RMIS View/Print Document Cover Sheet

This document was retrieved from the Boeing ISEARCH System.

Accession #: D196054401

Document #: SD-WM-ER-419

Title/Desc:

TANK 241BY105 HEADSPACE GAS & VAPOR
CHARACTERIZATION RESULTS FOR SAMPLES COLLECTED IN
5/1994 & 7/1994

ENGINEERING CHANGE NOTICE

Page 1 of 21. ECN No **625439**Proj.
ECN

2. ECN Category (mark one) Supplemental ☐ Direct Revision ☒ Change ECN ☐ Temporary ☐ Standby ☐ Supersedure ☐ Cancel/Void ☐	3. Originator's Name, Organization, MSIN, and Telephone No. D. R. BRATZEL, 75640, S7-21, 373-3579	3a. USQ Required? ☐ Yes ☒ No	4. Date 09/27/95
	5. Project Title/No./Work Order No. TANK 241-BY-105 HEADSPACE GAS AND VAPOR CHARACTERIZATION RESULTS FOR SAMPLES COLLECTED IN MAY 1994 AND JUNE 1994	6. Bldg./Sys./Fac. No. 2704HV/200E	7. Approval Designator N/A
11a. Modification Work ☐ Yes (fill out Blk. 11b) ☒ No (NA Blks. 11b, 11c, 11d)	11b. Work Package No. N/A	11c. Modification Work Complete N/A Cog. Engineer Signature & Date	11d. Restored to Original Condition (Temp. or Standby ECN only) N/A Cog. Engineer Signature & Date
12. Description of Change Title change and complete rewrite.			
13a. Justification (mark one) Criteria Change ☒ Design Improvement ☐ Environmental ☐ Facility Deactivation ☐ As-Found ☐ Facilitate Const ☐ Const. Error/Omission ☐ Design Error/Omission ☐			
13b. Justification Details Complete rewrite which includes all vapor sampling events to date and data qualification.			
14. Distribution (include name, MSIN, and no. of copies) See attached Distribution Sheet			RELEASE STAMP OFFICIAL RELEASE 3 BY WHC DATE SEP 28 1995 Sta. 4

ENGINEERING CHANGE NOTICE				Page 2 of 2		1. ECN (use no. from pg. 1) 625439													
15. Design Verification Required ☐ Yes ☒ No		16. Cost Impact <table border="0"> <tr> <td colspan="2">ENGINEERING</td> <td colspan="2">CONSTRUCTION</td> </tr> <tr> <td>Additional</td> <td>☐ \$</td> <td>Additional</td> <td>☐ \$</td> </tr> <tr> <td>Savings</td> <td>☐ \$</td> <td>Savings</td> <td>☐ \$</td> </tr> </table>				ENGINEERING		CONSTRUCTION		Additional	☐ \$	Additional	☐ \$	Savings	☐ \$	Savings	☐ \$	17. Schedule Impact (days) Improvement ☐ Delay ☐	
ENGINEERING		CONSTRUCTION																	
Additional	☐ \$	Additional	☐ \$																
Savings	☐ \$	Savings	☐ \$																

18. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 12. Enter the affected document number in Block 19.					
SDD/DD	☐	Seismic/Stress Analysis	☐	Tank Calibration Manual	☐
Functional Design Criteria	☐	Stress/Design Report	☐	Health Physics Procedure	☐
Operating Specification	☐	Interface Control Drawing	☐	Spares Multiple Unit Listing	☐
Criticality Specification	☐	Calibration Procedure	☐	Test Procedures/Specification	☐
Conceptual Design Report	☐	Installation Procedure	☐	Component Index	☐
Equipment Spec.	☐	Maintenance Procedure	☐	ASME Coded Item	☐
Const. Spec.	☐	Engineering Procedure	☐	Human Factor Consideration	☐
Procurement Spec.	☐	Operating Instruction	☐	Computer Software	☐
Vendor Information	☐	Operating Procedure	☐	Electric Circuit Schedule	☐
OM Manual	☐	Operational Safety Requirement	☐	ICRS Procedure	☐
FSAR/SAR	☐	IEFD Drawing	☐	Process Control Manual/Plan	☐
Safety Equipment List	☐	Cell Arrangement Drawing	☐	Process Flow Chart	☐
Radiation Work Permit	☐	Essential Material Specification	☐	Purchase Requisition	☐
Environmental Impact Statement	☐	Fac. Proc. Samp. Schedule	☐	Tickler File	☐
Environmental Report	☐	Inspection Plan	☐		☐
Environmental Permit	☐	Inventory Adjustment Request	☐		☐

19. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.

Document Number/Revision	Document Number/Revision	Document Number Revision

20. Approvals			
Signature	Date	Signature	Date
<u>OPERATIONS AND ENGINEERING</u>		<u>ARCHITECT-ENGINEER</u>	
Cog. Eng. D. R. Bratzel <i>DRB</i>	<i>9/25/95</i>	PE	
Cog. Mgr. T. J. Kelley <i>TJ Kelley</i>	<i>9/25/95</i>	QA	
QA		Safety	
Safety		Design	
Environ.		Environ.	
Other		Other	
Proj.			
Proj.			
Proj.			
Proj.			
		<u>DEPARTMENT OF ENERGY</u>	
		Signature or a Control Number that tracks the Approval Signature	
		<u>ADDITIONAL</u>	

Signature	Date	Signature	Date
<u>OPERATIONS AND ENGINEERING</u>		<u>ARCHITECT-ENGINEER</u>	
Cog. Eng. D. R. Bratzel <i>DRB</i>	<i>9/25/95</i>	PE	
Cog. Mgr. T. J. Kelley <i>TJK</i>	<i>7/25/95</i>	QA	
QA		Safety	
Safety		Design	
Environ.		Environ.	
Other		Other	
Proj.			
Proj.			
Proj.			
Proj.			
		<u>DEPARTMENT OF ENERGY</u>	
		Signature or a Control Number that tracks the Approval Signature	
		<u>ADDITIONAL</u>	

OPERATIONS AND ENGINEERING

Cog. Eng. D. R. Bratzel *DRB*
Cog. Mgr. T. J. Kelley *TJ Kelley*
QA

QA

Safety

Environ.Other

Proj.

Proj.

Proj.Proj.

ARCHITECT-ENGINEER

PEQA

Safety

Design

Environ.OtherDEPARTMENT OF ENERGY

Signature or a Control Number that tracks the Approval Signature

ADDITIONAL

RELEASE AUTHORIZATION

Document Number: WHC-SD-WM-ER-419, REV 2

Document Title: Tank 241-BY-105 Headspace Gas and Vapor
Characterization Results for Samples Collected in
May 1994 and July 1994

Release Date: 9/28/95

**This document was reviewed following the
procedures described in WHC-CM-3-4 and is:**

APPROVED FOR PUBLIC RELEASE

WHC Information Release Administration Specialist:

Kara Broz

TRADEMARK DISCLAIMER. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors.

This report has been reproduced from the best available copy. Available in paper copy. Printed in the United States of America. To obtain copies of this report, contact:

Westinghouse Hanford Company - Document Control Services
P.O. Box 1970, Mailstop H6-08, Richland, WA 99352
Telephone: (509) 372-2420; Fax: (509) 376-4989

THIS PAGE INTENTIONALLY LEFT BLANK

SUPPORTING DOCUMENT

1. Total Pages **59**

2. Title

TANK 241-BY-105 HEADSPACE GAS AND VAPOR
CHARACTERIZATION RESULTS FOR SAMPLES COLLECTED IN
MAY 1994 AND JULY 1994

3. Number

WHC-SD-WM-ER-419

4. Rev No.

2

5. Key Words

CHARACTERIZATION OBJECTIVES, TANK HEADSPACE,
SAMPLING EVENT, INORGANIC GASES, ORGANIC VAPORS

6. Author

Name: D. R. BRATZEL

DER-j 9/25/95
Signature

Organization/Charge Code 75640/N4AB1

7. Abstract

Significant changes have been made to all of the original vapor characterization reports. This report documents specific headspace gas and vapor characterization results for all vapor sampling events to date. In addition, changes have been made to the original vapor reports to qualify the data based on quality assurance issues associated with the performing laboratories.

8. RELEASE STAMP

OFFICIAL RELEASE
BY WHC
DATE - SEP 28 1995

Sta. 4

THIS PAGE INTENTIONALLY LEFT BLANK

THIS PAGE INTENTIONALLY LEFT BLANK

Tank 241-BY-105 Headspace Gas and Vapor Characterization Results for Samples Collected in May 1994 and July 1994

J. L. Huckaby
Pacific Northwest Laboratories

D. R. Bratzel
Westinghouse Hanford Company

Date Published
September 1995

Prepared for the U.S. Department of Energy
Office of Environmental Restoration and
Waste Management

Westinghouse
Hanford Company

P.O. Box 1970
Richland, Washington

Management and Operations Contractor for the
U.S. Department of Energy under Contract DE-AC06-87RL10930

Approved for Public Release

THIS PAGE INTENTIONALLY LEFT BLANK

Contents

1.0 INTRODUCTION	1
1.1 Characterization Objectives	1
1.2 Characterization Data Criteria	1
1.3 Sampling Overview	1
1.4 Tank Headspace Dynamics	2
2.0 SAMPLING EVENT	3
2.1 May 1994 <i>In Situ</i> Sampling Event	3
2.2 July 1994 Vapor Sampling System Sampling Event	3
3.0 INORGANIC GASES AND VAPORS	4
3.1 Ammonia, Hydrogen, and Nitrous Oxide	4
3.2 Carbon Dioxide and Carbon Monoxide	4
3.3 Nitric Oxide, Nitrogen Dioxide, Water and Tritium	5
3.4 Hydrogen Cyanide	5
3.5 Discussion of Inorganic Gases and Vapors	5
4.0 ORGANIC VAPORS	7
4.1 Positively Identified Organic Analytes	7
4.2 Tentatively Identified Organic Analytes	8
4.3 Total Nonmethane Organic Carbon	9
4.4 Discussion of Organic Analytes	9
5.0 SUMMARY	11
6.0 REFERENCES	12

Acronyms and Abbreviations

CES	consensus exposure standard
EPA	Environmental Protection Agency
GC	gas chromatograph
GC/MS	gas chromatograph/mass spectrometer
ISS	<i>in situ</i> sampling
LFL	lower flammability limit
MS	mass spectrometer
NFPA	National Fire Protection Association
NPH	normal paraffinic hydrocarbon
ORNL	Oak Ridge National Laboratory
PNL	Pacific Northwest Laboratory
ppmv	parts per million by volume, 1 ppmv = 10 ⁻⁴ vol%
TNMOC	total nonmethane organic carbon
TST	triple sorbent trap
vol%	percent by volume, 1 vol% = 10,000 ppmv
VSS	vapor sampling system
WHC	Westinghouse Hanford Company

Acknowledgements

The author wishes to thank Chris Simonen for her work verifying data and generating tables, and Shas Mattigod for his help with the construction and reviews of this document.

**Tank 241-BY-105 Headspace Gas and Vapor Characterization Results
for Samples Collected in May 1994 and July 1994**

1.0 INTRODUCTION

1.1 Characterization Objectives

Tank BY-105 headspace gas and vapor samples were collected and analyzed to help determine the potential risks of fugitive emissions to tank farm workers. The drivers and objectives of waste tank headspace sampling and analysis are discussed in *Program Plan for the Resolution of Tank Vapor Issues* (Osborne and Huckaby 1994). This report primarily discusses results from the July 1994 sampling event, but also includes selected results of the May 1994 sampling event. The tank BY-105 headspace was sampled in May 1994 in accordance with *Safety Assessment for Gas Sampling All Ferrocyanide Tanks* (Farley 1991), and in July 1994 in accordance with *Data Quality Objectives for Generic In-Tank Health and Safety Issue Resolution* (Osborne et al. 1994).

1.2 Characterization Data Criteria

Data Quality Objectives for Generic In-Tank Health and Safety Issue Resolution describes parameters for data collection to ensure appropriate conclusions can be drawn from the data. Tank headspace characterization data were collected to help in the evaluation of 1) headspace flammability, and 2) identification and quantification of compounds of toxicological concern.

Single Shell Tank Interim Operational Safety Requirements (Dougherty 1995) specifies that combustible constituents in tank headspaces be maintained below 25 % of the lower flammability limit (LFL). This essentially agrees with National Fire Protection Association requirements that combustible concentrations be maintained at or below 25 % of the LFL (NFPA 1992). Current governing operating specifications for Watchlist tanks, such as tank BY-105, specify that combustible constituents be maintained at or below 20 % of the LFL (WHC 1995a).

Headspace characterization data are used by Westinghouse Hanford Company (WHC) Tank Waste Remediation Systems Industrial Hygiene as source term data in the industrial hygiene strategy to protect workers from tank fugitive emissions. Because selection of worker protective equipment must be based on industrial hygiene monitoring of the work place and not on source term data (29 CFR 1910.120), tank headspace characterization data can not be used for this purpose. Furthermore, because there are mechanisms by which headspace constituents can be either diluted or concentrated as they are released to the atmosphere, the headspace characterization data should not be considered to be representative of emissions at the point of emission.

These statements notwithstanding, the data quality objectives document specifies that the industrial hygiene group be advised if constituents with toxicological properties exceed 50 % of the appropriate consensus exposure standard (CES) for non-carcinogens, or 10 % of the appropriate CES for carcinogens. A CES is defined as the most stringent of known regulatory or recommended toxicological values for the workplace (Osborne et al. 1994).

1.3 Sampling Overview

Tank BY-105 was vapor sampled in May 1994 using the *in situ* sampling (ISS) method, and again in July 1994 using the more robust vapor sampling system (VSS) method. Because the ISS sample volume flow measurement used during the May 1994 event was inherently less accurate than that of the VSS, the sorbent trap samples from the ISS event are not considered to be equivalent to those from the VSS sampling event (Huckaby et al. 1995). Furthermore, there are other discrepancies between results from the ISS and VSS methods that are not understood (Huckaby 1994a), and until the ISS method has been validated and the discrepancies resolved, results from early ISS events should be considered suspect.

Nevertheless, a brief description of the ISS event and hydrogen cyanide sampling results from the May 1994 ISS event are presented below, because this analyte was not sampled for during the VSS event. Huckaby et al. (1995) describe the bases for using the ISS method for hydrogen cyanide, and why it was not sampled for during the VSS event. All other results presented here are from the July 1994 VSS sampling event.

Samples collected are thought to have been representative of the tank headspace when the tank was sampled (Meacham et al. 1995), and sample analyses were designed to provide a reasonably accurate and complete characterization of the significant headspace constituents. No assessment has been made of how the tank BY-105 headspace composition changes with time, though studies of tank C-103 suggest that composition changes probably occur very slowly in passively ventilated tanks, such as tank BY-105 (Huckaby and Story 1994).

1.4 Tank Headspace Dynamics

Tank BY-105 is the second tank in a 3-tank cascade with tanks BY-104 and BY-106. It is connected to both tanks BY-104 and BY-106 via a 7.4-cm (2.9-in.) inside diameter, 7.6-m (25-ft) long underground cascade lines. Since these cascade lines connect the headspaces of these tanks, gases and vapors originating from the wastes in tank BY-104 or BY-106 may be transferred to tank BY-105 (unless the cascade lines are obstructed).

The cascade of tanks BY-104, BY-105, and BY-106 is passively ventilated, which means that the tanks are allowed to exhale air, waste gases, and vapors as the barometric pressure falls, and inhale ambient air as the barometric pressure rises. Each of these tanks has its own filtered breather riser. Barometric pressure typically rises and falls on a diurnal cycle, producing an average daily exchange of air equal to about 0.46 % of each tank headspace (Huckaby 1994b). Changes in the concentrations of tank headspace constituents due to barometric pressure changes are consequently very slow.

2.0 SAMPLING EVENT

2.1 May 1994 *In Situ* Sampling Event

Tank BY-105 was sampled using ISS methods on May 9, 1994 by WHC Sampling and Mobile Laboratories. This sampling was conducted to satisfy requirements of *Safety Assessment for Gas Sampling All Ferrocyanide Tanks* (Farley 1991). Samples were collected from a point approximately 6.7 m below the top of the flange on riser 12A, between 5:00 p.m. and 6:00 a.m.

Huckaby et al. (1995) give a general description of the ISS method and equipment. Pingel (1994) provides field sampling information for the tank BY-105 May 1994 ISS event, and Mahon (1995) provides revised sample volume measurements. In addition to the hydrogen cyanide and hydrogen gas results presented below, McVeety et al. (1995a) provide sample preparation and analysis results for selected organic and inorganic vapors, and Rasmussen (1994a) provide SUMMA™ canister analyses for selected gases.

2.2 July 1994 Vapor Sampling System Sampling Event

Headspace vapor samples were collected from tank BY-105 using the VSS on July 7, 1994 by WHC Sampling and Mobile Laboratories (WHC 1995b). Sample collection and analysis were performed as directed by the sample and analysis plan (Appendix A, WHC 1995b). The tank headspace temperature was determined to be 26 °C. Air from the tank BY-105 headspace was withdrawn via a heated sampling probe mounted in riser 10A, and transferred via heated tubing to the VSS sampling manifold. All heated zones of the VSS were maintained at approximately 65 °C.

Sampling media were prepared and analyzed by WHC, Oak Ridge National Laboratories (ORNL), Pacific Northwest Laboratories (PNL), and Oregon Graduate Institute of Science and Technology (OGIST) through a contract with Sandia National Laboratories. The 46 tank air samples and 2 ambient air control samples collected are listed in Table 2-1 by analytical laboratory. Table 2-1 also lists the 10 trip blanks provided by the laboratories.

A general description of vapor sampling and sample analysis methods is given by Huckaby et al. (1995). The sampling equipment, sample collection sequence, sorbent trap sample air flow rates and flow times, chain of custody information, and a discussion of the sampling event itself are given in WHC 1995b.

3.0 INORGANIC GASES AND VAPORS

Analytical results of sorbent trap and SUMMA^{TM,1} canister tank air samples for selected inorganic gases and vapors are given in Table 3-1 in parts per million by volume (ppmv) in dry air. The concentration of water vapor given in Table 3-1 has been adjusted to tank conditions as given in Section 3.3. Inorganic analyte sorbent traps were prepared and analyzed by PNL, and SUMMATM canisters were analyzed for inorganic analytes by OGIST. Reports by PNL (McVeety et al. 1995a) and OGIST (Rasmussen 1994b) describe sample preparation and analyses.

All inorganic sorbent trap samples from the May 1994 and July 1994 sampling events were analyzed by PNL within 52 and 21 days, respectively, of sample collection (Ligothe 1995). These samples were prepared and analyzed under PNL quality assurance impact level 3 guidelines.

WHC delayed shipment of SUMMATM canister samples from the July 1994 to OGIST, so analyses at OGIST were not begun until 67 days after the samples were collected. This exceeded the administratively chosen 60-day holding time limit of the WHC quality assurance project plan. Because OGIST did not have a WHC-approved quality assurance project plan in place when samples were analyzed, the OGIST data should be considered secondary results. In Table 3-1 and elsewhere in this report, the OGIST data are bracketed to distinguish them as secondary.

3.1 Ammonia, Hydrogen, and Nitrous Oxide

The reported ammonia concentration in the headspace of tank BY-105 was 43 ppmv. Ammonia concentrations at this level are not uncommon in the waste tank headspaces, and have been observed to be as high as 1080 ppmv in tank BY-108 (McVeety et al. 1995b). The 43 ppmv ammonia concentration in tank BY-105 is lower than that in most other passively ventilated tanks that have been sampled, but within the normal range. Given the LFL of ammonia in air is about 15 % by volume (vol%), the measured 43 ppmv corresponds to less than 0.04 % of the LFL, and does not contribute appreciably to the flammability of the headspace.

Analysis of hydrogen in SUMMATM canister samples from the July 1994 was not reported by OGIST. The 3 SUMMATM canister samples from the May 1994 ISS event were reported by OGIST to have an average [47.9 ppmv] of hydrogen. In general, hydrogen is of concern as a fuel. The measured [47.9 ppmv] of hydrogen in tank BY-105, however, represents only about 0.1 % of the LFL for hydrogen in air, and is not a flammability concern at this level.

Nitrous oxide in tank BY-105 was measured by OGIST to be [49.5 ppmv]. This is a relatively low concentration of nitrous oxide compared to other passively ventilated tanks, though it is within the range of typical values. Table 3-2 lists this and other constituents of tanks BY-104, BY-105, and BY-106 for comparison. Under proper conditions, nitrous oxide can serve as an oxidizer to support combustion. However, Cashdollar et al. (1992) found that nitrous oxide had no significant effect on the flammability of hydrogen and air mixtures for hydrogen concentrations less than 20 vol%, and that "small amounts of nitrous oxide (relative to air) do not appear to have much effect on the flammability". Their results suggest the measured nitrous oxide concentration is much too low to have a significant effect on the flammability of the tank BY-105 headspace.

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

3.2 Carbon Dioxide and Carbon Monoxide

The average measured headspace carbon dioxide concentration, 94 ppmv, is markedly lower than normal ambient air concentrations of about 350 to 400 ppmv. Carbon dioxide introduced by air exchange with the atmosphere is readily absorbed by caustic supernatant and interstitial liquids of the waste tanks, and converted to carbonate in solution. It is reasonable to expect the level of carbon dioxide in a tank headspace will therefore depend on the tank's breathing rate, and the pH and surface area of aqueous waste (i.e., supernate, interstitial liquid, and condensate) in the tank.

Carbon monoxide in the tank BY-105 headspace, at about [0.38 ppmv], is above its normal concentration in ambient air, where it typically is about 0.05 to 0.15 ppmv. Carbon monoxide may be a decomposition product of organic waste in the tank. Tanks known to have significantly higher organic vapor concentrations have also been observed to have higher carbon monoxide concentrations.

3.3 Nitric Oxide, Nitrogen Dioxide, Water and Tritium

Nitric oxide and nitrogen dioxide concentrations in the tank BY-105 headspace were determined to be 0.10 ppmv and ≤ 0.02 ppmv, respectively. These are both acid gases that would have very low equilibrium concentrations above the high pH interstitial liquid in tank BY-105. The measurable presence of nitric oxide is not uncommon in waste tank headspaces, and may be due to its formation from oxygen and nitrogen in the radiation field of the headspace. These constituents could potentially serve as oxidizers to support combustion, but at the measured concentrations would have a negligible effect on the flammability of the tank BY-105 headspace.

The water vapor concentration of tank BY-105 was determined to be about 14.9 mg/L at the measured headspace temperature of 26 °C and pressure of 991 mbar (745 torr), (WHC 1995b). This corresponds to water vapor partial pressure of 20.6 mbar (15.5 torr), to a dew point of 18.0 °C, and to a relative humidity of about 61 %.

Tritium was tested for using silica gel sorbent traps. It is assumed that tritium produced by the waste combines with hydroxide ions to form tritium-substituted water. Evaporation of the tritium-substituted water would then result in airborne radioactive contamination. Silica gel sorbent traps adsorb virtually all (normal and tritium-substituted) water vapor from the sampled tank air, and are analyzed at the WHC 222-S laboratory. Analysis of the silica gel indicated the total activity of the headspace to be below 50 pCi/L (WHC 1995b).

3.4 Hydrogen Cyanide

Analysis of the hydrogen cyanide specific sorbent traps indicated the concentration of this analyte to ≤ 0.005 ppmv in all 3 samples. The absence of hydrogen cyanide at measurable concentrations is consistent with the expectation that an acid gas, such as hydrogen cyanide, would not exist at significant concentrations above the caustic waste in tank BY-105. No hydrogen cyanide has been detected in any of the 10 waste tank headspaces sampled for this analyte (Huckaby et al. 1995).

3.5 Discussion of Inorganic Gases and Vapors

Aside from water vapor and carbon dioxide, the most abundant waste constituents in the tank BY-105 headspace are ammonia, hydrogen, and nitrous oxide. These have been detected in most tank

headspaces sampled to date, and usually are the dominate waste species. As indicated in Table 3-2, has the lowest concentrations of ammonia and nitrous oxide in the tank BY-104, BY-105, and BY-106 cascade.

The relative standard deviations of the inorganic gas and vapor results given in the last column in Table 3-1 are very good. Relative standard deviations range from 0.6 % for nitrous oxide to 27 % for nitric oxide. The nitric oxide precision is relatively poor because the quantities measured are close to the level of inherent contaminant in the samples. Because the precision reported depends both on sampling parameters (e.g., sample flow rate and flow time for sorbent traps) and analytical parameters (e.g., sample preparation, dilutions, etc.), the small relative standard deviations suggest proper control was maintained both in the field and in the laboratories.

As discussed briefly in Section 1.4, it is possible that gases and vapors generated by the waste in tanks BY-104 and BY-106 could be transferred to tank BY-105 via the cascade lines. If significant exchange of selected inorganic gases and vapors were taking place between adjacent tanks, either their headspace compositions would be very similar (if the exchange was mutual), or all constituents detected in one tank would be at or equal or higher concentrations in the other tank (if air flowed predominantly from 1 tank to the other). Data given in Table 3-2 do not clearly indicate the presence or lack of air exchange between tank BY-105 and either tank BY-104 or BY-106.

4.0 ORGANIC VAPORS

Organic vapors in the tank BY-105 headspace were sampled using SUMMA™ canisters, which were analyzed at PNL, and triple sorbent traps (TSTs), which were analyzed by ORNL. None of the positively or tentatively identified organic analytes were at or above levels of concern. Both laboratories used a gas chromatograph (GC) equipped with a mass spectrometer (MS) detector to separate, identify, and quantitate the analytes. Descriptions of sample device cleaning, sample preparations, and analyses are given by Jenkins et al. (1994) and Pool et al. (1995). A quantitative measurement of the total organic vapor concentration by the U.S. Environmental Protection Agency (EPA) task order 12 (TO-12) method was also performed by OGIST (EPA 1988, Rasmussen 1994b).

SUMMA™ sample results by PNL should be considered to be the primary organic vapor data for tank BY-105. These results were produced at PNL quality assurance impact level 3, and all PNL analyses were completed 19 days after sample collection (Ligotke 1995), well within the administratively chosen 60-day holding time (Keller 1994). No study has been performed to determine the stability of organic analytes in SUMMA™ canisters in the chemical matrix of waste tank samples.

ORNL analyses of TST samples from this and other waste tanks generally agree with, support, and augment the SUMMA™ sample results. However, because certain WHC quality assurance requirements were not satisfied by ORNL, the quality assurance assessment of ORNL by Hendrickson (1995) should be reviewed before results unique to the TST samples are used for decision making.

All TSTs prepared by ORNL had 3 surrogate compounds added to evaluate sample matrix effects, potential handling, storage, and shipment problems, and analytical instrumentation performance (Jenkins et al. 1995a). ORNL evaluated the surrogate recoveries using a statistical approach similar to that prescribed by *SW 846 Method 8260A Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS) Capillary Column Technique* (EPA 1992). Using this approach, ORNL reported that all surrogates had standard deviation values within the 95 % confidence interval for variance, indicating that no bias was introduced in the measurement of analyte quantities (Jenkins 1995a).

4.1 Positively Identified Organic Analytes

Positive identification of organic analytes using the methods employed by PNL and ORNL involves matching the GC retention times and MS data from a sample with that obtained by analysis of standards. The concentration of an analyte in the sample is said to be quantitatively measured if the response of the GC/MS has been established at several known concentrations of that analyte (i.e., the GC/MS has been calibrated for that analyte), and the MS response to the analyte in the sample is between the lowest and highest responses to the known concentrations (i.e., the analyte is within the calibration range).

ORNL and PNL were assigned different lists of organic compounds, or target analytes, to positively identify and measure quantitatively. The ORNL target analyte list was derived from a review of the tank C-103 headspace constituents by a panel of toxicology experts (Mahlum et al. 1994). The PNL target analyte list included 40 compounds in the Environmental Protection Agency (EPA) task order 14 (TO-14) method, which are primarily halocarbons and common industrial solvents (EPA 1988), plus 14 analytes selected mainly from the toxicology panel's review of vapor data on tank C-103.

Given in Table 4-1 are the organic compounds positively identified and quantitated in SUMMA™ canister samples by PNL. PNL performed analyses according to the EPA TO-14 methodology (EPA 1988, Pool et al. 1995). Only 4 of the 40 TO-14 analytes were observed to be above the 0.002 ppmv quantitation limit of the analyses. Averages reported are from analyses of 3 SUMMA™ canister samples except where noted. The OGIST measurement of methane is also included in Table 4-1.

ORNL positively identified 26 of 27 analytes selected by WHC, (1 analyte, 1,1-dichloroethene, was below its detection limit). Despite calibration of the instrument over about a 20-fold concentration range, 19 of the 26 positively identified compounds were measured to be outside of the calibration range in at least 1 of the TST samples. The 7 positively identified compounds which were measured to be within the instrument calibration range, and consequently were quantitated, are given in Table 4-2 with their reported 4-TST average concentrations. These 19 positively identified analytes which were not quantitated are listed in Tables 4-3 and 4-4. One compound, butanal, is given in Table 4-4 because analyses were performed after the ORNL practical holding time for this compound was exceeded. Data in Tables 4-3 and 4-4 may not be accurate to within $\pm 30\%$ as specified by Burnum (1995).

The ORNL practical holding time is defined as the holding time for which there is a 15 % risk that the concentration of an analyte in the sample will be below its initial concentration (Jenkins et al. 1995). The reported practical holding time of butanal is 1 day, and the TST samples were not analyzed until 8 days after being collected (Jenkins 1995b). It should be noted that the analyses were performed before the holding time study, and that the contractual holding time for the TST samples was 60 days.

Table 4-5 lists the 3 analytes common to both the ORNL and PNL analyses (dichloromethane, benzene, and toluene) and their concentrations measured in SUMMA™ and TST samples. The ORNL and PNL results differ by more than the allowed $\pm 30\%$ analytical accuracy, however, this difference is reasonable given that fundamentally different sampling devices and analytical methods were used. Each of these analytes is present at only trace levels.

The 3 most abundant organic compounds in the tank BY-105 headspace are methane, 1-butanol, and acetone. At [3.8 ppmv], the methane concentration is about 2 times higher than its normal ambient air concentration. Methane is probably formed during the chemical and radiolytic degradation of organic wastes in the tank. Methane is not a constituent of toxicological concern, and its LFL in air is about 5 vol%. This places the 3.8 ppmv of methane in tank BY-105 at about 0.008 % of its LFL. 1-Butanol, at 0.70 ppmv, and propanone, at 0.25 ppmv, similarly present virtually no flammable or toxicological risks.

4.2 Tentatively Identified Organic Analytes

In addition to the target analytes, the ORNL and PNL analytical procedures allow the tentative identification of other organic compounds. Tentative identification of analytes was performed by comparing the MS molecular fragmentation patterns with a library of known MS fragmentation patterns. This method allows an organic analyte to be identified (with reasonable certainty) as an alkane, a ketone, an aldehyde, etc., and may also determine its molecular weight. The method usually does not, however, allow the unambiguous identification of structural isomers, and this ambiguity increases with analyte molecular weight. Using this method, many analytes can be tentatively identified with reasonable confidence without having to inject each into the GC/MS to determine their GC retention times or specific MS patterns.

By the nature of the sampling devices, virtually all organic vapors present in the tank headspace are collected by both TST and SUMMA™ samples. Analyses of the samples are designed to recover, separate, and identify the organic vapors in the samples. TSTs are not good for collecting highly volatile compounds (i.e., molecules more volatile than propane), but are quite good for most others. In contrast, the recovery of very low volatility compounds (e.g., molecules with more than about 15 carbon atoms) and some polar compounds with moderate volatility (e.g., butanal) from SUMMA™ samples has been problematic.

The organic compounds tentatively identified in SUMMA™ canister samples by PNL are listed, with their estimated concentrations, in Table 4-6. Compounds are listed in Table 4-6 in the order by which they

eluted chromatographically, and only non-zero results are included in the reported averages. The list of tentatively identified compounds detected in TST samples, and their estimated concentrations, is given in Table 4-7. Compounds are listed in Table 4-7 according to the order by which the eluted chromatographically. The averages reported by ORNL in Table 4-7 are all 4-sample averages, and if an analyte was not detected in a sample, its concentration in that sample was considered to be zero for averaging purposes. Estimated concentrations are in mg/m^3 , based on dry air at 0 °C and 1.01 bar.

Because the list of tentatively identified organic compounds in TST samples is particularly long and locating any given compound may be difficult, the list has been sorted alphanumerically by compound name in Table 4-8. Table 4-9 gives the same list, sorted in order of decreasing estimated concentration. Numbers in the first columns of Tables 4-8 and 4-9 (Cmpd #) identify the location of the compound in Table 4-7.

The PNL and ORNL methods used to tentatively identify and estimate concentrations are described by Jenkins et al. (1994) and Pool et al. (1995), respectively, and should be reviewed before this data is used for decision making. Results in Tables 4-6 through 4-9 are presented in terms of observed peaks, and are not adjusted for the occurrence of split chromatographic peaks (e.g., Cmpd # 3, 4, and 5 in Table 4-7). In these instances, the estimated concentration of a compound split into multiple peaks is simply the sum of the individual peak estimates.

Concentrations given in Tables 4-6 through 4-9 should be considered rough estimates. The proper quantitation of all observed analytes is outside the scope and budget of these analyses, and the estimation of concentrations involves several important assumptions. The validity of each assumption depends on the analyte, and such factors as the specific configuration of the analytical instrumentation.

4.3 Total Nonmethane Organic Carbon

OGIST measured the TNMOC concentration in 3 SUMMA™ canister samples using the EPA TO-12 method (Rasmussen 1994b). The sample mean was $[12.7 \text{ mg}/\text{m}^3]$, with a standard deviation of $[0.4 \text{ mg}/\text{m}^3]$. As indicated in Table 3-2, the TNMOC concentration is much lower in tank BY-105 than in tank BY-104, but about the same as in tank BY-106.

4.4 Discussion of Organic Analytes

Some of the compounds listed in Tables 4-1 through 4-9 were introduced to the tank with process waste streams, and are detected in the headspace because the original inventory has not been completely evaporated or degraded. Examples of these are tributyl phosphate, which was used as an extractant in several Hanford processes; dibutyl butylphosphonate, which was a contaminant of tributyl phosphate; and the semivolatile normal paraffinic hydrocarbons (NPHs), (i.e., n-undecane, n-dodecane, n-tridecane, and n-pentadecane) and branched and cyclic alkanes (e.g., methylated decahydronaphthalenes, cyclopentanes, and cyclohexanes) with similar boiling points that were used as a diluent for tributyl phosphate. The specific presence of the decahydronaphthalenes and cyclohexanes, which were not observed in tank C-103 samples, is an indication of their different waste histories.

Most of the compounds in Tables 4-1 through 4-9, however, are believed to be chemical reaction and radiolytic reaction products of the semivolatile or nonvolatile organic waste stored in the tank. Specifically, 1-butanol is known to be formed by the hydrolysis of tributyl phosphate, and it has been suggested that the alcohols, aldehydes, ketones, nitriles, alkenes, and short chain alkanes are all degradation products of NPHs.

Examination of the compounds listed in Tables 4-1 through 4-9 suggests many of the volatile species (presumed to be degradation products of the NPHs) have functional groups on the molecule's first or second carbon atom. For example, most alkenes listed have their double bond between the first and second carbon atoms, and ketones generally have the double bonded oxygen atom on the second carbon atom.

As observed in other NPH-containing waste tanks, there are many small cyclic compounds, specifically cyclopropanes, cyclopentanes, and furans. The presence of these suggest that organic radicals, formed in the radiation field of the tank, play a role in the degradation of the semivolatile compounds.

5.0 SUMMARY

The tank BY-105 headspace was sampled in May 1994 and July 1994 for gases and vapors to address flammability and industrial hygiene concerns. Results unique to the May 1994 event and essentially all results from the July 1994 event have been reported. It was determined that no headspace constituents exceeded the flammability or industrial hygiene notification limits specified in the current *Vapor Sampling and Analysis Plan* (Homi 1995).

6.0 REFERENCES

- 29 CFR 1910.120, 1993, "Hazardous Waste Operations and Emergency Response", *Code of Federal Regulations*.
- Burnum, S. T., 1995, *Qualification of Reported WHC Vapor Program Data*, (letter 95-CHD-065 to president, Westinghouse Hanford Company, August 18), Department of Energy, Richland Operations Office, Richland, Washington.
- Cashdollar, K. L., M. Hertzberg, I. A. Zlochower, C. E. Lucci, G. M. Green, and R. A. Thomas, 1992, *Laboratory Flammability Studies of Mixtures of Hydrogen, Nitrous Oxide, and Air*, WHC-SD-WM-ES-219 Rev. 0, Westinghouse Hanford Company, Richland, Washington.
- Dougherty, L. F., 1995, *Single Shell Tank Interim Operational Safety Requirements*, WHC-SD-WM-OSR-005 Rev. 0, Westinghouse Hanford Company, Richland, Washington.
- EPA 1988, *Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air*, PB90-127374, U.S. Environmental Protection Agency, Washington, D.C.
- EPA 1992, *Test Methods for Evaluating Solid Waste*, SW-846 Rev. 1, U.S. Environmental Protection Agency, Washington, D.C.
- Farley, W. G., 1991, *Safety Assessment for Gas Sampling All Ferrocyanide Tanks*, WHC-SD-WM-SAD-009 Rev. 2, Westinghouse Hanford Company, Richland, Washington.
- Hendrickson, R. W., 1995, *Tank Vapor Characterization Oak Ridge National Laboratories Quality Assurance Assessment*, TWRSQA-95-0012, Westinghouse Hanford Company, Richland, Washington.
- Homi, C. S., 1995, *Vapor Sampling and Analysis Plan*, WHC-SD-WM-TP-335 Rev. 0G, Westinghouse Hanford Company, Richland, Washington.
- Huckaby, J. L., 1994a, *Vapor Sampling System (VSS) and In Situ Sampling (ISS) Method Comparison*, WHC-SD-WM-RPT-101 Rev. 0, Westinghouse Hanford Company, Richland, Washington.
- Huckaby, J. L., 1994b, *Tank 241-C-103 Headspace Flammability*, WHC-EP-0734 Rev. 1, Westinghouse Hanford Company, Richland, Washington.
- Huckaby, J. L., H. Babad, and D. R. Bratzel, 1995, *Headspace Gas and Vapor Characterization Summary for the 43 Vapor Program Suspect Tanks*, WHC-SD-WM-ER-514 Rev. 0, Westinghouse Hanford Company, Richland, Washington.
- Huckaby, J. L., and D. R. Bratzel, 1995a, *Tank 241-BY-104 Headspace Gas and Vapor Characterization Results for Samples Collected in April 1994 and June 1994*, WHC-SD-WM-ER-418, Rev. 1, Westinghouse Hanford Company, Richland, Washington.
- Huckaby, J. L., and D. R. Bratzel, 1995b, *Tank 241-BY-106 Headspace Gas and Vapor Characterization Results for Samples Collected in May 1994 and July 1994*, WHC-SD-WM-ER-420, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

WHC-SD-WM-ER-419 REV. 2

- Huckaby, J. L., and M. S. Story, 1994, *Vapor Characterization of Tank 241-C-103*, WHC-EP-0780 Rev. 0, Westinghouse Hanford Company, Richland, Washington.
- Jenkins, R. A, A. B. Dindal, C. E. Higgins, C. Y. Ma, and J. T. Skeen, 1994, *Analaysis of Tank 241-BY-105 Headspace Components*, Oak Ridge National Laboratory, Oak Ridge, Tennessee.
- Jenkins, R. A., 1995, *Unfilled*, (Letter 090195A to D. Bratzel, September 1), Oak Ridge National Laboratory, Oak Ridge, Tennessee
- Jenkins, R. A, A. B. Dindal, C. Y. Ma, M. A. Palausky, J. T. Skeen, and C. K. Bayne, 1995a, *Analysis of Tank 241-TY-103 Headspace Components*, ORNL-CASD-FR-241TY103.95 Rev. 0, Oak Ridge National Laboratory, Oak Ridge, Tennessee
- Jenkins, R. A, A. B. Dindal, C. Y. Ma, M. A. Palausky, J. T. Skeen, and C. K. Bayne, 1995, *Analysis of Tank 241-TY-104 Headspace Components*, ORNL-CASD-FR-241TY104.95 Rev. 1, Oak Ridge National Laboratory, Oak Ridge, Tennessee.
- Keller, K. K., 1994, *Quality Assurance Project Plan for Tank Vapor Characterization*, WHC-SD-WM-QAPP-013 Rev. 2, Westinghouse Hanford Company, Richland, Washington.
- Ligothe, M. W., 1995, *PNL Vapor Project Analytical Holding Times*, (Letter to D. R. Bratzel, September 23, 1995) Pacific Northwest Laboratory, Richland, Washington.
- Mahlum, D. D., J. Y. Young, and R. E. Weller, 1994, *Toxicologic Evaluation of Analytes from Tank 231-C-103*, PNL-10189, Pacific Northwest Laboratory, Richland, Washington.
- McVeety, B. D., K. H. Pool, M. W. Ligothe, T. W. Clauss, R. B. Lucke, A. K.Sharma, M. McCulloch, J. S. Fruchter, and S. C. Goheen, 1995a, *Vapor Space Characterization of Waste Tank 241-BY-105 (In Situ): Results from Samples Collected on 5/9/94*, PNL-10282 UC-606, Pacific Northwest Laboratory, Richland, Washington.
- McVeety, B. D., T. W. Clauss, M. W. Ligothe, K. H. Pool, R. B. Lucke, G. S. Klfinger, J. S. Young, M. McCulloch, J. S. Fruchter, and S. C. Goheen, 1995b, *Vapor Space Characterization of Waste Tank 241-BY-108: Results from Samples Collected on 10/27/94*, PNL-10495 UC-606, Pacific Northwest Laboratory, Richland, Washington.
- Meacham, J. E., H. Babad, R. J. Cash, G. T. Dukelow, S. J. Eberlein, D. W. Hamilton, G. D. Johnson, J. W. Osborne, M. A. Payne, D. J. Sherwood, D. A. Turner, and J. L. Huckaby, 1995, *Approach for Tank Safety Characterization of Hanford Site Waste*, WHC-EP-0843 Rev. 0, UC-2070, Westinghouse Hanford Company, Richland, Washington.
- NFPA 1992, *Standard on Explosion Prevention Systems*, NFPA 69, National Fire Protection Association, Quincy, Massachusetts.
- Osborne, J. W., and J. L. Huckaby, 1994, *Program Plan for the Resolution of Tank Vapor Issues*, WHC-EP-0562 Rev. 1, Westinghouse Hanford Company, Richland, Washington.
- Osborne, J. W., J. L. Huckaby, T. P. Rudolph, E. R. Hewitt, D. D. Mahlum, J. Y. Young, C. M. Anderson, 1994, *Data Quality Objectives for Generic In-Tank Health and Safety Issue Resolution*, WHC-SD-WM-DQO-002, Westinghouse Hanford Company, Richland, Washington.

WHC-SD-WM-ER-419 REV. 2

- Pingel, L. A., 1994, *Results from the In-Situ Vapor Sampling of Waste Tank BY-105*, (Internal memorandum 8E920-SAS94-091 to J. L. Huckaby, May 26), Westinghouse Hanford Company, Richland, Washington.
- Pool, K. H, M. W. Ligothke, T. W. Clauss, R. B. Lucke, B. D. McVeety, M. McCulloch, J. S. Fruchter, and S. C. Goheen, 1995, *Vapor Space Characterization of Waste Tank 241-BY-105: Results from Samples Collected on 7/7/94*, PNL-10256 UC-606, Pacific Northwest Laboratory, Richland, Washington.
- Rasmussen, R. A., 1994a, *Air Samples Collected at Waste Tanks: BY-103, BY-104, BY-105, BY-106, BY-111 by Westinghouse Hanford in 6-L SS SUMMA® Canisters*, Oregon Graduate Institute of Science and Technology, Beaverton, Oregon.
- Rasmussen, R. A., 1994b, *Air Samples Collected at Waste Tank 241-BY-105 on July 7, 1994 by Westinghouse Hanford in 6-L SS SUMMA® Canisters*, Oregon Graduate Institute of Science and Technology, Beaverton, Oregon.
- WHC 1995a, *Operating Specifications for Watchlist Tanks*, OSD-T-151-00030, Rev. B-9, Westinghouse Hanford Company, Richland, Washington
- WHC 1995b, *Vapor and Gas Sampling of Single-Shell Tank 241-BY-105 Using the Vapor Sampling System*, WHC-SD-WM-RPT-108, Westinghouse Hanford Company, Richland, Washington.

Table 2-1
Tank BY-105 Gas and Vapor Sample Type and Number for the July 1994 VSS Event

Laboratory	Sampling Device	Nominal Sample Volume (L)	Target Analytes	Number of Samples
Oak Ridge National Laboratories	Triple Sorbent Trap	4.0	Organic vapors	4 tank air samples + 2 trip blanks
Oregon Graduate Institute of Science and Technology	SUMMA™ canister	6.0	Hydrogen, Nitrous Oxide, Carbon Dioxide, Carbon Monoxide	3 tank air samples
Pacific Northwest Laboratories	Acidified Carbon Sorbent Trap	3.0	Ammonia	5 tank air samples + 2 trip blanks
	Triethanolamine Sorbent Trap	3.0	Nitrogen Dioxide	10 tank air samples + 2 trip blanks
	Oxidation bed + Triethanolamine Sorbent Trap	3.0	Nitric Oxide	10 tank air samples + 2 trip blanks
	Silica Gel Sorbent Trap	3.0	Water vapor	10 tank air samples + 2 trip blanks
	SUMMA™ canister	6.0	Organic vapors	3 tank air samples + 2 ambient air samples
WHC 222-S Laboratory	Silica Gel Sorbent Trap	2.0	Tritium-Substituted Water Vapor	1 tank air sample

Table 3-1
 Tank BY-105 Inorganic Gas and Vapor Concentrations --
 Analyses Oregon Graduate Institute of Science and Technology, and Pacific Northwest Laboratory

Compound	CAS ¹ Number	Sample Type	Number of samples	Average ² (ppmv)	Standard Deviation ² (ppmv)	RSD ^{2,3} (%)
Ammonia, NH ₃	7664-41-7	Sorbent Trap	5	43	1	2
Carbon Dioxide, CO ₂	124-38-9	SUMMA TM	3	[94]	[2]	[2]
Carbon Monoxide, CO	630-08-0	SUMMA TM	3	[0.38]	[0.04]	[11]
Hydrogen, H ₂	1333-74-0	SUMMA ^{TM,4}	3	[47.9]	[1.1]	[2]
Nitric Oxide, NO	10102-43-9	Sorbent Trap	10	0.10	0.03	27
Nitrogen Dioxide, NO ₂	10102-44-0	Sorbent Trap	10	≤ 0.02	--	--
Nitrous Oxide, N ₂ O	10024-97-2	SUMMA TM	3	[49.5]	[0.3]	[0.6]
Water Vapor, H ₂ O	7732-18-5	Sorbent Trap	10	20,800 (14.9 mg/L)	500 (0.3 mg/L)	2

1 CAS = Chemical Abstract Service.

2 Bracketed values are from OGIST and should be considered secondary results, non-bracketed values are from PNL and should be considered primary results.

3 RSD = relative standard deviation. Burnum (1995) specifies the RSD should be less than 25 %.

4 Hydrogen analyses of 7/7/94 samples was problematic, average given is for 3 SUMMATM canisters samples collected 5/9/94 (Rasmussen 1994a).

Table 3-2
Comparison of Tank BY-104, BY-105, and BY-106 Headspace Constituents --
Inorganic Analyses by Oregon Graduate Institute of Science and Technology,
and Organic Analyses by Oak Ridge National Laboratory¹

Tank:	BY-104 ²	BY-105	BY-106 ³
Date sampled, (mo/day/yr)	6/24/94	7/7/94	7/8/94
Headspace temperature, (°C)	26	26	27
Ammonia, (ppmv)	248	43	74
Hydrogen, (ppmv)	[295]	[47.9]	[45.5]
Carbon dioxide, (ppmv)	[10.5]	[94]	[47.6]
Carbon monoxide, (ppmv)	[1.0]	[0.38]	[0.45]
Nitric oxide, (ppmv)	0.29	0.10	0.13
Nitrogen dioxide, (ppmv)	≤ 0.07	≤ 0.02	0.05
Nitrous oxide, (ppmv)	[201]	[49.5]	[70.6]
Water vapor, (mg/m ³)	14.1	14.9	14.7
Water vapor, (% relative humidity)	58	76	57
Ethanenitrile (acetonitrile), (ppmv)	(0.33)	(0.081)	(0.12)
Propanone (acetone), (ppmv)	(1.2)	(0.25)	(0.37)
1-Butanol, (ppmv)	(1.0)	(0.70)	(0.34)
n-Dodecane, (ppmv)	(0.058)	(0.0081)	(0.0065)
n-Tridecane, (ppmv)	(0.084)	(0.010)	(0.0069)
Total nonmethane organic carbon, (mg/m ³)	[60.8]	[12.7]	[9.9]

1 Where PNL inorganic gas or vapor data was unavailable, OGIST results are given. OGIST results are in brackets to indicate the data should be considered secondary results. Organic vapor results are from ORNL, with non-quantitative values in parentheses and quantitative values not in parentheses.

2 Data are from Huckaby and Bratzel 1995a.

3 Data are from Huckaby and Bratzel 1995b.

Table 4-1
Tank BY-105 Quantitatively Measured Organic Compounds in SUMMA™ Samples --
Analyses by Pacific Northwest Laboratory

Cmpd #	Compound	CAS ¹ Number	Average ² (ppmv)	Standard Deviation (ppmv)	RSD ³ (%)
1	Methane ⁴	74-82-8	[3.8]	[<0.1]	[<3]
2	Dichlorodifluoromethane	75-71-8	0.002 ⁵	—	—
3	Trichlorofluoromethane	75-69-4	0.044	0.006	13
4	Toluene	108-88-3	0.0024	0.0002	9
5	1,3-Dimethylbenzene (m-xylene) + 1,4-Dimethylbenzene (p-xylene) ⁶	108-38-3 106-42-3	0.0023	0.0001	3

1 CAS = Chemical Abstract Service.

2 Average of 3 samples.

3 RSD = relative standard deviation. Burnum (1995) specifies the RSD should be less than 25 %.

4 Methane analyses were performed by OGIST and should be considered a secondary result (Ramussen 1994a).

5 Average of 2 samples, other sample result <0.002 ppmv.

6 m-xylene and p-xylene coelute and the reported value represents the sum of their concentrations.

Table 4-2
Tank BY-105 Quantitatively Measured Organic Compound Average Concentrations --
Analyses by Oak Ridge National Laboratory¹

Cmpd #	Compound	CAS ² Number	Average ³ (ppmv)	Standard Deviation (ppmv)	RSD ⁴ (%)
1	Dichloromethane (methylene chloride)	75-09-2	0.0052	0.0010	19
2	Benzene	71-43-2	0.0069	0.0007	11
3	2-Pentanone	107-87-9	0.012	0.002	14
4	Toluene	108-88-3	0.0086	0.0011	13
5	2-Hexanone	591-78-6	0.0054	0.0007	12
6	2-Heptanone	110-43-0	0.0044	0.0006	13
7	n-Nonane	111-84-2	0.0060	0.0006	10

1 Results in this table are quantitative (as defined in Section 4.1).

2 CAS = Chemical Abstract Service.

3 Average of 4, 4-L TST samples.

4 RSD = relative standard deviation. Burnum (1995) specifies the RSD should be less than 25 %.

Table 4-3
Tank BY-105 Positively Identified Organic Compounds in TST Samples --
Analyses by Oak Ridge National Laboratory¹

Cmpd #	Compound	CAS ² Number	Average ³ (ppmv)	Standard Deviation (ppmv)	RSD ⁴ (%)
1	Ethanenitrile (acetonitrile)	75-05-8	0.081	0.011	14
2	Propanone (acetone)	67-64-1	0.25	0.02	7
3	Propanenitrile	107-12-0	0.0017	0.0004	22
4	n-Hexane	110-54-3	0.086	0.009	10
5	1-Butanol	71-36-3	0.70	0.11	16
6	n-Butanenitrile	109-74-0	0.0010	0.0001	12
7	n-Heptane	142-82-5	0.039	0.003	8
8	n-Pentanenitrile	110-59-8	0.00079	0.00008	10
9	n-Octane	111-65-9	0.015	0.001	8
10	n-Hexanenitrile	628-73-9	0.00085	0.00016	19
11	n-Heptanenitrile	629-08-3	0.00049	0.00004	7
12	2-Octanone	111-13-7	0.0010	0.0002	19
13	n-Octanenitrile	124-12-9	0.00026	0.00002	7
14	n-Nonanenitrile	2243-27-8	0.00031	0.00004	14
15	n-Dodecane	112-40-3	0.0081	0.0008	10
16	n-Tridecane	629-50-5	0.010	0.002	15
17	Tributyl phosphate	126-73-8	0.00017	0.00013	76
18	Dibutyl butylphosphonate	75-46-4	0.000025	0.000013	52

1 Results in this table are not quantitative (as defined in Section 4.1) because measured values in at least 1 of the samples are outside instrument calibration limits.

2 CAS = Chemical Abstract Service.

3 Average of 4, 4-L TST samples.

4 RSD = relative standard deviation. Burnum (1995) specifies the RSD should be less than 25 %.

Table 4-4
Tank BY-105 Positively Identified Compounds in TST Samples
for which Practical Holding Times were Exceeded --
Analyses by Oak Ridge National Laboratory¹

Cmpd #	Compound	CAS ² Number	Average ³ (ppmv)	Standard Deviation (ppmv)	RSD ⁴ (%)
1	Butanal ⁵	123-72-8	0.047	0.008	16

1 Practical holding times are defined and discussed in Section 4.1.

2 CAS = Chemical Abstract Service.

3 Average of 4,4-L TST samples.

4 RSD = relative standard deviation. Burnum (1995) specifies the RSD should be less than 25 %.

5 The concentration of this analyte was not quantitatively measured (as defined in Section 4.1), because the measured concentration was outside of the instrumental calibration limits.

Table 4-5
Tank BY-105 Comparison of Organic Compounds in TST and SUMMA™ Samples --
Analyses by Pacific Northwest Laboratory
and Oak Ridge National Laboratory

Cmpd#	Compound	CAS ¹ Number	TST Average ² (ppmv)	SUMMA™ Average ³ (ppmv)	PRD ⁴ (%)
1	Dichloromethane (methylene chloride)	75-09-2	0.0052	<0.002	> 89
2	Benzene	71-43-2	0.0069	<0.002	> 110
3	Toluene	108-88-3	0.0086	0.0024	113

1 CAS = Chemical Abstract Service.

2 Average of 4, 4-L TST samples analyses.

3 Average of 3 samples analyses.

4 PRD = percent relative difference. Keller (1994) requires the PRD to be less than 20 %.

Table 4-6
 Tank BY-105 Tentatively Identified Organic Compounds in SUMMA™ Samples --
 Analyses by Pacific Northwest Laboratory

Cmpd #	Compound	CAS ¹ Number	Average ² (mg/m ³)	Standard ³ Deviation (mg/m ³)
1	Propene	115-07-1	0.96	0.19
2	Propane	74-98-6	0.28	0.04
3	Cyclopropane ⁴	75-19-4	0.07	0.01
4	2-Methylpropane	75-28-5	0.16	0.04
5	2-Methylpropene	115-11-7	0.34	0.07
6	n-Butane	106-97-8	0.25	0.05
7	C4 Alkene		0.06	0.01
8	2-Methyl-1-butene ⁵	563-46-2	0.05	--
9	Propanone (acetone)	67-64-1	0.16	0.04
10	2-Methylbutane	78-78-4	0.09	0.02
11	2-Pentene	109-68-2	0.12	0.02
12	C5 Alkane		0.19	0.04
13	2-Methylpentane	107-83-5	0.47	0.07
14	2-Butanone	78-93-3	0.07	0.01
15	3-Methylpentane	96-14-0	0.09	0.01
16	1-Hexene	107-01-7	0.14	0.02
17	n-Hexane (coeluent with an internal standard)	110-54-3	0.34	0.06
18	Unknown		0.12	0.02
19	C6 Alkene ⁴		0.06	0.01
20	1-Butanol	71-36-3	0.53	0.08
21	C7 Alkane		0.07	0.01
22	C7 Alkane		0.14	0.01
23	1-Heptene	592-76-7	0.06	0.01
24	n-Heptane	142-82-5	0.22	0.03
25	2-Methylheptane	592-27-8	0.08	0.01
26	2,4-Dimethylhexane	589-43-5	0.08	0.01
27	Siloxane ⁴		0.14	--
28	2-Butoxyethanol ³	111-76-2	0.06	0.01

WHC-SD-WM-ER-419 REV. 2

Cmpd #	Compound	CAS ¹ Number	Average ² (mg/m ³)	Standard ³ Deviation (mg/m ³)
29	Siloxane ⁵		0.07	--
30	n-Dodecane	112-70-3	0.09	0.01
31	C13 Alkane		0.07	0.01
32	C13 Alkane		0.09	0.02
33	n-Tridecane	629-50-5	0.14	0.03
34	C14 Alkane		0.12	0.02
35	n-Tetradecane	629-59-4	0.13	0.03
36	Unknown		0.08	0.02
37	Unknown ⁴		0.05	--
Sum of tentatively identified compounds:			5.96	

1. CAS = Chemical Abstract Service.

2. Average of 3 samples, values listed are estimates.

3. When the analyte was detected in only 2 samples, the entry is the relative difference (i.e., their difference divided by 2), values listed are estimates.

4. Detected in only 2 samples.

5. Detected in only 1 sample.

Table 4-7
Tank BY-105 Tentatively Identified Organic Compounds in TST Samples
in Order of Chromatographic Elution--
Analyses Conducted by Oak Ridge National Laboratory

Cmpd #	Compound	CAS ¹ Number	Average ² (mg/m ³)	Standard Deviation (mg/m ³)
1	1-Butene or C4-alkene	106-98-9	0.57	0.05
2	Butane	106-97-8	0.47	0.05
3	1-Propene,2-methyl or C4-alkene	115-11-7	0.079	0.006
4	1-Propene,2-methyl- or C4 alkene	115-11-7	0.073	0.050
5	1-Propene,2-methyl or C4-alkene	115-11-7	0.073	0.005
6	1-Butene,3-methyl-	563-45-1	0.068	0.008
7	Methane, oxybis (methyl ether)	115-10-6	0.027	0.008
8	C5-alkane		0.21	0.14
9	Methane, trichlorofluoro-	75-69-4	0.14	0.03
10	2-Pentene, (Z)	627-20-3	0.0053	0.0106
11	1-Pentene	109-67-1	0.38	0.05
12	Furan	110-00-9	0.039	0.028
13	C5-alkene and C5-alkyne		0.20	0.03
14	2-Pentene, (Z)	627-20-3	0.044	0.008
15	Cyclopropane, ethyl-	1191-96-4	0.055	0.010
16	Cyclopropane, 1,1-dimethyl-	1630-94-0	0.029	0.006
17	1-Pentyne and C5-alkene		0.013	0.009
18	1,2-Pentadiene	591-95-7	0.032	0.007
19	1,3-Butadiene, 2-methyl-	78-79-5	0.0043	0.0087
20	1-Pentene, 4-methyl-	691-37-2	0.15	0.01
21	Cyclopentane	287-92-3	0.052	0.013
22	Pentane, 2-methyl-	107-83-5	0.69	0.07
23	C6-alkene		0.030	0.008
24	Furan, 2,5-dihydro-	1708-29-8	0.022	0.004
25	1-Hexene	592-41-6	0.0078	0.0090
26	C6-alkene		0.0032	0.0064
27	Pentane, 3-methyl-	96-14-0	0.14	0.02

WHC-SD-WM-ER-419 REV. 2

Cmpd #	Compound	CAS ¹ Number	Average ² (mg/m ³)	Standard Deviation (mg/m ³)
28	1-Pentene, 2-methyl-	763-29-1	0.058	0.039
29	C6-alkene		0.21	0.03
30	3-Buten-2-one	78-94-4	0.021	0.001
31	2-Butanone	78-93-3	0.17	0.03
32	3-Hexene, (Z)	7642-09-3	0.019	0.004
33	2-Hexene, (Z)	7688-21-3	0.038	0.006
34	1-Butene, 2,3-dimethyl-	563-78-0	0.026	0.006
35	Cyclopropane, 1,2-dimethyl-3-methylene	4866-55-1	0.020	0.004
36	Cyclopropane, propyl-	2415-72-7	0.035	0.004
37	C6-alkene and others		0.025	0.003
38	Cyclopropane, (1-methylethyl)-	3638-35-5	0.081	0.013
39	2-Propanol	67-63-0	0.30	0.05
40	Furan, tetrahydro-	109-99-9	0.25	0.03
41	1,3-Pentadiene, 2-methyl-	1118-58-7	0.047	0.012
42	1,4-Hexadiene	592-45-0	0.033	0.007
43	Cyclopropane, butyl-	930-57-4	0.021	0.016
44	C4-Cyclopropane		0.0095	0.0189
45	2-Butenal	4170-30-3	0.040	0.008
46	2-Butanone, 3-methyl-	563-80-4	0.0031	0.0063
47	Hexane, 2-methyl-	591-76-4	0.058	0.002
48	1,4-Hexadiene	592-45-0	0.0012	0.0023
49	1-Hexene, 3,4-dimethyl-	16745-94-1	0.0032	0.0037
50	Cyclohexene	110-83-8	0.0043	0.0051
51	Cyclopropane, butyl-	930-57-4	0.0086	0.0016
52	Cyclopropane, butyl-	930-57-4	0.0086	0.0005
53	Cyclobutane, isopropyl-	872-56-0	0.014	0.001
54	Cyclopropane, butyl-	930-57-4	0.091	0.007
55	3-Heptene, (E)	14686-14-7	0.0043	0.0029
56	2-Butanol	78-92-2	0.0015	0.0030
57	2-Heptene	592-77-8	0.015	0.004

WHC-SD-WM-ER-419 REV. 2

Cmpd #	Compound	CAS ¹ Number	Average ² (mg/m ³)	Standard Deviation (mg/m ³)
58	Pentane, 2,4-dimethyl-	108-08-7	0.011	0.001
59	2-Heptene	592-77-8	0.0080	0.0007
60	Cyclohexane, methyl-	108-87-2	0.050	0.003
61	C7-alkene		0.0011	0.0022
62	Hexane, 2,4-dimethyl-	589-43-5	0.0021	0.0024
63	Cyclopentane, ethyl-	1640-89-7	0.010	0.001
64	2-Pentanol, 2-methyl-	590-36-3	0.010	0.002
65	Cyclopentane, 1,2,4-trimethyl-	4850-28-6	0.0066	0.0012
66	2-Pentanone, 4-methyl-	108-10-1	0.010	0.004
67	1-Heptene, 3-methyl- and others		0.0010	0.0021
68	Mixture		0.0057	0.0005
69	C8-alkene		0.027	0.004
70	1-Octene	111-66-0	0.0022	0.0026
71	Hexane, 2,3-dimethyl-	584-94-1	0.034	0.002
72	Mixture		0.016	0.026
73	Heptane, 3-methyl-	589-81-1	0.041	0.029
74	Cyclohexane, 1,3-dimethyl-	638-04-0	0.013	0.003
75	2,4-Hexadiene, 3-methyl- and C2-Cyclohexane		0.0035	0.0041
76	Unknown		0.0012	0.0025
77	3-Hexanone	589-38-8	0.021	0.002
78	Alkene		0.0045	0.0053
79	C7-Alkene		0.0100	0.0054
80	Ethane, 1,2-dimethoxy-	110-71-4	0.0030	0.0060
81	4-Octene, (E)	14850-23-8	0.0100	0.0025
82	Ethene, tetrachloro-	127-18-4	0.0011	0.0021
83	Acetic acid, butyl ester	123-86-4	0.0067	0.0016
84	Hexamethylcyclotrisiloxane	541-05-9	0.0078	0.0011
85	Alkene		0.0011	0.0021
86	Pyridine, 3-methyl-	108-99-6	0.0039	0.0044

WHC-SD-WM-ER-419 REV. 2

Cmpd #	Compound	CAS ¹ Number	Average ² (mg/m ³)	Standard Deviation (mg/m ³)
87	Heptane, 2,6-dimethyl-	1072-05-5	0.034	0.003
88	4-Heptenal, (Z)	6728-31-0	0.0078	0.0008
89	Cyclohexane, ethyl-	1678-91-7	0.016	0.002
90	Cyclohexane, 1,1,3-trimethyl-	3073-66-3	0.022	0.002
91	Alkanol and alkene		0.0091	0.0005
92	Mixture		0.013	0.006
93	Mixture		0.0093	0.0045
94	Cyclohexane, 1,3,5-trimethyl-	1839-63-0	0.0073	0.0019
95	Heptane, 2,3-dimethyl-	3074-71-3	0.0088	0.0077
96	Octane, 4-methyl-	2216-34-4	0.028	0.003
97	Octane, 3-methyl-	2216-33-3	0.036	0.019
98	4-Heptanone	123-19-3	0.016	0.006
99	Benzene, 1,2-dimethyl-	95-47-6	0.0079	0.0072
100	Heptane, 2,5-dimethyl-	2216-30-0	0.018	0.007
101	Butane, 1,1'-oxybis-	142-96-1	0.0083	0.0158
102	3-Heptanone	106-35-4	0.047	0.021
103	Styrene	100-42-5	0.0059	0.0008
104	3-Heptanol	589-82-2	0.011	0.003
105	Heptanal and others		0.0092	0.0050
106	1-Hexene, 3,5,5-trimethyl-	4316-65-8	0.0020	0.0040
107	1,1,2,3-Tetramethylcyclohexane	6783-92-2	0.0012	0.0028
108	1R,2T,4C,5T-1,2,4,5-Tetramethylcyclohexane		0.0013	0.0030
109	Cyclohexane, 1-ethyl-4-methyl, trans-	6236-88-0	0.0068	0.0008
110	2-Heptanone, 3-methyl-	2371-19-9	0.0073	0.0047
111	Mixture		0.020	0.011
112	2-Heptanol, 2-methyl- and others		0.0019	0.0102
113	Octane, 2,6-dimethyl-	2051-30-1	0.027	0.014
114	Cyclohexane, 1-propenyl-	5364-83-0	0.0030	0.0063
115	Pyridine, 3,5-dimethyl- and others		0.012	0.004

WHC-SD-WM-ER-419 REV. 2

Cmpd #	Compound	CAS ¹ Number	Average ² (mg/m ³)	Standard Deviation (mg/m ³)
116	Heptane, 3-ethyl-2-methyl-	14676-29-0	0.0071	0.0003
117	C9-alkene		0.0099	0.0136
118	2-Heptanone, 6-methyl-	928-68-7	0.049	0.026
119	Octane, 3,4-dimethyl-	15869-92-8	0.0062	0.0067
120	Benzene, propyl-	103-65-1	0.0010	0.0065
121	Nonane, 4-methyl-	17301-94-9	0.013	0.010
122	1,1,2,3-tetramethylcyclohexane	6783-92-2	0.027	0.005
123	C3-benzene and alkane		0.024	0.009
124	Octane, 2,3,7-trimethyl-	62016-34-6	0.016	0.006
125	Cycloheptane, methoxy and others		0.0047	0.0037
126	Alkyl-cyclohexene		0.0017	0.0037
127	Cyclohexane, 1-methyl-4-(1-methylethyl)	6069-98-3	0.0072	0.0017
128	C4-Cyclohexane		0.0014	0.0033
129	Cyclohexane, 1-methyl-4-(1-methylethyl)	6069-98-3	0.0049	0.0022
130	Phenol	108-95-2	0.014	0.005
131	Cyclotetrasiloxane and C4-cyclohexane		0.023	0.009
132	Butanoic acid butyl ester	109-21-7	0.0066	0.0224
133	Decane	124-18-5	0.058	0.029
134	Cyclopentane, (2-methylbutyl)-	53366-38-4	0.00094	0.00266
135	Cyclohexane, 1-methyl-3-propyl-	4291-80-9	0.0062	0.0015
136	3-Hexene, 3-ethyl-2,5-dimethyl-	62338-08-3	0.0039	0.0006
137	Cyclooctane, 1,5-dimethyl-	21328-57-4	0.0063	0.0012
138	1-Octanol, 2 butyl- and others		0.0046	0.0004
139	3-Hexene, 2,2,5,5-tetramethyl- and others		0.0061	0.0160
140	Nonane, 2,6-dimethyl-	17302-28-2	0.042	0.022
141	Mixture		0.0046	0.0009
142	1-Hexanol, 2-ethyl-	104-76-7	0.0071	0.0015
143	Mixture		0.0058	0.0045
144	C5-Cyclohexane		0.016	0.003
145	C5-Cyclohexane		0.0034	0.0037

WHC-SD-WM-ER-419 REV. 2

Cmpd #	Compound	CAS ¹ Number	Average ² (mg/m ³)	Standard Deviation (mg/m ³)
146	Cyclopropane, 1,1,2-trimethyl-3-(2-methylpropyl)-	41977-43-9	0.0081	0.0001
147	Nonane, 4,5-dimethyl-	17302-23-7	0.0061	0.0054
148	1,1-Dimethyl-2-propylcyclohexane		0.019	0.007
149	Decane, 4-methyl-	2847-72-5	0.0073	0.0049
150	Decane, 2-methyl-	6975-98-0	0.021	0.003
151	Naphthalene, decahydro, trans-	493-02-7	0.029	0.008
152	Ethanone, 1-phenyl-	98-86-2	0.0084	0.0021
153	Phenol, 3-methyl-	108-39-4	0.012	0.002
154	Cyclohexane, 1-(cyclohexylmethyl)-4-methyl-, trans-	54823-98-2	0.0080	0.0020
155	Cyclohexane, 2,4-diethyl-1-methyl-	61142-70-9	0.0042	0.0062
156	5-Undecene	4941-53-1	0.016	0.005
157	2-Nonanone	821-55-6	0.0047	0.0037
158	Benzenemethanol, a,a-dimethyl-	617-94-7	0.0090	0.0358
159	Undecane	1120-21-4	0.088	0.043
160	5-Undecene	4941-53-1	0.0034	0.0021
161	Furan, 3-(1,1-dimethylethyl)2,3-dihydro-	34314-82-4	0.0038	0.0008
162	Cyclopropane, 1-butyl-1-methyl-2-propyl-	41977-34-8	0.0049	0.0047
163	Undecane, 5-methyl-	1632-70-8	0.015	0.003
164	1-Nonyne	3452-09-3	0.0091	0.0134
165	Butanoic acid, 2-hexenyl ester, (E)	53398-83-7	0.039	0.020
166	3-Decyne	2384-85-2	0.0032	0.0025
167	6-Dodecene, (E)	7206-17-9	0.0091	0.0032
168	Cyclohexane, pentyl-	4292-92-6	0.017	0.007
169	Naphthalene, decahydro-2-methyl-	2958-76-1	0.032	0.014
170	1-Undecene, 4-methyl-	74630-39-0	0.0039	0.0149
171	6-Methylundecane	17302-33-9	0.036	0.010
172	Undecane, 4-methyl-	2980-69-0	0.019	0.004
173	Undecane, 2-methyl-	7045-71-8	0.032	0.012
174	C11-alkene		0.010	0.002

WHC-SD-WM-ER-419 REV. 2

Cmpd #	Compound	CAS ¹ Number	Average ² (mg/m ³)	Standard Deviation (mg/m ³)
175	Undecane, 3-methyl-	1002-43-3	0.014	0.005
176	C2-decahydronaphthalene		0.0026	0.0025
177	3-Undecene, 8-methyl-		0.0060	0.0031
178	Naphthalene, decahydro, 1,5-dimethyl-	66552-62-3	0.0036	0.0045
179	Decane, 2,3,6-trimethyl-	62238-12-4	0.010	0.005
180	C13-alkene		0.0019	0.0013
181	Cyclohexane, 1-methyl-3-pentyl-	54411-02-8	0.012	0.007
182	Cyclohexane, 1-methyl-4-(1-methylbutyl)-	54411-00-6	0.011	0.001
183	Undecane, 2,4-dimethyl- and others		0.0019	0.0022
184	Undecane, 2,6-dimethyl-	17301-23-4	0.066	0.003
185	Alkenyl-cyclopentane		0.0041	0.0003
186	Nonane, 5-butyl-	17312-63-9	0.012	0.0002
187	Undecane, 3-methyl-	1002-43-3	0.0034	0.0004
188	Cyclopentane, 1,1,3-trimethyl-3-(2-methyl-2-propenyl)-	74421-09-3	0.0091	0.0004
189	Cyclopentane, 1-pentyl-2-propyl-	62199-51-3	0.0030	0.0004
190	Alkene		0.00098	0.00196
191	Cyclohexane, 2-butyl-1,1,3-trimethyl-	54676-39-0	0.023	0.001
192	C3-decahydronaphthalene		0.0020	0.0041
193	C3-decahydronaphthalene		0.013	0.008
194	C3-decahydro-naphthalene		0.0068	0.0079
195	Cyclohexane, hexyl-	4292-75-5	0.016	0.006
196	Dodecane, 6-methyl-	6044-71-9	0.0082	0.0056
197	Undecane, 2,4-dimethyl-	17312-80-0	0.0064	0.0004
198	Dodecane, 4-methyl-	6117-97-1	0.017	0.001
199	Undecane, 2,10-dimethyl-	17301-27-8	0.039	0.003
200	Decane, 2,6,7-trimethyl-	62108-25-2	0.12	0.01
201	C7-cyclohexane		0.026	0.003
202	2(3H)-Benzofuranone, 3a,4,5,6-tetrahydro-3a,6,6-trimethyl-	16778-26-0	0.014	0.001
203	1-Tridecene	2437-56-1	0.0035	0.0003

WHC-SD-WM-ER-419 REV. 2

Cmpd #	Compound	CAS ¹ Number	Average ² (mg/m ³)	Standard Deviation (mg/m ³)
204	6-Tetradecene, cis		0.038	0.001
205	Phenol, 4-(1,1-dimethylethyl)- and others		0.0055	0.0005
206	Undecane, 2,4-dimethyl-	17312-80-0	0.0048	0.0005
207	C14-alkane		0.011	0.001
208	Tridecane, 6-methyl-	13287-21-3	0.033	0.003
209	1-Dodecanol	112-53-8	0.0011	0.0023
210	C8-Cyclohexane		0.0067	0.0002
211	C8-Cyclohexane		0.0012	0.0023
212	Mixture		0.0012	0.0025
213	Mixture		0.0084	0.0005
214	C9-cyclopentane		0.0081	0.0004
215	Tetradecane	629-59-4	0.017	0.001
216	Cyclohexane, octyl-	1795-15-9	0.035	0.002
217	Tridecane, 4-methyl-	26730-12-1	0.023	0.003
218	Tridecane, 2-methyl-	1560-96-9	0.029	0.005
219	Alkane		0.0044	0.0050
220	Decane, 2,3,8-trimethyl-	62238-14-6	0.0024	0.0047
221	Tridecane, 3-methyl-	6418-41-3	0.046	0.003
222	Dodecane, 2,6,10-trimethyl-	3891-98-3	0.15	0.01
223	Tetradecane	629-59-4	0.15	0.03
224	Tridecane, 4,8-dimethyl-	55030-62-1	0.029	0.001
225	Cyclohexane, 1,1,3-trimethyl-2-(3-methylpentyl)-	54965-05-8	0.0085	0.0024
226	Dodecane, 2,6,11-trimethyl-	31295-56-4	0.019	0.0005
227	Alkanol		0.0061	0.0041
228	Dodecane, 2,6,11-trimethyl-	31295-56-4	0.024	0.002
229	C15-Alkane		0.013	0.002
230	Dodecane, 2,6,11-trimethyl- or C15-alkane		0.028	0.004
231	Hexadecane	544-76-3	0.16	0.01
232	Tetradecane, 3-methyl-	18435-22-8	0.024	0.005

WHC-SD-WM-ER-419 REV. 2

Cmpd #	Compound	CAS ¹ Number	Average ² (mg/m ³)	Standard Deviation (mg/m ³)
233	Alkane		0.0087	0.0100
234	C16-alkane		0.016	0.001
235	1-Hexadecene	629-73-2	0.025	0.001
236	Pentadecane	629-62-9	0.14	0.03
237	1-Tetradecanol	112-72-1	0.0019	0.0037
238	C9-Cyclopentane		0.0016	0.0032
239	C9-Cyclohexane		0.012	0.001
240	C7-Cyclohexane		0.0056	0.0008
241	Tridecane, 5-propyl-	55045-11-9	0.0023	0.0016
242	Tetradecane, 2,6,10-trimethyl-	14905-56-7	0.017	0.003
243	Tetradecane, 4,11-dimethyl-	55045-12-0	0.0047	0.0055
244	Dodecane, 2-methyl-8-propyl-	55045-07-3	0.014	0.004
245	Decane, 3-cyclohexyl, 3-cyclohexyl-	13151-74-1	0.016	0.002
246	Hexadecane, 2-methyl-	1560-92-5	0.0066	0.0044
247	5-Undecanone, 2-methyl-	50639-02-6	0.0048	0.0034
248	Pentadecane	629-62-9	0.0043	0.0028
249	Hexadecane	544-76-3	0.051	0.017
250	3-Hexadecene, (Z)-	34303-81-6	0.0012	0.0014
251	Propanoic acid, 2-methyl-,1-(1,1-dimethyl-ethyl)-2-methyl-1,3- propanediyl ester	74381-40-1	0.026	0.017
252	1,2-Benzenedicarboxylic acid, diethyl ester	84-66-2	0.0095	0.0190
253	Pentadecane, 2,6,10-trimethyl-	3892-00-0	0.015	0.004
254	Cyclohexane, decyl	1795-16-0	0.0017	0.0011
255	5-Undecanone, 2-methyl-	50639-02-6	0.0021	0.0015
256	1-Hexadecene	629-73-2	0.0047	0.0015
257	Heptadecane	629-78-7	0.0073	0.0049
258	Pentadecane, 2,6,10,14-tetramethyl-	1921-70-6	0.0076	0.0027
259	Tetradecanoic acid	544-63-8	0.0080	0.0040
260	Octadecane	593-45-3	0.0011	0.0013
261	Siloxane		0.0011	0.0012

WHC-SD-WM-ER-419 REV. 2

Cmpd #	Compound	CAS ¹ Number	Average ² (mg/m ³)	Standard Deviation (mg/m ³)
262	Benzenesulfonamide, N-butyl-	3622-84-2	0.029	0.007
263	2-Pentadecanone, 6,10,14-trimethyl-	502-69-2	0.0029	0.0022
264	Pentadecanoic acid	1002-84-2	0.00097	0.00193
265	1-Hexadecanol	36653-82-4	0.0024	0.0018
266	Hexanedioic acid, dioctyl ester	123-79-5	0.0016	0.0031
267	Mixture		0.0012	0.0025
268	2-Heptadecanone	2922-51-2	0.00042	0.00085
269	2-Pentadecanone, 6,10,14-trimethyl-	502-69-2	0.00098	0.00113
270	Hexadecanoic acid	57-10-3	0.0085	0.0058
271	Hexadecane, 2,6,10,14-tetramethyl-	638-36-8	0.00055	0.00109
272	Hexadecanoic acid, 1-methylethyl ester	142-91-6	0.0041	0.0029
Sum of tentatively identified compounds:			8.60	

1 CAS = Chemical Abstract Service.

2 Average of 4, 4-L TST samples analyses, values listed are estimates.

Table 4-8
 Tank BY-105 Tentatively Identified Organic Compounds in TST Samples
 Sorted Alphanumerically--
 Analyses Conducted by Oak Ridge National Laboratory

Cmpd #	Compound	CAS ¹ Number	Average ² (mg/m ³)	Standard Deviation (mg/m ³)
1	1-Butene or C4-alkene	106-98-9	0.57	0.05
67	1-Heptene, 3-methyl- and others		0.0010	0.0021
3	1-Propene,2-methyl or C4-alkene	115-11-7	0.079	0.006
4	1-Propene,2-methyl- or C4 alkene	115-11-7	0.073	0.050
5	1-Propene,2-methyl or C4-alkene	115-11-7	0.073	0.005
6	1-Butene,3-methyl-	563-45-1	0.068	0.008
164	1-Nonyne	3452-09-3	0.0091	0.0134
49	1-Hexene, 3,4-dimethyl-	16745-94-1	0.0032	0.0037
265	1-Hexadecanol	36653-82-4	0.0024	0.0018
170	1-Undecene, 4-methyl-	74630-39-0	0.0039	0.0149
11	1-Pentene	109-67-1	0.38	0.05
70	1-Octene	111-66-0	0.0022	0.0026
142	1-Hexanol, 2-ethyl-	104-76-7	0.0071	0.0015
203	1-Tridecene	2437-56-1	0.0035	0.0003
256	1-Hexadecene	629-73-2	0.0047	0.0015
235	1-Hexadecene	629-73-2	0.025	0.001
17	1-Pentyne and C5-alkene		0.013	0.009
34	1-Butene, 2,3-dimethyl-	563-78-0	0.026	0.006
28	1-Pentene, 2-methyl-	763-29-1	0.058	0.039
20	1-Pentene, 4-methyl-	691-37-2	0.15	0.01
209	1-Dodecanol	112-53-8	0.0011	0.0023
138	1-Octanol, 2 butyl- and others		0.0046	0.0004
106	1-Hexene, 3,5,5-trimethyl-	4316-65-8	0.0020	0.0040
237	1-Tetradecanol	112-72-1	0.0019	0.0037
25	1-Hexene	592-41-6	0.0078	0.0090
148	1,1-Dimethyl-2-propylcyclohexane		0.019	0.007
252	1,2-Benzenedicarboxylic acid, diethyl ester	84-66-2	0.0095	0.0190

WHC-SD-WM-ER-419 REV. 2

Cmpd #	Compound	CAS ¹ Number	Average ² (mg/m ³)	Standard Deviation (mg/m ³)
18	1,2-Pentadiene	591-95-7	0.032	0.007
19	1,3-Butadiene, 2-methyl-	78-79-5	0.0043	0.0087
41	1,3-Pentadiene, 2-methyl-	1118-58-7	0.047	0.012
48	1,4-Hexadiene	592-45-0	0.0012	0.0023
42	1,4-Hexadiene	592-45-0	0.033	0.007
122	1,1,2,3-tetramethylcyclohexane	6783-92-2	0.027	0.005
107	1,1,2,3-Tetramethylcyclohexane	6783-92-2	0.0012	0.0028
108	1R,2T,4C,5T-1,2,4,5-Tetramethylcyclohexane		0.0013	0.0030
110	2-Heptanone, 3-methyl-	2371-19-9	0.0073	0.0047
112	2-Heptanol, 2-methyl- and others		0.0019	0.0102
14	2-Pentene, (Z)	627-20-3	0.044	0.008
39	2-Propanol	67-63-0	0.30	0.05
33	2-Hexene, (Z)	7688-21-3	0.038	0.006
263	2-Pentadecanone, 6,10,14-trimethyl-	502-69-2	0.0029	0.0022
31	2-Butanone	78-93-3	0.17	0.03
10	2-Pentene, (Z)	627-20-3	0.0053	0.0106
118	2-Heptanone, 6-methyl-	928-68-7	0.049	0.026
45	2-Butenal	4170-30-3	0.040	0.008
46	2-Butanone, 3-methyl-	563-80-4	0.0031	0.0063
268	2-Heptadecanone	2922-51-2	0.00042	0.00085
269	2-Pentadecanone, 6,10,14-trimethyl-	502-69-2	0.00098	0.00113
66	2-Pentanone, 4-methyl-	108-10-1	0.010	0.004
56	2-Butanol	78-92-2	0.0015	0.0030
64	2-Pentanol, 2-methyl-	590-36-3	0.010	0.002
157	2-Nonanone	821-55-6	0.0047	0.0037
59	2-Heptene	592-77-8	0.0080	0.0007
57	2-Heptene	592-77-8	0.015	0.004
75	2,4-Hexadiene, 3-methyl- and C2-Cyclohexane		0.0035	0.0041

WHC-SD-WM-ER-419 REV. 2

Cmpd #	Compound	CAS ¹ Number	Average ² (mg/m ³)	Standard Deviation (mg/m ³)
202	2(3H)-Benzofuranone, 3a,4,5,6-tetrahydro-3a,6,6-trimethyl-	16778-26-0	0.014	0.001
32	3-Hexene, (Z)	7642-09-3	0.019	0.004
136	3-Hexene, 3-ethyl-2,5-dimethyl-	62338-08-3	0.0039	0.0006
166	3-Decyne	2384-85-2	0.0032	0.0025
30	3-Buten-2-one	78-94-4	0.021	0.001
55	3-Heptene, (E)	14686-14-7	0.0043	0.0029
250	3-Hexadecene, (Z)-	34303-81-6	0.0012	0.0014
104	3-Heptanol	589-82-2	0.011	0.003
77	3-Hexanone	589-38-8	0.021	0.002
102	3-Heptanone	106-35-4	0.047	0.021
177	3-Undecene, 8-methyl-		0.0060	0.0031
139	3-Hexene, 2,2,5,5-tetramethyl- and others		0.0061	0.0160
98	4-Heptanone	123-19-3	0.016	0.006
81	4-Octene, (E)	14850-23-8	0.0100	0.0025
88	4-Heptenal, (Z)	6728-31-0	0.0078	0.0008
160	5-Undecene	4941-53-1	0.0034	0.0021
156	5-Undecene	4941-53-1	0.016	0.005
247	5-Undecanone, 2-methyl-	50639-02-6	0.0048	0.0034
255	5-Undecanone, 2-methyl-	50639-02-6	0.0021	0.0015
171	6-Methylundecane	17302-33-9	0.036	0.010
167	6-Dodecene, (E)	7206-17-9	0.0091	0.0032
204	6-Tetradecene, cis		0.038	0.001
83	Acetic acid, butyl ester	123-86-4	0.0067	0.0016
219	Alkane		0.0044	0.0050
233	Alkane		0.0087	0.0100
91	Alkanol and alkene		0.0091	0.0005
227	Alkanol		0.0061	0.0041
78	Alkene		0.0045	0.0053
85	Alkene		0.0011	0.0021

WHC-SD-WM-ER-419 REV. 2

Cmpd #	Compound	CAS ¹ Number	Average ² (mg/m ³)	Standard Deviation (mg/m ³)
190	Alkene		0.00098	0.00196
185	Alkenyl-cyclopentane		0.0041	0.0003
126	Alkyl-cyclohexene		0.0017	0.0037
99	Benzene, 1,2-dimethyl-	95-47-6	0.0079	0.0072
120	Benzene, propyl-	103-65-1	0.0010	0.0065
158	Benzenemethanol, a,a-dimethyl-	617-94-7	0.0090	0.0358
262	Benzenesulfonamide, N-butyl-	3622-84-2	0.029	0.007
2	Butane	106-97-8	0.47	0.05
101	Butane, 1,1'-oxybis-	142-96-1	0.0083	0.0158
132	Butanoic acid butyl ester	109-21-7	0.0066	0.0224
165	Butanoic acid, 2-hexenyl ester, (E)	53398-83-7	0.039	0.020
174	C11-alkene		0.010	0.002
180	C13-alkene		0.0019	0.0013
207	C14-alkane		0.011	0.001
229	C15-Alkane		0.013	0.002
234	C16-alkane		0.016	0.001
176	C2-decahydronaphthalene		0.0026	0.0025
192	C3-decahydronaphthalene		0.0020	0.0041
193	C3-decahydronaphthalene		0.013	0.008
123	C3-benzene and alkane		0.024	0.009
194	C3-decahydro-naphthalene		0.0068	0.0079
44	C4-Cyclopropane		0.0095	0.0189
128	C4-Cyclohexane		0.0014	0.0033
145	C5-Cyclohexane		0.0034	0.0037
144	C5-Cyclohexane		0.016	0.003
13	C5-alkene and C5-alkyne		0.20	0.03
8	C5-alkane		0.21	0.14
26	C6-alkene		0.0032	0.0064
37	C6-alkene and others		0.025	0.003
29	C6-alkene		0.21	0.03

WHC-SD-WM-ER-419 REV. 2

Cmpd #	Compound	CAS ¹ Number	Average ² (mg/m ³)	Standard Deviation (mg/m ³)
23	C6-alkene		0.030	0.008
61	C7-alkene		0.0011	0.0022
201	C7-cyclohexane		0.026	0.003
240	C7-Cyclohexane		0.0056	0.0008
79	C7-Alkene		0.0100	0.0054
211	C8-Cyclohexane		0.0012	0.0023
69	C8-alkene		0.027	0.004
210	C8-Cyclohexane		0.0067	0.0002
117	C9-alkene		0.0099	0.0136
214	C9-cyclopentane		0.0081	0.0004
239	C9-Cyclohexane		0.012	0.001
238	C9-Cyclopentane		0.0016	0.0032
53	Cyclobutane, isopropyl-	872-56-0	0.014	0.001
125	Cycloheptane, methoxy and others		0.0047	0.0037
60	Cyclohexane, methyl-	108-87-2	0.050	0.003
74	Cyclohexane, 1,3-dimethyl-	638-04-0	0.013	0.003
89	Cyclohexane, ethyl-	1678-91-7	0.016	0.002
90	Cyclohexane, 1,1,3-trimethyl-	3073-66-3	0.022	0.002
94	Cyclohexane, 1,3,5-trimethyl-	1839-63-0	0.0073	0.0019
109	Cyclohexane, 1-ethyl-4-methyl, trans-	6236-88-0	0.0068	0.0008
114	Cyclohexane, 1-propenyl-	5364-83-0	0.0030	0.0063
127	Cyclohexane, 1-methyl-4-(1-methylethyl)	6069-98-3	0.0072	0.0017
129	Cyclohexane, 1-methyl-4-(1-methylethyl)	6069-98-3	0.0049	0.0022
135	Cyclohexane, 1-methyl-3-propyl-	4291-80-9	0.0062	0.0015
154	Cyclohexane, 1-(cyclohexylmethyl)-4-methyl-, trans-	54823-98-2	0.0080	0.0020
155	Cyclohexane, 2,4-diethyl-1-methyl-	61142-70-9	0.0042	0.0062
168	Cyclohexane, pentyl-	4292-92-6	0.017	0.007
181	Cyclohexane, 1-methyl-3-pentyl-	54411-02-8	0.012	0.007
182	Cyclohexane, 1-methyl-4-(1-methylbutyl)-	54411-00-6	0.011	0.001

WHC-SD-WM-ER-419 REV. 2

Cmpd #	Compound	CAS ¹ Number	Average ² (mg/m ³)	Standard Deviation (mg/m ³)
191	Cyclohexane, 2-butyl-1,1,3-trimethyl-	54676-39-0	0.023	0.001
195	Cyclohexane, hexyl-	4292-75-5	0.016	0.006
216	Cyclohexane, octyl-	1795-15-9	0.035	0.002
225	Cyclohexane, 1,1,3-trimethyl-2-(3-methylpentyl)-	54965-05-8	0.0085	0.0024
254	Cyclohexane, decyl	1795-16-0	0.0017	0.0011
50	Cyclohexene	110-83-8	0.0043	0.0051
137	Cyclooctane, 1,5-dimethyl-	21328-57-4	0.0063	0.0012
21	Cyclopentane	287-92-3	0.052	0.013
63	Cyclopentane, ethyl-	1640-89-7	0.010	0.001
65	Cyclopentane, 1,2,4-trimethyl-	4850-28-6	0.0066	0.0012
134	Cyclopentane, (2-methylbutyl)-	53366-38-4	0.00094	0.00266
188	Cyclopentane, 1,1,3-trimethyl-3-(2-methyl-2-propenyl)-	74421-09-3	0.0091	0.0004
189	Cyclopentane, 1-pentyl-2-propyl-	62199-51-3	0.0030	0.0004
15	Cyclopropane, ethyl-	1191-96-4	0.055	0.010
16	Cyclopropane, 1,1-dimethyl-	1630-94-0	0.029	0.006
35	Cyclopropane, 1,2-dimethyl-3-methylene	4866-55-1	0.020	0.004
36	Cyclopropane, propyl-	2415-72-7	0.035	0.004
38	Cyclopropane, (1-methylethyl)-	3638-35-5	0.081	0.013
43	Cyclopropane, butyl-	930-57-4	0.021	0.016
51	Cyclopropane, butyl-	930-57-4	0.0086	0.0016
52	Cyclopropane, butyl-	930-57-4	0.0086	0.0005
54	Cyclopropane, butyl-	930-57-4	0.091	0.007
146	Cyclopropane, 1,1,2-trimethyl-3-(2-methylpropyl)-	41977-43-9	0.0081	0.0001
162	Cyclopropane, 1-butyl-1-methyl-2-propyl-	41977-34-8	0.0049	0.0047
131	Cyclotetrasiloxane and C4-cyclohexane		0.023	0.009
133	Decane	124-18-5	0.058	0.029
149	Decane, 4-methyl-	2847-72-5	0.0073	0.0049
150	Decane, 2-methyl-	6975-98-0	0.021	0.003

WHC-SD-WM-ER-419 REV. 2

Cmpd #	Compound	CAS ¹ Number	Average ² (mg/m ³)	Standard Deviation (mg/m ³)
179	Decane, 2,3,6-trimethyl-	62238-12-4	0.010	0.005
200	Decane, 2,6,7-trimethyl-	62108-25-2	0.12	0.01
220	Decane, 2,3,8-trimethyl-	62238-14-6	0.0024	0.0047
245	Decane, 3-cyclohexyl, 3-cyclohexyl-	13151-74-1	0.016	0.002
196	Dodecane, 6-methyl-	6044-71-9	0.0082	0.0056
198	Dodecane, 4-methyl-	6117-97-1	0.017	0.001
222	Dodecane, 2,6,10-trimethyl-	3891-98-3	0.15	0.01
226	Dodecane, 2,6,11-trimethyl-	31295-56-4	0.019	0.0005
228	Dodecane, 2,6,11-trimethyl-	31295-56-4	0.024	0.002
230	Dodecane, 2,6,11-trimethyl- or C15-alkane		0.028	0.004
244	Dodecane, 2-methyl-8-propyl-	55045-07-3	0.014	0.004
80	Ethane, 1,2-dimethoxy-	110-71-4	0.0030	0.0060
152	Ethanone, 1-phenyl-	98-86-2	0.0084	0.0021
82	Ethene, tetrachloro-	127-18-4	0.0011	0.0021
12	Furan	110-00-9	0.039	0.028
24	Furan, 2,5-dihydro-	1708-29-8	0.022	0.004
40	Furan, tetrahydro-	109-99-9	0.25	0.03
161	Furan, 3-(1,1-dimethylethyl)2,3-dihydro-	34314-82-4	0.0038	0.0008
257	Heptadecane	629-78-7	0.0073	0.0049
105	Heptanal and others		0.0092	0.0050
73	Heptane, 3-methyl-	589-81-1	0.041	0.029
87	Heptane, 2,6-dimethyl-	1072-05-5	0.034	0.003
95	Heptane, 2,3-dimethyl-	3074-71-3	0.0088	0.0077
100	Heptane, 2,5-dimethyl-	2216-30-0	0.018	0.007
116	Heptane, 3-ethyl-2-methyl-	14676-29-0	0.0071	0.0003
231	Hexadecane	544-76-3	0.16	0.01
246	Hexadecane, 2-methyl-	1560-92-5	0.0066	0.0044
249	Hexadecane	544-76-3	0.051	0.017
271	Hexadecane, 2,6,10,14-tetramethyl-	638-36-8	0.00055	0.00109

Cmpd #	Compound	CAS ¹ Number	Average ² (mg/m ³)	Standard Deviation (mg/m ³)
270	Hexadecanoic acid	57-10-3	0.0085	0.0058
272	Hexadecanoic acid, 1-methylethyl ester	142-91-6	0.0041	0.0029
84	Hexamethylcyclotrisiloxane	541-05-9	0.0078	0.0011
47	Hexane, 2-methyl-	591-76-4	0.058	0.002
62	Hexane, 2,4-dimethyl-	589-43-5	0.0021	0.0024
71	Hexane, 2,3-dimethyl-	584-94-1	0.034	0.002
266	Hexanedioic acid, dioctyl ester	123-79-5	0.0016	0.0031
7	Methane, oxybis (methyl ether)	115-10-6	0.027	0.008
9	Methane, trichlorofluoro-	75-69-4	0.14	0.03
68	Mixture		0.0057	0.0005
72	Mixture		0.016	0.026
92	Mixture		0.013	0.006
93	Mixture		0.0093	0.0045
111	Mixture		0.020	0.011
141	Mixture		0.0046	0.0009
143	Mixture		0.0058	0.0045
212	Mixture		0.0012	0.0025
213	Mixture		0.0084	0.0005
267	Mixture		0.0012	0.0025
151	Naphthalene, decahydro, trans-	493-02-7	0.029	0.008
169	Naphthalene, decahydro-2-methyl-	2958-76-1	0.032	0.014
178	Naphthalene, decahydro, 1,5-dimethyl-	66552-62-3	0.0036	0.0045
121	Nonane, 4-methyl-	17301-94-9	0.013	0.010
140	Nonane, 2,6-dimethyl-	17302-28-2	0.042	0.022
147	Nonane, 4,5-dimethyl-	17302-23-7	0.0061	0.0054
186	Nonane, 5-butyl-	17312-63-9	0.012	0.0002
260	Octadecane	593-45-3	0.0011	0.0013
96	Octane, 4-methyl-	2216-34-4	0.028	0.003
97	Octane, 3-methyl-	2216-33-3	0.036	0.019
113	Octane, 2,6-dimethyl-	2051-30-1	0.027	0.014

WHC-SD-WM-ER-419 REV. 2

Cmpd #	Compound	CAS ¹ Number	Average ² (mg/m ³)	Standard Deviation (mg/m ³)
119	Octane, 3,4-dimethyl-	15869-92-8	0.0062	0.0067
124	Octane, 2,3,7-trimethyl-	62016-34-6	0.016	0.006
236	Pentadecane	629-62-9	0.14	0.03
248	Pentadecane	629-62-9	0.0043	0.0028
253	Pentadecane, 2,6,10-trimethyl-	3892-00-0	0.015	0.004
258	Pentadecane, 2,6,10,14-tetramethyl-	1921-70-6	0.0076	0.0027
264	Pentadecanoic acid	1002-84-2	0.00097	0.00193
22	Pentane, 2-methyl-	107-83-5	0.69	0.07
27	Pentane, 3-methyl-	96-14-0	0.14	0.02
58	Pentane, 2,4-dimethyl-	108-08-7	0.011	0.001
130	Phenol	108-95-2	0.014	0.005
153	Phenol, 3-methyl-	108-39-4	0.012	0.002
205	Phenol, 4-(1,1-dimethylethyl)- and others		0.0055	0.0005
251	Propanoic acid, 2-methyl-,1-(1,1-dimethyl-ethyl)-2-methyl-1,3- propanediyl ester	74381-40-1	0.026	0.017
86	Pyridine, 3-methyl-	108-99-6	0.0039	0.0044
115	Pyridine, 3,5-dimethyl- and others		0.012	0.004
261	Siloxane		0.0011	0.0012
103	Styrene	100-42-5	0.0059	0.0008
215	Tetradecane	629-59-4	0.017	0.001
223	Tetradecane	629-59-4	0.15	0.03
232	Tetradecane, 3-methyl-	18435-22-8	0.024	0.005
242	Tetradecane, 2,6,10-trimethyl-	14905-56-7	0.017	0.003
243	Tetradecane, 4,11-dimethyl-	55045-12-0	0.0047	0.0055
259	Tetradecanoic acid	544-63-8	0.0080	0.0040
208	Tridecane, 6-methyl-	13287-21-3	0.033	0.003
217	Tridecane, 4-methyl-	26730-12-1	0.023	0.003
218	Tridecane, 2-methyl-	1560-96-9	0.029	0.005
221	Tridecane, 3-methyl-	6418-41-3	0.046	0.003
224	Tridecane, 4,8-dimethyl-	55030-62-1	0.029	0.001

WHC-SD-WM-ER-419 REV. 2

Cmpd #	Compound	CAS ¹ Number	Average ² (mg/m ³)	Standard Deviation (mg/m ³)
241	Tridecane, 5-propyl-	55045-11-9	0.0023	0.0016
159	Undecane	1120-21-4	0.088	0.043
163	Undecane, 5-methyl-	1632-70-8	0.015	0.003
172	Undecane, 4-methyl-	2980-69-0	0.019	0.004
173	Undecane, 2-methyl-	7045-71-8	0.032	0.012
175	Undecane, 3-methyl-	1002-43-3	0.014	0.005
183	Undecane, 2,4-dimethyl- and others		0.0019	0.0022
184	Undecane, 2,6-dimethyl-	17301-23-4	0.066	0.003
187	Undecane, 3-methyl-	1002-43-3	0.0034	0.0004
197	Undecane, 2,4-dimethyl-	17312-80-0	0.0064	0.0004
199	Undecane, 2,10-dimethyl-	17301-27-8	0.039	0.003
206	Undecane, 2,4-dimethyl-	17312-80-0	0.0048	0.0005
76	Unknown		0.0012	0.0025
Sum of tentatively identified compounds:			8.60	

1 CAS = Chemical Abstract Service.

2 Average of 4, 4-L TST samples analyses, values listed are estimates.

Table 4-9
 Tank BY-105 Tentatively Identified Organic Compounds in TST Samples
 Sorted by Estimated Concentration --
 Analyses Conducted by Oak Ridge National Laboratory

Cmpd #	Compound	CAS ¹ Number	Average ² (mg/m ³)	Standard Deviation (mg/m ³)
22	Pentane, 2-methyl-	107-83-5	0.69	0.07
1	1-Butene or C4-alkene	106-98-9	0.57	0.05
2	Butane	106-97-8	0.47	0.05
11	1-Pentene	109-67-1	0.38	0.05
39	2-Propanol	67-63-0	0.30	0.05
40	Furan, tetrahydro-	109-99-9	0.25	0.03
29	C6-alkene		0.21	0.03
8	C5-alkane		0.21	0.14
13	C5-alkene and C5-alkyne		0.20	0.03
31	2-Butanone	78-93-3	0.17	0.03
231	Hexadecane	544-76-3	0.16	0.01
20	1-Pentene, 4-methyl-	691-37-2	0.15	0.01
222	Dodecane, 2,6,10-trimethyl-	3891-98-3	0.15	0.01
223	Tetradecane	629-59-4	0.15	0.03
9	Methane, trichlorofluoro-	75-69-4	0.14	0.03
236	Pentadecane	629-62-9	0.14	0.03
27	Pentane, 3-methyl-	96-14-0	0.14	0.02
200	Decane, 2,6,7-trimethyl-	62108-25-2	0.12	0.01
54	Cyclopropane, butyl-	930-57-4	0.091	0.007
159	Undecane	1120-21-4	0.088	0.043
38	Cyclopropane, (1-methylethyl)-	3638-35-5	0.081	0.013
3	1-Propene, 2-methyl or C4-alkene	115-11-7	0.079	0.006
5	1-Propene, 2-methyl or C4-alkene	115-11-7	0.073	0.005
4	1-Propene, 2-methyl- or C4 alkene	115-11-7	0.073	0.050
6	1-Butene, 3-methyl-	563-45-1	0.068	0.008
184	Undecane, 2,6-dimethyl-	17301-23-4	0.066	0.003
47	Hexane, 2-methyl-	591-76-4	0.058	0.002

WHC-SD-WM-ER-419 REV. 2

Cmpd #	Compound	CAS ¹ Number	Average ² (mg/m ³)	Standard Deviation (mg/m ³)
28	1-Pentene, 2-methyl-	763-29-1	0.058	0.039
133	Decane	124-18-5	0.058	0.029
15	Cyclopropane, ethyl-	1191-96-4	0.055	0.010
21	Cyclopentane	287-92-3	0.052	0.013
249	Hexadecane	544-76-3	0.051	0.017
60	Cyclohexane, methyl-	108-87-2	0.050	0.003
118	2-Heptanone, 6-methyl-	928-68-7	0.049	0.026
102	3-Heptanone	106-35-4	0.047	0.021
41	1,3-Pentadiene, 2-methyl-	1118-58-7	0.047	0.012
221	Tridecane, 3-methyl-	6418-41-3	0.046	0.003
14	2-Pentene, (Z)	627-20-3	0.044	0.008
140	Nonane, 2,6-dimethyl-	17302-28-2	0.042	0.022
73	Heptane, 3-methyl-	589-81-1	0.041	0.029
45	2-Butenal	4170-30-3	0.040	0.008
199	Undecane, 2,10-dimethyl-	17301-27-8	0.039	0.003
12	Furan	110-00-9	0.039	0.028
165	Butanoic acid, 2-hexenyl ester, (E)	53398-83-7	0.039	0.020
33	2-Hexene, (Z)	7688-21-3	0.038	0.006
204	6-Tetradecene, cis		0.038	0.001
97	Octane, 3-methyl-	2216-33-3	0.036	0.019
171	6-Methylundecane	17302-33-9	0.036	0.010
36	Cyclopropane, propyl-	2415-72-7	0.035	0.004
216	Cyclohexane, octyl-	1795-15-9	0.035	0.002
87	Heptane, 2,6-dimethyl-	1072-05-5	0.034	0.003
71	Hexane, 2,3-dimethyl-	584-94-1	0.034	0.002
42	1,4-Hexadiene	592-45-0	0.033	0.007
208	Tridecane, 6-methyl-	13287-21-3	0.033	0.003
18	1,2-Pentadiene	591-95-7	0.032	0.007
169	Naphthalene, decahydro-2-methyl-	2958-76-1	0.032	0.014
173	Undecane, 2-methyl-	7045-71-8	0.032	0.012

WHC-SD-WM-ER-419 REV. 2

Cmpd #	Compound	CAS ¹ Number	Average ² (mg/m ³)	Standard Deviation (mg/m ³)
23	C6-alkene		0.030	0.008
224	Tridecane, 4,8-dimethyl-	55030-62-1	0.029	0.001
16	Cyclopropane, 1,1-dimethyl-	1630-94-0	0.029	0.006
218	Tridecane, 2-methyl-	1560-96-9	0.029	0.005
262	Benzenesulfonamide, N-butyl-	3622-84-2	0.029	0.007
151	Naphthalene, decahydro, trans-	493-02-7	0.029	0.008
230	Dodecane, 2,6,11-trimethyl- or C15-alkane		0.028	0.004
96	Octane, 4-methyl-	2216-34-4	0.028	0.003
122	1,1,2,3-tetramethylcyclohexane	6783-92-2	0.027	0.005
7	Methane, oxybis (methyl ether)	115-10-6	0.027	0.008
113	Octane, 2,6-dimethyl-	2051-30-1	0.027	0.014
69	C8-alkene		0.027	0.004
251	Propanoic acid, 2-methyl-, 1-(1,1-dimethyl-ethyl)-2-methyl-1,3- propanediyl ester	74381-40-1	0.026	0.017
201	C7-cyclohexane		0.026	0.003
34	1-Butene, 2,3-dimethyl-	563-78-0	0.026	0.006
235	1-Hexadecene	629-73-2	0.025	0.001
37	C6-alkene and others		0.025	0.003
123	C3-benzene and alkane		0.024	0.009
228	Dodecane, 2,6,11-trimethyl-	31295-56-4	0.024	0.002
232	Tetradecane, 3-methyl-	18435-22-8	0.024	0.005
217	Tridecane, 4-methyl-	26730-12-1	0.023	0.003
191	Cyclohexane, 2-butyl-1,1,3-trimethyl-	54676-39-0	0.023	0.001
131	Cyclotetrasiloxane and C4-cyclohexane		0.023	0.009
90	Cyclohexane, 1,1,3-trimethyl-	3073-66-3	0.022	0.002
24	Furan, 2,5-dihydro-	1708-29-8	0.022	0.004
30	3-Buten-2-one	78-94-4	0.021	0.001
77	3-Hexanone	589-38-8	0.021	0.002
150	Decane, 2-methyl-	6975-98-0	0.021	0.003
43	Cyclopropane, butyl-	930-57-4	0.021	0.016

WHC-SD-WM-ER-419 REV. 2

Cmpd #	Compound	CAS ¹ Number	Average ² (mg/m ³)	Standard Deviation (mg/m ³)
35	Cyclopropane, 1,2-dimethyl-3-methylene	4866-55-1	0.020	0.004
111	Mixture		0.020	0.011
226	Dodecane, 2,6,11-trimethyl-	31295-56-4	0.019	0.0005
148	1,1-Dimethyl-2-propylcyclohexane		0.019	0.007
172	Undecane, 4-methyl-	2980-69-0	0.019	0.004
32	3-Hexene, (Z)	7642-09-3	0.019	0.004
100	Heptane, 2,5-dimethyl-	2216-30-0	0.018	0.007
215	Tetradecane	629-59-4	0.017	0.001
198	Dodecane, 4-methyl-	6117-97-1	0.017	0.001
168	Cyclohexane, pentyl-	4292-92-6	0.017	0.007
242	Tetradecane, 2,6,10-trimethyl-	14905-56-7	0.017	0.003
98	4-Heptanone	123-19-3	0.016	0.006
195	Cyclohexane, hexyl-	4292-75-5	0.016	0.006
89	Cyclohexane, ethyl-	1678-91-7	0.016	0.002
144	C5-Cyclohexane		0.016	0.003
245	Decane, 3-cyclohexyl, 3-cyclohexyl-	13151-74-1	0.016	0.002
72	Mixture		0.016	0.026
234	C16-alkane		0.016	0.001
124	Octane, 2,3,7-trimethyl-	62016-34-6	0.016	0.006
156	5-Undecene	4941-53-1	0.016	0.005
57	2-Heptene	592-77-8	0.015	0.004
253	Pentadecane, 2,6,10-trimethyl-	3892-00-0	0.015	0.004
163	Undecane, 5-methyl-	1632-70-8	0.015	0.003
175	Undecane, 3-methyl-	1002-43-3	0.014	0.005
53	Cyclobutane, isopropyl-	872-56-0	0.014	0.001
202	2(3H)-Benzofuranone, 3a,4,5,6-tetrahydro-3a,6,6-trimethyl-	16778-26-0	0.014	0.001
244	Dodecane, 2-methyl-8-propyl-	55045-07-3	0.014	0.004
130	Phenol	108-95-2	0.014	0.005
229	C15-Alkane		0.013	0.002

WHC-SD-WM-ER-419 REV. 2

Cmpd #	Compound	CAS ¹ Number	Average ² (mg/m ³)	Standard Deviation (mg/m ³)
17	1-Pentyne and C5-alkene		0.013	0.009
92	Mixture		0.013	0.006
193	C3-decahydronaphthalene		0.013	0.008
74	Cyclohexane, 1,3-dimethyl-	638-04-0	0.013	0.003
121	Nonane, 4-methyl-	17301-94-9	0.013	0.010
115	Pyridine, 3,5-dimethyl- and others		0.012	0.004
239	C9-Cyclohexane		0.012	0.001
181	Cyclohexane, 1-methyl-3-pentyl-	54411-02-8	0.012	0.007
153	Phenol, 3-methyl-	108-39-4	0.012	0.002
186	Nonane, 5-butyl-	17312-63-9	0.012	0.0002
58	Pentane, 2,4-dimethyl-	108-08-7	0.011	0.001
207	C14-alkane		0.011	0.001
104	3-Heptanol	589-82-2	0.011	0.003
182	Cyclohexane, 1-methyl-4-(1-methylbutyl)-	54411-00-6	0.011	0.001
179	Decane, 2,3,6-trimethyl-	62238-12-4	0.010	0.005
66	2-Pentanone, 4-methyl-	108-10-1	0.010	0.004
81	4-Octene, (E)	14850-23-8	0.0100	0.0025
63	Cyclopentane, ethyl-	1640-89-7	0.010	0.001
79	C7-Alkene		0.0100	0.0054
174	C11-alkene		0.010	0.002
64	2-Pentanol, 2-methyl-	590-36-3	0.010	0.002
117	C9-alkene		0.0099	0.0136
252	1,2-Benzenedicarboxylic acid, diethyl ester	84-66-2	0.0095	0.0190
44	C4-Cyclopropane		0.0095	0.0189
93	Mixture		0.0093	0.0045
105	Heptanal and others		0.0092	0.0050
188	Cyclopentane, 1,1,3-trimethyl-3-(2-methyl-2-propenyl)-	74421-09-3	0.0091	0.0004
167	6-Dodecene, (E)	7206-17-9	0.0091	0.0032
164	1-Nonyne	3452-09-3	0.0091	0.0134

WHC-SD-WM-ER-419 REV. 2

Cmpd #	Compound	CAS ¹ Number	Average ² (mg/m ³)	Standard Deviation (mg/m ³)
91	Alkanol and alkene		0.0091	0.0005
158	Benzenemethanol, a,a-dimethyl-	617-94-7	0.0090	0.0358
95	Heptane, 2,3-dimethyl-	3074-71-3	0.0088	0.0077
233	Alkane		0.0087	0.0100
51	Cyclopropane, butyl-	930-57-4	0.0086	0.0016
52	Cyclopropane, butyl-	930-57-4	0.0086	0.0005
270	Hexadecanoic acid	57-10-3	0.0085	0.0058
225	Cyclohexane, 1,1,3-trimethyl-2-(3-methylpentyl)-	54965-05-8	0.0085	0.0024
213	Mixture		0.0084	0.0005
152	Ethanone, 1-phenyl-	98-86-2	0.0084	0.0021
101	Butane, 1,1'-oxybis-	142-96-1	0.0083	0.0158
196	Dodecane, 6-methyl-	6044-71-9	0.0082	0.0056
214	C9-cyclopentane		0.0081	0.0004
146	Cyclopropane, 1,1,2-trimethyl-3-(2-methylpropyl)-	41977-43-9	0.0081	0.0001
154	Cyclohexane, 1-(cyclohexylmethyl)-4-methyl-, trans-	54823-98-2	0.0080	0.0020
59	2-Heptene	592-77-8	0.0080	0.0007
259	Tetradecanoic acid	544-63-8	0.0080	0.0040
99	Benzene, 1,2-dimethyl-	95-47-6	0.0079	0.0072
84	Hexamethylcyclotrisiloxane	541-05-9	0.0078	0.0011
25	1-Hexene	592-41-6	0.0078	0.0090
88	4-Heptenal, (Z)	6728-31-0	0.0078	0.0008
258	Pentadecane, 2,6,10,14-tetramethyl-	1921-70-6	0.0076	0.0027
257	Heptadecane	629-78-7	0.0073	0.0049
110	2-Heptanone, 3-methyl-	2371-19-9	0.0073	0.0047
149	Decane, 4-methyl-	2847-72-5	0.0073	0.0049
94	Cyclohexane, 1,3,5-trimethyl-	1839-63-0	0.0073	0.0019
127	Cyclohexane, 1-methyl-4-(1-methylethyl)	6069-98-3	0.0072	0.0017
142	1-Hexanol, 2-ethyl-	104-76-7	0.0071	0.0015

WHC-SD-WM-ER-419 REV. 2

Cmpd #	Compound	CAS ¹ Number	Average ² (mg/m ³)	Standard Deviation (mg/m ³)
116	Heptane, 3-ethyl-2-methyl-	14676-29-0	0.0071	0.0003
109	Cyclohexane, 1-ethyl-4-methyl, trans-	6236-88-0	0.0068	0.0008
194	C3-decahydro-naphthalene		0.0068	0.0079
83	Acetic acid, butyl ester	123-86-4	0.0067	0.0016
210	C8-Cyclohexane		0.0067	0.0002
132	Butanoic acid butyl ester	109-21-7	0.0066	0.0224
65	Cyclopentane, 1,2,4-trimethyl-	4850-28-6	0.0066	0.0012
246	Hexadecane, 2-methyl-	1560-92-5	0.0066	0.0044
197	Undecane, 2,4-dimethyl-	17312-80-0	0.0064	0.0004
137	Cyclooctane, 1,5-dimethyl-	21328-57-4	0.0063	0.0012
119	Octane, 3,4-dimethyl-	15869-92-8	0.0062	0.0067
135	Cyclohexane, 1-methyl-3-propyl-	4291-80-9	0.0062	0.0015
227	Alkanol		0.0061	0.0041
139	3-Hexene, 2,2,5,5-tetramethyl- and others		0.0061	0.0160
147	Nonane, 4,5-dimethyl-	17302-23-7	0.0061	0.0054
177	3-Undecene, 8-methyl-		0.0060	0.0031
103	Styrene	100-42-5	0.0059	0.0008
143	Mixture		0.0058	0.0045
68	Mixture		0.0057	0.0005
240	C7-Cyclohexane		0.0056	0.0008
205	Phenol, 4-(1,1-dimethylethyl)- and others		0.0055	0.0005
10	2-Pentene, (Z)	627-20-3	0.0053	0.0106
162	Cyclopropane, 1-butyl-1-methyl-2-propyl-	41977-34-8	0.0049	0.0047
129	Cyclohexane, 1-methyl-4-(1-methylethyl)	6069-98-3	0.0049	0.0022
247	5-Undecanone, 2-methyl-	50639-02-6	0.0048	0.0034
206	Undecane, 2,4-dimethyl-	17312-80-0	0.0048	0.0005
157	2-Nonanone	821-55-6	0.0047	0.0037
243	Tetradecane, 4,11-dimethyl-	55045-12-0	0.0047	0.0055
256	1-Hexadecene	629-73-2	0.0047	0.0015
125	Cycloheptane, methoxy and others		0.0047	0.0037

WHC-SD-WM-ER-419 REV. 2

Cmpd #	Compound	CAS ¹ Number	Average ² (mg/m ³)	Standard Deviation (mg/m ³)
141	Mixture		0.0046	0.0009
138	1-Octanol, 2 butyl- and others		0.0046	0.0004
78	Alkene		0.0045	0.0053
219	Alkane		0.0044	0.0050
55	3-Heptene, (E)	14686-14-7	0.0043	0.0029
19	1,3-Butadiene, 2-methyl-	78-79-5	0.0043	0.0087
50	Cyclohexene	110-83-8	0.0043	0.0051
248	Pentadecane	629-62-9	0.0043	0.0028
155	Cyclohexane, 2,4-diethyl-1-methyl-	61142-70-9	0.0042	0.0062
185	Alkenyl-cyclopentane		0.0041	0.0003
272	Hexadecanoic acid, 1-methylethyl ester	142-91-6	0.0041	0.0029
170	1-Undecene, 4-methyl-	74630-39-0	0.0039	0.0149
136	3-Hexene, 3-ethyl-2,5-dimethyl-	62338-08-3	0.0039	0.0006
86	Pyridine, 3-methyl-	108-99-6	0.0039	0.0044
161	Furan, 3-(1,1-dimethylethyl)2,3-dihydro-	34314-82-4	0.0038	0.0008
178	Naphthalene, decahydro, 1,5-dimethyl-	66552-62-3	0.0036	0.0045
203	1-Tridecene	2437-56-1	0.0035	0.0003
75	2,4-Hexadiene, 3-methyl- and C2-Cyclohexane		0.0035	0.0041
145	C5-Cyclohexane		0.0034	0.0037
187	Undecane, 3-methyl-	1002-43-3	0.0034	0.0004
160	5-Undecene	4941-53-1	0.0034	0.0021
26	C6-alkene		0.0032	0.0064
49	1-Hexene, 3,4-dimethyl-	16745-94-1	0.0032	0.0037
166	3-Decyne	2384-85-2	0.0032	0.0025
46	2-Butanone, 3-methyl-	563-80-4	0.0031	0.0063
114	Cyclohexane, 1-propenyl-	5364-83-0	0.0030	0.0063
80	Ethane, 1,2-dimethoxy-	110-71-4	0.0030	0.0060
189	Cyclopentane, 1-pentyl-2-propyl-	62199-51-3	0.0030	0.0004
263	2-Pentadecanone, 6,10,14-trimethyl-	502-69-2	0.0029	0.0022

WHC-SD-WM-ER-419 REV. 2

Cmpd #	Compound	CAS ¹ Number	Average ² (mg/m ³)	Standard Deviation (mg/m ³)
176	C2-decahydronaphthalene		0.0026	0.0025
265	1-Hexadecanol	36653-82-4	0.0024	0.0018
220	Decane, 2,3,8-trimethyl-	62238-14-6	0.0024	0.0047
241	Tridecane, 5-propyl-	55045-11-9	0.0023	0.0016
70	1-Octene	111-66-0	0.0022	0.0026
255	5-Undecanone, 2-methyl-	50639-02-6	0.0021	0.0015
62	Hexane, 2,4-dimethyl-	589-43-5	0.0021	0.0024
106	1-Hexene, 3,5,5-trimethyl-	4316-65-8	0.0020	0.0040
192	C3-decahydronaphthalene		0.0020	0.0041
237	1-Tetradecanol	112-72-1	0.0019	0.0037
112	2-Heptanol, 2-methyl- and others		0.0019	0.0102
183	Undecane, 2,4-dimethyl- and others		0.0019	0.0022
180	C13-alkene		0.0019	0.0013
254	Cyclohexane, decyl	1795-16-0	0.0017	0.0011
126	Alkyl-cyclohexene		0.0017	0.0037
238	C9-Cyclopentane		0.0016	0.0032
266	Hexanedioic acid, dioctyl ester	123-79-5	0.0016	0.0031
56	2-Butanol	78-92-2	0.0015	0.0030
128	C4-Cyclohexane		0.0014	0.0033
108	1R,2T,4C,5T-1,2,4,5-Tetramethylcyclohexane		0.0013	0.0030
250	3-Hexadecene, (Z)-	34303-81-6	0.0012	0.0014
211	C8-Cyclohexane		0.0012	0.0023
76	Unknown		0.0012	0.0025
212	Mixture		0.0012	0.0025
107	1,1,2,3-Tetramethylcyclohexane	6783-92-2	0.0012	0.0028
267	Mixture		0.0012	0.0025
48	1,4-Hexadiene	592-45-0	0.0012	0.0023
209	1-Dodecanol	112-53-8	0.0011	0.0023
260	Octadecane	593-45-3	0.0011	0.0013

WHC-SD-WM-ER-419 REV. 2

Cmpd #	Compound	CAS ¹ Number	Average ² (mg/m ³)	Standard Deviation (mg/m ³)
261	Siloxane		0.0011	0.0012
61	C7-alkene		0.0011	0.0022
82	Ethene, tetrachloro-	127-18-4	0.0011	0.0021
85	Alkene		0.0011	0.0021
67	1-Heptene, 3-methyl- and others		0.0010	0.0021
120	Benzene, propyl-	103-65-1	0.0010	0.0065
264	Pentadecanoic acid	1002-84-2	0.00097	0.00193
190	Alkene		0.00098	0.00196
269	2-Pentadecanone, 6,10,14-trimethyl-	502-69-2	0.00098	0.00113
134	Cyclopentane, (2-methylbutyl)-	53366-38-4	0.00094	0.00266
271	Hexadecane, 2,6,10,14-tetramethyl-	638-36-8	0.00055	0.00109
268	2-Heptadecanone	2922-51-2	0.00042	0.00085
Sum of tentatively identified compounds:			8.60	

1 CAS = Chemical Abstract Service.

2 Average of 4, 4-L TST samples analyses, values listed are estimates.