### Engineering Data Transmittal

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**SPECIAL ANALYTICAL SUPPORT**

**Subject:** SST-241-S-101. SAMPLING USING THE VAPOR SAMPLING SYSTEM

**Date:** AUG 05 1997

**Page:** 1 of 1

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<th>Document/Drawing No.</th>
<th>Sheet No.</th>
<th>Rev. No.</th>
<th>Title or Description of Data Transmitted</th>
<th>Approval Designator</th>
<th>Reason for Transmittal</th>
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<th>Receiver Disposition</th>
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**Reason for Transmittal**

- 1. Approval
- 2. Release
- 3. Information
- 4. Review
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- 6. Dist. (Receipt Acknow. Required)
- 7. Disapproved w/comment
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- 9. Reviewed w/comment
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**Control No.**

- Approved
- Disapproved w/comments
- Approved w/comments

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**Cognizant Manager**

L.L. Lockrem  

**Date**

7/2/97

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**Approval Designator**

E, S, O, D or N/A

(see WHC-CM-3-5, Sec. 12.7)

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- 1. Approval
- 2. Release
- 3. Information
- 4. Review
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- 7. Disapproved w/comment
- 8. Approved w/comment
- 9. Reviewed w/comment
- 10. Reviewed no/comment

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**Design Authority/ Cognizant Manager**

L.L. Lockrem  

**Date**

7/2/97

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**Authorized Representative**

Authorized Representative Date for Receiving Organization

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**Signature of EDT Orignator**

Signature of EDT Orignator  

5/6/97

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**Pending**

BD-7400-172-1 (05/96) GEF097
VAPOUR AND GAS SAMPLING OF THE SINGLE-SHELL TANK 241-S-101 USING The in Situ Vapor Sampling System

G. S. Caprio
SGN Eurisys Services Company, Richland, WA 99352
U.S. Department of Energy Contract DE-AC06-96RL13200


SUMMA is a trademark of Molecitics, Inc.
Vapor and Gas Sampling of Single-Shell Tank 241-S-101 Using the In Situ Vapor Sampling System

G. S. Caprio, Field Scientist
Vapor Sampling Project
Special Analytical Studies

R. D. Mahon, Project Lead
Vapor Sampling Project
Special Analytical Studies

L. L. Lockrem, Manager
Special Analytical Studies

Date: 7/17/97
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LIST OF TERMS

CGI: Combustible Gas Indicator
COC: Chain Of Custody
DOT: U.S. Department of Transportation
GSA: Gamma Energy Analysis
ISVS: In Situ Vapor Sampling System
NH₃: Ammonia
H₂O: 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
TOC: Total Organic Carbon
TST: Triple Sorbent Trap
VT: Vapor Team, personnel from Sampling and Mobile Laboratories and Special Analytical Studies
WHC: Westinghouse Hanford Company
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VAPOR AND GAS SAMPLING OF SINGLE-SHELL TANK 241-S-101
USING THE IN SITU VAPOR SAMPLING SYSTEM

1.0 SCOPE

The Vapor Issue Resolution Program tasked the Vapor Team (VT) to collect representative headspace samples from Hanford Site single-shell tank (SST) 241-S-101. This document presents In Situ Vapor Sampling System (ISVS) data resulting from the June 6, 1996 sampling of SST 241-S-101. Analytical results will be presented in separate reports issued by the Pacific Northwest National Laboratory (PNNL) which supplied and analyzed the sample media.

2.0 SAMPLING EQUIPMENT DESCRIPTION

2.1 IN SITU VAPOR SAMPLING SYSTEM

The VT, consisting of Sampling and Mobile Laboratories (SML) and Special Analytical Studies (SAS) personnel, used the ISVS to collect representative samples of the air, gases, and vapors from the headspace of SST 241-S-101 on June 6, 1996. WHC-SD-WM-SDD-068 Rev. 0, System Design Description for the In Situ Vapor Sampling System (Blanchard 1996a) describes, in detail the ISVS performance, its characteristics, and its operation.

In situ sampling is a method designed to collect vapor samples of the homogeneous headspace of waste tanks. Sample media, consisting of sorbent traps and radiological filters, are lowered into the tank headspace. Tank gases are drawn through the media by means of the ISVS manifold, which measure the volume of gas drawn through the system. The sample media are collected together in a sample head assembly (SHA). The SHA provides for twelve sorbent or triple sorbent trap (TST) samples (single sample each) to be sampled in sets of four, one SW* sampling line, and one line for radiological filtration.

The SHA is protected from external contamination and breakage by a transparent plastic tube. The plastic tube is cut, formed, and connected to the SHA. The plastic tube also prevents any part of the SHA from accidentally falling into the tank.

A set of 1/4 or 5/16 inch diameter flexible tubes, approximately 50 feet long, are held together with spiral wrap to form a "tube bundle", which connects the ISVS to the SHA. The tube bundle and SHA are assembled prior to sampling and are referred to as the "sample assembly".

Sorbent traps are pencil-size stainless steel or glass tubes that contain vapor-adsorbing media. The sorbent traps may be used singly or may be prepared with several individual traps joined in series (a sorbent train). A known amount of sample vapor is passed through the tube, which traps (by adsorption) virtually all the target analytes. The concentration of analytes in the vapor sampled is calculated from the quantity of analyte found in the sorbent media and the volume of vapor passed through the sorbent trap. In addition to the sorbent traps, SUMMA* canisters are also used to collect samples.

SUMMA* canisters are stainless steel vessels with internal surfaces that have been prepared by the SUMMA* process, which passivates active sites on the canister walls to minimize adsorption of gases and vapors. An analytical laboratory must clean and evacuate SUMMA* canisters before each use. The
evacuated canister is filled with sample vapor through a valve, which is then closed to seal the sample inside. SUMMA® canisters allow collection and transfer of whole-air samples from location to an analytical laboratory where the sample is analyzed. The standard capacity of each SUMMA® canister is 6 liters.

The ISVS consists of five sample stations, (four for sorbent trap sampling and one for SUMMA® sampling) terminating in 1/4 inch outside diameter stainless steel tubing. Each sorbent sample station is independently operable at the selected flow rate, from 50 to 500 standard cubic centimeters per minute (sccm).

The system is a portable sampling system. It is designed to allow setup and preparation to be performed outside of the tank farm, with a minimum number of steps to be performed inside the farm. It operates on 110V AC power. The ISVS was designed to meet the requirements of National Fire Protection Association 70 – 1993 (the National Electrical Code) for general industrial use. Before the ISVS can be used in any tank, procedures require a flammability check of the waste tank which shows that concentrations of flammable materials are well below lower flammability limits.

Tank gases passing through the ISVS will either pass through a sorbent trap and then a backup line dryer, or through the on-board activated charcoal/drierite cartridge. A check valve is installed in the system to prevent any possibility of siphoning materials into the waste tanks.

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 1996b). 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 VT retains these documents in the project file. The project specific number for this sampling event is S6-058.

3.2 OPERATIONS AND SAMPLING PERSONNEL

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

G. S. Caprio, Field Scientist
R. D. Mahon, Lead Scientist
C. S. McClellan, Sampling Technician.

The ISVS was set up at SST 241-S-101 on June 6, 1996 and was allowed to warm up for approximately 15 minutes. Sampling began at approximately 11:13 on June 6, 1996, and was completed by 13:30 the same day.

3.3 INDUSTRIAL HYGIENE FIELD RESULTS

Prior to inserting the tube bundle into SST 241-S-101, an industrial hygiene technician field tested tank vapors. The technician purged the instrument with tank gas for 5 minutes and then field measured vapor stream contents
using a combustible gas indicator (CGI) and an organic vapor meter (OVM). The technician measured the tank vapors at the breather filter, three feet down the riser, and twenty feet down the riser. The measurements reported at the breather filter: LEL 0%, NH₃ 50 ppm, O₂ 21.0%, and TOC 20 ppm. The measurements approximately three feet down were: LEL 1%, NH₃ 550 ppm, O₂ 20.7%, and TOC 47 ppm. The measurements approximately twenty feet down were: LEL 1%, NH₃ 650 ppm, O₂ 20.7%, and TOC 51 ppm.

3.4 AMBIENT CONDITIONS

The weather the day of the sampling event, June 6, 1996, was sunny and clear, with a light breeze blowing from S-101 towards S-102. Graphs of ambient temperatures and pressures taken at the Hanford Meteorological Station, which is about 2.5 miles north east of S-Farm, are provided in Appendix B.

3.5 SAMPLE COLLECTION

One analytical laboratory provided sample media. PNNL provided SUMMA™ canisters, sorbent traps for organic vapors, ammonia (NH₃), NOₓ, and water vapor (H₂O).

The VT began inserting the sample media into the SHA at 1530 on June 5, 1996, and finished at approximately 1850. The SHA was connected to tube bundle 14B. The top collar as described in ECN 632433 was used for this sampling event. The sample assembly was transported to 241-S-101 on June 6, 1996, and connected to ISVS #1 for the sampling event.

Prior to sample collection, a leak check of the ISVS sampling manifold and transfer tubing was performed. Pressure gauge readings were recorded at the beginning of the leak check. The gauge readings were used for the leak check calculations but for report purposes will be converted to absolute pressure. The system was evacuated to approximately 135.4 mbar (4 inHg) and leakage of ambient air into the system was observed by monitoring system pressure for 5 minutes. Leakage resulted in an increase of 0 mbar (0 inHg) in system pressure during the 5 minute test.

The tank flange was opened and the tube bundle was lowered 6.7 meters (22 feet). Tank vapor was drawn through each TST, sorbent, and SUMMA™ line for a specified period of time. Appendix A indicates the exact times and volumes of tank gas that was drawn through each sample.

After the final sample was collected the sample assembly was removed from the tank. A clean work area was prepared and the SHA was disassembled in the farm. Following the HPT survey the samples were packaged as radiation material and transported back to a custody secure RMA. The in-line filters were transported to 222-S for analysis. The next several sampling events were scheduled in SX-farm and therefore the ISVS was left inside the farm.

3.6 RADIATION SCREENING

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 <15 pCi/g of sample media.  
Alpha activity <5 pCi/g of sample media.
The sample media was not filtered for radiological particulates. The idea of unfiltered samples was to provide better analytical data for the laboratories. The samples were released for shipment based on the analytical results of the series of two filters and tritium trap collected through one of the 1/4 inch flexible lines. Based on the radiological results for the filters and tritium trap it is believed that the same concentration of radiological contaminates passed through the other 13 lines. The filters were analyzed by 222-S Laboratory. Based on the analytical results provided in Table 1 the samples were shipped to PNNL and delivered to J. A. Edwards. The VT scientists use the activity results in Table 1 to calculate pCi/g of sample media. The VT maintains this information in the project-specific file.

Table 1. Radionuclide Analysis Results

<table>
<thead>
<tr>
<th>Filter</th>
<th>Sample Identifier</th>
<th>Activity Results(^a) (pCi/sample)</th>
<th>Activity(^b) (pCi/L of tank gas)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upstream filter</td>
<td>S6058-A21.OU1</td>
<td>Total Alpha = &lt;0.157</td>
<td>= &lt;0.157</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total Beta = &lt;1.67</td>
<td>= &lt;1.67</td>
</tr>
<tr>
<td></td>
<td></td>
<td>GEA = &lt;detectable</td>
<td>= &lt;detectable</td>
</tr>
<tr>
<td>Downstream filter</td>
<td>S6058-A22.OD1</td>
<td>Total Alpha = &lt;0.258</td>
<td>= &lt;0.258</td>
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<tr>
<td></td>
<td></td>
<td>Total Beta = &lt;1.99</td>
<td>= &lt;1.99</td>
</tr>
<tr>
<td></td>
<td></td>
<td>GEA = &lt;detectable</td>
<td>= &lt;detectable</td>
</tr>
<tr>
<td>Tritium Trap</td>
<td>S6058-A03.OT1</td>
<td>Total Activity = 9.5</td>
<td>= 9.5</td>
</tr>
</tbody>
</table>

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

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

\(^b\)Numbers based on 1 liter for the total volume of tank vapor through the filters.

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

All sorbent trains, TSTS, and SUMMA\(^a\) canisters received from PNNL are kept in a custody locked storage area maintained by SML. Sorbent trains and TSTS were maintained at 4 ± 2°C in a refrigeration unit. SUMMA\(^a\) canisters were stored in the same locked storage area, but were not refrigerated. The sample media was picked up from PNNL by SAS and transported in a government vehicle to a custody locked storage area. Appendix C lists the sample identifiers, sample types, and COC form numbers for the sampling event.

From the time that samples are received by SAS until they are shipped back to the analytical laboratory, all COCs are maintained by SAS in accordance with WHC-IP-1127-1.3, Chain-of-Custody/Special Analysis Request for RCRA and CERCLA Protocol Samples (WHC 1995a).

5.0 QUALITY ASSURANCE AND CONTROLS

5.1 CLEANLINESS OF SYSTEM

Immediately prior to sampling of SST 241-S-101, the ISVS manifold was purged with ambient air for 5 minutes at 1 L/min. After this purge an ambient air SUMMA\(^a\) sample was drawn through the ISVS manifold and the 1/4 inch SUMMA\(^a\) sampling line. A second ambient air SUMMA\(^a\) sample was collected 10 meters upwind from the tank breather filter. The ambient air samples were then
collected to confirm by laboratory analysis that the ISVS sampling manifold was free of trace organic contaminants (or to determine which contaminants were present and at what concentration). For further details, refer to WHC-IP-1127-4.8 (WHC 1995b) and the project-specific file located with the VT.

5.2 INSTRUMENT CALIBRATION

The ISVS uses mass flow meters to measure the flow rate and totalizers to measure the total volume of sample vapor drawn through the sample media. Errors associated with the mass flow meters and totalizers were determined by the Westinghouse Hanford Company (WHC) Standards Laboratory before the SST 241-S-101 sampling event. Duration of flow are specified by the analytical laboratories that supply and analyze the sorbent traps.

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).

Instruments located in the ISVS are calibrated on an annual basis at the WHC Standards Laboratory. ISVS instrumentation calibration data, maintained in files by the VT, are summarized in Table 2. According to the calibration schedule shown in Table 2, all instrumentation was within its calibration period during the SST 241-S-101 sampling event.

Table 2. Calibration Data.

<table>
<thead>
<tr>
<th>_element</th>
<th>Calibration Date</th>
<th>Expiration Date</th>
<th>WHC Standards Laboratory Code</th>
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<tr>
<td>Rotameter AALBORG 102-05</td>
<td>8/8/95</td>
<td>8/8/96</td>
<td>518-28-13-001</td>
</tr>
<tr>
<td>Digital Thermometer HH22</td>
<td>1/11/96</td>
<td>1/11/97</td>
<td>518-79-06-003</td>
</tr>
<tr>
<td>Vacuum Gauge ASHCROFT</td>
<td>8/7/95</td>
<td>8/7/96</td>
<td>518-31-05-003</td>
</tr>
<tr>
<td>Headspace Thermocouple</td>
<td>5/31/96</td>
<td>5/31/97</td>
<td>518-78-02-010</td>
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<tr>
<td>Mass Flowmeters Sierra 822-13-OV1 FM-1/FT-1</td>
<td>8/8/95</td>
<td>8/8/96</td>
<td>518-28-03-015</td>
</tr>
<tr>
<td>Mass Flowmeters Sierra 822-13-OV1 FM-3/FT-3</td>
<td>8/8/95</td>
<td>8/8/96</td>
<td>518-28-03-017</td>
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</table>

The totalizers were calibrated in conjunction with the mass flow meters and the calibration data is summarized in Table 3.
Table 3. Totalizer Calibration Data.

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<th>Number</th>
<th>Calibration Date</th>
<th>Expiration Date</th>
<th>Flow Rate (stdccm/min)</th>
<th>Time (min)</th>
<th>Calc. Total</th>
<th>UUT</th>
<th>Deviation</th>
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<tr>
<td>3494-1 FT-1</td>
<td>8/8/95</td>
<td>8/8/96</td>
<td>247.1</td>
<td>5.833</td>
<td>1441.2</td>
<td>1500</td>
<td>3.9%</td>
</tr>
<tr>
<td>3494-2 FT-2</td>
<td>8/8/95</td>
<td>8/8/96</td>
<td>253.8</td>
<td>7.065</td>
<td>1793.1</td>
<td>1800</td>
<td>0.4%</td>
</tr>
<tr>
<td>3494-3 FT-3</td>
<td>8/8/95</td>
<td>8/8/96</td>
<td>262.7</td>
<td>5.081</td>
<td>1334.7</td>
<td>1300</td>
<td>2.6%</td>
</tr>
<tr>
<td>3494-4 FT-4</td>
<td>8/8/95</td>
<td>8/8/96</td>
<td>25.2</td>
<td>5.186</td>
<td>1302.8</td>
<td>1300</td>
<td>0.2%</td>
</tr>
</tbody>
</table>

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 ISVS immediately prior to sampling operations.

6.0 ANOMALIES

The VT used the Sampling and Analysis Plan and WHC-IP-1127-4.8, Vapor Sampling of Waste Tanks Using In Situ Vapor Sampling System (ISVS), (1995b) to guide the sample collection. Anomalies, however, were noted during the sample collection.

The SUMMA™ sample line was not connected to the ISVS when sample S6058-A02.309 was collected. The sample collected ambient air that was drawn through the SUMMA™ port on the ISVS. Sample S6058-A04.310 was designated for tank gas but was used as an ambient air sample collected through the SUMMA™ line.

Three of the samples became detached from the flexible tubing inside the SHA. Two of the three were detached before the tube bundle was inserted into the tank, S6058-A16.590 and S6058-A18.1027, both field blanks. Due to the fact that the two samples were field blanks and the possibility of affecting sample and tube bundle integrity, they were not reconnected before insertion.
After the tube bundle was removed from the tank it was noted that Sample S6058-A12.1023 was detached from the flexible 5/16 inch tubing. It is unknown if the tubing came off before or after the tank gas was drawn through the sample. The volume of this sample is suspect.

These anomalies were also noted on the sample log sheets in Appendix A.

7.0 REFERENCES


Trible, T.C., R.S. Viswanath, 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.


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APPENDIX A
SAMPLE LOG SHEETS
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Set up ISVS (Section 8.1)
Ensure particulate filters are installed
LEAK CHECK (APPENDIX I) Leak Rate: 0 inch Hg in 5 min
Tank Temperature 30.4°C

### ISVS Sampling of S-101

<table>
<thead>
<tr>
<th>Probe</th>
<th>Desired Flow Rate (SCCM)</th>
<th>Desired Duration (min.)</th>
<th>Desired Total Flow Rate SCCM</th>
<th>Actual Flow Rate SCCM</th>
<th>Actual Start Time</th>
<th>Actual End Time</th>
<th>Actual Total Time</th>
<th>Actual Total Flow Rate SCCM</th>
</tr>
</thead>
<tbody>
<tr>
<td>WHC Sample ID</td>
<td>Sample ID</td>
<td>Line Port</td>
<td>Description</td>
<td>Flow Rate (SCCM)</td>
<td>Duration (min.)</td>
<td>Total Flow Rate SCCM</td>
<td>Flow Rate SCCM</td>
<td>Start Time</td>
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<tr>
<td>S6058- A01</td>
<td>308</td>
<td>NA</td>
<td>NA</td>
<td>Upwind SUMMA #1</td>
<td>5</td>
<td>5000</td>
<td>1</td>
<td>1112</td>
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<tr>
<td>S6058- A02</td>
<td>309</td>
<td>S</td>
<td>SUMMA</td>
<td>Ambient #2</td>
<td>1</td>
<td>1 instruction</td>
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<td>1</td>
<td>1 instruction</td>
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<td>1133</td>
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</table>

Purge SUMMA line of sample assembly with ambient air

Uncap and insert sample bundle into tank

Connect bundle lines: 1 1

Purge SUMMA line /w tank

---

*S = Anomalies noted on Page 3.

---

**S101XLS 1/10/97 8:57 AM**
### ISVS Sampling of S-101

<table>
<thead>
<tr>
<th>WHC Sample ID</th>
<th>PNNL Sample ID</th>
<th>Probe</th>
<th>Cart Description</th>
<th>Desired Flow Rate (SCCM)</th>
<th>Desired Duration (min.)</th>
<th>Desired Total Flow Rate (SCC)</th>
<th>Actual Flow Rate (SCC)</th>
<th>Actual Start Time</th>
<th>Actual End Time</th>
<th>Actual Total Flow Rate (SCC)</th>
<th>Actual Total Time (min.)</th>
<th>Actual Total Flow Rate (SCC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>S6058- A07 S85</td>
<td>S85</td>
<td>2</td>
<td>NH3/N20/NO/H20</td>
<td>200</td>
<td>10</td>
<td>2000</td>
<td>213.00</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>1241</td>
<td>NA</td>
</tr>
<tr>
<td>S6058- A08 S86</td>
<td>S86</td>
<td>3</td>
<td>NH3/N20/NO/H20</td>
<td>200</td>
<td>10</td>
<td>2000</td>
<td>205.00</td>
<td>12:41:30</td>
<td>NA</td>
<td>NA</td>
<td>1242</td>
<td>NA</td>
</tr>
<tr>
<td>S6058- A09 S87</td>
<td>S87</td>
<td>4</td>
<td>NH3/N20/NO/H20</td>
<td>200</td>
<td>10</td>
<td>2000</td>
<td>198.00</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>1242</td>
<td>NA</td>
</tr>
<tr>
<td>S6058- A10 S88</td>
<td>S88</td>
<td>5</td>
<td>NH3/N20/NO/H20</td>
<td>200</td>
<td>10</td>
<td>2000</td>
<td>212.00</td>
<td>12:42:30</td>
<td>NA</td>
<td>NA</td>
<td>1242</td>
<td>NA</td>
</tr>
</tbody>
</table>

Connect bundle lines:

- 6 1
- 7 2
- 8 3
- 9 4

Remove sample bundle from tank and cap

Dismantle sample bundle:

- S6058- A21 0U1 S96WV0063 1 1 Bundle line 1 Upstream filter
- S6058- A22 0D1 S96WV0064 1 1 Bundle line 1 Downstream filter
- S6058- A03 OT1 S96WV0065 1 1 Bundle line 1 tritium trap
- S6058- A15 S89 S89 10 NA Bundle store NH3/N20/NO/H20 FIELD BLANK #1
- *S6058- A16 S90 S90 11 NA Bundle store NH3/N20/NO/H20 FIELD BLANK #2

Remove filters from cart manifold ports 1, 2, 3, 4, and SUMMA to release cart.

* = Anomalies noted on Page 3.
## ISVS Sampling of S-101

<table>
<thead>
<tr>
<th>WHC Sample ID</th>
<th>Desired Flow Rate</th>
<th>Desired Duration (min.)</th>
<th>Desired Total Flow SCCM</th>
<th>Actual Flow Rate SCCM</th>
<th>Actual Start Time</th>
<th>Actual End Time</th>
<th>Actual Total Flow SCCM</th>
<th>Actual Flow Time (min.)</th>
<th>Actual SCCM</th>
</tr>
</thead>
<tbody>
<tr>
<td>PNNL Sample ID</td>
<td>Sample ID Line Port</td>
<td>Description</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: SCCM for the ISVS is reported at 760 torr, 21°C.

### ANOMALIES

**S6058-A02.309**
- SUMMA line was not connected to cart when sample was collected. Sample collected ambient air drawn in through the SUMMA port on cart.

**S6058-A04.310**
- Tank gas SUMMA was used for Ambient air through SUMMA line to make up for SUMMA 309 mistake.

**S6058-A12.1023**
- 1325 hrs, after Sample Head Assembly was removed from tank: TST sample line was disconnected at 5/16 inch tygon connection to silica gel. It is unknown if the tygon came off the silica gel before or after the tank gas was drawn through the TSTs. The volume of this sample is suspect.

**S6058-A16.590**
- 1148 hrs, before Sample Head Assembly was inserted into tank: NH3 Field Blank line was disconnected at 5/16 inch tygon connection to silica gel. Because this was a Field Blank, it was not connected before the Sample Head Assembly was lowered into the tank and sampled.

**S6058-A18.1027**
- 1148 hrs, before Sample Head Assembly was inserted into tank: TST Field Blank line was disconnected at 5/16 inch tygon connection to silica gel. Because this was a Field Blank, it was not connected before the Sample Head Assembly was lowered into the tank and sampled.

* = Anomalies noted on Page 3.

BUNDLE TOTAL TANK GAS USED DURING SAMPLING RUNS (Liters) 26.85
S-101 ISVS SAMPLING RADIOLOGICAL SCREENING RESULTS

Note: #VALUE! = <Detectable

<table>
<thead>
<tr>
<th>S6058-A21.OU / S96WV0053</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>PARALLEL UPSTREAM FILTER</td>
<td>Liters</td>
<td>pCi / liter</td>
</tr>
<tr>
<td>GEA-Co-60</td>
<td>1.00</td>
<td>&lt;0.157</td>
</tr>
<tr>
<td>Cs-134</td>
<td>&lt;1.67</td>
<td>#VALUE!</td>
</tr>
<tr>
<td>Eu-152</td>
<td>&lt;9.165</td>
<td>&lt;Detectable</td>
</tr>
<tr>
<td>Eu-154</td>
<td>&lt;7.629</td>
<td>&lt;Detectable</td>
</tr>
<tr>
<td>Eu-155</td>
<td>&lt;6.69</td>
<td>&lt;Detectable</td>
</tr>
<tr>
<td>TOTAL VOLUME</td>
<td>1.00</td>
<td>&lt;0.157</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>S6058-A22.OD1 / S96WV0064</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>PARALLEL DOWNSTREAM FILTER</td>
<td>Liters</td>
<td>pCi / liter</td>
</tr>
<tr>
<td>GEA-Co-60</td>
<td>1.00</td>
<td>&lt;0.258</td>
</tr>
<tr>
<td>Cs-134</td>
<td>&lt;1.199</td>
<td>#VALUE!</td>
</tr>
<tr>
<td>Cs-137</td>
<td>&lt;12.08</td>
<td>&lt;Detectable</td>
</tr>
<tr>
<td>Eu-152</td>
<td>&lt;7.629</td>
<td>&lt;Detectable</td>
</tr>
<tr>
<td>Eu-154</td>
<td>&lt;2.67</td>
<td>&lt;Detectable</td>
</tr>
<tr>
<td>Eu-155</td>
<td>&lt;2.78</td>
<td>&lt;Detectable</td>
</tr>
<tr>
<td>TOTAL VOLUME</td>
<td>1.00</td>
<td>&lt;0.258</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>S6058-A03.OFT / S96WV0065</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>TRITIUM TRAP</td>
<td>Liters</td>
<td>pCi / liter</td>
</tr>
<tr>
<td>TOTAL VOLUME</td>
<td>1</td>
<td>9.5</td>
</tr>
<tr>
<td>TOTAL ACTIVITY</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SAMPLE EXPOSURE ANALYSIS, USING TOTAL OF BOTH UPSTREAM AND DOWNSTREAM FILTER ANALYSIS AS POSSIBLE EXPOSURE LEVEL

# = VALUE! and ALPHA Less than DOT shipping limits
Total Alpha (pCi / liter) = #VALUE!
Total Beta (pCi / liter) = #VALUE!
Total GEA Cs-137 (pCi/liter) = < Detectable

SORBENT SAMPLING Used 5 g for sorbent mass

TOTAL VOLUME PER SAMPLE 2.00 Liters

<table>
<thead>
<tr>
<th>Trinit per SAMPLE</th>
<th>NH3 (5 gram)</th>
<th>3.60 pCi per gram</th>
<th>pCi per gram</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALPHA per SAMPLE</td>
<td>NH3 (5 gram)</td>
<td>#VALUE! pCi per gram</td>
<td></td>
</tr>
<tr>
<td></td>
<td>H2O (5 gram)</td>
<td>3.60 pCi per gram</td>
<td>pCi per gram</td>
</tr>
<tr>
<td></td>
<td>#VALUE! pCi per gram</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>#VALUE! pCi per gram</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BETA per SAMPLE</td>
<td>NH3 (5 gram)</td>
<td>#VALUE! pCi per gram</td>
<td></td>
</tr>
<tr>
<td></td>
<td>H2O (5 gram)</td>
<td>#VALUE! pCi per gram</td>
<td></td>
</tr>
<tr>
<td></td>
<td>#VALUE! pCi per gram</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>#VALUE! pCi per gram</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GEA per SAMPLE (Cs-137)</td>
<td>NH3 (5 gram)</td>
<td>#VALUE! pCi per gram</td>
<td></td>
</tr>
<tr>
<td></td>
<td>H2O (5 gram)</td>
<td>#VALUE! pCi per gram</td>
<td></td>
</tr>
<tr>
<td></td>
<td>#VALUE! pCi per gram</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>#VALUE! pCi per gram</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TST SAMPLING Used 4.5 g for TST mass

TOTAL VOLUME PER SAMPLE 0.20 Liter

<table>
<thead>
<tr>
<th>Trinit per Sample</th>
<th>TST (4.5 gram)</th>
<th>0.42 pCi per gram</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALPHA per Sample</td>
<td>#VALUE! pCi per gram</td>
<td></td>
</tr>
<tr>
<td></td>
<td>#VALUE! pCi per gram</td>
<td></td>
</tr>
<tr>
<td>BETA per Sample</td>
<td>#VALUE! pCi per gram</td>
<td></td>
</tr>
<tr>
<td></td>
<td>#VALUE! pCi per gram</td>
<td></td>
</tr>
<tr>
<td>GEA per Sample (Cs-137)</td>
<td>TST (4.5 gram)</td>
<td>#VALUE! pCi per gram</td>
</tr>
<tr>
<td></td>
<td>#VALUE! pCi per gram</td>
<td></td>
</tr>
<tr>
<td></td>
<td>#VALUE! pCi per gram</td>
<td></td>
</tr>
</tbody>
</table>

SUMMA SAMPLING

TOTAL VOLUME PER CANISTER 6 Liters (air at 300K, 1 bar = 1.161 g/L)

<table>
<thead>
<tr>
<th>Trinit per CANISTER</th>
<th>8.18 pCi per gram</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALPHA PER CANISTER</td>
<td>#VALUE! pCi per gram</td>
</tr>
<tr>
<td>BETA PER CANISTER</td>
<td>#VALUE! pCi per gram</td>
</tr>
<tr>
<td>GEA PER CANISTER (Cs-137)</td>
<td>#VALUE! pCi per gram</td>
</tr>
<tr>
<td></td>
<td>#VALUE! pCi per gram</td>
</tr>
</tbody>
</table>
APPENDIX B

AMBIENT CONDITIONS
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WEATHER DURING ISVS SAMPLING OF 241-S-101
APPENDIX C

CHAIN-OF-CUSTODY FORMS
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Battelle Pacific National Northwest Lab  

**CHAIN OF CUSTODY**  

Custody Form Initiator: J. A. Edwards - PNNL  
Company Contact: R. D. Mahon - WHC  
Project Designation/Sampling Locations: 200 West Tar 241-S-101  
Ice Chest No.:  
Bill of Lading/Airbill No.: N/A  
Method of Shipment: Government Truck  
Shipped to: PNNL  
Possible Sample Hazards/Remarks: Unknown at time of sampling

### Sample Identification

<table>
<thead>
<tr>
<th>Sample Identification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>S6058 - A01 . 308</td>
<td>Collect Ambient Air Sample SUMMA #1</td>
</tr>
<tr>
<td>S6058 - A02 . 309</td>
<td>Collect Ambient Air Sample SUMMA #2 (through tube bundle)</td>
</tr>
<tr>
<td>S6058 - A04 . 310</td>
<td>Collect SUMMA #3</td>
</tr>
<tr>
<td>S6058 - A05 . 311</td>
<td>Collect SUMMA #4</td>
</tr>
<tr>
<td>S6058 - A06 . 312</td>
<td>Collect SUMMA #5</td>
</tr>
</tbody>
</table>

### Field Transfer of Custody

<table>
<thead>
<tr>
<th>Relinquished By</th>
<th>Date</th>
<th>Time</th>
<th>Received By</th>
<th>Date</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>J A Edwards</td>
<td>06-03-96</td>
<td>12:55</td>
<td>CSW</td>
<td>06-03-96</td>
<td>12:55</td>
</tr>
<tr>
<td>CSW</td>
<td>6-12-96</td>
<td>11:46</td>
<td>CSW</td>
<td>6-12-96</td>
<td>11:46</td>
</tr>
<tr>
<td>CSW</td>
<td>6-12-96</td>
<td>12:30</td>
<td>J A Edwards</td>
<td>6-12-96</td>
<td>12:30</td>
</tr>
</tbody>
</table>

### 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 222?  
  - RSR/release? (a ≤100/β ≤400 pCi/g)  
  - COC copy for LRB, RIS filed?  

(Revised 05/30/96 PNNL)

Comments:  

**S6058-A02.309** Summa line was not connected to ISYS when this sample was collected. This sample collected air drawn in through the SUMMA port on the cart.  

**S6058-A04.310** Tank 6 gas SUMMA was used for ambient air through the SUMMA line to make up for SUMMA 309 mistake.
**Chain of Custody**

<table>
<thead>
<tr>
<th>Field Transfer of Custody</th>
<th>Chain of Possession</th>
<th>(Sign and Print Names)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relinquished By:</td>
<td>Date</td>
<td>Time</td>
</tr>
<tr>
<td>G W Dennis</td>
<td>05-31-96</td>
<td>11:00</td>
</tr>
<tr>
<td>J A Edwards</td>
<td>06-06-96</td>
<td>12:35</td>
</tr>
<tr>
<td>C M Choi</td>
<td>06-12-96</td>
<td>11:40</td>
</tr>
<tr>
<td>E S Criter</td>
<td>06-12-96</td>
<td>12:30</td>
</tr>
</tbody>
</table>

Comments:

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

(POC) [X] Y

**Final Sample Disposition**

- **POC (WHC-SD-WM-TP-335, REV. 2, Table 2b)**
- **A-6000-407 (1292) WEF061**

Comments:

- **S6058-A16, S90** → NH₃ Field Blank was disconnected at 5/6" Tygon to Silica Gel. Because this was a field blank it was not reconnected before being lowered into the tank.

(Revised 05/30/96 PNNL)
**Battelle Pacific Northwest Laboratory**

**CHAIN OF CUSTODY**

**WHC 100088**

<table>
<thead>
<tr>
<th>Custody Form Initiator</th>
<th>J. A. Edwards - PNL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company Contact</td>
<td>R. D. Mahon - WHC</td>
</tr>
<tr>
<td>Project Designation/Sampling Locations</td>
<td>200 West Tank Farm 241-S-101 Tank Vapor Sample SAF S6058 (ISVS Cart)</td>
</tr>
<tr>
<td>Ice Chest No.</td>
<td></td>
</tr>
<tr>
<td>Ertco Hi/Lo thermometer No.</td>
<td>PNL-T-00</td>
</tr>
<tr>
<td>Bill of Lading/Airbill No.</td>
<td>N/A</td>
</tr>
<tr>
<td>Method of Shipment</td>
<td>Government Truck</td>
</tr>
<tr>
<td>Shipped to</td>
<td>WHC</td>
</tr>
</tbody>
</table>

**Possible Sample Hazards/Remarks: Unknown at time of sampling**

<table>
<thead>
<tr>
<th>Sample Identification</th>
</tr>
</thead>
<tbody>
<tr>
<td>S6058 - A11 . 1022</td>
</tr>
<tr>
<td>S6058 - A12 . 1023</td>
</tr>
<tr>
<td>S6058 - A13 . 1024</td>
</tr>
<tr>
<td>S6058 - A14 . 1025</td>
</tr>
<tr>
<td>S6058 - A17 . 1026</td>
</tr>
<tr>
<td>S6058 - A18 . 1027</td>
</tr>
<tr>
<td>S6058 - A19 . 1029</td>
</tr>
<tr>
<td>S6058 - A20 . 1030</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Field Transfer of Custody</th>
<th>[ ] Relinquished By</th>
<th>[X ] Chain of Possession</th>
<th>Received By</th>
<th>[ ] Date</th>
<th>[ ] Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>J. Jula</td>
<td></td>
<td></td>
<td></td>
<td>06-04-96</td>
<td>12:00</td>
</tr>
<tr>
<td>JA Edwards</td>
<td></td>
<td></td>
<td></td>
<td>06-04-96</td>
<td>12:55</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>06-04-96</td>
<td>12:20</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>06-04-96</td>
<td>12:30</td>
</tr>
</tbody>
</table>

**Final Sample Disposition**

<table>
<thead>
<tr>
<th>Comments:</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ PNL (only) Checklist</td>
</tr>
<tr>
<td>☐ Pick-up / Delivery</td>
</tr>
<tr>
<td>☐ Comments:</td>
</tr>
</tbody>
</table>

**Comments:**

S6058 - A12 . 1023 > TST Sample #2 was discarded at 5/16" tygon connection to silica gel. It is unknown if the tygon was off before or after tank gas was connected. CO<sub>2</sub> was sampled and delivered to WHC. Carbon was not flushed from tygon.

H<sub>i</sub> = 50°F / L<sub>i</sub> = 50°F (pick up at PNL to WHC)

H<sub>i</sub> = 60°F / L<sub>i</sub> = 60°F (delivery at WHC from PNL)

H<sub>i</sub> = 50°F / L<sub>i</sub> = 50°F (at return to PNL from WHC)

H<sub>i</sub> = 50°F / L<sub>i</sub> = 50°F (delivery from WHC to PNL)

S6058 - A8 . 1027 > TST Field blank was discarded at 5/16" tygon connection to silica gel. Because it was a field blank, it was not reconnected before being lowered into tank.

6/12/96  

A-6000-407 (12/92) WEF061  

1 of 1  
C-5
**Westinghouse Hanford Company\n**

**CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST**

**Collector:** Glenn Caprio/Rick Mahon  
**Contact/Requestor:** Rick Mahon  
**Tel. No.:** 373-7437  
**MSIN:** S3-27  
**FAX:** 373-7076  
**SAF Number:** S6250  
**Sample Origin:** S-101  
**Purchase Order/Charge Code:** E29937/75745

**Project Title:** ISYS Vapor Sampling  
**Logbook #:** N/A  
**Jacket #:** n/a  
**Temp.:** n/a

**Shipped To (Lab):** 222-S Laboratory  
**Method of Shipment:** Government Vehicle  
**Bill of Lading/Air Bill No.:** n/a

**Protocol:**  
- **Sample No.:** S6058-222.001  
  - **Lab. ID:** S96HW  
  - **Date:** 6/30/96  
  - **Time:** 11:30  
  - **Method:**  
    - **Container:** AT/TB/GEA  
    - **Sample Analysis:** Total Activity

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Lab. ID</th>
<th>Date</th>
<th>Time</th>
<th>Method</th>
<th>Container</th>
<th>Sample Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>S6058-222.001</td>
<td>S96HW</td>
<td>6/30/96</td>
<td>11:30</td>
<td>AT/TB/GEA</td>
<td>Total Activity</td>
<td></td>
</tr>
</tbody>
</table>

**Permeative:** n/a  

**Poss Ste Will HAZARDS/REMARKS:** MSDS  
**SPECIAL INSTRUCTIONS:** These samples require multi-day analysis to calculate decay rates. Please analyze these once every 5 days for 20 days. Please fax reports to Rick Mahon. Thanks.

**Final Sample Disposition:** Disposed

---

All samples containing hazardous materials shall be picked up by requester and stored in similar container or site of origin.
DISTRIBUTION SHEET

To
Distribution

From
Special Analytical Support, Numatec Hanford

Date 8/7/97

Project Title/Work Order
VAPOR AND GAS SAMPLING USING THE IN SITU VAPOR SAMPLING SYSTEM

EDT No. L20720

ECN No.

Name | MSIN | Text With All Attach. | Text Only | Attach./ Appendix Only | EDT/ECN Only
--- | --- | --- | --- | --- | ---
Lockheed Martin Hanford Company
L. L. Buckley | R2-12 | X

Lockheed Martin Services, Inc.
Central Files | A3-88 | X

SGN Eurisys Services Corporation
E. S. Mast | S3-90 | X

PNNL
J. L. Huckaby | K6-80 | X