Detectable	< Detectable	< Detectable
Th-229	< Detectable	< Detectable	< Detectable	Th-229	< Detectable	< Detectable	< Detectable
TI-208	< Detectable	< Detectable	< Detectable	TI-208	< Detectable	< Detectable	< Detectable
Co-109	< Detectable	< Detectable	< Detectable	Co-109	< Detectable	< Detectable	< Detectable
Cs-137	< Detectable	< Detectable	< Detectable	Cs-137	< Detectable	< Detectable	< Detectable
S6019-A23-Q01 / S86W0009 VSS DOWNSTREAM FILTER	Liters 275.20	PCI / liter 17.20	PCI / liter 0.06	S6019-A24-Q01 / S86W0010 VSS DOWNSTREAM FILTER	Liters 275.20	PCI / liter 3.1	PCI / liter 0.01
BETA	< Detectable	< Detectable	< Detectable	BETA	< Detectable	< Detectable	< Detectable
ALPHA	< Detectable	< Detectable	< Detectable	ALPHA	< Detectable	< Detectable	< Detectable
GEA - Am-243	< Detectable	< Detectable	< Detectable	GEA - Am-243	< Detectable	< Detectable	< Detectable
BI-212	< Detectable	< Detectable	< Detectable	BI-212	< Detectable	< Detectable	< Detectable
Np-237	< Detectable	< Detectable	< Detectable	Np-237	< Detectable	< Detectable	< Detectable
Pb-212	< Detectable	< Detectable	< Detectable	Pb-212	< Detectable	< Detectable	< Detectable
Th-229	< Detectable	< Detectable	< Detectable	Th-229	< Detectable	< Detectable	< Detectable
TI-208	< Detectable	< Detectable	< Detectable	TI-208	< Detectable	< Detectable	< Detectable
S6019-A23-Q01 / S86W0013 TRITIUM TRAP	Liters 1	PCI / liter 17.3	PCI / liter 17.3				
TOTAL VOLUME							
TOTAL ACTIVITY							
SAMPLE EXPOSURE ANALYSIS, USING VSS DOWNSTREAM FILTER ANALYSIS AS POSSIBLE EXPOSURE LEVEL = BETA and ALPHA Less than DOT shipping limits							
SORBENT SAMPLING							
TOTAL VOLUME PER SAMPLE	2.00 Liters			TST SAMPLING	0.20 Liter		
ALPHA PER SAMPLE	< Detectable PCI			ALL TSTS, BETA	3.22E-03		
BETA PER SAMPLE	0.03 pCi per gram Beta			ALL TSTS, ALPHA	Detectable		
NH3 (0.75 gram)	0.04 pCi per gram Beta			ALL TSTS, GEA	Detectable		
NO2 (0.69 gram)	0.05 pCi per gram Beta			ALL TSTS, Tritium	4.94		
H2O (0.45 gram)	< Detectable PCI						
GEA PER SAMPLE							
Uranium per Sample (0.75 gram)	48.13						
NO2 (0.69 gram)	57.67						
H2O (0.45 gram)	76.89						
SUMMA SAMPLING							
TOTAL VOLUME PER CANNISTER	6 Liters						
BETA PER SAMPLE	0.01 PCI Beta						
ALPHA PER SAMPLE	< Detectable PCI						
GEA PER SAMPLE	< Detectable PCI						
TRITIUM PER SAMPLE	14.5063473 PCI						

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APPENDIX B
AMBIENT CONDITIONS

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WEATHER DURING VSS/ISVS SAMPLING OF 241-C-107



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APPENDIX C
CHAIN-OF-CUSTODY FORMS

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Battelle Pacific National Northwest Lab	CHAIN OF CUSTODY	WHC 100049
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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 373-3783
Project Designation/Sampling Locations	200 West Tank Farm 241-C-107 Tank Vapor Sample SAF S6019 VSS	Collection date 03 - 26 - 96 Preparation date 03 - 25 - 96
Ice Chest No.		Field Logbook No. WHC- <u>N-647-10</u>
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

S6019 - A03 . 026	Collect Ambient Air Sample, Upwind #1
S6019 - A04 . 031	Collect Ambient Air Sample, Through #2
S6019 - A05 . 032	Collect SUMMA #3
S6019 - A06 . 057	Collect SUMMA #4
S6019 - A07 . 059	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 <i>J.A. Edwards</i>	03-25-96	1330	K.J. Yang <i>K.J. Yang</i>	03-25-96	1330
<i>K.J. Yang</i>	3-26-96	0700	R.D. Mahon <i>R.D. Mahon</i>	3-26-96	0700
<i>R.D. Mahon</i>	4-2-96	1200	T.B. Utter <i>T.B. Utter</i>	4-2-96	1200
<i>T.B. Utter</i>	4-2-96	1505	J.A. Edwards <i>J.A. Edwards</i>	4-2-96	1505

Final Sample Disposition

Comments:

- | | | |
|------------------------------------|---|-----------|
| | Pick-up / Delivery | Comments: |
| ◇ PNNL (only) Checklist | | |
| ◇ Media labeled and checked? | <input checked="" type="checkbox"/> Y / <input checked="" type="checkbox"/> N | |
| ◇ Letter of instruction? | <input checked="" type="checkbox"/> Y / <input checked="" type="checkbox"/> N | |
| ◇ Media in good condition? | <input checked="" type="checkbox"/> Y / <input checked="" type="checkbox"/> N | |
| ◇ COC info/signatures complete? | <input checked="" type="checkbox"/> Y / <input checked="" type="checkbox"/> N | |
| ◇ Rad release stickers on samples? | <input checked="" type="checkbox"/> Y / <input checked="" type="checkbox"/> N | |
| ◇ Activity report from 2225? | <input checked="" type="checkbox"/> Y / <input checked="" type="checkbox"/> N | |
| ◇ RSR/copy? (a ≤100/B ≤400 pCi/g) | <input checked="" type="checkbox"/> Y / <input checked="" type="checkbox"/> N | |
| ◇ COC copy for LRB, RIDs filed? | <input checked="" type="checkbox"/> Y / <input checked="" type="checkbox"/> N | |

POC *[Signature]* POC *[Signature]*

(Revised 11/30/95 PNNL)

Battelle Pacific National Northwest Lab	CHAIN OF CUSTODY	WHC 100045
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-C-107 Tank Vapor Sample SAF S6019 VSS	Collection date 03-26-96 Preparation date 03-25-96
Ice Chest No.		Field Logbook No. WHC- <u>N-647.10</u>
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

S6019 - A17 . S16	Collect NH ₃ /H ₂ O Sorbent Trap
S6019 - A18 . S17	Collect NH ₃ /H ₂ O Sorbent Trap
S6019 - A19 . S18	Collect NH ₃ /H ₂ O Sorbent Trap
S6019 - A20 . S19	Collect NH ₃ /H ₂ O Sorbent Trap
S6019 - A21 . S20	Open, close and store NH ₃ /H ₂ O field blank #1
S6019 - A22 . S21	Open, close and store NH ₃ /H ₂ O field blank #2

<input type="checkbox"/> Field Transfer of Custody	<input checked="" type="checkbox"/> Chain of Possession		(Sign and Print Names)			
Relinquished By	Date	Time	Received By	Date	Time	
G W Dennis <i>G W Dennis</i>	03-25-96	0920	J A Edwards <i>J A Edwards</i>	03-25-96	0920	
J A Edwards <i>J A Edwards</i>	03-25-96	1430	K.J. Vance <i>K.J. Vance</i>	03-25-96	1430	
K.J. Vance <i>K.J. Vance</i>	3-26-96	0700	R D Mahon <i>R D Mahon</i>	3-26-96	0700	
R D Mahon <i>R D Mahon</i>	4-2-96	1200	T B White <i>T B White</i>	4-2-96	1200	
T B White <i>T B White</i>	4-2-96	1505	J A Edwards <i>J A Edwards</i>	4-2-96	1505	

Final Sample Disposition

Comments:

PNNL (only) Checklist	Pick-up / Delivery	Comments:
<input type="checkbox"/> Media labeled and checked?	<input checked="" type="checkbox"/> Y / N	
<input type="checkbox"/> Letter of instruction?	<input checked="" type="checkbox"/> Y / N	
<input type="checkbox"/> Media in good condition?	<input checked="" type="checkbox"/> Y / N	
<input type="checkbox"/> COC info/signatures complete?	<input checked="" type="checkbox"/> Y / N	
<input type="checkbox"/> Rad release stickers on samples?	<input checked="" type="checkbox"/> Y / N	
<input type="checkbox"/> Activity report from 222S?	<input checked="" type="checkbox"/> Y / N	
<input type="checkbox"/> RSR/copy? (a ≤100/B ≤400 pCi/g)	<input checked="" type="checkbox"/> Y / N	
<input type="checkbox"/> COC copy for LRB, RIDS filed?	<input checked="" type="checkbox"/> Y / N	
POC <i>(Signature)</i>	POC <i>(Signature)</i>	

(Revised 11/30/95 PNNL)

Battelle Pacific National Northwest Lab	CHAIN OF CUSTODY	WHC 100041
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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-C-107 Tank Vapor Sample SAF S6019 (VSS Truck)	Collection date 03-26-96 Preparation date 03-22-96
Ice Chest No.		Field Logbook No. WHC- <u>11-61710</u>
Ertco Hi/Lo thermometer No.	PNL-T-004	
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

S6019 - A08 . 800	Collect TST Sample # 1	
S6019 - A09 . 801	Collect TST Sample # 2	
S6019 - A10 . 802	Collect TST Sample # 3	
S6019 - A11 . 803	Collect TST Sample # 4	
S6019 - A12 . 805	Open, close & store TST Field Blank # 1	In VSS truck
S6019 - A13 . 812	Open, close & store TST Field Blank # 2	In VSS truck
S6019 - A14 . 813	Store TST Trip Blank # 1	N/A
S6019 - A15 . 815	Store TST Trip Blank # 2	N/A

[] Field Transfer of Custody			[X] Chain of Possession		(Sign and Print Names)		
Relinquished By	Date	Time	Received By	Date	Time		
J.L Julva <i>Joseph J. Julva</i>	03-25-96	1230	J.A Edwards <i>J.A Edwards</i>	03-25-96	1230		
J.A Edwards <i>J.A Edwards</i>	03-25-96	1330	R.D Mahon <i>R.D Mahon</i>	03-25-96	1330		
R.D Mahon <i>R.D Mahon</i>	3-26-96	0700	R.D Mahon <i>R.D Mahon</i>	3-26-96	0700		
R.D Mahon <i>R.D Mahon</i>	4-2-96	1200	J.A Edwards <i>J.A Edwards</i>	4-2-96	1505		4/2/96
T.B Utzell <i>T.B Utzell</i>	4-2-96	1505	J.A Edwards <i>J.A Edwards</i>	4-2-96	1505		

Final Sample Disposition

Comments:	Pick-up / Delivery	Comments:
PNL (only) Checklist		
Media labeled and checked?	<input checked="" type="checkbox"/> Y / <input checked="" type="checkbox"/> N	
Letter of instruction?	<input checked="" type="checkbox"/> Y / <input checked="" type="checkbox"/> N	
Media in good condition?	<input checked="" type="checkbox"/> Y / <input checked="" type="checkbox"/> N	
COC info/signatures complete?	<input checked="" type="checkbox"/> Y / <input checked="" type="checkbox"/> N	
Sorbents shipped on ice? (<5°C)	<input checked="" type="checkbox"/> Y / <input checked="" type="checkbox"/> N	
Hi/Lo thermometer - <u>Keep upright!</u>	<input checked="" type="checkbox"/> Y / <input checked="" type="checkbox"/> N	
Hi/Lo thermometer	/ Y / N	Hi -15°C / Lo -15°C (pick up at PNL to WHC)
Rad release stickers on samples?	/ Y / N	Hi _____°C / Lo _____°C (delivery at WHC from PNL)
Activity report from 2225?	/ Y / N	Hi _____°C / Lo _____°C (at return to PNL from WHC)
RSR/recopy? (a ≤100/B ≤400 pCi/g)	/ Y / N	Hi +12°C / Lo -17°C (at delivery from WHC to PNL)
COC copy for LRB, RIDS filed?	/ Y / N	
	POC <input checked="" type="checkbox"/> <u>RL</u>	

(Revised 06/21/95 PNL)

Westinghouse Hanford Company	CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST			COC# 009810
Collector Glenn Caprio/Tim Utecht	Contract/Requestor Rick Meehan	Tel. No. 373-7437	MSIN 53-27	FAX
SAF Number 56019	Sample Origin C-107	Purchase Order/Charge Code E29937	Temp. N/A	
Project Title VSS Completion of C-107	Logbook# WHC-13-647-10	Ice Chart#		
Shipped To (Lab) 222-S	Method of Shipment Co. Vehicle	Bill of Lading/Air Bill No. N/A		
Protocol N202	Days Turnaround 24 hr Turnaround	Offsite Property No. N/A		Preservative

Sample No.	Lab ID	Date	Time	No/Type Container	Sample Analysis	MSDS	Yes	No	HAZ	Remarks	Hold Time
56019-116.071	0013			(1) Silica Gel	Total Activity						
56019-122.001	0007			(1) Polin Dish	AT/TC/SEA						
56019-124.001	0008			(1)							
56019-125.012	0010			(1)							
56019-126.002	0011			(1)							
56019-127.001	0012			(1) Silica Gel	Total Activity						
56019-128.001	0013			(1)							
56019-129.001	0014			(1)							

POSSIBLE SAMPLE HAZARDS/REMARKS List all known wastes.		SPECIAL INSTRUCTIONS Please see results to Rick Malcom at 373-7076. Thru-LS	
Requisitioned By Glen S. Caprio	Print JL	Received By JL	Signature JL
Requisitioned By	Print	Received By	Signature
Requisitioned By	Print	Received By	Signature
Requisitioned By	Print	Received By	Signature

Final Sample Disposition Disposal Method: Return to container per lab procedure, used as process.	Date/Time Disposed By
--	--------------------------

Matrix* S - Soil SE - Sediment SO - Solid SL - Sludge W - Water OI - Other A - Air	DS - Down Solids DL - Down Liquids T - Tissue W - Waste V - Vegetation X - Other
---	---

A-8001-500 (07/85)

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>621173</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			