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TANK 241S111 HEADSPACE GAS & VAPOR
CHARACTERIZATION RESULTS FOR SAMPLES COLLECTED IN
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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.

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Tank 241-S-111 Headspace Gas and Vapor Characterization Results for Samples Collected in March 1995

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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
3.0 INORGANIC GASES AND VAPORS	4
3.1 Ammonia, Hydrogen, and Nitrous Oxide	4
3.2 Carbon Monoxide and Carbon Dioxide	4
3.3 Nitric Oxide, Nitrogen Dioxide, Water, and Tritium	5
3.4 Discussion of Inorganic Gases and Vapors	5
4.0 ORGANIC VAPORS	7
4.1 Positively Identified Organic Compounds	7
4.2 Tentatively Identified Organic Compounds	8
4.3 Discussion of Organic Compounds	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
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%
TST	triple sorbent trap
vol%	percent by volume, 1 vol% = 10,000 ppmv
VSS	vapor sampling system
WHC	Westinghouse Hanford Company

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Tank 241-S-111 Headspace Gas and Vapor Characterization Results
for Samples Collected in March 1995

1.0 INTRODUCTION

1.1 Characterization Objectives

Tank S-111 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). Tank S-111 was vapor sampled 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 was 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). However, current governing operating specifications for single shell Watchlist waste tanks, such as tank S-111, 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 headspace characterization data presented here are from a single sampling event. Samples collected are thought to have been representative of the tank S-111 headspace when the tank was sampled, and sample analyses were designed to provide a reasonably accurate and complete characterization of the significant headspace constituents (Meacham et al. 1995). No assessment has been made of how the tank S-111 headspace composition changes with time, though studies of tank C-103 suggest that composition changes probably occur very slowly in the passively ventilated tanks (Huckaby and Story 1994).

1.4 Tank Headspace Dynamics

Tank S-111 is the second tank in a 3-tank cascade with tanks S-110 and S-112. It is connected to tanks S-110 and S-112 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 S-110 or tank S-112 may be transferred to tank S-111 (unless the cascade lines are obstructed). At this time, however, no headspace characterization data is available for either tanks S-110 or S-112 to assess their potential effect on tank S-111.

The cascade of tanks S-110, S-111, and S-112 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 1994). Changes in the concentrations of tank headspace constituents due to barometric pressure changes are consequently very slow.

2.0 SAMPLING EVENT

Headspace gas and vapor samples were collected from tank S-111 using the vapor sampling system (VSS) on March 21, 1995 by WHC Sampling and Mobile Laboratories (WHC 1995b). Sample collection and analysis were performed as directed by *Tank 241-S-111 Tank Characterization Plan* (Homi 1995a). The tank headspace temperature was determined to be 23 °C. Air from the S-111 headspace was withdrawn from a single elevation via a 6.7-m long heated sampling probe mounted in riser 14, and transferred via heated tubing to the VSS sampling manifold. All heated zones of the VSS were maintained at approximately 60 °C. All tank air samples were collected between 11:12 a.m. and 3:17 p.m., with no anomalies noted.

Sampling media were prepared and analyzed by WHC, Oak Ridge National Laboratories (ORNL), and Pacific Northwest Laboratories (PNL). The 40 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 14 trip blanks and 2 field 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 SUMMATM¹ canister tank air samples for selected inorganic gases and vapors are given in Table 2-1 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. All inorganic gas and vapor tank samples, ambient air samples, and trip and field blanks were prepared and analyzed by PNL per PNL quality assurance impact level 2 procedures (Klinger et al. 1995a). PNL analyses of SUMMATM canisters and sorbent traps for inorganic compounds were performed 51 and 20 days, respectively, after sample collection (Ligotke 1995). Both SUMMATM canister, and sorbent trap analyses were within the maximum 60-day holding time allowed by the WHC quality assurance project plan (Keller 1994).

3.1 Ammonia, Hydrogen, and Nitrous Oxide

Six sorbent trap samples from tank S-111 indicated an average ammonia concentration of 122 ppmv. This concentration of ammonia is typical of the waste tanks that have been sampled. Ammonia has been observed in virtually all of the passively ventilated waste tanks sampled to date, at concentrations ranging from about 3 ppmv in tank C-108 (Lucke et al. 1995), to 1040 ppmv in BY-108 (McVeety et al. 1995). Given the LFL of ammonia in air is about 15 % by volume (vol%), the measured 122 ppmv corresponds to about 0.08% of the LFL, and does not contribute appreciably to the flammability of the headspace.

The concentration of hydrogen in tank S-111 was determined to be 391 ppmv. Hydrogen in the waste tanks is of concern as a fuel. Given that the LFL for hydrogen in air is about 4 vol%, 391 ppmv hydrogen concentration in tank S-111 corresponds to about 1 % of its LFL. At this level, hydrogen is not a flammability concern in tank S-111.

The average nitrous oxide concentration reported by PNL for the 3 SUMMATM canister samples was 48 ppmv. Nitrous oxide has been detected in other passively ventilated waste tanks at average concentrations as low as about 12 ppmv in tank TX-105 (Klinger et al. 1995b), and as high as 878 ppmv in tank U-103 (Ligotke et al. 1995). Under the 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 S-111 headspace.

3.2 Carbon Monoxide and Carbon Dioxide

Carbon monoxide in the tank S-111 headspace was measured to be < 23 ppmv in all 3 SUMMATM canister samples. In ambient air it typically ranges from 0.05 to 0.15 ppmv. Because different analytical methods have been used to measure carbon monoxide in the waste tanks sampled to date, the information on carbon monoxide has varied from tank to tank. However, in waste tank headspace elevated carbon monoxide concentrations are common, and are thought to be due to the decomposition of organic waste

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

in the tanks. Carbon monoxide has not been measured at very high levels in any of the waste tanks, the highest level measured to date was [26.7 ppmv] in tank C-103² (Huckaby and Story 1994).

The carbon dioxide concentration in the tank S-111 headspace, reported to be < 23 ppmv in all 3 of the SUMMA™ canister samples, is significantly lower than it is in ambient air. Carbon dioxide is normally present in the ambient air at a concentration of 350 to 400 ppmv, and is typically lower than ambient in the waste tank headspaces. The 2 ambient air samples collected at the start of the tank S-111 gas and vapor sampling event, for example, were measured to have an average 354 ppmv of carbon dioxide.

Carbon dioxide introduced by air exchange with the atmosphere is readily absorbed by caustic supernatant and interstitial liquids in the waste tanks, and converted to carbonate in solution. Like the carbon monoxide measurements, because different analytical methods have been used to measure carbon dioxide in the waste tank samples, the information on waste tank carbon dioxide varies. The < 23 ppmv of carbon dioxide characterization of the tank S-111 headspace is consistent with typical values for the waste tanks that have been sampled.

3.3 Nitric Oxide, Nitrogen Dioxide, Water, and Tritium

Nitric oxide and nitrogen dioxide concentrations in the tank S-111 headspace were determined to be ≤ 0.07 and ≤ 0.01 ppmv, respectively. These are acid gases that would have very low equilibrium concentrations above the high pH sludge in tank S-111. The measurable presence of nitric oxide is not uncommon in the 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 S-111 headspace.

The water vapor concentration of tank S-111 was determined to be about 11.0 mg/L, at the measured tank headspace temperature of 23 °C and pressure of 975 mbar (731.2 torr), (WHC 1995b). This corresponds to a water vapor partial pressure of 15.0 mbar (11.2 torr), to a dew point of 13 °C, and to a relative humidity of about 53 %.

Silica gel sorbent traps were used to test for tritium. 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. Radiochemical analysis of the silica gel trap indicated the total activity of the headspace to be less than 50 pCi/L (WHC 1995b).

3.4 Discussion of Inorganic Gases and Vapors

Except for water vapor, the most abundant waste constituents in the tank S-111 headspace are hydrogen, ammonia, and nitrous oxide. These have been detected in most of the tank headspaces that have been sampled, and are usually the dominant gaseous species.

² The carbon monoxide measurement in tank C-103 was made by Oregon Graduate Institute of Science and Technology, and placed in brackets to emphasize it should be considered secondary data.

WHC-SD-WM-ER-507 REV. 0

The relative standard deviations of the inorganic gas and vapor results given in the last column in Table 2-1 are good for the methods used. Relative standard deviations range from about 0.3 % for hydrogen to about 4 % for nitrous oxide. 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.), small relative standard deviations suggest proper control was maintained both in the field and in the laboratories.

4.0 ORGANIC VAPORS

Organic vapors in the tank S-111 headspace were sampled using SUMMA™ canisters, which were analyzed by PNL, and triple sorbent traps (TSTs), which were analyzed by ORNL. Both PNL and ORNL 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. (1995a) and Klinger et al. (1995a).

SUMMA™ sample results should be considered to be the primary organic vapor data for tank S-111. PNL results were produced at PNL quality assurance impact level 2. All PNL analyses were completed 55 days after sample collection (Ligotke 1995), which was within the administratively chosen 60-day maximum holding time (Keller 1994). No holding time study has been performed to determine the stability of organic analytes in SUMMA™ canisters in the chemical matrix of the 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 Compounds

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 from the 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 39 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 from tank C-103.

Table 4-1 lists the organic compounds positively identified and quantitated in SUMMA™ samples. SUMMA™ analyses were performed according to a modified version of the TO-14 methodology, except for methane analysis, which was analyzed with the inorganic gases (Klinger et al. 1995a). Only 2 of the 39 TO-14 target analytes and 5 of the 14 additional target analytes were measured to be above the 0.005

ppmv detection limit of the analyses. Averages reported are from analyses of 3 SUMMA™ canister samples.

Jenkins et al. (1995a) report the positive identification of 25 of 27 target analytes in TST samples. Dibutyl butylphosphonate and tributyl phosphate were the only TST target analytes not detected, though dichloromethane was detected in only 1 TST sample. The average concentrations of the two detected and quantitated detected target analytes (ethanenitrile, and toluene), from the analysis of 4 TSTs, are given in Table 4-2. Despite calibration of the instrument over about a 20-fold concentration range, the concentrations of 18 compounds were determined to be below the lower calibration limit of the analyses in at least 1 of the TST samples. These analytes are listed in Table 4-3. Data in Table 4-3 should not be considered quantitative and 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. Table 4-4 lists the 5 analytes which exceeded the ORNL practical holding times, and may have been affected by the 51-day period between sample collection and analysis (Jenkins 1995b). Jenkins et al. (1995b) describe the ORNL practical holding time study, and report practical holding times for these compounds. It should be noted that the contractual holding time for the TST samples was 60 days. Data in Table 4-4 may not be accurate to within $\pm 30\%$ as specified by Burnum (1995).

Eleven target analytes were common to both TST and SUMMA™ analyses. Table 4-5 lists these, and their reported average concentrations in TST and SUMMA™ samples. Eight of these 11 analytes were determined by both laboratories to be below the 0.005 ppmv PNL analytical detection limit, and results for the remaining 3 analytes agree reasonably well.

Both PNL and ORNL report target analyte concentrations in ppmv of analyte in dry air. To correct for the measured water vapor content of tank S-111 and obtain concentration in ppmv of analyte in moist tank air, multiply the dry-air ppmv concentrations by 0.985.

The most abundant analytes in Tables 4-1 through 4-4 are propanone and 1-butanol, both of which was measured to have an average concentration of between 0.05 and 0.2 ppmv in the tank S-111 samples. At the reported concentrations, the target analytes do not individually or collectively represent a flammability hazard.

4.2 Tentatively Identified Organic Compounds

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 these methods, many analytes can be tentatively identified with reasonable confidence without having to inject standards of 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 list of tentatively identified compounds recovered from SUMMA™ samples, with estimated concentrations, is given in Table 4-6. Compounds are listed in Table 4-6 in order of decreasing estimated concentration, 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 in the order by which they 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/m³, based on dry air at 0 °C and 1.01 bar.

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

The ORNL and PNL methods used to tentatively identify and estimate concentrations are described by Jenkins et al. (1995a) and Klinger et al. (1995a), respectively, and should be reviewed before this data is used for decision making. Concentrations given in Tables 4-6 through 4-9 should be considered rough estimates.

4.3 Discussion of Organic Compounds

A convenient way to consider the organic compounds listed in Tables 4-1 through 4-7 is to separate them into 2 categories: 1) Organic compounds added to tank S-111 as waste that are still evaporating; and 2) organic compounds that have been generated by reactions of the original waste.

The first category encompasses all organic compounds that were placed into the tank as waste. This category includes the semivolatile straight-chain alkanes, which were used as diluents of tributyl phosphate in various plutonium extraction processes. These alkanes (i.e., n-undecane, n-dodecane, n-tridecane, and n-tetradecane) are often referred to in Hanford site literature as the normal paraffinic hydrocarbons (NPHs). Though NPHs are positively identified in tank S-111, their concentrations are very low compared to other NPH-rich tanks.

Tributyl phosphate was probably also added to the tank as waste. The fact that tributyl phosphate was not detected in the tank S-111 samples does not preclude its existence in either the waste or the headspace of tank S-111. Informal tests by ORNL indicate that tributyl phosphate is adsorbed by the glass fiber filters used during sampling to protect the samples from radiolytic particulate contamination. This would result in loss of tributyl phosphate from the sampled air, and an underestimation of its actual concentration in the tank headspace. The prominence of 1-butanol, a known hydrolysis product of tributyl phosphate, in the tank S-111 organic vapor samples suggests that small amounts of tributyl phosphate are present in the waste.

The second category includes all organic compounds that have been generated via radiolytic and chemical reactions of the waste. The majority of compounds listed in Tables 4-1 through 4-7 fall into this category, including the alcohols, aldehydes, ketones, nitriles, and volatile alkanes, all of which have been

associated with the degradation of the NPHs. Though not present in high concentrations, 6 straight-chain alkyl nitriles were identified in TST samples. Several nitrogen heterocyclic compounds were also detected in TST samples.

On the basis of concentrations, alcohols are the dominant organic compounds in the tank S-111 headspace. Methanol, ethanol, and 1-propanol account for about 20 % of the total estimated concentration of organic compounds in TST samples, and about 46 % of the total estimated concentration of organic compounds in SUMMA™ canister samples. The abundance of volatile alcohols is common to most other waste tanks located in the 200 West area of the Hanford Site.

The total organic vapor concentration of tank S-111 was estimated by Jenkins et al. (1995a) to be about 1.5 mg/m³ from the analysis of 4 TST samples by GC/MS. A similar summation of organic compounds measured in SUMMA™ samples from tank S-111 provides an estimated total organic vapor concentration of 2.0 mg/m³. This disagreement is largely due to the different estimated concentrations of the dominant alcohols in the 2 sample types.

In summary, the organic vapor concentrations in tank S-111 are relatively low. The organic vapors in tank S-111 indicate that small quantities of the NPH process diluent and tributyl phosphate may be present in the waste. As with most other 200 West Area waste tanks that have been sampled, the concentrations of short-chain alcohols are higher in tank S-111 than in waste tanks with higher NPH vapor concentrations. Conversely, ketones and aldehydes are less abundant in tank S-111 than in NPH-rich waste tanks.

5.0 SUMMARY

The tank S-111 headspace was sampled in March 1995 for gases and vapors to address flammability and industrial hygiene concerns. Collection and analysis of samples has 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* (Horn 1995b).

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6.0 REFERENCES

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Table 2-1
Tank S-111 Gas and Vapor Sample Type and Number

Laboratory	Sampling Device	Nominal Sample Volume (L)	Target Analytes	Number of Samples
Oak Ridge National Laboratories	Triple Sorbent Trap	0.2	Organic vapors	4 tank air samples
		1.0	Organic vapors	4 tank air samples
		4.0	Organic vapors	4 tank air samples + 2 trip blanks + 2 field blanks
Pacific Northwest Laboratories	Acidified Carbon Sorbent Trap	3.0	Ammonia	6 tank air samples + 3 trip blank
	Triethanolamine Sorbent Trap	3.0	Nitrogen Dioxide	6 tank air samples + 3 trip blank
	Oxidation Bed + Triethanolamine Sorbent Trap	3.0	Nitric Oxide	6 tank air samples + 3 trip blank
	Silica Gel Sorbent Trap	3.0	Water vapor	6 tank air samples + 3 trip blanks
	SUMMA™ canister	6.0	Carbon Dioxide, Carbon Monoxide, Hydrogen, Methane, Nitrous Oxide, Organic vapors	3 tank air samples + 2 ambient air samples
WHC 222-S Laboratory	Silica Gel Sorbent Trap	1.0	Tritium-Substituted Water Vapor	1 tank air sample

Table 3-1
 Tank S-111 Inorganic Gas and Vapor Sample --
 Analyses Conducted by Pacific Northwest Laboratory

Compound	CAS ¹ Number	Sample Type	Number of Samples	Average (ppmv)	Standard Deviation (ppmv)	RSD ² (%)
Ammonia, NH ₃	7664-41-7	Sorbent Trap	6	122	3	2.5
Carbon Dioxide, CO ₂	124-38-9	SUMMA™	3	< 23	--	--
Carbon Monoxide, CO	630-08-0	SUMMA™	3	< 23	--	--
Hydrogen, H ₂	1333-74-0	SUMMA™	3	391	1	0.3
Nitric Oxide, NO	10102-43-9	Sorbent Trap	6	≤ 0.07	--	--
Nitrogen Dioxide, NO ₂	10102-44-0	Sorbent Trap	6	≤ 0.01	--	--
Nitrous Oxide, N ₂ O	10024-97-2	SUMMA™	3	48	2	4
Water Vapor, H ₂ O	7732-18-5	Sorbent Trap	6	15,300 (11.0 mg/L)	200 (0.1 mg/L)	1.2

1 CAS = Chemical Abstracts Service.

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

Table 4-1
Tank S-111 Quantitatively Measured Organic Compounds in SUMMA™ Samples --
Analyses Conducted by Pacific Northwest Laboratory

Cmpd #	Compound	CAS ¹ Number	Average ² (ppmv)	Standard Deviation ³ (ppmv)	RSD ⁴ (%)
1	Ethanenitrile (acetonitrile)	75-05-8	0.011	0.001	8
2	Propanone (acetone)	67-64-1	0.15	0.02	16
3	Trichlorofluoromethane	75-69-4	0.021	0.003	12
4	1-Propanol ⁵	71-23-8	0.0080	0.0050	--
5	2-Butanone	78-93-3	0.010	0.002	20
6	Tetrahydrofuran	109-99-9	0.017	0.0001	1
7	Toluene	108-88-3	0.022	0.001	4
8	Methane	74-82-8	< 23	--	--
Sum of positively identified compounds:			0.75	mg/m ³	

1 CAS = Chemical Abstract Service.

2 Average of 3 samples.

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

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

5 Detected in only 2 samples.

Table 4-2
Tank S-111 Quantitatively Measured 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	0.021	0.004	17
2	Toluene	108-88-3	0.018	0.0004	2

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

2 CAS = Chemical Abstract Service.

3 Average of 4 TST samples: 1 was 1-L and 3 were 4-L.

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

Table 4-3
Tank S-111 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	1,1-dichloroethene (vinylidene chloride)	75-35-4	0.00017	0.00001	5
2	Dichloromethane (methylene chloride)	75-09-2	0.00010	--	--
3	n-Propanenitrile	107-12-0	0.0015	0.0003	21
4	n-Hexane	110-54-3	0.0031	0.0002	6
5	Benzene	71-43-2	0.0030	0.0001	3
6	n-Butanenitrile	109-74-0	0.0035	0.0003	9
7	n-Heptane	142-82-5	0.0018	0.0001	4
8	2-Hexanone	591-78-6	0.00072	0.00001	2
9	n-Octane	111-65-9	0.00066	0.00001	2
10	n-Hexanenitrile	628-73-9	0.00017	0.00001	4
11	2-Heptanone	110-43-0	0.00072	0.00004	5
12	n-Nonane	111-84-2	0.00039	0.00001	1
13	n-Heptanenitrile	629-08-3	0.000081	0.000006	7
14	2-Octanone	111-13-7	0.00017	0.00001	4
15	n-Decane	124-18-5	0.00034	0.00002	7
16	n-Undecane	1120-21-4	0.00024	0.00001	3
17	n-Dodecane	112-40-3	0.00012	0.00002	12
18	n-Tridecane	629-50-5	0.00020	0.00002	7

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 TST samples: 1 was 1-L and 3 were 4-L.

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

Table 4-4
Tank S-111 Positively Identified Organic 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	Propanone ⁵ (acetone)	67-64-1	0.094	0.011	11
2	Butanal ⁵	123-72-8	0.013	0.001	7
3	1-Butanol ⁶	71-36-3	0.059	0.005	9
4	2-Pentanone ⁶	107-87-9	0.0019	0.0001	4
5	n-Pentanenitrile ^{6,7}	110-59-8	0.00029	0.00004	13

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

2 CAS = Chemical Abstract Service.

3 Average of 4 TST samples: 1 was 1-L and 3 were 4-L.

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

5 The concentration of this analyte is quantitatively measured (as defined in Section 4.1).

6 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.

7 Detected in only 3 samples.

Table 4-5
Tank S-111 Comparison of Organic Compounds in TST and SUMMA™ Samples --
Analyses by Pacific Northwest Laboratory
and Oak Ridge National Laboratory

Compound	CAS ¹ Number	TST Average ² (ppmv)	SUMMA™ Average ³ (ppmv)	PRD ⁴ (%)
1,1-Dichloroethene (vinylidene chloride)	75-35-4	0.00017	< 0.005	--
Dichloromethane (methylene chloride)	75-09-2	0.000034	< 0.005	--
Propanone (acetone)	67-64-1	0.094	0.15	46
Ethanenitrile (acetonitrile)	75-05-8	0.021	0.011	62
Propanenitrile	107-12-0	0.0015	< 0.005	--
n-Butanenitrile	109-74-0	0.0035	< 0.005	--
Benzene	71-43-2	0.0030	< 0.005	--
Toluene	108-88-3	0.018	0.022	20
n-Hexane	110-54-3	0.0031	< 0.005	--
n-Heptane	142-82-5	0.0018	< 0.005	--
n-Decane	124-18-5	0.00034	< 0.005	--

1 CAS = Chemical Abstract Service.

2 Average of 4 TST samples: 1 was 1-L and 3 were 4-L by ORNL.

3 Average of 3 samples by PNL.

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

Table 4-6
Tank S-111 Tentatively Identified Organic Compounds in SUMMA™ Samples --
Analyses by Pacific Northwest Laboratory

Cmpd #	Compound	CAS ¹ Number	Average ² (mg/m ³)	Standard Deviation (mg/m ³)
1	Methanol (methyl alcohol)	67-56-1	0.48	0.04
2	Ethanol	64-17-5	0.44	0.01
3	Propane	74-98-6	0.19	0.03
4	1-Butanol	71-36-3	0.10	0.02
5	n-Butane	106-97-8	0.06	< 0.01
Sum of tentatively identified compounds:			1.27	

1 CAS = Chemical Abstract Service.

2 Average of 3 samples by PNL, values listed are estimated.

Table 4-7
Tank S-111 Tentatively Identified Organic Compounds in TST Samples
in Order of Chromatographic Elution --
Analyses by Oak Ridge National Laboratory

Cmpd #	Compounds	CAS ¹ Number	Average ² (mg/m ³)	Standard Deviation (mg/m ³)
1	1-Propene, 2-methyl-	115-11-7	0.012	0.002
2	Methyl Alcohol	67-56-1	0.051	0.102
3	Methanol and acetone		0.061	0.070
4	Acetaldehyde and acetone		0.035	0.070
5	Propane, 2,2-dimethyl-	463-82-1	0.0032	0.0064
6	1-Propene, 2-methyl-	115-11-7	0.0022	0.0044
7	1-Butene	106-98-9	0.0044	0.0029
8	Hydrazine, 1,1-dimethyl and nitric oxide or ethane		0.0039	0.0030
9	Ethanol	64-17-5	0.25	0.04
10	Trichloromonofluoromethane	75-69-4	0.038	0.016
11	Silane, chlorotrimethyl-	75-77-4	0.012	0.020
12	Isopropyl Alcohol	67-63-0	0.037	0.006
13	Alkane		0.0046	0.0031
14	1-Propanol	71-23-8	0.014	0.010
15	Benzenemethanol, alpha, methyl- and 1-propanol		0.0064	0.0128
16	2-Butanone	78-93-3	0.016	0.004
17	1-Pentene, 4-methyl-	691-37-2	0.00071	0.00143
18	Furan, tetrahydro-	109-99-9	0.030	0.005
19	Silane, dimethoxydimethyl-	1112-39-6	0.0029	0.0058
20	Acetic acid and others		0.0063	0.0078
21	2-Butanone, 3-methyl-	563-80-4	0.0020	0.0023
22	1H-Pyrazole, 3-methyl-	1453-58-3	0.0031	0.0021
23	2-Butanone, 3,3-dimethyl-	75-97-8	0.012	0.001
24	Pyrazine	290-37-9	0.042	0.006

Cmpd #	Compounds	CAS ¹ Number	Average ² (mg/m ³)	Standard Deviation (mg/m ³)
25	Propane, 2-methyl-2-nitro-	594-70-7	0.0094	0.0027
26	N-Nitrosodimethylamine	62-75-9	0.034	0.010
27	Pyridine, 3,4-dimethyl-	583-58-4	0.0018	0.0036
28	Furan, 2,3-dihydro	1191-99-7	0.0064	0.0026
29	Benzothiazole, 2-phenyl-	883-93-2	0.0059	0.0103
30	2-Pentanone, 4,4-dimethyl-	590-50-1	0.0026	0.0018
31	Aziridine, 2-ethyl-	2549-67-9	0.015	0.009
32	Tetrachloroethylene	127-18-4	0.0031	0.0021
33	Cyclotrisiloxane, hexamethyl-	541-05-9	0.038	0.037
34	Pyrazine, methyl-	109-08-0	0.0018	0.0023
35	Oxazole, 4,5-dihydro-2-methyl-	1120-64-5	0.0018	0.0013
36	Ethylbenzene	100-41-4	0.0036	0.0010
37	Oxirane, (1-methylbutyl)-	53229-39-3	0.0018	0.0012
38	Benzene, 1,3-dimethyl-	108-38-3	0.0090	0.0014
39	Propane, 2-[(1,1-dimethylethyl) sulfonyl]-2-methyl-	1886-75-5	0.0035	0.0030
40	3-Heptanone	106-35-4	0.0076	0.0005
41	Benzene, 1,3-dimethyl-	108-38-3	0.0073	0.0002
42	Pyrazine, 2,5-dimethyl-	123-32-0	0.00093	0.00108
43	2-Heptanone, 6-methyl-	928-68-7	0.0067	0.0021
44	Cyclohexanol	108-93-0	0.00055	0.00110
45	Benzaldehyde	100-52-7	0.0045	0.0034
46	Cyclotetrasiloxane, octamethyl-	556-67-2	0.021	0.016
47	2H-Pyran-2-one, 6-hexyltetrahydro-	710-04-3	0.00067	0.00134
48	1,2,4-Trimethylbenzene	95-63-6	0.0018	0.0012
49	Decane, 4-methyl-	2847-72-5	0.00095	0.00109
50	1-Hexanol, 2-ethyl-	104-76-7	0.0018	0.0012
51	Benzyl Alcohol	100-51-6	0.0021	0.0014
52	Mixture		0.0017	0.0011

WHC-SD-WM-ER-507 REV. 0

Cmpd #	Compounds	CAS ¹ Number	Average ² (mg/m ³)	Standard Deviation (mg/m ³)
53	2(3H)-Furanone, 5-ethylidihydro-	695-06-7	0.00055	0.00110
54	Nonanal	124-19-6	0.00040	0.00080
56	Benzoic acid, 2-[(trimethylsilyl)oxy]-, trimethyl ester	3789-85-3	0.010	0.013
57	2(3H)-Furanone, dihydro-5-propyl-	105-21-5	0.00095	0.00111
58	Tetradecane	629-59-4	0.00044	0.00087
59	1,1'-Biphenyl, 2-chloro-	2051-60-7	0.00042	0.00083
60	Heptanoic acid, butyl ester	5454-28-4	0.00074	0.00148
61	Benzenesulfonamide, N-butyl-	3622-84-2	0.0082	0.0055
62	Isopropyl Palmitate	142-91-6	0.00042	0.00084
Sum of tentatively identified compounds:			0.87	

1 CAS = Chemical Abstract Service.

2 Average of 4 TST samples; 1 was 1-L and 3 were 4-L, values listed are estimated.

Table 4-8
Tank S-111 Tentatively Identified Organic Compounds in TST Samples
Sorted Alphanumerically --
Analyses by Oak Ridge National Laboratory

Cmpd #	Compounds	CAS ¹ Number	Average ² (mg/m ³)	Standard Deviation (mg/m ³)
1	1-Propene, 2-methyl-	115-11-7	0.012	0.002
17	1-Pentene, 4-methyl-	691-37-2	0.00071	0.00143
14	1-Propanol	71-23-8	0.014	0.010
50	1-Hexanol, 2-ethyl-	104-76-7	0.0018	0.0012
7	1-Butene	106-98-9	0.0044	0.0029
6	1-Propene, 2-methyl-	115-11-7	0.0022	0.0044
59	1,1'-Biphenyl, 2-chloro-	2051-60-7	0.00042	0.00083
55	1,2-Bis(trimethylsilyl)-4,5-dimethyl- cyclohexa-1,4-diene		0.0016	0.0031
48	1,2,4-Trimethylbenzene	95-63-6	0.0018	0.0012
22	1H-Pyrazole, 3-methyl-	1453-58-3	0.0031	0.0021
21	2-Butanone, 3-methyl-	563-80-4	0.0020	0.0023
30	2-Pentanone, 4,4-dimethyl-	590-50-1	0.0026	0.0018
23	2-Butanone, 3,3-dimethyl-	75-97-8	0.012	0.001
43	2-Heptanone, 6-methyl-	928-68-7	0.0067	0.0021
16	2-Butanone	78-93-3	0.016	0.004
53	2(3H)-Furanone, 5-ethylidihydro-	695-06-7	0.00055	0.00110
57	2(3H)-Furanone, dihydro-5-propyl-	105-21-5	0.00095	0.00111
47	2H-Pyran-2-one, 6-hexyltetrahydro-	710-04-3	0.00067	0.00134
40	3-Heptanone	106-35-4	0.0076	0.0005
4	Acetaldehyde and acetone		0.035	0.070
20	Acetic acid and others		0.0063	0.0078
13	Alkane		0.0046	0.0031
31	Aziridine, 2-ethyl-	2549-67-9	0.015	0.009
45	Benzaldehyde	100-52-7	0.0045	0.0034

Cmpd #	Compounds	CAS ¹ Number	Average ² (mg/m ³)	Standard Deviation (mg/m ³)
38	Benzene, 1,3-dimethyl-	108-38-3	0.0090	0.0014
41	Benzene, 1,3-dimethyl-	108-38-3	0.0073	0.0002
15	Benzenemethanol, alpha, methyl- and 1-propanol		0.0064	0.0128
61	Benzenesulfonamide, N-butyl-	3622-84-2	0.0082	0.0055
56	Benzoic acid, 2-[(trimethylsilyl)oxy]-, trimethyl ester	3789-85-3	0.010	0.013
29	Benzothiazole, 2-phenyl-	883-93-2	0.0059	0.0103
51	Benzyl Alcohol	100-51-6	0.0021	0.0014
44	Cyclohexanol	108-93-0	0.00055	0.00110
46	Cyclotetrasiloxane, octamethyl-	556-67-2	0.021	0.016
33	Cyclotrisiloxane, hexamethyl-	541-05-9	0.038	0.037
49	Decane, 4-methyl-	2847-72-5	0.00095	0.00109
9	Ethanol	64-17-5	0.25	0.04
36	Ethylbenzene	100-41-4	0.0036	0.0010
18	Furan, tetrahydro-	109-99-9	0.030	0.005
28	Furan, 2,3-dihydro-	1191-99-7	0.0064	0.0026
60	Heptanoic acid, butyl ester	5454-28-4	0.00074	0.00148
8	Hydrazine, 1,1-dimethyl and nitric oxide or ethane		0.0039	0.0030
12	Isopropyl Alcohol	67-63-0	0.037	0.006
62	Isopropyl Palmitate	142-91-6	0.00042	0.00084
3	Methanol and acetone		0.061	0.070
2	Methyl Alcohol	67-56-1	0.051	0.102
52	Mixture		0.0017	0.0011
26	N-Nitrosodimethylamine	62-75-9	0.034	0.010
54	Nonanal	124-19-6	0.00040	0.00080
35	Oxazole, 4,5-dihydro-2-methyl-	1120-64-5	0.0018	0.0013
37	Oxirane, (1-methylbutyl)-	53229-39-3	0.0018	0.0012

WHC-SD-WM-ER-507 REV. 0

Cmpd #	Compounds	CAS ¹ Number	Average ² (mg/m ³)	Standard Deviation (mg/m ³)
5	Propane, 2,2-dimethyl-	463-82-1	0.0032	0.0064
25	Propane, 2-methyl-2-nitro-	594-70-7	0.0094	0.0027
39	Propane, 2-[(1,1-dimethylethyl) sulfonyl]-2-methyl-	1886-75-5	0.0035	0.0030
24	Pyrazine	290-37-9	0.042	0.006
34	Pyrazine, methyl-	109-08-0	0.0018	0.0023
42	Pyrazine, 2,5-dimethyl-	123-32-0	0.00093	0.00108
27	Pyridine, 3,4-dimethyl-	583-58-4	0.0018	0.0036
11	Silane, chlorotrimethyl-	75-77-4	0.012	0.020
19	Silane, dimethoxydimethyl-	1112-39-6	0.0029	0.0058
32	Tetrachloroethylene	127-18-4	0.0031	0.0021
58	Tetradecane	629-59-4	0.00044	0.00087
10	Trichloromonofluoromethane	75-69-4	0.038	0.016
Sum of tentatively identified compounds:			0.87	

1 CAS = Chemical Abstract Service.

2 Average of 4 TST samples; 1 was 1-L and 3 were 4-L, values listed are estimated.

Table 4-9
Tank S-111 Tentatively Identified Organic Compounds in TST Samples
Sorted by estimated Concentration --
Analyses by Oak Ridge National Laboratory

Cmpd #	Compounds	CAS ¹ Number	Average ² (mg/m ³)	Standard Deviation (mg/m ³)
9	Ethanol	64-17-5	0.25	0.04
3	Methanol and acetone		0.061	0.070
2	Methyl Alcohol	67-56-1	0.051	0.102
24	Pyrazine	290-37-9	0.042	0.006
10	Trichloromonofluoromethane	75-69-4	0.038	0.016
33	Cyclotrisiloxane, hexamethyl-	541-05-9	0.038	0.037
12	Isopropyl Alcohol	67-63-0	0.037	0.006
4	Acetaldehyde and acetone		0.035	0.070
26	N-Nitrosodimethylamine	62-75-9	0.034	0.010
18	Furan, tetrahydro-	109-99-9	0.030	0.005
46	Cyclotetrasiloxane, octamethyl-	556-67-2	0.021	0.016
16	2-Butanone	78-93-3	0.016	0.004
31	Aziridine, 2-ethyl-	2549-67-9	0.015	0.009
14	1-Propanol	71-23-8	0.014	0.010
11	Silane, chlorotrimethyl-	75-77-4	0.012	0.020
1	1-Propene, 2-methyl-	115-11-7	0.012	0.002
23	2-Butanone, 3,3-dimethyl-	75-97-8	0.012	0.001
56	Benzoic acid, 2-[(trimethylsilyl)oxy]-, trimethyl ester	3789-85-3	0.010	0.013
25	Propane, 2-methyl-2-nitro-	594-70-7	0.0094	0.0027
38	Benzene, 1,3-dimethyl-	108-38-3	0.0090	0.0014
61	Benzenesulfonamide, N-butyl-	3622-84-2	0.0082	0.0055
40	3-Heptanone	106-35-4	0.0076	0.0005
41	Benzene, 1,3-dimethyl-	108-38-3	0.0073	0.0002
43	2-Heptanone, 6-methyl-	928-68-7	0.0067	0.0021

Cmpd #	Compounds	CAS ¹ Number	Average ² (mg/m ³)	Standard Deviation (mg/m ³)
15	Benzenemethanol, alpha, methyl- and 1-propanol		0.0064	0.0128
28	Furan, 2,3-dihydro-	1191-99-7	0.0064	0.0026
20	Acetic acid and others		0.0063	0.0078
29	Benzothiazole, 2-phenyl-	883-93-2	0.0059	0.0103
13	Alkane		0.0046	0.0031
45	Benzaldehyde	100-52-7	0.0045	0.0034
7	1-Butene	106-98-9	0.0044	0.0029
8	Hydrazine, 1,1-dimethyl- and nitric oxide or ethane		0.0039	0.0030
36	Ethylbenzene	100-41-4	0.0036	0.0010
39	Propane, 2-[(1,1-dimethylethyl) sulfonyl]-2-methyl-	1886-75-5	0.0035	0.0030
5	Propane, 2,2-dimethyl-	463-82-1	0.0032	0.0064
22	1H-Pyrazole, 3-methyl-	1453-58-3	0.0031	0.0021
32	Tetrachloroethylene	127-18-4	0.0031	0.0021
19	Silane, dimethoxydimethyl-	1112-39-6	0.0029	0.0058
30	2-Pentanone, 4,4-dimethyl-	590-50-1	0.0026	0.0018
6	1-Propene, 2-methyl-	115-11-7	0.0022	0.0044
51	Benzyl Alcohol	100-51-6	0.0021	0.0014
21	2-Butanone, 3-methyl-	563-80-4	0.0020	0.0023
35	Oxazole, 4,5-dihydro-2-methyl-	1120-64-5	0.0018	0.0013
34	Pyrazine, methyl-	109-08-0	0.0018	0.0023
27	Pyridine, 3,4-dimethyl-	583-58-4	0.0018	0.0036
37	Oxirane, (1-methylbutyl)-	53229-39-3	0.0018	0.0012
50	1-Hexanol, 2-ethyl-	104-76-7	0.0018	0.0012
48	1,2,4-Trimethylbenzene	95-63-6	0.0018	0.0012
52	Mixture		0.0017	0.0011
55	1,2-Bis(trimethylsilyl)-4,5-dimethyl-cyclohexa-1,4-diene		0.0016	0.0031

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Cmpd #	Compounds	CAS ¹ Number	Average ² (mg/m ³)	Standard Deviation (mg/m ³)
49	Decane, 4-methyl-	2847-72-5	0.00095	0.00109
57	2(3H)-Furanone, dihydro-5-propyl-	105-21-5	0.00095	0.00111
42	Pyrazine, 2,5-dimethyl-	123-32-0	0.00093	0.00108
17	1-Pentene, 4-methyl-	691-37-2	0.00071	0.00143
60	Heptanoic acid, butyl ester	5454-28-4	0.00074	0.00148
47	2H-Pyran-2-one, 6-hexyltetrahydro-	710-04-3	0.00067	0.00134
53	2(3H)-Furanone, 5-ethyl-dihydro-	695-06-7	0.00055	0.00110
44	Cyclohexanol	108-93-0	0.00055	0.00110
59	1,1'-Biphenyl, 2-chloro-	2051-60-7	0.00042	0.00083
58	Tetradecane	629-59-4	0.00044	0.00087
54	Nonanal	124-19-6	0.00040	0.00080
62	Isopropyl Palmitate	142-91-6	0.00042	0.00084
Sum of tentatively identified compounds:			0.87	

1 CAS = Chemical Abstract Service.

2 Average of 4 TST samples; 1 was 1-L and 3 were 4-L, values listed are estimates.

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