Pacific Northwest National Laboratory

Operated by Battelle for the
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TANK VAPOR CHARACTERIZATION PROJECT

Tank 241-BY-101 Headspace Gas and Vapor Characterization Results from Samples Collected on August 29, 1996

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August 1997

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with the U.S. Department of Energy
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Summary

This report presents the results from analyses of samples taken from the headspace of waste storage tank 241-BY-101 (Tank BY-101) at the Hanford Site in Washington State. Tank headspace samples collected by Westinghouse Hanford Company (WHC) were analyzed by Pacific Northwest National Laboratory (PNNL) to determine headspace concentrations of selected non-radioactive analytes. Analyses were performed by the Vapor Analytical Laboratory (VAL) at PNNL. Vapor concentrations from sorbent trap samples are based on measured sample volumes provided by WHC.

No analytes were determined to be above the immediate notification limits specified by the sampling and analysis plan (SAP) (Buckley 1996). Total non-methane organic compounds (TNMOCs) were the principal flammable constituent of the Tank BY-101 headspace, determined to be present at approximately 0.136% of its lower flammability limit (LFL). Total headspace flammability was estimated to be <0.313% of the LFL.

Average measured concentrations of targeted gases, inorganic vapors, and selected organic vapors are provided in Table S.1. A summary of experimental methods, including sampling methodology, analytical procedures, and quality assurance and control methods are presented in Section 2.0. Detailed descriptions of the analytical results are provided in Section 3.0.

Table S.1. Average Measured Concentrations of Gases and Inorganic and Organic Vapors in Tank BY-101 Sampled on 8/29/96

<u>Category</u>	<u>Sample Medium</u>	<u>Analyte</u>	<u>Concentration^(a)</u>	<u>Units</u>
Inorganic Vapors	Sorbent Traps	Ammonia	60	ppmv
		Nitrogen Dioxide (NO ₂)	<0.16	ppmv
		Nitric Oxide (NO)	<0.16	ppmv
		Water	9.8	mg/L
Permanent Gases	SUMMA™ Canisters	Hydrogen	29	ppmv
		Methane	<25	ppmv
		Carbon Dioxide	27	ppmv
		Carbon Monoxide	<17	ppmv
		Nitrous Oxide (N ₂ O)	57	ppmv
Total Non-Methane Organic Compounds	SUMMA™ Canisters	Total Non-Methane Organic Compounds	57.26	mg/m ³
Volatile Organic Vapors	SUMMA™ Canisters	1-Butanol	33.002	mg/m ³
		Acetone	3.099	mg/m ³
		Trichlorofluoromethane	2.457	mg/m ³
Volatile Organic Vapors	Sorbent Traps	1-Butanol	34.959	mg/m ³
		Acetone	1.624	mg/m ³
		1-Chloro-1,1-difluoroethane	1.621	mg/m ³
Flammables	SUMMA™ Canisters and Sorbent Traps	Flammables	<0.313	% LFL

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The authors gratefully acknowledge the support of other project staff at PNNL who contributed to the successful completion of this sampling and analysis activity. S. O. Slate, K. P. Schielke, L. M. P. Thomas, and G. W. Dennis supported inorganic laboratory work.

Terms and Abbreviations

% D	% Difference
CAS	Chemical Abstracts Service
CCB	continuing calibration blank
CCV	continuing calibration verification
COC	chain-of-custody
DIW	deionized water
EPA	U.S. Environmental Protection Agency
EQL	estimated quantitation limit
GC/FID	gas chromatography/flame ionization detector
GC/MS	gas chromatograph/mass spectrometer
GC/TCD	gas chromatography/thermal conductivity detection
IC	ion chromatography
ICB	initial calibration blank
ICV	initial calibration verification
IDL	instrument detection limit
IS	internal standard
ISE	ion selective electrode
ISVS	In Situ Vapor Sampling System
LFL	lower flammability limit
MW	molecular weight
NIST	National Institute for Standards and Technology
OSHA	Occupational Safety and Health Administration
PNL	Pacific Northwest Laboratory (previous name for the laboratory)
PNNL	Pacific Northwest National Laboratory
ppbv	part per billion by volume
ppm	parts per million
ppmv	part per million by volume
QA	quality assurance
RPD	relative percent difference
SAP	sample and analysis plan
SCIC	suppressed-conductivity ion chromatography
SRM	standard reference material
STP	standard temperature and pressure
SUMMA™	process for passivating stainless steel
TBP	tributyl phosphate
TEA	triethanolamine
TIC	tentatively identified compound
TNMOC	total non-methane organic compound
TST	triple sorbent trap
UHP	ultra high purity
VAL	Vapor Analytical Laboratory
VSS	vapor sampling system
WHC	Westinghouse Hanford Company

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1.0 Introduction

This report presents results of chemical analyses of vapor samples collected by WHC on August 29, 1996 from the headspace of waste storage tank 241-BY-101 (Tank BY-101) at the Hanford Site in Washington State. Pacific Northwest National Laboratory^(a) provided SUMMA™ canisters and sorbent traps for sample collection, and analyzed the samples according to instructions in the SAP (Buckley 1996). Analytical work was performed by the PNNL VAL in the 300 Area of the Hanford Site under the PNNL Tank Vapor Characterization Project.

Pacific Northwest National Laboratory provided six sets of sorbent traps for selected inorganic analytes (four samples and two field blanks), five SUMMA™ canisters for permanent gases and organic analytes (three headspace samples and two ambient air samples), and eight triple sorbent traps (TSTs) for organic analytes (four samples, two field blanks, and two trip blanks). Sample devices and controls were provided to WHC on August 26, 1996, and returned to PNNL on September 9, 1996. Westinghouse Hanford Company measured and reported to PNNL the sample volumes needed to determine headspace concentrations from sorbent trap samples.

Specific analytical methods for sample analysis are described in Section 2.0. Results and known sampling and analytical variances from established quality assurance (QA) requirements, where significant, are documented in Section 3.0. Chain-of-custody forms used to document possession and transfer of samples and controls are provided in Appendix A. Appendix B contains a complete listing of target analyte results for the organic analyses.

^(a) Pacific Northwest National Laboratory is operated for the U. S. Department of Energy by Battelle under Contract DE-AC06-76RLO 1830. The previous name of the laboratory was Pacific Northwest Laboratory. The former name is used when previously published documents are referenced.

2.0 Analytical Methods

Table 2.1 summarizes the analytes, sampling media, analytical methods, and laboratory procedures. Table 2.2 summarizes information regarding sample media, handling, and storage procedures.

Table 2.1. Sampling and Analysis Methods Summary

<u>Analyte</u>	<u>Sampling Media</u>	<u>Extraction Method</u>	<u>Analysis Method</u>	<u>Procedure</u>
Ammonia	Acidified carbon bead sorbent trap	Aqueous extraction	ISE analysis	PNL-ALO-226
Nitric Oxide and Nitrogen Dioxide	Triethanolamine impregnated sorbent traps	Aqueous extraction	IC	PNL-ALO-212
Water Vapor	Other inorganic sorbent traps + silica gel sorbent trap	None	Gravimetric analysis (sample weight gain)	PNL-TVP-09
Carbon Monoxide, Carbon Dioxide, Hydrogen, Methane, and Nitrous Oxide	SUMMA™ canisters	Analysis of SUMMA™ canister subsample	GC/TCD	PNL-TVP-05
Organic Vapors	Triple sorbent traps	Thermal desorption	GC/MS	PNL-TVP-10
Organic Vapors	SUMMA™ canisters	Cryo-focusing of SUMMA™ canister subsample	GC/MS	PNL-TVP-03
Total Non-Methane Organic Compounds	SUMMA™ canisters	Cryo-focusing of SUMMA™ canister subsample	GC/FID	PNL-TVP-08

Table 2.2. Sample Media Preparation, Handling, and Storage

<u>Sampling Media</u>	<u>Supplier and Catalog Number</u>	<u>Preparation Procedure</u>	<u>Handling and Storage Procedure</u>
Inorganic vapor sorbent traps	SKC No. 226-29 SKC No. 226-40-02 SKC No. 226-10-04	PNL-TVP-09	PNL-TVP-07
SUMMA™ canisters	Scientific Instrumentation Specialist	PNL-TVP-02	PNL-TVP-07
Triple sorbent traps	Supelco CarboTrap 300	PNL-TVP-10	PNL-TVP-07

2.1 Inorganic Vapors

Solid sorbent traps, prepared in multi-trap sampling trains, were supplied to WHC for sampling the tank headspace. Blanks and exposed samples were returned to PNNL for analyses. Analyses were performed to provide information on the tank-headspace concentration of the following analytes: ammonia, nitrogen dioxide (NO₂), nitric oxide (NO), and water. Samples were prepared, handled, and disassembled as described in Technical Procedure PNL-TVP-09^(a).

2.1.1 Sampling Methodology

Standard glass tubes containing sorbent materials to trap ammonia, NO, NO₂, and water vapors were obtained, prepared, and submitted for vapor sampling. The sorbent traps were selected based on their use by the Occupational Safety and Health Administration (OSHA) to perform workplace monitoring and because of available procedures and verification results associated with that particular application. Each sorbent trap contained two sorbent sections separated by a glass wool plug. Sorbent media in the two sections were segregated and analyzed separately (except for analysis for water). Analyses of the second sorbent (breakthrough) sections were performed to demonstrate complete collection of the target analyte by the first sorbent section.

The ammonia sorbent traps contained carbon beads impregnated with sulfuric acid; nominally, 500 mg were contained in the primary and 250 mg in the breakthrough sections. The ammonia was chemisorbed as ammonium sulfate [(NH₄)₂SO₄]. The NO₂ traps contained a zeolite impregnated with triethanolamine (TEA), with 400 mg in the primary and 200 mg in the breakthrough sections. The NO₂ was absorbed and disproportionated to equi-molar quantities of nitrite ions (NO₂⁻) and nitrate ions (NO₃⁻). Glass tubes containing 800 mg of an oxidant were used to convert NO to NO₂. The converted NO was then collected as nitrite and nitrate in an NO₂ trap. The water traps contained a total of 450 mg of silica gel. All sorbent traps for a given analyte were from a single manufacturer's batch.

After sample preparation, sorbent trains were stored at ≤ 10°C because of handling recommendations for the oxidizer tubes attached to some samples. After receipt of exposed and

^(a) Pacific Northwest Laboratory. 12/95. *Sorbent Trap Preparation for Sampling and Analysis: Waste Tank Inorganic Vapor Samples*, PNL-TVP-09 (Rev. 2), PNL Technical Procedure, Richland, Washington.

radiologically cleared samples from WHC and disassembly of the sorbent trains, samples were provided to the analytical laboratory at ambient temperature.

The sorbent traps were prepared in multi-trap trains configured so sample air flow passed in order through the ammonia, nitrogen dioxide, oxidizer, nitric oxide, and desiccant traps. Traps were weighed and then connected to each other using uniform lengths of 3/8-in. perfluoroalkoxy-grade (PFA) Teflon® tubing. The perfluoroalkoxy-grade tubing was heated in hot air and forced over the open ends of the traps to form a tight seal. The inlets of the sorbent trains each consist of a short section of tubing having a 3/8-in. stainless steel Swagelok® nut, and sealed using a Swagelok® cap. The trailing ends of the sorbent trains were each sealed with red plastic caps provided by the manufacturer.

2.1.1.1 Concentration Calculations. Concentration, in parts per million by volume (ppmv), was determined by dividing the amount of analyte, in μmol , by the moles of the dried tank air sampled. For example, the concentration of a 3.00-L sample containing 75.0 μg of ammonia equals

$$\frac{(75.0 \mu\text{g})(22.4 \text{ L/mol})}{(17.0 \mu\text{g}/\mu\text{mol})(3.00 \text{ L})} = 32.9 \text{ ppmv} \quad (2.1)$$

Measured sample volumes were specified by WHC at standard temperature and pressure (STP; 0°C, 1.013 bar). Because water vapor is removed as an analyte before the sample air stream passes through the mass flow meters, sample volumes exclude water vapor.

2.1.2 Analytical Procedures

2.1.2.1 Ammonia Analysis. The sorbent material from the ammonia traps was placed into labeled 20-mL glass scintillation vials. Vials containing front-section sorbent material were treated with 10.0 mL of deionized water (DIW), and vials containing breakthrough-section sorbent material were treated with 5.0 mL of DIW. Ammonia present was measured using the ion selective electrode (ISE) procedure PNL-ALO-226^(a). Briefly, the method includes 1) preparing a 1000- $\mu\text{g}/\text{mL}$ ammonia stock standard solution from dried reagent-grade NH_4Cl and DIW, 2) preparing 0.1-, 0.5-, 1.0-, 10-, and 100- $\mu\text{g}/\text{mL}$ ammonia working calibration standards by serial dilution of the freshly made stock standard, 3) generating an initial calibration curve from the measured electromotive force signal versus ammonia concentration data obtained for the set of working standards, 4) performing a calibration-verification check, using a mid-range dilution of a certified National Institute for Standards and Technology (NIST)-traceable 0.1 M NH_4Cl standard from an independent source, at a minimum of once per batch, 5) continuing this sequence until all samples of the batch have been measured, including duplicates and spiked samples, and 6) remeasuring the complete set of calibration standards (at the end of the session). Electromotive force signal measurements obtained for samples are compared to those for standards to determine ammonia concentration in the samples.

2.1.2.2 Nitrite Analysis. The sorbent material for NO_2 and NO traps were desorbed in an aqueous TEA and n-butanol solution and analyzed by suppressed-conductivity ion chromatography

^(a) Procedure entitled "Ammonia (Nitrogen) in Aqueous Samples," PNL-ALO-226 Rev. 0, in the *Analytical Chemistry Laboratory (ACL) Procedure Compendium*, Vol. 3: Inorganic Instrumental Methods. Pacific Northwest National Laboratory, Richland, Washington.

(SCIC) for nitrite according to PNL-ALO-212, Rev. 1^(a) modified to obviate interferences by concentrations of non-target analytes. Specifically, the modifications used were 1) eluent 1.44 mM Na₂CO₃ + 1.8 mM NaHCO₃ at 2.0 mL/min, 2) one guard column (AG4A) and two separator columns (AS4A) in series instead of just one separator column, and 3) all standards, samples, and blanks injected into the sample loop through 0.45-μm syringe filters.

Primary and breakthrough section materials were analyzed separately using identical procedures. Each analytical session was conducted as follows. Working nitrite standards were prepared by diluting a stock nitrite standard with desorbing solution. An initial calibration curve was prepared from the instrument response versus nitrite standard concentration data for the set of working standards. A calibration verification check using one of the midrange standards was performed at a minimum of once per batch. If the instrument response indicated that sample nitrite concentration was outside the calibration range, the sample was diluted with desorbing solution and reanalyzed. After all samples of a batch were analyzed, the complete set of calibration standards was remeasured to verify consistent instrument response. Instrument responses observed for samples were compared to those for standards to determine the nitrite concentration of the samples. Because the analytes were collected on the sorbent as equal quantities of nitrite and nitrate, and the analysis was specific for nitrite, the moles of NO₂ and NO were determined by doubling the analytically determined moles of nitrite.

2.1.2.3 Water Analysis. All sorbent traps used to make each multi-trap train were weighed using a semi-micro mass balance, after labeling and breaking the glass tube ends, without plastic end caps. After receipt of exposed samples, the sorbent traps were again weighed to determine the change in mass. Mass gain was assumed to be entirely due to collection of water vapor. Field blanks were used to correct results.

2.1.3 Quality Assurance/Quality Control

Analytical work was performed according to quality levels identified in PNL-ALO-212, PNL-ALO-226, and Quality Assurance Plan ETD-002. Estimated quantitation limits (EQLs) for the inorganic vapors are given in Table 2.3.

The accuracy of concentration measurements depends on errors associated with both sampling and analysis. Ammonia results were estimated to be within 5% of their true values. The uncertainty includes preparation of standards, purity of the ammonium salt used to prepare standards, potential operator bias, ambient temperature variations, etc. Working standards are traceable to NIST standard reference material (SRM) by using an independent calibration verification standard certified to be NIST-traceable. Nitrite analyses (for NO₂ and NO) are performed using certified but not NIST-traceable SRM; this is because NIST does not make a nitrite SRM. Based on experience in comparing nitrite working standards prepared from several different sources and factors mentioned for ammonia above, the estimated maximum bias for NO₂ results is ± 10%, and for NO results it is ± 5%.

^(a) Procedure entitled "Determination of Inorganic Anions by Ion Chromatography," PNL-ALO-212, in the *Analytical Chemistry Laboratory (ACL) Procedure Compendium*, Vol. 3: Inorganic Instrumental Methods. Pacific Northwest National Laboratory, Richland, Washington.

Table 2.3 Quantitation Limits for Selected Inorganic Analytes

<u>Analyte</u>	<u>Formula</u>	<u>EQL^(a) (ppmv)</u>
Ammonia	NH ₃	0.71
Nitrogen Dioxide	NO ₂	0.16
Nitric oxide	NO	0.16
Mass (water) ^(b)	n/a	0.3 mg/L

(a) The lowest calibration standard is defined as the EQL.

(b) The vapor-mass concentration, thought to be largely water vapor, is determined gravimetrically.

n/a = not applicable.

The accuracy of measurements of sample mass is typically ± 0.1 mg, or less than 1% of the mass changes of most samples. The analytical accuracy of measurements of the change in mass of sorbent trains, based on the variability in mass change of field blank multi-trap trains, is determined for each sample job and is typically about ± 1 mg per five-trap sorbent train.

2.2 Permanent Gases

SUMMA™ canister samples were analyzed for carbon dioxide, carbon monoxide, hydrogen, methane, and nitrous oxide (N₂O).

2.2.1 SUMMA™ Canister Preparation

All SUMMA™ canisters are cleaned and verified contaminant-free according to PNNL Technical Procedure PNL-TVP-02^(a) before use. The cleaning procedure uses an EnTech 3000 cleaning system that alternately fills the canisters with purified humid air and evacuates them for several cycles while the canister is heated. If the canister is verified as clean, the canister is evacuated to 5 mtorr and tagged. Before sending the canisters to the field for sampling, the canister vacuum is measured to determine if any leakage has occurred. If the vacuum has remained constant during storage, the canisters are prehumidified with 100 μ L of distilled water and labeled. Canisters stored more than 30 but less than 60 days are re-evacuated and rehumidified before use. If stored more than 60 days, the canisters are recleaned and validated before use. All canisters are stored at room temperature.

2.2.2 Analytical Procedure

The SUMMA™ canister samples were analyzed for five permanent gases by gas chromatography/thermal conductivity detection (GC/TCD). Aliquots of sampled air (undiluted) are drawn directly from each SUMMA™ canister into a 5-mL gas-tight syringe and injected into a

^(a) Pacific Northwest Laboratory. 8/94. *Cleaning SUMMA™ Canisters and the Validation of the Cleaning Process*, PNL-TVP-02 (Rev. 0), PNL Technical Procedure, Pacific Northwest Laboratory, Richland, Washington.

Hewlett-Packard 5890 GC/TCD fitted with a loop injector valve and a column switching valve. An aliquot of 5 mL is used so that the 1.0-mL injection loop is completely purged with sample air, ensuring that no dilution of the sample takes place within the injection loop. One set of GC conditions is used to analyze for carbon monoxide, carbon dioxide, N₂O, and methane using helium as the carrier gas. A second GC/TCD analysis is performed for hydrogen using nitrogen as the carrier gas to enhance the signal sensitivity and lower the detection limit for this analyte. The permanent gases and the derived EQLs are listed in Table 2.4.

Table 2.4 Quantitation Limits for Permanent Gases

<u>Analyte</u>	<u>Formula</u>	<u>EQL (ppmv)</u>
Carbon Dioxide	CO ₂	17
Carbon Monoxide	CO	17
Methane	CH ₄	25
Hydrogen	H ₂	17
Nitrous Oxide	N ₂ O	17

2.2.3 Quality Assurance/Quality Control

Standards for the permanent gas analyses were blended from commercially prepared and certified standards. The instrument was calibrated at five different concentrations for methane over a range of 25 to 2100 ppmv, calibrated for carbon monoxide, carbon dioxide, and N₂O over a range of 17 to 2100 ppmv, and calibrated for hydrogen over a range of 17 to 2120 ppmv. An average response factor from the calibration was used for quantification.

Each analyte was quantitated by comparison of sample analyte peak area to the calibration plot generated for the compound. The EQL for the method has been established as the low level calibration standard. Before and after each sample analysis set, a gas standard was run to evaluate system performance and to measure system accuracy. The calculated concentration of the individual gases in the standards fell within $\pm 25\%$ of the expected concentrations.

2.3 Total Non-Methane Organic Compounds

2.3.1 Analytical Procedure

SUMMA™ canister samples were analyzed for total non-methane organic compounds (TNMOCs) according to PNNL Technical Procedure PNL-TVP-08^(a), which is similar to U.S. Environmental Protection Agency (EPA) Task Order 12 (TO-12). Twenty-four hours before analysis, SUMMA™ canister samples are pressurized with purified air (Aadco Instruments, Inc., 1920 Sherwood St., Clearwater, Florida 34625). The original pressure is first measured using a calibrated diaphragm gauge (Cole Parmer), then pressurized to a level exactly twice the original pressure.

^(a) Pacific Northwest Laboratory. 12/95. *Determination of TO-12 Total Nonmethane Organic Compounds in Hanford Waste Tank Headspace Samples Using SUMMA™ Passivated Canister Sampling and Flame Ionization Detection*, PNL-TVP-08 (Rev. 1), PNL Technical Procedure, Richland, Washington.

The method uses an EnTech 7000 cryoconcentration system interfaced with a Hewlett-Packard 5890 gas chromatograph/flame ionization detector (GC/FID). The EnTech concentrator is used to pull a metered volume of 50 to 100 mL of sample air from the SUMMA™ canister mounted on an EnTech 7016CA 16-canister autosampler. The sample is cryogenically concentrated, and constituents are trapped in a stainless steel tube containing glass beads and Tenax. The glass bead/Tenax trap is heated to 180°C and purged with ultra high purity (UHP) helium into the GC/FID. The GC oven is programmed to run at a 150°C isothermal temperature. Chromatographic separation is not needed in this method since quantitation is from the entire FID response over the run time.

Concentration in mg/m³ was derived from the 10-point multilevel calibration curve from the propane standard using the following equation:

$$\text{mg/m}^3 = \frac{(\text{ng TNMOC}) \times (\text{dilution factor})}{\text{mL sampled volume}} \quad (2.2)$$

2.3.2 Quality Assurance/Quality Control

The TNMOC is calibrated by using propane as the calibration standard. The instrument calibration mixture for the TNMOC analysis consists of NIST 99.999% propane analyzed using a 10-point, multilevel, linear regression curve.

Immediately before running the analysis sequence, a leak-check procedure, which includes evacuating the transfer lines and monitoring the pressure, must be performed on the sample manifold tower. The control limits on this test require that the change in pressure is <1.5 psi, and the absolute pressure after evacuation is <3 psi for each manifold position specified in the sequence table. If either criterion is not met, it must be corrected before the samples are analyzed.

Before the tank samples were analyzed, a diagnostic check was performed on the GC/FID instrument by running a system cleanliness procedure and an instrument continuing calibration as described in PNL-TVP-08. First, two blank volumes of Aadco purified air were analyzed to check the cleanliness of the system. This demonstrates through the analysis of a zero-air blank that the level of interference is acceptable in the analytical system. The analysis of purified air must be below 0.1 mg/m³. Second, an instrument continuing calibration is run using 100-mL UHP propane followed by one blank volume of Aadco air.

2.4 SUMMA™ Canister Sample Analyses

2.4.1 Analytical Procedure

SUMMA™ canister samples were analyzed according to PNNL Technical Procedure PNL-TVP-03^(a), which is a modified version of EPA Task Order 14 (TO-14). The method uses an EnTech 7000 cryoconcentration system interfaced with a 5972 Hewlett-Packard benchtop gas chromatograph/mass spectrometer (GC/MS). The EnTech concentrator is used to pull a metered

^(a) Pacific Northwest National Laboratory. 8/96. *Determination of TO-14 Volatile Organic Compounds in Hanford Tank Headspace Samples Using SUMMA™ Passivated Canister Sampling and Gas Chromatographic-Mass Spectrometric Analysis*, PNL-TVP-03 (Rev. 2), PNNL Technical Procedure, Richland, Washington.

volume of sample air from the SUMMA™ canister, cryogenically concentrate the condensible organic vapors, then transfer the vapors to the GC/MS for analysis. A 100-mL volume of sample is measured and analyzed from the tank headspace. The organic components in the sampled air are separated on a J&W Scientific DB-1 phase, 60-m by 0.32-mm internal diameter with 3-μm film thickness column. The GC oven is programmed to run a temperature gradient beginning at 40°C, hold for 5 min, and ramp at 4°C per min to a final temperature of 260°C, with a 5-min hold.

The instrument calibration mixture for the PNL-TVP-03 analysis consists of organic analytes listed in Appendix B, Table B.1. These target analytes are quantitated in this analysis. The calibration mixture was prepared by blending a commercially prepared TO-14 calibration mixture with a mixture created using a Kin-Tek® permeation-tube standard generation system. The operation of the permeation-tube system follows the method detailed in PNNL Technical Procedure PNL-TVP-06^(a). The standard calibration mix was analyzed using six different concentrations, and a response factor for each compound was calculated. The GC/MS response for these compounds has been determined previously to be linearly related to concentration. Instrument detection limits and EQLs have been determined.

Quantitative concentrations for the target analytes were calculated using the average response factors generated using the internal standard (IS) method described in procedure PNL-TVP-03. The conversion from ppbv to mg/m³ assumes STP conditions (0°C and 1.013 bar) and was calculated using the gross molecular weight (MW) of the compound from the following equation:

$$\text{concentration in mg/m}^3 = \frac{(\text{concentration in ppbv})(\text{MW})}{(1000)(22.4 \text{ L/mol})} \quad (2.3)$$

The tentatively identified compounds (TICs) are determined by mass-spectral interpretation and comparison of the spectra with the EPA/NIST and WILEY electronic mass spectra libraries. Chromatographic peaks with an area count greater than, or equal to, one-tenth of the total area count of the nearest eluting IS are tentatively identified and their concentrations are estimated. The quality of the mass spectra match was then reviewed by the principal investigators before the identification was assigned to each chromatographic peak.

The concentration of each TIC was estimated using a relative response factor calculated using the total peak area for the nearest eluting IS. The IS peak area was used to calculate a response factor using the IS concentration in mg/m³:

$$\text{Response Factor} = \frac{\text{IS conc. (mg/m}^3\text{)}}{\text{IS peak area}} \quad (2.4)$$

The calculated response factor was then multiplied by the TIC peak area to give an estimated concentration for that compound. All calculated sample concentrations were multiplied by a factor of 2 to account for the dilution step described in Section 2.3.1.

^(a) Pacific Northwest Laboratory. 11/94. *Preparation of TO-14 Volatile Organic Compounds Gas Standards*, PNL-TVP-06 (Rev. 0). PNL Technical Procedure, Richland, Washington.

2.4.2 Quality Assurance/Quality Control

Before the tank sample was analyzed, a diagnostic check was performed on the GC/MS instrument by running an instrument "high-sensitivity tune", as described in PNL-TVP-03. Upon satisfactory completion of the instrument diagnostic check, a blank volume of purified nitrogen was analyzed to check the cleanliness of the system. The instrument was then calibrated using a standard gas mixture containing the organic compounds listed in Table B.1. A gas mixture containing bromochloromethane, 1,4-difluorobenzene, chlorobenzene- d_5 , and bromofluorobenzene was used as an IS for all blank, calibration standard, and sample analyses. Analyte responses from sample components, ISs, and standards were obtained from the extracted ion plot from their selected mass ion. The calibration was generated by calculating the relative response ratios of the IS to calibration standard responses and plotting the ratios against the ratio of the calibration-standard concentration (in ppbv) to the IS concentration. Once it was determined that the relative response was linear with increasing concentration, an average response factor was calculated for each target analyte and used to determine the concentration of target compounds in each sample. Method blanks were analyzed before and after calibration verification standards.

2.5 Triple Sorbent Trap Sample Analyses

2.5.1 Sampling Methodology

Samples are collected on Supelco 300 graphite-based TSTs. Before field deployment, each trap is heated to 380°C under inert gas flow for a minimum of 60 min. Traps are prepared in batches with each tank sampling job constituting one batch. One trap is selected from each batch and run immediately to verify cleanliness. All remaining traps in the batch receive equal amounts of three surrogate compounds (hexafluorobenzene, toluene- d_8 , and bromobenzene- d_5). One trap per batch is run immediately to verify successful addition of surrogate spikes to that batch. Traps are then placed in individually labeled plastic shipping tubes (Supelco TD³), which are sealed with gasketed end caps. This provides a rugged, headspace-free shipping and storage method. As a precautionary measure, sample tubes are kept in refrigerated storage before and after sampling.

2.5.2 Analytical Procedure

The Supelco 300 tubes were analyzed according to PNNL Technical Procedure PNL-TVP-10^(a), with the exceptions noted in Section 3.4.1. The method employs Supelco CarbotrapTM 300 traps for sample collection and preconcentration. The traps are ground-glass tubes (11.5 cm long X 6 mm OD, 4 mm ID) containing a series of sorbents arranged in order of increasing retentivity. Each trap contains 300 mg of CarbotrapTM C, 200 mg of CarbotrapTM B, and 125 mg of CarbosieveTM S-III. The first two sorbents are deactivated graphite with limited sorption power for less volatile compounds. The final trapping stage, the CarbosieveTM S-III, is a graphitized molecular sieve used to retain the most volatile components, including some permanent gases such as Freon-12. Following sample collection and addition of IS, the traps are transferred to a Dynatherm ACEM 900 thermal desorber unit for analysis. The trap on the ACEM 900 is then desorbed by ballistic heating to 350°C with the sample then transferred to a smaller focusing trap. A 10:1 split is used during the transfer with 10% of the sample analyzed and the rest retained for reanalysis. The split sample

^(a) Pacific Northwest National Laboratory. 2/96. *Determination of Volatile Organic Compounds in Hanford Waste Tank Headspace Samples Using Triple Sorbent Trap Sampling and Gas Chromatograph-Mass Spectrometer Analysis*, PNL-TVP-10 (Rev. 2), PNNL Technical Procedure, Richland, Washington.

collected on a second identical Carbotrap™ 300 trap is used for repeat analysis on at least one sample per batch. Since the IS also follows the same path, quantitation may be performed directly on the repeat run without changing the calibration. Following desorption from the Carbotrap™ 300 trap, the analyte is transferred to a long, thin focusing trap filled with the same type of trapping materials as the Carbotrap™ 300 traps and in approximately the same ratios. The purpose of the focusing trap is to provide an interface to a capillary GC column, which may be thermally desorbed using helium at a flow rate compatible with the column and MS interface (1.2 mL/min). The focusing trap is ballistically heated to thermally desorb components onto a capillary GC column. The column is subsequently temperature programmed to separate the method analytes, which are then detected by the MS.

The instrument calibration mixture for the TST analysis consists of the compounds listed in Appendix B, Table B:2. These compounds that are directly quantified in this analysis make up the target analyte list (these compounds will be referred to as target analytes). The calibration mixture is prepared in common with the mixture used for the SUMMA™ analysis (see Section 2.4.2). The standard calibration mix was analyzed using six different concentrations, and a response factor for each compound was calculated. Volumes of standard added to the traps are measured by pressure difference on a SUMMA™ canister of known volume. The GC/MS response for these compounds has been determined previously to be linearly related to concentration.

Quantitative concentrations for the target analytes were calculated directly from the calibration curve generated using the IS method described in procedure PNL-TVP-10. The conversion from ppbv to mg/m³ assumes STP conditions (0°C and 1.013 bar) and was calculated directly from the following equation:

$$\text{mg/m}^3 = \frac{(\text{ppbv}/1000) \times \text{g mol wt of compound}}{22.4 \text{ L/mol}} \quad (2.5)$$

The TICs are determined by mass-spectral interpretation and comparison of the spectra with the EPA/NIST and WILEY Libraries, which are a part of the Hewlett-Packard 5971/5972 instrument operating system. Chromatographic peaks with an area count greater than, or equal to, one-tenth of the total area count of the nearest eluting IS are tentatively identified and quantitatively estimated. The quality of the mass-spectral searches was then reviewed by the principal investigators before the identification was assigned to each chromatographic peak.

The concentration of each TIC was estimated using a relative response factor calculated using the total peak area for the nearest eluting IS. The IS peak area was used to calculate a response factor using the IS concentration in mg/m³:

$$\text{Response Factor} = \frac{\text{IS conc. (mg/m}^3\text{)}}{\text{IS peak area}} \quad (2.6)$$

The calculated response factor was then multiplied by the TIC peak area to give an estimated concentration for that compound.

2.5.3 Quality Assurance/Quality Control

Before tank samples were analyzed, a diagnostic check was performed on the GC/MS instrument by running a full auto tune, as described in PNL-TVP-10. Upon satisfactory completion of the instrument diagnostic check, a blank trap was analyzed to check the cleanliness of the system. The instrument was then calibrated using six different concentrations of standard gas mixture containing the compounds listed in Table B.2. A gas mixture containing difluorobenzene, chlorobenzene- d_5 , and 1,4 bromofluorobenzene was used as an IS for all calibration standard and sample analyses. Analyte responses from sample components, ISs, and standards were obtained from the extracted ion plot from their selected mass ion. A continuing calibration was generated by calculating the relative response ratios of the IS to calibration standard responses and plotting the ratios against the ratio of the calibration-standard concentration (in ppbv) to the IS concentration. Once it was determined that the relative response was linear with increasing concentration, an average response factor was calculated for each target analyte and used to determine the concentration of target compounds in each sample.

3.0 Analysis Results

Results from the sampling of the headspace of Tank BY-101 on August 29, 1996 (Sample Job S6084) are provided below.

3.1 Inorganic Vapors

Measured vapor concentrations of ammonia, nitric oxide (NO), nitrogen dioxide (NO₂), and water are given in Table 3.1. The vapor concentration results were based on four samples for each compound with the exception of only three samples for NO₂. The four inorganic vapors were collected at the same time using sorbent traps connected in series. Sample air was drawn first through an ammonia trap, then through a three-tube system that collected NO₂ and NO (described below), and then through a desiccant trap to remove any remaining water vapor.

Two field blank multi-trap trains, identical to sample multi-trap trains discussed in Section 2.1, were included in the tube bundle lowered into the headspace of Tank BY-101 during sample job S6084. No air was pulled through these field blank multi-trap trains. Any analyte found in the field blank multi-trap trains over and above levels in unexposed tubes was attributed to passive sampling. Data in Table 3.1 have been corrected for these minor effects of passive sampling.

Results provided in Table 3.1 are estimated to be accurate to within $\pm 10\%$ and within the $\pm 30\%$ specified by the SAP. Percent relative standard deviations of the measured concentrations were $<7\%$, which is within the 25% specified by the SAP.

3.1.1 Ammonia

Ammonia analyses were performed on September 16, 1996, 18 days after sample collection and within established holding times (Ligotke et al. 1995). All samples (100%) were successfully analyzed, and no deviations from the procedure were noted.

The blank-corrected ammonia quantities in the sorbent traps ranged from 4.63 to 5.37 μmol in front sections; blank corrected back sorbent section ammonia concentrations were $<0.01 \mu\text{mol}$. Blank corrections of 0.13 μmol in front and 0.07 μmol in the back sections, were about 2.5% of collected quantities. The analysis of one sample was duplicated and indicated a reproducibility of $\pm 1.1\%$. One blank sorbent trap was spiked with 17 ppm of ammonia and yielded a percentage recovery of 103%. One sample leachate was spiked after initial analysis with approximately the quantity of ammonia in the sample and yielded a percentage recovery of 100%. The initial and continuing calibration verification (ICV, CCV) standards, using NIST-traceable material, yielded percentage recoveries of 99% (ICV) and 101% and 103% (CCV) during the analytical session. A five-point calibration was performed over an ammonia range of 0.1 to 100 $\mu\text{g/ml}$.

3.1.2 Nitric Oxide and Nitrogen Dioxide

Nitric oxide and nitrogen oxide analyses were performed on September 16 and 17, 1996, 18 and 19 days after sample collection, and within established holding times (Ligotke et al. 1995). One NO₂ sample result was lost due to instrument malfunction.

Blank-corrected NO_2^- quantities in the sorbent traps were all $<0.013 \mu\text{mol}$. Nitrite blank levels used to correct data were $0.0067 \mu\text{mol}$ in front (four of four blanks analyzed) and $0.0044 \mu\text{mol}$ in back (two of four blanks analyzed) sorbent sections. The analyses of two samples were duplicated and yielded repeatabilities of $\pm 4.1\%$ and $\pm 0.9\%$. Two sample leachates were spiked with 0.125 and 0.25 ppm NO_2^- and yielded percentage recoveries of 88% and 98% , respectively. A 4-point calibration was performed over a concentration range of 0 to $0.5 \mu\text{g/mL NO}_2^-$ in the desorbing matrix.

3.1.3 Water

Analyses for water vapor were performed on September 12, 1996, 14 days after sample collection and within established holding times (Ligotke et al. 1995). All samples (100%) were successfully analyzed.

All multi-trap sample mass gain is assumed to be due to adsorption of water. This is justified because the total mass concentration of other vapors in the headspace of Hanford waste tanks are typically two to three orders of magnitude less than the mass concentration of the water vapor found in even relatively dry tanks. Water vapor concentrations are given in Table 3.1 for both moist air at tank conditions and for dry air at STP (0°C and 1.013 bar). Because the sample volumes were measured after all water vapor was removed by the sorbent traps, the measured sample volumes are for dry air. The average water vapor concentration was 9.8 mg of water per L of dry air at STP. The result was determined from an average mass gain of 23.4 mg from all four multi-trap trains. The blank correction applied to the results was -5.1 mg per multi-trap train. A control mass was measured and indicated a measurement accuracy of $\pm 0.1 \text{ mg}$. The average water vapor concentration corresponds to a tank headspace dew point at 9.7°C and relative humidity at 47% at the time of sampling.

3.2 Permanent Gases

Hydrogen analyses were performed on September 12, 1996, and analyses for other permanent gases were performed on September 17, 1996. All analyses were conducted within the 60-day administrative holding time as specified in the WHC Tank Vapor Characterization QA Plan (WHC 1994). All samples (100%) were successfully analyzed and used in the averages. No deviations from standard procedures were noted.

Measured concentrations of carbon monoxide, carbon dioxide, hydrogen, methane, and N_2O are provided in Table 3.2. Results were based on three samples for each compound. Hydrogen at an average concentration of 29 ppmv and N_2O at an average concentration of 57 ppmv were detected in Tank BY-101. Carbon dioxide was present at a lower concentration in the tank headspace than in ambient air, where it typically ranges between 300 and 400 ppmv . The relative percent difference (RPD) between duplicate analyses of a single SUMMA™ canister was 28% for hydrogen and 9% for N_2O .

Results provided in Table 3.2 are estimated to be accurate to within $\pm 30\%$ as specified by the SAP.

3.3 Total Non-Methane Organic Compounds

Analyses for TNMOCs were performed on September 27, 1996, which is within the 60-day administrative holding time as specified in the WHC Tank Vapor Characterization QA Plan (WHC 1994). All three tank samples and the two ambient samples (100%) were successfully analyzed and used in the averages. No deviations from standard procedures were noted.

Table 3.3 lists results of the EPA TO-12 analysis of SUMMA™ canister samples for TNMOCs. Results in Table 3.3 are reported in two different units; in the upper row the mass concentration (mg/m^3) of non-methane organic compounds is given at STP (0°C and 1.013 bar), and in the lower row, by EPA TO-12 convention, as ppmv of carbon based on propane as the standard. The average concentration in the three tank headspace samples was $57.26 \text{ mg}/\text{m}^3$ or 23.90 ppmv of carbon. The RPD between duplicate analyses of a single SUMMA™ canister was 3%. The $57.26 \text{ mg}/\text{m}^3$ value compares to $48.70 \text{ mg}/\text{m}^3$ for the sum of all target compounds identified in the analysis of the SUMMA™ canisters. Results provided in Table 3.3 are estimated to be accurate to within $\pm 30\%$ as specified by the SAP.

3.3.1 Procedural Deviations, Observations, and Anomalies.

The calibration method described in Section 2.3.2 reflects a deviation from procedure PNL-TVP-08. Refer to Deviation Report JAE082996 for further details.

3.4 Organic Compound Characterization

Organic vapors in the Tank BY-101 headspace were sampled with SUMMA™ canisters and TSTs. These sampling methods are fundamentally different, but provide comparable results for many of the target analytes.

3.4.1 SUMMA™ Canister Results

Analyses of SUMMA™ canisters for organic vapors were performed on September 22 and October 4, 1996. All analyses were conducted within the 60-day administrative holding time as specified in the WHC Tank Vapor Characterization QA Plan (WHC 1994). All samples (100%) were successfully analyzed. Procedural deviations, observations, and anomalies are presented in Section 3.4.1.1.

Measured concentrations of target analytes and TICs are presented in Table 3.4 below. Forty-four target analytes and eight TICs above the IDL were detected in the tank headspace samples. Of these, 42 target analytes and all TICs were identified in two or more tank headspace samples. The compounds 1-butanol at $33.002 \text{ mg}/\text{m}^3$, acetone at $3.099 \text{ mg}/\text{m}^3$, and trichlorofluoromethane at $2.457 \text{ mg}/\text{m}^3$ were the three most abundant compounds identified in the tank headspace samples. The total average concentration was $44.46 \text{ mg}/\text{m}^3$ for the target analytes, $4.24 \text{ mg}/\text{m}^3$ for the TICs and $48.70 \text{ mg}/\text{m}^3$ combined. This compares to a total concentration of $57.26 \text{ mg}/\text{m}^3$ identified in the TO-12 analysis of the three tank headspace samples.

SUMMA™ canister sample S6084-A05.072 was analyzed in replicate for target analytes and TICs to determine analytical precision. The RPD results are presented in Table 3.5. The RPDs were

calculated for analytes detected above the IDL and found in both replicates. Thirty-two of 41 target analytes and five of seven TICs had RPDs of less than 10%.

Results of analyses of target analytes and TICs in ambient air and ambient air through the ISVS samples are provided in Table 3.6. No TICs were observed in the ambient samples. Thirteen target compounds were observed in one or both of the ambient air samples. All target compounds were observed below the EQL with the exception of 1,1,2-trichloro-1,2,2-trifluoroethane which was observed at 8.3 ppbv in the ambient air through the ISVS sample.

A representative total ion chromatogram showing the major constituents identified in the SUMMA™ analysis is provided in Figure 3.1.

Appendix B, Table B.1 contains a complete listing of target analyte results from the SUMMA™ analyses. These data originate directly from the evaluated instrument data and have not been rounded. The intent of the data is to list the analytes that were analyzed and to present the detection limit values associated with analytes that were not detected.

3.4.1.1 Procedural Deviations, Observations, and Anomalies.

The SUMMA™ samples were analyzed in two batches. The sample analytical sequence runs were as follows:

Batch #1 (file identifier 26092201.d) - S6084-A01.040, S6084-A02.045, S6084-A04.047, S6084-A05.072, S6084-A05.072 REP, S6084-A06.293;

Batch #2 (file identifier 26100401.d) - S6084-A04.047, S6084-A05.072, S6084-A05.072 REP, S6084-A06.293.

Batch #1:

All target compounds met the 25% D criterion in the CCV with the exception of decane (31.6%), undecane (25.0%), and tetradecane (31.1%). None of the target compounds that failed the CCV were found in tank samples with the exception of tetradecane in the replicate analysis of tank sample S6084-A05.072.

Batch #2:

The initial analyses of BY-101 tank samples (batch file 26092202.b) resulted in 1-butanol concentrations that exceeded the upper quantitation limit. The samples were further diluted (1:10) and 30 mL of each tank sample were reanalyzed in batch file 26100402.b. Only 1-butanol concentrations will be reported using the analyses from this batch.

All target compounds met the 25% D criterion in the CCV with the exception of methanol (32.7%), vinyl chloride (26.7%), 1,3-butadiene (33.4%), butane (31.1%), bromomethane (36.3%), and tetradecane (54.3%). None of the target compounds that failed the CCV were quantified and reported using this analytical batch.

No target compounds were present in the CCB above the EQL except methylene chloride (1.32 ng on column, 1.74 ppbv) and cis-1,3-dichloropropene (0.36 ng on column, 0.37 ppbv). Neither of these compounds was quantified and reported using this analytical batch.

Information common to both batches:

The percent difference (% D) for the initial calibration verification was less than 25% for all target compounds with the exception of 1,3-butadiene (27.0%), 1-butanol (45.9%), pyridine (86.5%), cyclohexanone (32.1%), tridecane (52.7%) and tetradecane (98.1%).

The initial calibration blank (ICB) showed evidence of contamination carry-over from the initial calibration verification. Tubing between the multiposition and the 2 position valves within the Entech were changed following analysis of this ICB. Target compounds exceeding the EQL in a 200 mL ICB were chloroethane (1.17 ng on column, 2.02 ppbv), acetonitrile (2.30 ng on column, 6.27 ppbv), acetone (3.98 ng on column, 7.68 ppbv), trichlorofluoromethane (2.40 ng on column, 1.96 ppbv), pentane (1.58 ng on column, 2.45 ppbv), methylene chloride (1.94 ng on column, 2.56 ppbv), 1,1,2-trichloro-1,2,2-trifluoroethane (2.61 ng on column, 1.56 ppbv), 1,1-dichloroethane (1.63 ng on column, 1.84 ppbv), hexane (2.25 ng on column, 2.92 ppbv), chloroform (1.97 ng on column, 1.84 ppbv), 1,1,1-trichloroethane (2.20 ng on column, 1.85 ppbv), benzene (1.19 ng on column, 1.71 ppbv), carbon tetrachloride (2.27 ng on column, 1.65 ppbv), trichloroethene (2.12 ng on column, 1.81 ppbv), cis-1,3-dichloropropene (1.43 ng on column, 1.44 ppbv), pyridine (40.71 ng on column, 57.64 ppbv), trans-1,3-dichloropropene (1.47 ng on column, 1.48 ppbv), pentanenitrile (2.70 ng on column, 3.64 ppbv), 1,1,2-trichloroethane (2.05 ng on column, 1.72 ppbv), toluene (1.354 ng on column, 1.64 ppbv), 1,2-dibromoethane (2.67 ng on column, 1.59 ppbv), tetrachloroethylene (2.41 ng on column, 1.63 ppbv), and chlorobenzene (1.72 ng on column, 1.71 ppbv). Note that no target compounds exceeding the EQL were detected at concentrations greater than 5 ppbv except acetonitrile, acetone, and pyridine.

The compound 1,3-butadiene is not currently included in the method performance section of the procedure for System 2; however, this analyte was analyzed by this method. The low level standard is used as the EQL for this compound. Sample results are flagged with a less-than symbol (<) when less than the EQL value.

3.4.2 Triple Sorbent Trap Sample Results

Analyses of TSTs were performed on September 19 and 20, 1996. All analyses were conducted within the 60-day administrative holding time as specified in the WHC Tank Vapor Characterization QA Plan (WHC 1994). All samples (100%) were successfully analyzed. Procedural deviations, observations, and anomalies are presented in Section 3.4.2.1.

Measured concentrations of target analytes and TICs are presented in Table 3.7. Results are based on three samples for each compound. Thirty-nine target analytes above the IDL and 8 TICs were detected in the tank headspace samples. Of these, 38 target analytes and six TICs were identified in two or more tank headspace samples. One of the eight TICs was identified as an unknown. The compounds 1-butanol at 34.959 mg/m³, acetone at 1.624 mg/m³, and 1-chloro-1,1-difluoroethane at 1.621 mg/m³ were the three most abundant compounds identified in the tank headspace sample. The

total concentration of the target analytes was 44.03 mg/m³ and the total concentration of the TICs was 4.22 mg/m³. The total concentration of all compounds found was 48.25 mg/m³.

Triple sorbent trap sample S6084-A12.1154 was analyzed in replicate for target analytes and TICs to determine analytical precision. The RPD results are presented in Table 3.8. The RPDs were calculated for analytes detected above the detection limit and found in both replicates. Seventeen of 37 target analytes and two of four TICs had RPDs of less than 10%.

Results of analyses of target analytes and TICs in the field and trip blanks are provided in Table 3.9. Thirty-two target compounds were identified in one or more of the blank samples. Most of the compounds were found in the field blank samples. Most of the compounds observed were below the EQL; however, acetone, trichlorofluoromethane, hexane, 1-butanol, 4-methyl-2-pentanone, heptane, 4-methyl-2-pentanone, toluene, ethylbenzene, p/m-xylene, styrene, and o-xylene, exceed the EQLs. In addition to the target compounds, 10 TICs were observed in one or more of the blank samples.

A representative total ion chromatogram showing the major constituents identified in the triple sorbent trap analysis is provided in Figure 3.2.

Appendix B, Tables B.2 and B.3 contain complete listings of target analyte results from the TST analyses. These data originate directly from the evaluated instrument data and have not been rounded. The intent of the data is to list the analytes that were analyzed and to present the detection limit values associated with analytes that were not detected.

3.4.2.1 Procedural Deviations, Observations, and Anomalies. Samples were run under the protocols of procedure PNL-TVP-10, Rev. 2 with the initial calibration performed on September 9, 1996 and quantitated against a CCV run at beginning of the batch.

The TST samples were analyzed in two batches. The sample analytical sequence runs were as follows:

Batch #1 (file identifier 46091901.d) - S6084-A17.1157, S6084-A18.1158, S6084-A19.1159, S6084-A20.1160;

Batch #2 (file identifier 46092001.d) - S6084-A11.1153, S6084-A12.1154, S6084-A12.1154 REP, S6084-A13.1155.

Batch #1:

Samples included in this batch consisted of the two field blanks and two trip blanks.

The CCV showed acceptable performance as specified in the procedure for all target compounds except tetradecane (49%). Due to the CCV failure, the results for this compound have a greater uncertainty. The CCB was clean of all target and TIC compounds except for methylene chloride, 2-butanone, and 1-butanol which were below the EQL. The CCB concentration of 2-butanone was comparable to that in the samples and should be flagged with a "B". Environmental contamination problems apparently associated in past work with field bundle preparation were evident in this sampling job.

The siloxane compounds are believed to be originating from the C-Flex tubing used in the ISVS sample bundle.

Batch #2:

Samples included in this batch consisted of the three tanks samples and one replicate analysis of a tank sample.

All IS relative responses were within nominal method limits except for the third IS on the analysis of sample S6084-A12.1054. Variations in IS response with this method are associated with minor differences in tube packing density which can result in a decrease in split ratio and an increased sensitivity. In this method performance studies including detection limits were run at the highest split ratio (i.e., lowest sensitivity) and data quality is not impacted provided the IS responses for individual samples are not anomalously low in absolute as opposed to relative intensity. For runs with high absolute response, an increase in sensitivity is obtained, however, no effect on the data was evident in this case. Rerun of the samples was not an option. The CCB was clean of all target and TIC compounds except for methylene chloride which was below the EQL.

Target compounds found at levels in excess of the EQL in at least one of the samples the samples include: methanol, butane, ethanol, acetonitrile, acetone, **trichlorofluoromethane**, pentane, **methylene chloride**, propanol, 2-butanone, hexane, tetrahydrofuran, 1-butanol (E), cyclohexane, **heptane**, 4-methyl-2-pentanone, toluene, ethylbenzene, p/m xylene, styrene, o-xylene, nonane, 1-2-4-trimethylbenzene, decane, undecane, and tetradecane. A number of other target compounds were detected in at least one of the samples at trace levels (below EQL). TICs detected in one or more samples include: **2-methyl-1-propene**, **1-butene**, butanal, 2-3-5-trimethyl-hexane, 2-4-dimethyl-heptane, octamethyl cyclotetrasiloxane. The target compounds and TICs detected in the field blanks are highlighted in bold and probably represent environmental contamination associated with assembly of the ISVS sampling bundle. The siloxane compounds are believed to be originating from the C-Flex tubing used in the ISVS sample bundle.

Sample volumes for all ISVS tank samples have been corrected to STP from the 21°C calibration used on the sampling cart flowmeters. The correction was included in the reported data to provide seamless compatibility with past VSS data which were collected using a 0°C calibration.

Information common to both batches:

Very narrow air spikes (mass 32) occasionally are present in chromatograms from this period. This problem has been traced to high frequency air bursts from the surface of MS vacuum system o-rings. Attempts at permanently eliminating this problems have been unsuccessful to date and the matter has been referred to HP for further investigation. It has no known impact on data quality but the spikes do appear as features on the total ion chromatogram.

Field blanks, trip blanks, and all samples contained 1-chloro, 1,1-difluoroethane. This compound has appeared persistently in most samples sent to the field in the past including blanks. It is believed to be a fugitive refrigerant. That material is never present in tubes

archived for a similar amount of time in the 326 Vapor Lab or 329 Building temporary storage. The origin of the material is unclear but since it has shown up in trip blanks as well as field blanks, the most likely candidate is one of the refrigerators used for interim storage.

Tributyl phosphate (TBP) is included in the target list based on a calibration performed on January 5 and 9, 1996. The TBP was introduced onto a series of double sorbent traps as a methanolic solution standard rather than a vapor standard. This served to determine the retention time and verify the mass spectral characteristics of the compound. However, verification of the calibration acceptability was not performed because the compound is not present in the CCV. At present, it is not possible to prepare a gas standard from this material. The calibration information on TBP demonstrated that detectability at 0.08 ppbv (based on a 200-mL sample) was possible. Tributyl phosphate was not detected in any sample.

Methanol, ethanol, and 1,3-butadiene are not currently included in the method performance section of the procedure; however, these analytes were analyzed by this method. Sample results are flagged with a less-than symbol (<) when less than the EQL value.

3.5 Flammability

The analytical results presented above can be used to estimate the tank BY-101 headspace flammability at the time of sampling. Flammability is calculated using the ammonia concentration from the inorganic analysis, carbon monoxide, hydrogen, and methane concentrations measured from the permanent gas analysis, and the TNMOC concentration determined from the TO-12 analysis. Table 3.10 summarizes the calculated flammability data. Total non-methane organic compounds and hydrogen were the principal flammable constituents of the Tank BY-101 headspace, determined to be present at approximately 0.136% and 0.073% of their LFLs. Total headspace flammability was estimated to be <0.313% of the LFL. In calculation of the LFL, a compound detection limit value was used to calculate a conservative LFL value if it was not detected in the tank headspace samples.

Table 3.1 Inorganic Vapor Concentrations from Tank BY-101 Sampled on 8/29/96

Analyte	CAS Number	S6084-A07-82R	S6084-A08-83R	S6084-A09-84R	S6084-A10-85R	Average	Standard Deviation
Ammonia (ppmv)	7664-41-7	62	65	56	58	60	4
Nitric Oxide (ppmv)		<0.16	<0.16	<0.16	<0.16	<0.16	
Nitrogen Dioxide (ppmv)		NA	<0.16	<0.16	<0.16	<0.16	
Water ^(a) (mg/L)		10.4	9.4	9.5	10.1	9.8	0.5
Water ^(b) (mg/L)		9.3	8.5	8.5	9.0	8.8	0.4

(a) Dry air at 0°C and 1.013 bar.

(b) Moist air at tank temperature and pressure.

NA Not analyzed; instrument malfunction

Table 3.2. Permanent Gas Analysis Results from Tank BY-101 Sampled on 8/29/96

Permanent Gas Analyte	Ambient Air Upwind S6084-A01.040 ^(a)	Ambient Air Through Bundle S6084-A02.045 ^(a)	Tank Samples				RPD ^(c) %	Mean ppmv	St. Dev. ^(d)
	Concentration (ppmv)	Concentration (ppmv)	S6084-A04.047 ^(a) Concentration (ppmv)	S6084-A06.293 ^(a) Concentration (ppmv)	S6084-A05.072 ^(a) Concentration (ppmv)	S6084-A05.072 ^{(a)(b)} Concentration (ppmv)			
Hydrogen	<17	<17	24	37	25	33	28	29	7
Methane	<25	<25	<25	<25	<25	<25		<25	
Carbon Dioxide	377	384	22	32	<17	23		27	7
Carbon Monoxide	<17	<17	<17	<17	<17	<17		<17	
Nitrous Oxide	<17	<17	58	53	59	54	9	57	3

(a) WHC sample identification number.

(b) Replicate analysis for S6084-A05.072; results are not included in the calculation of mean concentrations.

(c) Relative percent differences (RPDs) for replicate analysis.

(d) Standard deviation

Table 3.3. Total Non-Methane Organic Compound Analysis Results from Tank BY-101 Sampled on 8/29/96

	Ambient Air Upwind	Ambient Air Through Bundle	Tank Samples				RPD ^(c) %	Mean	St. Dev
	S6084-A01.040 ^(a) Concentration	S6084-A02.045 ^(a) Concentration	S6084-A04.047 ^(a) Concentration	S6084-A06.293 ^(a) Concentration	S6084-A05.072 ^{(a) (b)} Concentration	S6084-A05.072 ^{(a) (b)} Concentration			
TO-12 (mg/m ³)	< 0.59	< 0.59	56.98	57.70	57.11	55.24	3	57.26	0.38
Total Carbon (ppm)								23.90	

(a) WHC sample identification number.

(b) Replicate analysis for S6084-A05.072; results are not included in the calculation of average concentrations.

(c) Relative percent difference (RPD) based on replicate analysis.

Table 3.4. Organic Compound Concentrations in SUMMA™ Canisters from Tank BY-101 Sampled on 8/29/96

Target Analytes ^(a)	CAS	MW	Ret Time	S6084-A04.047 ^(c) ISVS			S6084-A05.072 ^{(c)(d)} ISVS			S6084-A06.293 ^(c) ISVS			Mean and Standard Deviation			
				(mg/m ³)	(ppbv)	Flag	(mg/m ³)	(ppbv)	Flag	(mg/m ³)	(ppbv)	Flag	(mg/m ³)	St. Dev.	(ppbv)	St. Dev.
Dichlorodifluoromethane	75-71-8	121	4.2	0.012	2.2	J	0.011	2.1	J	0.012	2.2	J	0.012	0.000	2.2	0.060
1,2-dichloro 1,1,2,2-tetrafluoroethane	76-14-2	171	4.8	0.011	1.4	J	0.010	1.4	U	0.010	1.4	U	e	e	e	e
Methanol	67-56-1	32	5.0	0.581	406		0.566	396		0.512	358		0.553	0.036	387	25
1,3-Butadiene	106-99-0	54	5.5	0.165	68	Y	0.150	62	Y	0.135	56	Y	0.150	0.015	62	6.2
Butane	106-97-8	58	5.6	0.319	123		0.302	116		0.279	107		0.300	0.020	116	7.8
Ethanol	64-17-5	46	6.8	0.517	252		0.516	251		0.478	233		0.504	0.023	245	11
Acetonitrile	75-05-8	41	7.3	0.024	13	J	0.025	14	J	0.025	14	J	0.025	0.001	13	0.47
Acetone	67-64-1	58	7.8	3.221	1242		3.056	1179		3.020	1165		3.099	0.107	1195	41
Trichlorofluoromethane	75-69-4	137	8.2	2.513	410		2.444	399		2.415	394		2.457	0.050	401	8.1
Pentane	109-66-0	72	9.0	0.091	28		0.092	28		0.091	28		0.091	0.001	28	0.17
1,1-Dichloroethene	75-35-4	97	9.5	0.004	0.83	U	0.006	1.3	J	0.006	1.4	J	0.006	e	1.3	e
Methylene Chloride	75-09-2	85	9.7	0.025	6.6		0.025	6.6		0.025	6.5		0.025	0.000	6.6	0.061
1,1,2-trichloro 1,1,2,2-trifluoroethane	76-13-1	187	10.3	0.021	2.5	J	0.021	2.6	J	0.021	2.5	J	0.021	0.000	2.5	0.042
Propanenitrile	107-12-0	55	11.1	0.015	6.3	J	0.015	6.1	J	0.015	6.0	J	0.015	0.000	6.1	0.16
Propanol	71-23-8	60	11.2	0.512	191		0.576	215		0.506	189		0.531	0.039	198	15
2-Butanone	78-93-3	72	12.8	0.947	294		0.977	304		0.946	294		0.957	0.018	297	5.5
Hexane	110-54-3	86	14.0	0.058	15		0.061	16		0.059	15		0.059	0.002	15	0.46
Chloroform	67-66-3	119	14.2	0.006	1.2	J	0.006	1.1	J	0.006	1.1	J	0.006	0.000	1.1	0.015
Tetrahydrofuran	109-99-9	72	15.0	0.261	81		0.276	86		0.267	83		0.268	0.008	83	2.4
1,1,1-Trichloroethane	71-55-6	133	16.2	0.009	1.5	J	0.009	1.5	J	0.009	1.6	J	0.009	0.000	1.5	0.051
1-Butanol	71-36-3	74	16.8	31.574	9542	*	31.832	9620	*	35.601	10759	*	33.002	2.254	9974	681
Benzene	71-43-2	78	17.1	0.008	2.4	J	0.008	2.3	J	0.008	2.4	J	0.008	0.000	2.4	0.040
Carbon Tetrachloride	56-23-5	154	17.4	0.007	1.1	J	0.007	1.1	J	0.008	1.1	J	0.007	0.000	1.1	0.029
Trichloroethene	79-01-6	131	19.1	0.006	1.0	J	0.006	1.1	J	0.006	1.1	J	0.006	0.000	1.1	0.058
Heptane	142-82-5	100	19.7	0.038	8.6		0.043	9.6		0.043	9.5		0.041	0.003	9.2	0.57
4-Methyl-2-Pentanone	108-10-1	100	20.9	0.149	33		0.220	49		0.154	34		0.174	0.039	39	8.8
Pyridine	110-86-1	79	21.0	0.008	2.2	U	1.501	425	S	0.010	2.7	J	0.756	e	214	e
Pentanenitrile	110-59-8	83	22.0	0.008	2.1	J	0.035	9.4	J	0.008	2.2	J	0.017	0.016	4.6	4.2
1,1,2-Trichloroethane	79-00-5	133	22.4	0.006	1.1	J	0.003	0.47	U	0.007	1.1	J	0.007	e	1.1	e
Toluene	108-88-3	92	23.0	0.083	20		0.094	23		0.093	23		0.090	0.006	22	1.5
1,2-Dibromoethane	106-93-4	188	24.5	0.003	0.36	U	0.008	0.98	J	0.008	1.0	J	0.008	e	0.99	e
Tetrachloroethylene	127-18-4	166	25.6	0.012	1.6	J	0.014	1.9	J	0.014	1.9	J	0.013	0.001	1.8	0.14
Chlorobenzene	108-90-7	113	27.2	0.006	1.1	J	0.006	1.3	J	0.006	1.2	J	0.006	0.000	1.2	0.076
Hexanenitrile	628-73-9	97	27.5	0.006	1.5	U	0.150	35	S	0.009	2.0	J	0.079	e	18	e
Ethylbenzene	100-41-4	106	28.0	0.015	3.2	J	0.018	3.8	J	0.017	3.5	J	0.017	0.001	3.5	0.28
p/m-Xylene	106-42-3	106	28.5	0.054	11	J	0.062	13	J	0.059	12	J	0.058	0.004	12	0.82

Table 3.4 (Cont'd). Organic Compound Concentrations in SUMMA™ Canisters from Tank BY-101 Sampled on 8/29/96

Target Analytes ^(a)	CAS	MW	Ret Time	S6084-A04.047 ^(c) ISVS			S6084-A05.072 ^{(c)(d)} ISVS			S6084-A06.293 ^(c) ISVS			Mean and Standard Deviation			
				(mg/m ³)	(ppbv)	Flag	(mg/m ³)	(ppbv)	Flag	(mg/m ³)	(ppbv)	Flag	(mg/m ³)	St. Dev.	(ppbv)	St. Dev.
Cyclohexanone	108-94-1	98	28.9	0.006	1.5	U	0.054	12	J	0.006	1.5	U	e	e	e	e
o-Xylene	95-47-6	106	29.7	0.033	6.9	J	0.038	8.1	J	0.038	8.0	J	0.036	0.003	7.7	0.69
Nonane	111-84-2	128	30.2	0.016	2.7	J	0.018	3.2	J	0.019	3.3	J	0.018	0.002	3.1	0.31
Decane	124-18-5	142	34.8	0.017	2.7	J	0.025	3.9	J	0.021	3.3	J	0.021	0.004	3.3	0.57
Undecane	1120-21-4	156	39.2	<0.111	<16		<0.111	<16		<0.111	<16		0.092	0.012	13	1.8
Dodecane	112-40-3	170	43.2	<0.348	<46		<0.348	<46		<0.348	<46		0.235	0.025	31	3.3
Tridecane	629-50-5	184	46.9	0.449	54		0.518	63		0.467	57		0.478	0.036	58	4.4
Tetradecane	629-59-4	198	50.4	<0.228	<26		<0.228	<26		<0.228	<26		0.198	0.016	22	1.8
Total Target Analyte Concentration													44.456			
Tentatively Identified Compounds ^(b)																
Propene	115-07-1	42	4.0	0.409	218		0.376	201		0.377	201		0.387	0.019	207	9.9
Propane	74-98-6	44	4.1	1.000	509		0.950	484		0.886	451		0.946	0.057	481	29
Acetaldehyde	75-07-0	44	4.9	0.343	175		0.193	98		0.228	116		0.255	0.079	130	40
Isopropyl Alcohol	67-63-0	60	8.4	0.279	104		0.327	122		0.259	97		0.288	0.035	108	13
Butanal	123-72-8	72	12.6	1.923	598		2.036	634		1.889	588		1.949	0.077	606	24
Unknown			13.2	0.117	f		0.116	f		nd	nd		0.116	e	e	e
2-Pentanone	107-87-9	86	17.8	0.161	42		0.175	46		0.171	45		0.169	0.007	44	1.9
3-Heptanone	106-35-4	114	28.6	0.131	26		0.136	27		0.126	25		0.131	0.005	26	0.95
Total TIC Concentration													4.241			

Data Quality Flags

Y Initial calibration and CCV was performed; however, the analyte was not part of the current operating procedure.

J Target compound detected above the IDL but below the EQL.

S Suspect Data

U Target compound not detected at or above the IDL.

* Denotes diluted value was reported for target compound in table.

(a) Detected target analytes.

(b) Semi-quantitative estimate calculated using concentration of closest eluting IS.

(c) WHC sample identification number.

(d) Replicates of this sample are found in Table 3.5.

(e) Mean and/or standard deviation are not meaningful for this analyte.

(f) No molecular weight available for calculation.

nd Not detected

Table 3.5. Comparison of Organic Compound Concentrations from Replicate Analysis of a Single SUMMATM Canister from Tank BY-101 Sampled on 8/29/96

Target Analytes ^(a)	CAS	MW	Ret Time	S6084-A05.072 ^(c)						RPD ^(d)
				(mg/m ³)	(ppbv)	Flag	(mg/m ³)	(ppbv)	Flag	
Dichlorodifluoromethane	75-71-8	121	4.2	0.011	2.1	J	0.011	2.1	J	1
Methanol	67-56-1	32	5.0	0.566	396		0.532	372		6
1,3-Butadiene	106-99-0	54	5.5	0.150	62	Y	0.164	68	Y	9
Butane	106-97-8	58	5.6	0.302	116		0.291	112		4
Ethanol	64-17-5	46	6.8	0.516	251		0.503	245		3
Acetonitrile	75-05-8	41	7.3	0.025	14	J	0.025	14	J	0
Acetone	67-64-1	58	7.8	3.056	1179		3.180	1226		4
Trichlorofluoromethane	75-69-4	137	8.2	2.444	399		2.489	406		2
Pentane	109-66-0	72	9.0	0.092	28		0.095	29		3
1,1-Dichloroethene	75-35-4	97	9.5	0.006	1.3	J	0.006	1.5	J	15
Methylene Chloride	75-09-2	85	9.7	0.025	6.6		0.024	6.4		3
1,1,2-Trichloro-2,2,2-trifluoroethane	76-13-1	187	10.3	0.021	2.6	J	0.021	2.5	J	0
Propanenitrile	107-12-0	55	11.1	0.015	6.1	J	0.015	6.2	J	2
Propanol	71-23-8	60	11.2	0.576	215		0.528	197		9
2-Butanone	78-93-3	72	12.8	0.977	304		0.994	309		2
Hexane	110-54-3	86	14.0	0.061	16		0.061	16		0
Chloroform	67-66-3	119	14.2	0.006	1.1	J	0.006	1.1	J	0
Tetrahydrofuran	109-99-9	72	15.0	0.276	86		0.271	84		2
1,1,1-Trichloroethane	71-55-6	133	16.2	0.009	1.5	J	0.009	1.5	J	1
1-Butanol	71-36-3	74	16.8	31.832	9620	*	31.368	9480	*	1
Benzene	71-43-2	78	17.1	0.008	2.3	J	0.009	2.5	J	7
Carbon Tetrachloride	56-23-5	154	17.4	0.007	1.1	J	0.008	1.1	J	4
Trichloroethene	79-01-6	131	19.1	0.006	1.1	J	0.006	1.1	J	2
Heptane	142-82-5	100	19.7	0.043	9.6		0.043	9.7		1
4-Methyl-2-Pentanone	108-10-1	100	20.9	0.220	49		0.159	35		32
Pyridine	110-86-1	79	21.0	1.501	425	S	0.140	40		166
Pentanenitrile	110-59-8	83	22.0	0.035	9.4	J	0.008	2.2	J	123
1,1,2-Trichloroethane	79-00-5	133	22.4	0.003	0.47	U	0.007	1.2	J	
Toluene	108-88-3	92	23.0	0.094	23		0.095	23		0
1,2-Dibromoethane	106-93-4	188	24.5	0.008	0.98	J	0.008	0.96	J	2
Tetrachloroethylene	127-18-4	166	25.6	0.014	1.9	J	0.014	1.8	J	1
Chlorobenzene	108-90-7	113	27.2	0.006	1.3	J	0.006	1.2	J	3
Hexanenitrile	628-73-9	97	27.5	0.150	35	S	0.009	2.0	J	178
Ethylbenzene	100-41-4	106	28.0	0.018	3.8	J	0.017	3.6	J	5
p/m-Xylene	106-42-3	106	28.5	0.062	13	J	0.061	13	J	1
Cyclohexanone	108-94-1	98	28.9	0.054	12	J	0.006	1.5	U	
o-Xylene	95-47-6	106	29.7	0.038	8.1	J	0.038	8.0	J	1
Nonane	111-84-2	128	30.2	0.018	3.2	J	0.019	3.3	J	4
Decane	124-18-5	142	34.8	0.025	3.9	J	0.021	3.4	J	14
Undecane	1120-21-4	156	39.2	<0.111	<16		<0.111	<16		13
Dodecane	112-40-3	170	43.2	<0.348	<46		<0.348	<46		8
Tridecane	629-50-5	184	46.9	0.518	63		0.445	54		15
Tetradecane	629-59-4	198	50.4	<0.228	<26		0.270	31		22

Table 3.5 (Cont'd). Comparison of Organic Compound Concentrations from Replicate Analysis of a Single SUMMATM Canister from Tank BY-101 Sampled on 8/29/96

Tentatively Identified Compounds ^(b)	CAS	MW	Ret Time	S6084-A05.072 ^(c)				RPD ^(d) %
				(mg/m ³)	(ppbv) Flag	(mg/m ³)	(ppbv) Flag	
Propene	115-07-1	42	4.0	0.376	201	0.376	200	0
Propane	74-98-6	44	4.1	0.950	484	0.936	476	2
Acetaldehyde	75-07-0	44	4.9	0.193	98	0.253	129	27
Isopropyl Alcohol	67-63-0	60	8.4	0.327	122	0.276	103	17
Butanal	123-72-8	72	12.6	2.036	634	1.996	621	2
Unknown		0	13.2	0.116	e	nd	nd	
2-Pentanone	107-87-9	86	17.8	0.175	46	0.180	47	3
3-Heptanone	106-35-4	114	28.6	0.136	27	0.131	26	3

Data Quality Flags

Y Initial calibration and CCV was performed; however, the analyte was not part of the current operating procedure.

J Target compound detected above the IDL but below the EQL.

S Suspect Data

U Target compound not detected at or above the IDL.

* Denotes diluted value was reported for target compound in table.

(a) Detected target analytes.

(b) Semi-quantitative estimate calculated using concentration of closest eluting IS.

(c) WHC sample identification number.

(d) Relative percent differences (RPDs) based on mg/m³ values.

(e) No molecular weight available for calculation.

nd Not detected

Table 3.6. Organic Compound Concentrations in Ambient Air and Ambient Air through the ISVS in SUMMA™ Canisters Associated with the Sampling of Tank BY-101 on 8/29/96

Target Analytes ^(a)	CAS	MW	Ret Time	S6084-A01.040 ^(b)			S6084-A02.045 ^(b)		
				Upwind Ambient Air			Ambient Air through ISVS		
				(mg/m ³)	(ppbv)	Flag	(mg/m ³)	(ppbv)	Flag
Dichlorodifluoromethane	75-71-8	121	4.2	0.007	1.3	U	0.010	1.9	J
1,2-dichloro-1,1,2,2-tetrafluoroethane	76-14-2	171	4.8	0.010	1.4	U	0.011	1.4	J
Ethanol	64-17-5	46	6.8	0.005	2.4	U	0.010	4.6	J
Acetone	67-64-1	58	7.8	0.029	11	J	0.006	2.3	U
Trichlorofluoromethane	75-69-4	137	8.2	0.008	1.3	J	0.009	1.5	J
Methylene Chloride	75-09-2	85	9.7	0.018	4.7	J	0.020	5.4	J
1,1,2-trichloro-2,2,2-trifluoroethane	76-13-1	187	10.3	0.004	0.53	U	0.069	8.3	
Hexane	110-54-3	86	14.0	0.004	1.1	J	0.006	1.5	J
Chloroform	67-66-3	119	14.2	0.006	1.0	J	0.006	1.1	J
1,1,1-Trichloroethane	71-55-6	133	16.2	0.002	0.30	U	0.006	1.1	J
Carbon Tetrachloride	56-23-5	154	17.4	0.007	0.99	J	0.007	1.0	J
Toluene	108-88-3	92	23.0	0.002	0.58	J	0.004	0.99	J
1,2-Dibromoethane	106-93-4	188	24.5	0.006	0.68	J	0.006	0.74	J

Data Quality Flags

J Target compound detected above the IDL but below the EQL.

U Target compound not detected at or above the IDL.

(a) Detected target analytes.

(b) WHC sample identification number.

Table 3.7 Organic Compound Concentrations in Triple Sorbent Traps Collected from Tank BY-101 Sampled on 8/29/96

Target Analytes ^(a)	CAS	MW	Ret Time	S6084-A11.1153 ^(c) ISVS			S6084-A12.1154 ^{(c)(d)} ISVS			S6084-A13.1155 ^(c) ISVS			Mean and Standard Deviation			
				(mg/m ³)	(ppbv)	Flag	(mg/m ³)	(ppbv)	Flag	(mg/m ³)	(ppbv)	Flag	(mg/m ³)	St. Dev.	(ppbv)	St. Dev.
Methanol	67-56-1	32	10.0	0.682	477	Y	0.787	550	Y	0.672	470	Y	0.714	0.064	499	44
Butane	106-97-8	58	10.8	0.240	92		0.236	91		0.214	82		0.230	0.014	89	5.4
Ethanol	64-17-5	46	12.5	0.358	174	Y	0.361	175	Y	0.339	165	Y	0.353	0.011	171	5.6
Acetonitrile	75-05-8	41	13.0	0.055	30		0.054	29		0.044	24		0.051	0.006	28	3.4
Acetone	67-64-1	58	13.7	1.624	626		1.564	603		1.684	649		1.624	0.060	626	23
Trichlorofluoromethane	75-69-4	137	14.1	1.258	205		1.156	188		1.289	210		1.234	0.070	201	11
Pentane	109-66-0	72	14.9	0.096	30		0.095	30		0.090	28		0.094	0.003	29	0.98
Methylene Chloride	75-09-2	85	15.8	0.172	45	J	0.282	74		0.107	28	J	0.187	0.088	49	23
Propanenitrile	107-12-0	55	17.0	0.012	4.8	J	0.013	5.4	J	0.011	4.4	J	0.012	0.001	4.9	0.48
Propanol	71-23-8	60	17.0	0.393	146		0.435	162		0.410	153		0.413	0.021	154	8.0
2-Butanone	78-93-3	72	18.6	0.730	227		0.588	183		0.729	226		0.682	0.082	212	25
Hexane	110-54-3	86	19.9	0.074	19		0.077	20		0.001	0.35	U	0.076	e	20	e
Tetrahydrofuran	109-99-9	72	20.7	0.209	65		0.214	66		0.226	70		0.216	0.009	67	2.8
1,1,1-Trichloroethane	71-55-6	133	21.9	0.012	2.1	J	0.009	1.5	J	0.011	1.8	J	0.011	0.002	1.8	0.28
1-Butanol	71-36-3	74	22.3	37.098	11230	E	31.538	9547	E	36.241	10970	E	34.959	2.993	10582	906
Benzene	71-43-2	78	22.8	0.010	2.8	J	0.010	3.0	J	0.010	2.8	J	0.010	0.000	2.8	0.12
Cyclohexane	110-82-7	84	23.3	0.040	11	J	0.004	1.2	U	0.004	1.2	U	e	e	e	e
Trichloroethene	79-01-6	131	24.7	0.006	1.0	J	0.009	1.5	J	0.004	0.71	J	0.006	0.002	1.1	0.38
Heptane	142-82-5	100	25.2	0.063	14		0.073	16		0.111	25		0.082	0.026	18	5.7
4-Methyl-2-Pentanone	108-10-1	100	26.3	0.331	74		0.280	63		0.296	66		0.302	0.026	68	5.9
Toluene	108-88-3	92	28.5	0.789	192		0.667	162		0.651	158		0.702	0.076	171	18
Octane	111-65-9	114	30.4	0.018	3.5	J	0.022	4.3	J	0.023	4.5	J	0.021	0.003	4.1	0.51
Tetrachloroethylene	127-18-4	166	31.0	0.012	1.7	J	0.014	1.9	J	0.014	1.9	J	0.013	0.001	1.8	0.12
Ethylbenzene	100-41-4	106	33.4	0.251	53		0.215	45		0.188	40		0.218	0.032	46	6.7
p/m-Xylene	106-42-3	106	33.9	0.792	167		0.693	146		0.602	127		0.695	0.095	147	20
Cyclohexanone	108-94-1	98	34.3	0.115	26	J	0.143	33		0.076	17	J	0.111	0.033	25	7.6
Styrene	100-42-5	104	34.8	0.060	13		0.059	13		0.045	9.6		0.054	0.008	12	1.8
o-Xylene	95-47-6	106	35.1	0.233	49		0.199	42		0.183	39		0.205	0.025	43	5.4
Nonane	111-84-2	128	35.4	0.030	5.3		0.028	4.9		0.028	5.0		0.029	0.001	5.0	0.20
1-Ethyl-2-methyl benzene	611-14-3	120	38.4	0.013	2.4	J	0.014	2.5	J	0.010	1.9	J	0.012	0.002	2.3	0.34
1,3,5-Trimethylbenzene	108-67-8	120	38.6	0.012	2.2	J	0.013	2.4	J	0.009	1.7	J	0.011	0.002	2.1	0.39
1,2,4-Trimethylbenzene	95-63-6	120	39.9	0.028	5.3		0.032	6.0		0.023	4.3	J	0.028	0.005	5.2	0.87
Decane	124-18-5	142	40.1	0.059	9.3		0.061	9.5		0.046	7.2		0.055	0.008	8.7	1.3
1,3-Dichlorobenzene	541-73-1	147	40.5	0.016	2.4	J	0.016	2.4	J	0.012	1.8	J	0.014	0.002	2.2	0.32
1,4-Dichlorobenzene	106-46-7	147	40.7	0.016	2.4	J	0.016	2.4	J	0.012	1.9	J	0.015	0.002	2.2	0.32
Undecane	1120-21-4	156	44.4	0.038	5.5	J	0.050	7.2		0.057	8.2		0.048	0.009	6.9	1.4
Dodecane	112-40-3	170	48.4	0.054	7.1	J	0.095	12	J	0.148	19	J	0.099	0.047	13	6.2
Tridecane	629-50-5	184	52.2	0.148	18	J	0.220	27	J	0.370	45	J	0.246	0.113	30	14
Tetradecane	629-59-4	198	55.7	0.110	12	J	0.186	21		0.306	35		0.200	0.099	23	11
Total Target Analyte Concentration													44.03			

Table 3.7 (Cont'd) Organic Compound Concentrations in Triple Sorbent Traps Collected from Tank BY-101 Sampled on 8/29/96

Tentatively Identified Compounds ^(b)	CAS	MW	Ret Time	S6084-A11.1153 ^(c) ISVS			S6084-A12.1154 ^{(c)(d)} ISVS			S6084-A13.1155 ^(e) ISVS			Mean and Standard Deviation			
				(mg/m ³)	(ppbv)	Flag	(mg/m ³)	(ppbv)	Flag	(mg/m ³)	(ppbv)	Flag	(mg/m ³)	St. Dev.	(ppbv)	St. Dev.
Ethane, 1-chloro-1,1-difluoro-	75-68-3	100	8.8	1.007	225		2.235	501		nd	nd		1.621	e	363	e
1-Propene, 2-methyl-	115-11-7	56	10.4	0.238	95		0.233	93		0.195	78		0.222	0.024	89	9.5
1-Butene	106-98-9	56	13.7	0.220	88		nd	nd		nd	nd		e	e	e	e
Butanal	123-72-8	72	18.4	0.571	178		0.896	279		0.577	180		0.681	0.186	212	58
Unknown			23.9	nd	nd		nd	nd		0.156	f		e	e	e	e
Hexane, 2,3,5-trimethyl-	1069-53-0	128	31.5	0.219	38		0.182	32		0.169	30		0.190	0.026	33	4.6
Heptane, 2,4-dimethyl-	2213-23-2	128	31.7	0.803	141		0.616	108		0.579	101		0.666	0.120	117	21
Cyclotetrasiloxane, octamethyl-	556-67-2	296	39.4	0.856	65	Z	0.818	62	Z	nd	nd		0.837	e	63	e
Total TIC Concentration													4.22			

Data Quality Flags

E Target compound exceeds upper quantification limit (UQL).

J Target compound detected above the IDL but below the EQL.

U Target compound not detected at or above the IDL.

Y Initial calibration and CCV was performed; however, the analyte was not part of the current operating procedure.

Z The siloxane compounds are suspected to be originating from the silicone tubing used in the sample bundle.

(a) Detected target analytes.

(b) Semi-quantitative estimate calculated using concentration of closest eluting IS.

(c) WHC sample identification number.

(d) Replicates of this sample are found in Table 3.8

(e) Mean and/or standard deviation are not meaningful for this analyte.

(f) No molecular weight available for calculation.

nd Not detected

Table 3.8 Comparison of Organic Compound Concentrations from Replicate Analysis of a Single Triple Sorbent Trap from Tank BY-101 Sampled on 8/29/96

Target Analytes ^(a)	CAS	MW	Ret Time	S6084-A12.1154 ^(c) ISVS						RPD ^(d)
				(mg/m ³)	(ppbv)	Flag	(mg/m ³)	(ppbv)	Flag	
Methanol	67-56-1	32	10.0	0.787	550	Y	0.565	395	Y	33
Butane	106-97-8	58	10.8	0.236	91		0.209	80		12
Ethanol	64-17-5	46	12.5	0.361	175	Y	<0.275	<133	Y	
Acetonitrile	75-05-8	41	13.0	0.054	29		0.054	29		1
Acetone	67-64-1	58	13.7	1.564	603		1.371	529		13
Trichlorofluoromethane	75-69-4	137	14.1	1.156	188		1.178	192		2
Pentane	109-66-0	72	14.9	0.095	30		0.090	28		5
Methylene Chloride	75-09-2	85	15.8	0.282	74		0.266	70		6
Propanenitrile	107-12-0	55	17.0	0.013	5.4	J	0.010	4.1	J	27
Propanol	71-23-8	60	17.0	0.435	162		0.353	132		21
2-Butanone	78-93-3	72	18.6	0.588	183		0.685	213		15
Hexane	110-54-3	86	19.9	0.077	20		0.069	18		11
Tetrahydrofuran	109-99-9	72	20.7	0.214	66		0.211	66		1
1,1,1-Trichloroethane	71-55-6	133	21.9	0.009	1.5	J	0.012	2.0	J	29
1-Butanol	71-36-3	74	22.3	31.538	9547	E	38.492	11652	E	20
Benzene	71-43-2	78	22.8	0.010	3.0	J	0.012	3.5	J	16
Cyclohexane	110-82-7	84	23.3	0.004	1.2	U	0.046	12		
Trichloroethene	79-01-6	131	24.7	0.009	1.5	J	0.007	1.2	J	18
Heptane	142-82-5	100	25.2	0.073	16		0.068	15		7
4-Methyl-2-Pentanone	108-10-1	100	26.3	0.280	63		0.255	57		9
Toluene	108-88-3	92	28.5	0.667	162		0.668	162		0
Octane	111-65-9	114	30.4	0.022	4.3	J	0.019	3.8	J	12
Tetrachloroethylene	127-18-4	166	31.0	0.014	1.9	J	0.014	1.8	J	4
Ethylbenzene	100-41-4	106	33.4	0.215	45		0.205	43		5
p/m-Xylene	106-42-3	106	33.9	0.693	146		0.676	143		2
Cyclohexanone	108-94-1	98	34.3	0.143	33		0.071	16	J	67
Styrene	100-42-5	104	34.8	0.059	13		0.054	12		9
o-Xylene	95-47-6	106	35.1	0.199	42		0.189	40		5
Nonane	111-84-2	128	35.4	0.028	4.9		0.026	4.5		8
1-Ethyl-2-methyl benzene	611-14-3	120	38.4	0.014	2.5	J	0.012	2.2	J	15
1,3,5-Trimethylbenzene	108-67-8	120	38.6	0.013	2.4	J	0.011	2.1	J	14
1,2,4-Trimethylbenzene	95-63-6	120	39.9	0.032	6.0		0.028	5.1		16
Decane	124-18-5	142	40.1	0.061	9.5		0.053	8.4		13
1,3-Dichlorobenzene	541-73-1	147	40.5	0.016	2.4	J	0.015	2.2	J	8
1,4-Dichlorobenzene	106-46-7	147	40.7	0.016	2.4	J	0.015	2.2	J	8
Undecane	1120-21-4	156	44.4	0.050	7.2		0.045	6.5	J	10
Dodecane	112-40-3	170	48.4	0.095	12	J	0.081	11	J	16
Tridecane	629-50-5	184	52.2	0.220	27	J	0.198	24	J	10
Tetradecane	629-59-4	198	55.7	0.186	21		0.171	19		8

Tentatively

Identified Compounds^(b)

Ethane, 1-chloro-1,1-difluoro-	75-68-3	100	8.8	2.235	501		1.920	430		15
1-Propene, 2-methyl-	115-11-7	56	10.4	0.233	93		nd	nd		
Butanal	123-72-8	72	18.4	0.896	279		0.500	156		57
Hexane, 2,3,5-trimethyl-	1069-53-0	128	31.5	0.182	32		0.178	31		2
Heptane, 2,4-dimethyl-	2213-23-2	128	31.7	0.616	108		0.625	109		1
Cyclotetrasiloxane, octamethyl-	556-67-2	296	39.4	0.818	62		nd	nd		

Data Quality Flags

E Target compound exceeds upper quantification limit (UQL).

J Target compound detected above the IDL but below the EQL.

U Target compound not detected at or above the IDL.

Y Initial calibration and CCV was performed; however, the analyte was not part of the current operating procedure.

(a) Detected target analytes.

(b) Semi-quantitative estimate calculated using concentration of closest eluting IS.

(c) WHC sample identification number.

(d) Relative percent differences (RPDs) based on mg/m³ values.

nd Not detected

Table 3.9 Organic Compound Concentrations in Triple Sorbent Trap Blank Samples Associated with the Sampling of Tank BY-101 on 8/29/96

Target Analytes ^(a)	CAS	MW	Ret Time	S6084-A17.1157 ^(c) ISVS			S6084-A18.1158 ^(c) ISVS			S6084-A19.1159 ^(c) ISVS			S6084-A20.1160 ^(c) ISVS		
				FB #1			FB #2			TB #1			TB #2		
				(mg/m ³)	(ppbv)	Flag	(mg/m ³)	(ppbv)	Flag	(mg/m ³)	(ppbv)	Flag	(mg/m ³)	(ppbv)	Flag
Methanol	67-56-1	32	10.0	<0.274	<192	Y	<0.274	<192	Y	<0.274	<192	Y	<0.274	<192	Y
Butane	106-97-8	58	10.8	0.020	7.8	J	0.022	8.5	J	0.004	1.4	U	0.004	1.4	U
Acetonitrile	75-05-8	41	13.0	0.004	2.2	J	0.004	2.0	J	0.003	1.8	U	0.003	1.8	U
Acetone	67-64-1	58	13.7	0.073	28		0.067	26	J	0.007	2.8	U	0.007	2.8	U
Trichlorofluoromethane	75-69-4	137	14.1	0.054	8.9		0.064	10		0.004	0.72	U	0.005	0.80	J
Pentane	109-66-0	72	14.9	0.017	5.3	J	0.017	5.3	J	0.003	0.89	U	0.003	0.89	U
Methylene Chloride	75-09-2	85	15.8	0.149	39	J	0.174	46		0.124	33	J	0.879	232	
2-Butanone	78-93-3	72	18.6	0.020	6.1	J,B	0.028	8.8	B	0.002	0.68	U	0.002	0.68	U
Hexane	110-54-3	86	19.9	0.020	5.1		0.023	6.0		0.001	0.32	U	0.001	0.32	U
Tetrahydrofuran	109-99-9	72	20.7	0.007	2.1	J	0.010	3.1	J	0.004	1.1	U	0.004	1.1	U
1,1,1-Trichloroethane	71-55-6	133	21.9	0.008	1.4	J	0.008	1.4	J	0.003	0.44	U	0.003	0.44	U
1-Butanol	71-36-3	74	22.3	0.543	164		1.263	382		0.008	2.3	U	0.008	2.3	U
Benzene	71-43-2	78	22.8	0.004	1.2	J	0.005	1.4	J	0.001	0.40	U	0.001	0.40	U
Trichloroethene	79-01-6	131	24.7	0.005	0.93	J	0.006	1.1	J	0.004	0.63	J	0.028	4.7	J
Heptane	142-82-5	100	25.2	0.022	4.8		0.044	9.7		0.002	0.35	U	0.002	0.35	U
4-Methyl-2-Pentanone	108-10-1	100	26.3	0.142	32		0.145	32		0.002	0.46	U	0.002	0.46	U
Toluene	108-88-3	92	28.5	0.441	107		0.443	108		0.001	0.28	J	0.003	0.74	J
Tetrachloroethylene	127-18-4	166	31.0	0.003	0.41	J	0.003	0.34	U	0.003	0.34	U	0.003	0.34	U
Ethylbenzene	100-41-4	106	33.4	0.120	25		0.117	25		0.001	0.30	U	0.001	0.30	U
p/m-Xylene	106-42-3	106	33.9	0.369	78		0.360	76		0.003	0.63	U	0.003	0.63	U
Cyclohexanone	108-94-1	98	34.3	0.070	16	J	0.089	20	J	0.013	2.9	U	0.013	2.9	U
Styrene	100-42-5	104	34.8	0.029	6.1		0.027	5.9		0.002	0.33	U	0.002	0.33	U
o-Xylene	95-47-6	106	35.1	0.108	23		0.101	21		0.002	0.40	U	0.002	0.40	U
Nonane	111-84-2	128	35.4	0.012	2.1	J	0.011	2.0	J	0.001	0.22	U	0.001	0.22	U
1-Ethyl-2-methyl benzene	611-14-3	120	38.4	0.006	1.2	J	0.006	1.1	J	0.002	0.44	U	0.002	0.44	U
1,3,5-Trimethylbenzene	108-67-8	120	38.6	0.006	1.1	J	0.006	1.1	J	0.002	0.44	U	0.002	0.44	U
1,2,4-Trimethylbenzene	95-63-6	120	39.9	0.015	2.8	J	0.015	2.8	J	0.003	0.47	U	0.003	0.47	U
Decane	124-18-5	142	40.1	0.032	5.0		0.030	4.6	J	0.003	0.47	U	0.003	0.47	U
1,3-Dichlorobenzene	541-73-1	147	40.5	0.008	1.2	J	0.007	1.0	J	0.003	0.48	U	0.003	0.48	U
1,4-Dichlorobenzene	106-46-7	147	40.7	0.008	1.3	J	0.007	1.1	J	0.003	0.43	U	0.003	0.43	U
Undecane	1120-21-4	156	44.4	0.015	2.2	J	0.017	2.4	J	0.004	0.63	U	0.004	0.63	U
Tetradecane	629-59-4	198	55.7	0.058	6.5	J	0.036	4.0	J	0.011	1.2	J	0.023	2.6	J

Table 3.9 (Cont'd) Organic Compound Concentrations in Triple Sorbent Trap Blank Samples Associated with the Sampling of Tank BY-101 on 8/29/9

Tentatively Identified Compounds ^(b)	CAS	MW	Ret Time	S6084-A17.1157 ^(c) ISVS			S6084-A18.1158 ^(c) ISVS			S6084-A19.1159 ^(c) ISVS			S6084-A20.1160 ^(c) ISVS		
				FB #1			FB #2			TB #1			TB #2		
				(mg/m ³)	(ppbv)	Flag	(mg/m ³)	(ppbv)	Flag	(mg/m ³)	(ppbv)	Flag	(mg/m ³)	(ppbv)	Flag
Ethane, 1-chloro-1,1-difluoro-	75-68-3	100	8.8	0.595	133		0.568	127		0.309	69		5.916	1325	
1-Propene, 2-methyl-	115-11-7	56	10.4	0.178	71		0.122	49		nd	nd		nd	nd	
1-Butene	106-98-9	56	13.7	0.161	64		0.137	55		nd	nd		nd	nd	
Hexane, 3-methyl-	589-34-4	100	23.9	0.063	14		0.132	29		nd	nd		nd	nd	
Cyclotrisiloxane, hexamethyl-	541-05-9	222	31.1	1.348	136	Z	1.415	143	Z	nd	nd		nd	nd	
Hexane, 2,3,5-trimethyl-	1069-53-0	128	31.5	0.128	22		0.126	22		nd	nd		nd	nd	
Heptane, 2,4-dimethyl-	2213-23-2	128	31.7	0.462	81		0.454	79		nd	nd		nd	nd	
2,4-Dimethyl-1-heptene	19549-87-2	126	32.6	0.062	11		nd	nd		nd	nd		nd	nd	
Cyclotetrasiloxane, octamethyl-	556-67-2	296	39.4	0.443	34	Z	0.436	33	Z	nd	nd		nd	nd	
Unknown C12 Alkane		170	42.9	nd	nd		0.494	d		nd	nd		nd	nd	

Data Quality Flags

J Target compound detected above the IDL but below the EQL.

U Target compound not detected at or above the IDL.

Y Initial calibration and CCV was performed; however, the analyte was not part of the current operating procedure.

Z The siloxane compounds are suspected to be originating from the silicone tubing used in the sample bundle.

(a) Detected target analytes.

(b) Semi-quantitative estimate calculated using concentration of closest eluting IS.

(c) WHC sample identification number.

(d) Value was not calculated by the instrument.

nd Not detected

Table 3.10 Flammability Data for Tank BY-101 Sampled on 8/29/96

Analyte	CAS #	Lower Flammability Limit(LFL)	Average Measured Concentrations	% of LFL ^(a)
Ammonia (ppm)	7664-41-7	150000	60	0.040
Carbon Monoxide (ppm)	630-08-0	125000	<17	<0.014
Hydrogen (ppm)	1333-74-0	40000	29	0.073
Methane (ppm)	74-82-8	50000	<25	<0.05
TNMOC (mg/m ³)		42000	57.26	0.136
Total				<0.313

(a) Less than values are calculated using the average concentration less than values.
These values are summed to determine the total LFL.

Figure 3.1b Typical Total Ion Chromatogram (36 - 70 min) for SUMMA™ Canister Samples from Tank BY-101 Sampled on 8/29/96

Figure 3.2b Typical Total Ion Chromatogram (36 - 70 min) for Triple Sorbent Trap Samples from Tank BY-101 Sampled on 8/29/96

4.0 Conclusions

The concentrations of inorganic and organic analytes were determined from samples of the headspace of Tank BX-105 on August 29, 1996 (Sample Job S6084). The vapor concentrations were based either on whole-volume samples (SUMMA™ canisters) or on sorbent traps exposed to sample flow. In the case of the canisters, the concentrations were based on analytical results and the tracking of dilution/concentration of sample volumes obtained directly from the canisters. In the case of the sorbent traps, concentrations were based on analytical results and sample volumes reported by WHC. Known sampling and analytical variances from established quality assurance requirements, where significant, were documented in this report, as required by the SAP (Buckley 1996). No immediate notifications were provided because analytical results indicated no specific analytes exceeded the notification levels; notification levels and notification procedures are described in the SAP (Buckley 1996).

5.0 References

Buckley, L. L. 1996. *Vapor Sampling and Analysis Plan*. WHC-SD-WM-TP-335, Rev. 2C, Westinghouse Hanford Company, Richland, Washington.

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Pacific Northwest National Laboratory. *Analytical Laboratory Procedure Compendium*. Procedure PNL-ALO-271. PNL-MA-599, Pacific Northwest National Laboratory, Richland, Washington.

Pacific Northwest National Laboratory. *Quality Assurance Plan for Activities Conducted by the Pacific Northwest National Laboratory Vapor Analytical Laboratory (VAL) and the Pacific Northwest National Laboratory Tank Vapor Characterization Project*. ETD-002, Rev. 1, Pacific Northwest National Laboratory, Richland, Washington.

U.S. Department of Energy. *Hanford Analytical Services Quality Assurance Plan (HASQAP)*. DOE/RL-94-55, Rev. 2, United States Department of Energy, Richland, Washington.

Westinghouse Hanford Company (WHC). 1994. *Quality Assurance Project Plan for Tank Vapor Characterization*. WHC-SD-WM-QAPP-013, Rev. 2, Westinghouse Hanford Company, Richland, Washington.

Appendix A

Chain-of-Custody Sample Control Forms

Custody Form Initiator

J. A. Edwards - PNNL

Telephone (509) 373-0141

Page 85-3009 / FAX 376-2329

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-BY-101 Tank Vapor Sample SAF S6084

(ISVS Cart)

Collection date 08 - 29 - 96

Preparation date 08 - - - 96

Ice Chest No.

Field Logbook No. WHC-N - 647-8

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

S6084 - A07 . 82R .

Collect NH₃/NO_x/H₂O Sorbent Trap

S6084 - A08 . 83R .

Collect NH₃/NO_x/H₂O Sorbent Trap

S6084 - A09 . 84R .

Collect NH₃/NO_x/H₂O Sorbent Trap

S6084 - A10 . 85R .

Collect NH₃/NO_x/H₂O Sorbent Trap

S6084 - A15 . 86R .

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

S6084 - A16 . 87R .

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

[] Field Transfer of Custody			[X] Chain of Possession			(Sign and Print Names)	
Relinquished By	Date	Time	Received By	Date	Time		
G W Dennis <i>A.W.D.</i>	08-7-96	0930	J L Julia <i>J.L. Julia</i>	08-7-96	0930		
<i>W.C. Dennis</i>	08-26-96	1400	<i>GS Caprio</i>	08-26-96	1400		
<i>W.C. Dennis</i>	9-9-96	1415	<i>JA Edwards</i>	9-9-96	1415		
<i>JA Edwards</i>	9-12-96	1500	<i>G.W. Dennis</i>	9-12-96	1500		

Final Sample Disposition

Comments:

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

Pick-up / Delivery

Y/N
Y/N
Y/N
Y/N
Y/N
Y/N
Y/N
Y/N

Comments:

POC

(Signature)

POC

(Signature)

(WHC-SD-WM-TP-335, REV. 2, Table 2b)
A-6000-407 (12/92) WEF061

1 of 1

(Revised 05/30/96 PNNL)

Custody Form Initiator

J. A. Edwards - PNNL

Telephone (509) 373-0141

Page 85-3009 / FAX 376-2329

Company Contact

R. D. Mahon - WHC

Telephone (509) 373-2891

Page 85-3656 / FAX 373-3793

Project Designation/Sampling Locations 200 West Tank Farm
241-BY-101 Tank Vapor Sample SAF S6084
(ISVS Cart)

Collection date 08 - 29 - 96

Preparation date 08 - 01 - 96

Ice Chest No.

Field Logbook No. WHC-N 447-8

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

S6084 - A01 . 040 Collect Ambient Air Sample SUMMA #1
S6084 - A02 . 045 Collect Ambient Air Sample SUMMA #2 (through tube bundle)

S6084 - A04 . 047 Collect SUMMA #3
S6084 - A05 . 072 Collect SUMMA #4
S6084 - A06 . 293 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	08-26-96	1400	GS CAPRIO / J A Edwards	08-26-96	1400	
GS CAPRIO	9-9-96	1415	J A Edwards / J A Edwards	9-9-96	1415	

Final Sample Disposition

Comments:

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

(WHC-SD-WM-TP-335, REV. 2, Table 2b)

POC

POC

(Revised 05/30/96 PNNL)

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-BY-101 Tank Vapor Sample SAF S6084
(ISVS Cart)Collection date 08 29 - 96

Preparation date 08 -16 - 96

Ice Chest No.

Field Logbook No. WHC-V-617-8

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

S6084 - A11 . 1153	PNL Triple Sorbent Trap (TST) Sample # 1
S6084 - A12 . 1154	PNL TST Sample # 2
S6084 - A13 . 1155	PNL TST Sample # 3
S6084 - A14 . 1156	PNL TST Sample # 4
S6084 - A17 . 1157	Open, close & store TST Field Blank # 1
S6084 - A18 . 1158	Open, close & store TST Field Blank #2
S6084 - A19 . 1159	Store TST Trip Blank #1
S6084 - A20 . 1160	Store TST Trip Blank #2

[] Field Transfer of Custody		[X] Chain of Possession		(Sign and Print Names)	
Relinquished By	Date	Time	Received By	Date	Time
JL Julia	08-21-96	0800	JA Edwards	08-21-96	0800
JA Edwards	08-26-96	1400	GS CAPRIO / JA Edwards	08-26-96	1400
GS CAPRIO	9-9-96	1415	JA Edwards	9-9-96	1415
JA Edwards	9-13-96	0805	JL Julia / JA Edwards	9-13-96	0805

Final Sample Disposition

Comments:

- PNL (only) Checklist
- Media labeled and checked?
 - Letter of instruction?
 - Media in good condition?
 - COC info/signatures complete?
 - Sorbents shipped on ice? (<5°C)
 - Hi/Lo thermometer - Keep upright!
 - Hi/Lo thermometer
 - Rad release stickers on samples?
 - Activity report from 222S?
 - COC copy for LRB, RIDS filed?

Pick-up / Delivery

Y/N
Y/N
Y/N
Y/N
Y/N
Y/N
Y/N
Y/N
Y/N
Y/N

Comments:

Cooler Temperature Status

Hi	°C / Lo	°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	°C / Lo	°C (at delivery from WHC to PNL)

POC

POC

(Revised 06/21/95 PNL)

Appendix B

Listing of All Target Compounds for Organic Compound Analysis

Table B.1. SUMMA™ Analysis Results for All Target Analytes for Samples Collected from the Headspace of Tank BY-101 on 8/29/96

Target Analytes	CAS	MW	S6084-A01.040			S6084-A02.045			S6084-A04.047 ISVS			S6084-A05.072 ISVS			S6084-A05.072 Rep			S6084-A06.293 ISVS		
			Ret Time	Upwind Ambient (mg/m ³)	Ambient (ppbv)	Flag	Ambient Through ISVS (mg/m ³)	(ppbv)	Flag	(mg/m ³)	(ppbv)	Flag	(mg/m ³)	(ppbv)	Flag	(mg/m ³)	(ppbv)	Flag	(mg/m ³)	(ppbv)
Dichlorodifluoromethane	75-71-8	121	4.2	0.007	1.3 U	0.0101	1.87 J	0.012	2.23 J	0.0114	2.11 J	0.0113	2.09 J	0.0116	2.16 J					
Chloromethane	74-87-3	50	4.6	0.002	0.89 U	0.002	0.89 U	0.002	0.89 U	0.002	0.89 U	0.002	0.89 U	0.002	0.89 U					
1,2-dichloro1,1,2,2-tetrafluoroethane	76-14-2	171	4.8	0.0104	1.36 U	0.011	1.44 J	0.0105	1.38 J	0.0104	1.36 U	0.0104	1.36 U	0.0104	1.36 U					
Methanol	67-56-1	32	5.0	0.0126	8.81 U	0.0126	8.81 U	0.5811	406.24	0.5661	395.75	0.5321	371.98	0.5118	357.84					
Vinyl Chloride	75-01-4	63	5.1	0.006	2.15 U	0.006	2.15 U	0.006	2.15 U	0.006	2.15 U	0.006	2.15 U	0.006	2.15 U					
1,3-Butadiene	106-99-0	54	5.5	<0.083	<34	<0.083	<34	0.1648	68.36 Y	0.1501	62.25 Y	0.1641	68.08 Y	0.1348	55.93 Y					
Butane	106-97-8	58	5.6	0.0076	2.93 U	0.0076	2.93 U	0.3192	123.03	0.3018	116.33	0.2912	112.24	0.2786	107.39					
Bromomethane	74-83-9	95	6.1	0.0268	6.32 U	0.0268	6.32 U	0.0268	6.32 U	0.0268	6.32 U	0.0268	6.32 U	0.0268	6.32 U					
Chloroethane	75-00-3	65	6.5	0.002	0.69 U	0.002	0.69 U	0.002	0.69 U	0.002	0.69 U	0.002	0.69 U	0.002	0.69 U					
Ethanol	64-17-5	46	6.8	0.005	2.43 U	0.0095	4.61 J	0.5174	251.88	0.516	251.22	0.5025	244.65	0.4776	232.5					
Acetonitrile	75-05-8	41	7.3	0.0032	1.75 U	0.0032	1.75 U	0.0236	12.88 J	0.0253	13.79 J	0.0254	13.86 J	0.0248	13.53 J					
Acetone	67-64-1	58	7.8	0.0294	11.36 J	0.006	2.31 U	3.2211	1242.29	3.0562	1178.68	3.1795	1226.26	3.0203	1164.86					
Trichlorofluoromethane	75-69-4	137	8.2	0.0079	1.29 J	0.0092	1.5 J	2.5125	409.69	2.4441	398.54	2.4892	405.9	2.4154	393.87					
Pentane	109-66-0	72	9.0	0.0024	0.75 U	0.0024	0.75 U	0.0906	28.13	0.0917	28.47	0.0948	29.42	0.0913	28.36					
1,1-Dichloroethene	75-35-4	97	9.5	0.0036	0.83 U	0.0036	0.83 U	0.0036	0.83 U	0.0055	1.27 J	0.0064	1.47 J	0.0061	1.4 J					
Methylene Chloride	75-09-2	85	9.7	0.0179	4.72 J	0.0203	5.35 J	0.025	6.6	0.025	6.59	0.0243	6.42	0.0246	6.49					
1,1,2-trichloro1,2,2-trifluoroethane	76-13-1	187	10.3	0.0044	0.53 U	0.0691	8.26	0.0207	2.47 J	0.0213	2.55 J	0.0213	2.54 J	0.0209	2.49 J					
Propanenitrile	107-12-0	55	11.1	0.005	2.03 U	0.005	2.03 U	0.0154	6.27 J	0.0149	6.05 J	0.0152	6.19 J	0.0146	5.95 J					
Propanol	71-23-8	60	11.2	0.0042	1.57 U	0.0042	1.57 U	0.5115	190.64	0.5759	214.64	0.528	196.79	0.5058	188.52					
1,1-Dichloroethane	75-34-3	99	12.0	0.0022	0.5 U	0.0022	0.5 U	0.0022	0.5 U	0.0022	0.5 U	0.0022	0.5 U	0.0022	0.5 U					
2-Butanone	78-93-3	72	12.8	0.0028	0.87 U	0.0028	0.87 U	0.9472	294.25	0.9772	303.54	0.9939	308.74	0.9458	293.81					
cis-1,2-Dichloroethene	156-59-2	97	13.6	0.0036	0.83 U	0.0036	0.83 U	0.0036	0.83 U	0.0036	0.83 U	0.0036	0.83 U	0.0036	0.83 U					
Hexane	110-54-3	86	14.0	0.0044	1.14 J	0.0057	1.47 J	0.0575	14.95	0.061	15.86	0.0609	15.82	0.0592	15.39					
Chloroform	67-66-3	119	14.2	0.0055	1.03 J	0.0057	1.07 J	0.0062	1.16 J	0.0061	1.14 J	0.0061	1.14 J	0.006	1.13 J					
Tetrahydrofuran	109-99-9	72	15.0	0.0026	0.81 U	0.0026	0.81 U	0.2612	81.14	0.2764	85.86	0.2712	84.24	0.2673	83.03					
1,2-Dichloroethane	107-06-2	99	15.6	0.0022	0.5 U	0.0022	0.5 U	0.0022	0.5 U	0.0022	0.5 U	0.0022	0.5 U	0.0022	0.5 U					
1,1,1-Trichloroethane	71-55-6	133	16.2	0.0018	0.3 U	0.0064	1.08 J	0.0087	1.46 J	0.0091	1.53 J	0.0092	1.54 J	0.0093	1.56 J					
Butanenitrile	109-74-0	69	16.2	0.005	1.62 U	0.005	1.62 U	0.005	1.62 U	0.005	1.62 U	0.005	1.62 U	0.005	1.62 U					
1-Butanol	71-36-3	74	16.8	0.009	2.72 U	0.009	2.72 U	31.5737	9541.96 *	31.8324	9620.16 *	31.3683	9479.91 *	35.6012	10759.14 *					
Benzene	71-43-2	78	17.1	0.0016	0.46 U	0.0016	0.46 U	0.0084	2.4 J	0.0081	2.32 J	0.0087	2.49 J	0.0082	2.35 J					
Carbon Tetrachloride	56-23-5	154	17.4	0.0068	0.99 J	0.0069	1.01 J	0.0074	1.07 J	0.0073	1.07 J	0.0076	1.1 J	0.0077	1.12 J					
Cyclohexane	110-82-7	84	17.6	0.005	1.33 U	0.005	1.33 U	0.005	1.33 U	0.005	1.33 U	0.005	1.33 U	0.005	1.33 U					
1,2-Dichloropropane	78-87-5	113	18.7	0.0026	0.52 U	0.0026	0.52 U	0.0026	0.52 U	0.0026	0.52 U	0.0026	0.52 U	0.0026	0.52 U					
Trichloroethene	79-01-6	131	19.1	0.0014	0.24 U	0.0014	0.24 U	0.0059	1 J	0.0064	1.1 J	0.0063	1.07 J	0.0064	1.1 J					
Heptane	142-82-5	100	19.7	0.0036	0.8 U	0.0036	0.8 U	0.0382	8.55	0.0427	9.56	0.0432	9.66	0.0425	9.5					
cis-1,3-Dichloropropene	10061-01-5	111	20.9	0.0002	0.04 U	0.0002	0.04 U	0.0002	0.04 U	0.0002	0.04 U	0.0002	0.04 U	0.0002	0.04 U					
4-Methyl-2-Pentanone	108-10-1	100	20.9	0.0058	1.3 U	0.0058	1.3 U	0.1491	33.34	0.2195	49.09	0.1585	35.44	0.1539	34.42					
Pyridine	110-86-1	79	21.0	0.0076	2.15 U	0.0076	2.15 U	0.0076	2.15 U	1.5014	425.16 S	0.1398	39.6	0.0097	2.74 J					
trans-1,3-Dichloropropene	10061-02-6	111	21.9	0.0028	0.57 U	0.0028	0.57 U	0.0028	0.57 U	0.0028	0.57 U	0.0028	0.57 U	0.0028	0.57 U					
Pentanenitrile	110-59-8	83	22.0	0.0038	1.02 U	0.0038	1.02 U	0.0079	2.12 J	0.035	9.43 J	0.0083	2.23 J	0.008	2.16 J					
1,1,2-Trichloroethane	79-00-5	133	22.4	0.0028	0.47 U	0.0028	0.47 U	0.0064	1.07 J	0.0028	0.47 U	0.007	1.18 J	0.0067	1.12 J					
Toluene	108-88-3	92	23.0	0.0024	0.58 J	0.0041	0.99 J	0.0831	20.21	0.0944	22.95	0.0946	23.01	0.0932	22.66					
1,2-Dibromoethane	106-93-4	188	24.5	0.0057	0.68 J	0.0062	0.74 J	0.003	0.36 U	0.0082	0.98 J	0.008	0.96 J	0.0084	1 J					
Octane	111-65-9	114	25.1	0.0048	0.94 U	0.0048	0.94 U	0.0048	0.94 U	0.0048	0.94 U	0.0048	0.94 U	0.0048	0.94 U					
Tetrachloroethylene	127-18-4	166	25.6	0.0034	0.46 U	0.0034	0.46 U	0.012	1.62 J	0.0137	1.85 J	0.0135	1.83 J	0.0139	1.87 J					
Chlorobenzene	108-90-7	113	27.2	0.0026	0.52 U	0.0026	0.52 U	0.0056	1.12 J	0.0064	1.26 J	0.0062	1.24 J	0.0062	1.24 J					

Table B.1 (Cont'd) SUMMA™ Analysis Results for All Target Analytes for Samples Collected from the Headspace of Tank BY-101 on 8/29/96

Target Analytes	CAS	MW	S6084-A01.040		S6084-A02.045		S6084-A04.047 ISVS		S6084-A05.072 ISVS		S6084-A05.072 Rep		S6084-A06.293 ISVS	
			Ret Time (mg/m ³)	Flag	Upwind Ambient (mg/m ³)	Flag	Ambient Through ISVS (mg/m ³)	Flag	(mg/m ³)	Flag	(mg/m ³)	Flag	(mg/m ³)	Flag
Hexamethylnitile	628-73-9	97	27.5	0.0064	1.48 U	0.0064	1.48 U	0.0064	0.1499	34.57 S	0.0087	2.01 J	0.0087	2 J
Ethylbenzene	100-41-4	106	28.0	0.0034	0.72 U	0.0034	0.72 U	0.0153	3.23 J	3.79 J	0.0171	3.61 J	0.0166	3.51 J
p/m-Xylene	106-42-3	106	28.5	0.0084	1.77 U	0.0084	1.77 U	0.0543	11.45 J	13.08 J	0.0613	12.92 J	0.0589	12.43 J
Cyclohexanone	108-94-1	98	28.9	0.0064	1.46 U	0.0064	1.46 U	0.0064	0.0541	12.36 J	0.0064	1.46 U	0.0064	1.46 U
Styrene	100-42-5	104	29.4	0.0104	2.24 U	0.0104	2.24 U	0.0104	2.24 U	2.24 U	0.0104	2.24 U	0.0104	2.24 U
1,1,2,2-Tetrachloroethane	79-34-5	168	29.6	0.0152	2.03 U	0.0152	2.03 U	0.0152	2.03 U	2.03 U	0.0152	2.03 U	0.0152	2.03 U
o-Xylene	95-47-6	106	29.7	0.0116	2.45 U	0.0116	2.45 U	0.0384	6.88 J	8.1 J	0.038	8.02 J	0.0381	8.03 J
Nonane	111-84-2	128	30.2	0.0102	1.78 U	0.0102	1.78 U	0.0156	2.73 J	3.19 J	0.0189	3.29 J	0.0189	3.31 J
1-Ethyl-2-Methyl-Benzene	611-14-3	120	33.1	0.0216	4.03 U	0.0216	4.03 U	0.0216	4.03 U	4.03 U	0.0216	4.03 U	0.0216	4.03 U
1,3,5-Trimethylbenzene	108-67-8	120	33.3	0.0172	3.21 U	0.0172	3.21 U	0.0172	3.21 U	3.21 U	0.0172	3.21 U	0.0172	3.21 U
1,2,4-Trimethylbenzene	95-63-6	120	34.6	0.0196	3.65 U	0.0196	3.65 U	0.0196	3.65 U	3.65 U	0.0196	3.65 U	0.0196	3.65 U
Decane	124-18-5	142	34.8	0.0144	2.27 U	0.0144	2.27 U	0.0173	2.73 J	3.86 J	0.0213	3.35 J	0.0208	3.28 J
1,3-Dichlorobenzene	541-73-1	147	35.1	0.0132	2.01 U	0.0132	2.01 U	0.0132	2.01 U	2.01 U	0.0132	2.01 U	0.0132	2.01 U
1,4-Dichlorobenzene	106-46-7	147	35.3	<0.132	<20	<0.132	<20	<0.132	<20	<20	<0.132	<20	<0.132	<20
1,2-Dichlorobenzene	95-50-1	147	36.4	<0.132	<20	<0.132	<20	<0.132	<20	<20	<0.132	<20	<0.132	<20
Undecane	1120-21-4	156	39.2	<0.111	<16	<0.111	<16	<0.111	<16	<16	<0.111	<16	<0.111	<16
1,2,4-Trichlorobenzene	120-82-1	181	42.6	<0.486	<60	<0.486	<60	<0.486	<60	<60	<0.486	<60	<0.486	<60
Dodecane	112-40-3	170	43.2	<0.348	<46	<0.348	<46	<0.348	<46	<46	<0.348	<46	<0.348	<46
Hexachloro-1,3-butadiene	87-68-3	261	44.4	0.0233	2 U	0.0233	2 U	0.0233	0.0233	2 U	0.0233	2 U	0.0233	2 U
Tridecane	629-50-5	184	46.9	<0.312	<38	0.4485	54.49	0.5184	62.99	<26	0.4453	54.1	0.4669	56.73
Tetradecane	629-59-4	198	50.4	<0.228	<26	<0.228	<26	<0.228	<26	<26	0.2703	30.52	<0.228	<26

J Target compound detected above the IDL but below the EQL.

S Suspect Data

U Target compound not detected at or above the IDL.

Y Initial calibration and CCV was performed; however, the analyte was not part of the current operating procedure.
* Denotes diluted value was reported for target compound in table.

Table B.2. Triple Sorbent Trap Analysis Results for All Target Analytes for Samples Collected from the Headspace of Tank BY-101 on 8/29/96

Target Analytes	CAS	MW	Ret Time	S6084-A11.1153 ISVS			S6084-A12.1154 ISVS			S6084-A12.1154 ISVS REP			S6084-A13.1155 ISVS		
				(mg/m ³)	(ppbv)	Flag	(mg/m ³)	(ppbv)	Flag	(mg/m ³)	(ppbv)	Flag	(mg/m ³)	(ppbv)	Flag
Dichlorodifluoromethane	75-71-8	121	7.8	0.0046	0.85	U	0.0045	0.83	U	0.0045	0.83	U	0.0046	0.85	U
Chloromethane	74-87-3	50	8.8	0.0034	1.5	U	0.0033	1.47	U	0.0033	1.47	U	0.0034	1.51	U
1,2-dichloro 1,1,2,2-tetrafluoroethane	76-14-2	171	9.5	0.0034	0.44	U	0.0033	0.43	U	0.0033	0.43	U	0.0034	0.45	U
Methanol	67-56-1	32	10.0	0.6821	476.85	Y	0.7867	550.03	Y	0.5646	394.74	Y	0.6719	469.72	Y
Vinyl Chloride	75-01-4	63	9.9	0.0032	1.16	U	0.0032	1.13	U	0.0032	1.13	U	0.0033	1.16	U
1,3-Butadiene	106-99-0	54	10.5	<0.208	< 86	Y	<0.208	< 86	Y	<0.208	< 86	Y	<0.208	< 86	Y
Butane	106-97-8	58	10.8	0.24	92.47		0.2363	91.03		0.2088	80.44		0.2141	82.48	
Chloroethane	75-00-3	65	12.1	0.0044	1.53	U	0.0043	1.5	U	0.0043	1.5	U	0.0044	1.54	U
Ethanol	64-17-5	46	12.5	0.3577	173.91	Y	0.3605	175.28	Y	<0.275	< 133	Y	0.3394	165.02	Y
Acetonitrile	75-05-8	41	13.0	0.0552	30.14		0.0535	29.19		0.0539	29.43		0.0437	23.83	
Acetone	67-64-1	58	13.7	1.624	626.34		1.5641	603.23		1.3714	528.9		1.6835	649.27	
Trichlorofluoromethane	75-69-4	137	14.1	1.2577	205.08		1.1557	188.46		1.1778	192.05		1.2893	210.24	
Pentane	109-66-0	72	14.9	0.0961	29.9		0.0952	29.63		0.0902	28.05		0.0903	28.09	
1,1-Dichloroethene	75-35-4	97	15.5	0.0022	0.51	U	0.0022	0.5	U	0.0022	0.5	U	0.0022	0.51	U
Methylene Chloride	75-09-2	85	15.8	0.1717	45.28	J	0.2816	74.28		0.2662	70.21		0.1066	28.13	J
1,1,2-trichloro 1,1,2,2-trifluoroethane	76-13-1	187	16.3	0.0032	0.39	U	0.0032	0.38	U	0.0032	0.38	U	0.0033	0.39	U
Propanenitrile	107-12-0	55	17.0	0.0119	4.83	J	0.0132	5.37	J	0.0101	4.09	J	0.0108	4.41	J
Propanol	71-23-8	60	17.0	0.3929	146.45		0.4354	162.28		0.3529	131.51		0.4095	152.64	
1,1-Dichloroethane	75-34-3	99	18.0	0.0015	0.34	U	0.0015	0.33	U	0.0015	0.33	U	0.0015	0.34	U
2-Butanone	78-93-3	72	18.6	0.7298	226.71		0.5881	182.69		0.6846	212.66		0.7291	226.48	
cis-1,2-Dichloroethene	156-59-2	97	19.5	0.0027	0.62	U	0.0026	0.61	U	0.0026	0.61	U	0.0027	0.62	U
Hexane	110-54-3	86	19.9	0.0738	19.17		0.0772	20.07		0.0692	17.99		0.0014	0.35	U
Chloroform	67-66-3	119	20.0	0.0031	0.58	U	0.003	0.56	U	0.003	0.56	U	0.0031	0.58	U
Tetrahydrofuran	109-99-9	72	20.7	0.2085	64.78		0.2136	66.35		0.2111	65.58		0.226	70.2	
1,2-Dichloroethane	107-06-2	99	21.4	0.0012	0.27	U	0.0012	0.26	U	0.0012	0.26	U	0.0012	0.27	U
Butanenitrile	109-74-0	69	21.8	0.0015	0.49	U	0.0015	0.48	U	0.0015	0.48	U	0.0015	0.49	U
1,1,1-Trichloroethane	71-55-6	133	21.9	0.0122	2.05	J	0.0089	1.5	J	0.0119	1.99	J	0.0107	1.79	J
1-Butanol	71-36-3	74	22.3	37.0976	11230	E	31.538	9546.64	E	38.4917	11652	E	36.2408	10970	E
Benzene	71-43-2	78	22.8	0.0096	2.75	J	0.0104	2.97	J	0.0122	3.49	J	0.0096	2.76	J
Carbon Tetrachloride	56-23-5	154	23.1	0.0015	0.22	U	0.0015	0.21	U	0.0015	0.21	U	0.0015	0.22	U
Cyclohexane	110-82-7	84	23.3	0.0399	10.62	J	0.0043	1.15	U	0.0461	12.27		0.0044	1.18	U
1,2-Dichloropropane	78-87-5	113	24.3	0.0021	0.41	U	0.002	0.4	U	0.002	0.4	U	0.0021	0.41	U
Trichloroethene	79-01-6	131	24.7	0.006	1.03	J	0.0086	1.47	J	0.0072	1.23	J	0.0042	0.71	J
Heptane	142-82-5	100	25.2	0.0626	14.01		0.0731	16.35		0.0682	15.25		0.1112	24.86	
4-Methyl-2-Pentanone	108-10-1	100	26.3	0.3311	74.05		0.2796	62.53		0.2551	57.04		0.2964	66.28	
cis-1,3-Dichloropropene	10061-01-5	111	26.3	0.0014	0.27	U	0.0013	0.26	U	0.0013	0.26	U	0.0014	0.27	U

Table B.2 (Cont'd) Triple Sorbent Trap Analysis Results for All Target Analytes for Samples Collected from the Headspace of Tank BY-101 on 8/29/96

Target Analytes	CAS	MW	Ret Time	S6084-A11.1153 ISVS			S6084-A12.1154 ISVS			S6084-A12.1154 ISVS REP			S6084-A13.1155 ISVS		
				(mg/m ³)	(ppbv)	Flag	(mg/m ³)	(ppbv)	Flag	(mg/m ³)	(ppbv)	Flag	(mg/m ³)	(ppbv)	Flag
Pyridine	110-86-1	79	26.5	0.023	6.51	U	0.0224	6.34	U	0.0224	6.34	U	0.0231	6.54	U
trans-1,3-Dichloropropene	10061-02-6	111	27.4	0.0029	0.58	U	0.0028	0.56	U	0.0028	0.56	U	0.0029	0.58	U
Pentanenitrile	110-59-8	83	27.4	0.0009	0.23	U	0.0008	0.23	U	0.0008	0.23	U	0.0009	0.23	U
1,1,2-Trichloroethane	79-00-5	133	27.8	0.0017	0.28	U	0.0016	0.27	U	0.0016	0.27	U	0.0017	0.28	U
Toluene	108-88-3	92	28.5	0.7892	191.86		0.6673	162.23		0.668	162.41		0.6506	158.16	
1,2-Dibromoethane	106-93-4	188	30.0	0.0025	0.3	U	0.0025	0.29	U	0.0025	0.29	U	0.0025	0.3	U
Octane	111-65-9	114	30.4	0.0179	3.52	J	0.0218	4.29	J	0.0194	3.81	J	0.0229	4.49	J
Tetrachloroethylene	127-18-4	166	31.0	0.0124	1.67	J	0.014	1.89	J	0.0135	1.82	J	0.0139	1.88	J
Chlorobenzene	108-90-7	113	32.6	0.0012	0.23	U	0.0012	0.23	U	0.0012	0.23	U	0.0012	0.24	U
Hexanenitrile	628-73-9	97	32.8	0.0031	0.71	U	0.003	0.69	U	0.003	0.69	U	0.0031	0.71	U
Ethylbenzene	100-41-4	106	33.4	0.2512	53		0.2149	45.34		0.2048	43.2		0.1882	39.71	
p/m-Xylene	106-42-3	106	33.9	0.7919	167.09		0.6925	146.11		0.6755	142.51		0.6016	126.93	
Cyclohexanone	108-94-1	98	34.3	0.1146	26.16	J	0.1427	32.56		0.0713	16.26	J	0.0762	17.38	J
Styrene	100-42-5	104	34.8	0.0597	12.83		0.0586	12.59		0.0537	11.54		0.0447	9.62	
1,1,2,2-Tetrachloroethane	79-34-5	168	35.0	0.0063	0.83	U	0.0061	0.81	U	0.0061	0.81	U	0.0063	0.84	U
o-Xylene	95-47-6	106	35.1	0.2331	49.18		0.1989	41.97		0.1887	39.82		0.1834	38.69	
Nonane	111-84-2	128	35.4	0.03	5.25		0.0279	4.88		0.0257	4.49		0.0283	4.95	
1-Ethyl-2-methyl benzene	611-14-3	120	38.4	0.0128	2.38	J	0.0135	2.52	J	0.0116	2.16	J	0.0101	1.87	J
1,3,5-Trimethylbenzene	108-67-8	120	38.6	0.012	2.24	J	0.013	2.42	J	0.0113	2.11	J	0.009	1.68	J
1,2,4-Trimethylbenzene	95-63-6	120	39.9	0.0282	5.26		0.0324	6.04		0.0275	5.13		0.0231	4.3	J
Decane	124-18-5	142	40.1	0.0589	9.28		0.0606	9.54		0.0534	8.41		0.046	7.24	
1,3-Dichlorobenzene	541-73-1	147	40.5	0.0156	2.38	J	0.0157	2.39	J	0.0145	2.21	J	0.012	1.83	J
1,4-Dichlorobenzene	106-46-7	147	40.7	0.0158	2.4	J	0.0159	2.42	J	0.0147	2.24	J	0.0121	1.85	J
1,2-Dichlorobenzene	95-50-1	147	41.8	0.0051	0.77	U	0.0049	0.75	U	0.0049	0.75	U	0.0051	0.78	U
Undecane	1120-21-4	156	44.4	0.0383	5.49	J	0.0498	7.15		0.045	6.46	J	0.0571	8.19	
1,2,4-Trichlorobenzene	120-82-1	181	48.0	0.0167	2.06	U	0.0163	2.01	U	0.0163	2.01	U	0.0168	2.07	U
Dodecane	112-40-3	170	48.4	0.0542	7.14	J	0.0947	12.48	J	0.0809	10.66	J	0.1478	19.48	J
Hexachloro-1,3-butadiene	87-68-3	261	49.8	0.0221	1.9	U	0.0215	1.85	U	0.0215	1.85	U	0.0222	1.91	U
Tridecane	629-50-5	184	52.2	0.1476	17.96	J	0.2198	26.76	J	0.1981	24.11	J	0.3695	44.98	J
Tetradecane	629-59-4	198	55.7	0.11	12.44	J	0.1856	20.99		0.1713	19.38		0.3058	34.59	
Tributyl Phosphate	126-73-8	266	63.1	<0.0107	<0.9	Z	<0.0104	<0.88	Z	<0.0104	<0.88	Z	<0.0107	<0.9	Z

E Target compound exceeds upper quantification limit (UQL).

J Target compound detected above the IDL but below the EQL.

U Target compound not detected at or above the IDL.

Y Initial calibration and CCV was performed; however, the analyte was not part of the current operating procedure.

Z Retention time and mass spectral characteristics were determined and detectability possible at 0.8 ppbv; however, this compound is not currently part of the analytical method. See Section 3.4.2.1 for more information.

Table B.3. Triple Sorbent Trap Analysis Results for All Target Analytes from Blank Samples Associated with the Sampling of Tank BY-101 on 8/29/96

Target Analytes	CAS	MW	Ret Time	S6084-A17.1157 ISVS			S6084-A18.1158 ISVS			S6084-A19.1159 ISVS			S6084-A20.1160 ISVS		
				FB #1			FB #2			TB #1			TB #2		
				(mg/m ³)	(ppbv)	Flag	(mg/m ³)	(ppbv)	Flag	(mg/m ³)	(ppbv)	Flag	(mg/m ³)	(ppbv)	Flag
Dichlorodifluoromethane	75-71-8	121	7.8	0.0043	0.79 U		0.0043	0.79 U		0.0043	0.79 U		0.0043	0.79 U	
Chloromethane	74-87-3	50	8.8	0.0032	1.4 U		0.0032	1.4 U		0.0032	1.4 U		0.0032	1.4 U	
1,2-dichloro-1,1,2,2-tetrafluoroethane	76-14-2	171	9.5	0.0032	0.41 U		0.0032	0.41 U		0.0032	0.41 U		0.0032	0.41 U	
Methanol	67-56-1	32	10.0	<0.274	< 192 Y		<0.274	< 192 Y		<0.274	< 192 Y		<0.274	< 192 Y	
Vinyl Chloride	75-01-4	63	9.9	0.003	1.08 U		0.003	1.08 U		0.003	1.08 U		0.003	1.08 U	
1,3-Butadiene	106-99-0	54	10.5	<0.208	< 86 Y		<0.208	< 86 Y		<0.208	< 86 Y		<0.208	< 86 Y	
Butane	106-97-8	58	10.8	0.0203	7.82 J		0.0221	8.5 J		0.0036	1.39 U		0.0036	1.39 U	
Chloroethane	75-00-3	65	12.1	0.0041	1.42 U		0.0041	1.42 U		0.0041	1.42 U		0.0041	1.42 U	
Ethanol	64-17-5	46	12.5	<0.275	< 133 Y		<0.275	< 133 Y		<0.275	< 133 Y		<0.275	< 133 Y	
Acetonitrile	75-05-8	41	13.0	0.0039	2.15 J		0.0036	1.96 J		0.0033	1.8 U		0.0033	1.8 U	
Acetone	67-64-1	58	13.7	0.0727	28.05		0.0674	26 J		0.0072	2.78 U		0.0072	2.78 U	
Trichlorofluoromethane	75-69-4	137	14.1	0.0544	8.88		0.0644	10.49		0.0044	0.72 U		0.0049	0.8 J	
Pentane	109-66-0	72	14.9	0.0169	5.25 J		0.0172	5.34 J		0.0029	0.89 U		0.0029	0.89 U	
1,1-Dichloroethene	75-35-4	97	15.5	0.0021	0.47 U		0.0021	0.47 U		0.0021	0.47 U		0.0021	0.47 U	
Methylene Chloride	75-09-2	85	15.8	0.1491	39.32 J		0.1743	45.96		0.1241	32.72 J		0.8789	231.8	
1,1,2-trichloro-1,2,2-trifluoroethane	76-13-1	187	16.3	0.003	0.36 U		0.003	0.36 U		0.003	0.36 U		0.003	0.36 U	
Propanenitrile	107-12-0	55	17.0	0.0019	0.77 U		0.0019	0.77 U		0.0019	0.77 U		0.0019	0.77 U	
Propanol	71-23-8	60	17.0	0.0053	1.99 U		0.0053	1.99 U		0.0053	1.99 U		0.0053	1.99 U	
1,1-Dichloroethane	75-34-3	99	18.0	0.0014	0.32 U		0.0014	0.32 U		0.0014	0.32 U		0.0014	0.32 U	
2-Butanone	78-93-3	72	18.6	0.0196	6.1 J,B		0.0284	8.82 B		0.0022	0.68 U		0.0022	0.68 U	
cis-1,2-Dichloroethene	156-59-2	97	19.5	0.0025	0.58 U		0.0025	0.58 U		0.0025	0.58 U		0.0025	0.58 U	
Hexane	110-54-3	86	19.9	0.0196	5.09		0.0229	5.95		0.0013	0.32 U		0.0013	0.32 U	
Chloroform	67-66-3	119	20.0	0.0029	0.53 U		0.0029	0.53 U		0.0029	0.53 U		0.0029	0.53 U	
Tetrahydrofuran	109-99-9	72	20.7	0.0066	2.05 J		0.01	3.11 J		0.0035	1.07 U		0.0035	1.07 U	
1,2-Dichloroethane	107-06-2	99	21.4	0.0011	0.25 U		0.0011	0.25 U		0.0011	0.25 U		0.0011	0.25 U	
Butanenitrile	109-74-0	69	21.8	0.0014	0.45 U		0.0014	0.45 U		0.0014	0.45 U		0.0014	0.45 U	
1,1,1-Trichloroethane	71-55-6	133	21.9	0.0084	1.41 J		0.0082	1.38 J		0.0027	0.44 U		0.0027	0.44 U	
1-Butanol	71-36-3	74	22.3	0.5426	164.24		1.2632	382.36		0.0075	2.29 U		0.0075	2.29 U	
Benzene	71-43-2	78	22.8	0.0042	1.2 J		0.0048	1.36 J		0.0014	0.4 U		0.0014	0.4 U	
Carbon Tetrachloride	56-23-5	154	23.1	0.0014	0.2 U		0.0014	0.2 U		0.0014	0.2 U		0.0014	0.2 U	
Cyclohexane	110-82-7	84	23.3	0.0041	1.09 U		0.0041	1.09 U		0.0041	1.09 U		0.0041	1.09 U	
1,2-Dichloropropane	78-87-5	113	24.3	0.0019	0.38 U		0.0019	0.38 U		0.0019	0.38 U		0.0019	0.38 U	
Trichloroethene	79-01-6	131	24.7	0.0054	0.93 J		0.0063	1.08 J		0.0037	0.63 J		0.0275	4.69 J	
Heptane	142-82-5	100	25.2	0.0216	4.82		0.0435	9.73		0.0015	0.35 U		0.0015	0.35 U	
4-Methyl-2-Pentanone	108-10-1	100	26.3	0.1416	31.67		0.1451	32.45		0.0021	0.46 U		0.0021	0.46 U	
cis-1,3-Dichloropropene	10061-01-5	111	26.3	0.0013	0.25 U		0.0013	0.25 U		0.0013	0.25 U		0.0013	0.25 U	
Pyridine	110-86-1	79	26.5	0.0214	6.06 U		0.0214	6.06 U		0.0214	6.06 U		0.0214	6.06 U	
trans-1,3-Dichloropropene	10061-02-6	111	27.4	0.0027	0.53 U		0.0027	0.53 U		0.0027	0.53 U		0.0027	0.53 U	

Table B.3 (Cont'd) Triple Sorbent Trap Analysis Results for All Target Analytes from Blank Samples Associated with the Sampling of Tank BY-101 on 8/29/96

Target Analytes	CAS	MW	Ret Time	S6084-A17.1157 ISVS			S6084-A18.1158 ISVS			S6084-A19.1159 ISVS			S6084-A20.1160 ISVS		
				FB #1	FB #2	Flag	FB #1	FB #2	Flag	TB #1	TB #2	Flag	TB #1	TB #2	Flag
				(mg/m ³)	(ppbv)		(mg/m ³)	(ppbv)		(mg/m ³)	(ppbv)		(mg/m ³)	(ppbv)	
Pentanenitrile	110-59-8	83	27.4	0.0008	0.22 U		0.0008	0.22 U		0.0008	0.22 U		0.0008	0.22 U	
1,1,2-Trichloroethane	79-00-5	133	27.8	0.0015	0.26 U		0.0015	0.26 U		0.0015	0.26 U		0.0015	0.26 U	
Toluene	108-88-3	92	28.5	0.4407	107.15		0.4426	107.59		0.0011	0.28 J		0.003	0.74 J	
1,2-Dibromoethane	106-93-4	188	30.0	0.0024	0.28 U		0.0024	0.28 U		0.0024	0.28 U		0.0024	0.28 U	
Octane	111-65-9	114	30.4	0.0027	0.52 U		0.0027	0.52 U		0.0027	0.52 U		0.0027	0.52 U	
Tetrachloroethylene	127-18-4	166	31.0	0.0031	0.41 J		0.0025	0.34 U		0.0025	0.34 U		0.0025	0.34 U	
Chlorobenzene	108-90-7	113	32.6	0.0011	0.22 U		0.0011	0.22 U		0.0011	0.22 U		0.0011	0.22 U	
Hexanenitrile	628-73-9	97	32.8	0.0029	0.66 U		0.0029	0.66 U		0.0029	0.66 U		0.0029	0.66 U	
Ethylbenzene	100-41-4	106	33.4	0.1203	25.38		0.1173	24.75		0.0014	0.3 U		0.0014	0.3 U	
p/m-Xylene	106-42-3	106	33.9	0.3694	77.93		0.3601	75.97		0.003	0.63 U		0.003	0.63 U	
Cyclohexanone	108-94-1	98	34.3	0.0695	15.85 J		0.0888	20.27 J		0.0125	2.85 U		0.0125	2.85 U	
Styrene	100-42-5	104	34.8	0.0286	6.14		0.0274	5.9		0.0015	0.33 U		0.0015	0.33 U	
1,1,2,2-Tetrachloroethane	79-34-5	168	35.0	0.0058	0.77 U		0.0058	0.77 U		0.0058	0.77 U		0.0058	0.77 U	
o-Xylene	95-47-6	106	35.1	0.108	22.78		0.1006	21.22		0.0019	0.4 U		0.0019	0.4 U	
Nonane	111-84-2	128	35.4	0.0122	2.13 J		0.0112	1.95 J		0.0013	0.22 U		0.0013	0.22 U	
1-Ethyl-2-methyl benzene	611-14-3	120	38.4	0.0062	1.15 J		0.0061	1.13 J		0.0024	0.44 U		0.0024	0.44 U	
1,3,5-Trimethylbenzene	108-67-8	120	38.6	0.006	1.12 J		0.0057	1.06 J		0.0024	0.44 U		0.0024	0.44 U	
1,2,4-Trimethylbenzene	95-63-6	120	39.9	0.015	2.79 J		0.015	2.8 J		0.0025	0.47 U		0.0025	0.47 U	
Decane	124-18-5	142	40.1	0.0316	4.97		0.0295	4.64 J		0.003	0.47 U		0.003	0.47 U	
1,3-Dichlorobenzene	541-73-1	147	40.5	0.0082	1.24 J		0.0069	1.04 J		0.0032	0.48 U		0.0032	0.48 U	
1,4-Dichlorobenzene	106-46-7	147	40.7	0.0082	1.25 J		0.0069	1.05 J		0.0029	0.43 U		0.0029	0.43 U	
1,2-Dichlorobenzene	95-50-1	147	41.8	0.0047	0.72 U		0.0047	0.72 U		0.0047	0.72 U		0.0047	0.72 U	
Undecane	1120-21-4	156	44.4	0.0154	2.22 J		0.0165	2.37 J		0.0044	0.63 U		0.0044	0.63 U	
1,2,4-Trichlorobenzene	120-82-1	181	48.0	0.0155	1.91 U		0.0155	1.91 U		0.0155	1.91 U		0.0155	1.91 U	
Dodecane	112-40-3	170	48.4	0.0255	3.36 U		0.0255	3.36 U		0.0255	3.36 U		0.0255	3.36 U	
Hexachloro-1,3-butadiene	87-68-3	261	49.8	0.0205	1.76 U		0.0205	1.76 U		0.0205	1.76 U		0.0205	1.76 U	
Tridecane	629-50-5	184	52.2	0.054	6.57 U		0.054	6.57 U		0.054	6.57 U		0.054	6.57 U	
Tetradecane	629-59-4	198	55.7	0.0577	6.53 J		0.0355	4.01 J		0.0106	1.2 J		0.023	2.6 J	
Tributyl Phosphate	126-73-8	266	63.1	<0.0099	<0.83 Z		<0.0099	<0.83 Z		<0.0099	<0.83 Z		<0.0099	<0.83 Z	

B Compound found in associated laboratory blank.

J Target compound detected above the IDL but below the EQL.

U Target compound not detected at or above the IDL.

Y Initial calibration and CCV was performed; however, the analyte was not part of the current operating procedure.

Z Retention time and mass spectral characteristics were determined and detectability possible at 0.8 ppbv;
however, this compound is not currently part of the analytical method. See Section 3.4.2.1 for more information.

Distribution List

PNNL-11475

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