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**Vapor Space Characterization of
Waste Tank 241-C-109 (*In Situ*):
Results from Samples
Collected on 6/23/94**

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S. C. Goheen

October 1995

Prepared for Westinghouse Hanford Company
under a Related Services Agreement
with the U.S. Department of Energy
under Contract DE-AC06-76RLO 1830

Pacific Northwest Laboratory
Operated for the U.S. Department of Energy
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Summary

This report describes organic analyses results from *in situ* samples obtained from the headspace of the Hanford waste storage Tank 241-C-109 (referred to as Tank C-109). The results described here were obtained to support safety and toxicological evaluations.

Organic compounds were quantitatively determined. Thirteen organic tentatively identified compounds (TICs) were observed above the detection limit of (ca.) 10 ppbv, but standards for most of these were not available at the time of analysis, and the reported concentrations are semiquantitative estimates. In addition, we looked for the 40 standard TO-14 analytes. Of these, only one was observed above the 2-ppbv calibrated instrumental detection limit. However, it is believed, even though the values for dichlorodifluoromethane and trichlorofluoromethane are below the instrumental detection limit, they are accurate at these low concentrations. The six analytes account for approximately 100% of the total organic components in Tank C-109. These six organic analytes with the highest estimated concentrations are listed in Summary Table 1. Detailed descriptions of the results appear in the text.

Summary Table 1. Summary Results of Inorganic and Organic Samples Collected from the Headspace of Tank C-109 on 6/23/94

<u>Category</u>	<u>Analyte</u>	<u>Vapor^(a) Concentration</u>	<u>Units</u>
Organic	Methyl nitrate	0.115	mg/m ³
	1,1,2-Trichloro- 1,1,2-trifluoroethane	0.109	mg/m ³
	Acetonitrile	0.100	mg/m ³
	Acetone	0.083	mg/m ³
	Nonanal	0.073	mg/m ³
	Methylbenzene (toluene)	0.008	mg/m ³

(a) Vapor concentrations were determined using sample-volume data provided by Westinghouse Hanford Company and are based on averaged data.

Acknowledgments

The authors gratefully acknowledge the support of other project staff at Pacific Northwest Laboratory who contributed to the successful completion of this sampling and analysis activity. Jeff Edwards served as the PNL single-point-of-contact and coordinated sample handling and communications with Westinghouse Hanford Company. K. B. Olsen assisted in preparing the organic portion of this report. Bruce Lerner performed method development and validation work that supported the inorganic vapor sampling. Sally Slate and May-Lin Thomas analyzed inorganic samples, and Annalisa Krupsha and Gary Dennis prepared the solid-sorbent sample trains. Georgia K. Ruebsamen provided word processing support.

Abbreviations

CAS	Chemical Abstracts Service
COC	chain of custody
EPA	U.S. Environmental Protection Agency
GC/MS	gas chromatography/mass spectrometry
HEPA	high-efficiency particulate air (filter)
HP	Hewlett Packard
IS	internal standard
ISS	<i>in situ</i> sampling system
NPH	normal paraffin hydrocarbon
PNL	Pacific Northwest Laboratory
ppbv	part per billion by volume
ppmv	part per million by volume
STP	standard temperature and pressure
TIC	tentatively identified compound
WHC	Westinghouse Hanford Company

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1.0 Introduction

This report describes results of the analyses of tank-headspace samples taken from the Hanford waste Tank 241-C-109 (referred to as Tank C-109). Pacific Northwest Laboratory (PNL)^(a) contracted with Westinghouse Hanford Company (WHC) to provide sampling devices and to analyze inorganic and organic analytes collected from the tank headspace. The sample job was designated S4031, and samples were collected by WHC on June 23, 1994, using the *in situ* sampling system (ISS). The results of the analyses are expected to be used to estimate the potential toxicity of tank-headspace gas as described in *Data Quality Objectives for Generic In-Tank Health and Safety Vapor Issue Resolution*, WHC-SD-WM-DQO-002, Rev. 0.

Sampling devices, including six sorbent trains (for inorganic analyses), were supplied to WHC on June 23, 1994. Four SUMMATM canisters (for organic analyses) were supplied to the WHC sampling staff on June 11, and one SUMMATM canister was supplied on June 21. Samples were taken (by WHC) from the tank headspace on June 29 and returned to PNL from the field on June 29. Inorganic (sorbent trap) samples were delivered to PNL on chain of custody (COC) No. 007478 (see Figure 1.1a), and four SUMMATM canisters were delivered on COC No. 006891 (see Figure 1.1b). One SUMMATM canister was delivered on COC No. 007476 (see Figure 1.1c). SUMMATM canister sample No. S4031-----137 was taken as a surrogate sample. Westinghouse Hanford Company and PNL agreed that analysis of the surrogate sample was not required.

The samples were inspected upon delivery to the 326/23B laboratory and logged into PNL record book 55408 before implementation of PNL Technical Procedure PNL-TVP-07^(b). The inorganic samples were found to be contaminated with smearable beta/gamma radiation and were placed in the 329/13-A radiation freezer until further disposition. The canisters were found to be free of radiation contamination and were stored in the 326/23B laboratory at ambient (25°C) temperature until the time of analysis. Access to the 326/23B laboratory is limited to PNL personnel working on the waste-tank safety program. Analyses described in this report were performed at PNL in the 300 area of the Hanford Reservation. Analytical methods that were used are described in the text. Organic analyses were performed using cryogenic preconcentration followed by gas chromatography/mass spectrometry (GC/MS).

-
- (a) Pacific Northwest Laboratory is operated for the U. S. Department of Energy by Battelle Memorial Institute under Contract DE-AC06-76RLO 1830.
- (b) PNL-TVP-07, Rev. 0, October 1994, *Sample Shipping and Receiving Procedure for PNL Waste Tank Samples*, PNL-Technical Procedure, Tank Vapor Project, Richland, Washington.

Westinghouse Hanford Company		CHAIN OF CUSTODY		WHC 007478	
Custody Form Initiator	J. A. Edwards	Telephone	(509)	373-0141	
		Pager		85-3009	
Company Contact	L. A. Pingel	Telephone	(509)	373-4051	
Project Designation/Sampling Locations 200 East Tank Farm		Collection Date	06 - 23 - 94		
241-C-109 Tank Vapor Sample SAF S4031		Preparation Date	06 - 22 - 94		
Ice Chest No.		Field Logbook No.	WHC-N-_____		
Bill of Lading/Airbill No.	N/A	Offsite Property No.	N/A		
Method of Shipment	Government Truck				
Shipped to	WHC				
Possible Sample Hazards/Remarks Unknown at time of sampling					

Sample Identification

S4031 - ---- . W80	NH ₃ /NO _x /H ₂ O (Sample #1)	
S4031 - ---- . W81	NH ₃ /NO _x /H ₂ O (Sample #2)	
S4031 - ---- . W82	NH ₃ /NO _x /H ₂ O (Sample #3)	
S4031 - ---- . W84	OVS/H₂O (Radiological survey)	RMA 6/23/94
S4031 - ---- . W83	HCN/H ₂ O (Sample #1)	
S4031 - ---- . W85	HCN/H ₂ O (Sample #2)	
S4031 - ---- . W86	HCN/H ₂ O (Sample #3)	

[X] Field Transfer of Custody		[] Chain of Possession		(Sign and Print Names)		
Relinquished By	Date	Time	Received By	Date	Time	
J. A. Edwards <i>J. A. Edwards</i>	06-23-94	0636	Rob Arnold <i>Rob Arnold</i>	6/23/94	0630	
RM Arnold <i>RM Arnold</i>	7-14-94	1550	J. A. Edwards <i>J. A. Edwards</i>	7/14/94	1330	

(version 02-28-94)

Final Sample Disposition

Disposal Method:

Disposed by:

Date/Time:

Comments

A-6000-407 (12/92) WEF061

Figure 1.1a Chain-of-Custody for Inorganic Samples from Tank C-109

Westinghouse Hanford Company		CHAIN OF CUSTODY		WHC 006891
Custody Form Initiator	J. A. Edwards	Telephone	(509) 373-0141	
		Fax	85-3009	
Company Contact	L. A. Pingel	Telephone	(509) 373-4051	
Project Designation/Sampling Locations 200 East Tank Farm		Collection Date	06-23-94	
C 1027 Tank	Vapor Sample SAF S4040	Preparation Date	06-14-94	
Ice Chest No.	(In-Silo)	Field Logbook No.	WHC-N-____	
Bill of Lading/Airbill No.	N/A	Offsite Property No.	N/A	
Method of Shipment	Government Truck			
Shipped to	PNL			
Possible Sample Hazards/Remarks Unknown at time of sampling				

Sample Identification

³¹
 S4040 - - - - 134 Ambient air SUMMA
³¹
 S4040 - - - - 135 Tank air SUMMA #1
³¹
 S4040 - - - - 136 Tank air SUMMA #2
³¹
 S4040 - - - - 137 SUMMA Surrogate
³¹

[X] Field Transfer of Custody		[] Chain of Possession (Sign and Print Names)			
Relinquished By	Date	Time	Received By	Date	Time
J. A. Edwards	06-14-94	1500	T. B. Utecht	06-21-94	1500
R. M. Arnold	6-21-94	0730	A. Samaras	6-27-94	1830

(Revised 02/28/94)

Final Sample Disposition

Disposal Method:

Disposed by:

Date/Time:

A-6000-407 (12/92) WEF061

Figure 1.1b Chain-of-Custody for Organic Samples from Tank C-109

Westinghouse Hanford Company		CHAIN OF CUSTODY		WHC 007476
Custody Form Initiator	J. A. Edwards	Telephone	(509) 373-0141	
		Fax	85-3009	
Company Contact	L. A. Pingel	Telephone	(509) 373-4051	
Project Designation/Sampling Locations 200 East Tank Farm		Collection Date	06-23-94	
C 1027 Tank	Vapor Sample SAF 54040 54031	Preparation Date	06-20-94	
Ice Chest No.	(In-Situ)	Field Logbook No.	WHC-N-___	
Bill of Lading/Airbill No.	N/A	Offsite Property No.	N/A	
Method of Shipment	Government Truck			
Shipped to	PNL			
Possible Sample Hazards/Remarks Unknown at time of sampling				

Sample Identification

S4040-³¹ - - - - S097 Tank air SUMMA #3

[X] Field Transfer of Custody		[] Chain of Possession		(Sign and Print Names)	
Relinquished By	Date	Time	Received By	Date	Time
J. A. Edwards <i>J. A. Edwards</i>	06-21-94	0630	Rob Arnold <i>Rob Arnold</i>	06-21-94	0630
Rob Arnold <i>Rob Arnold</i>	6-22-94	1330	J. A. Edwards <i>J. A. Edwards</i>	6/22/94	1330

(Revised 02/28/94)

Final Sample Disposition

Disposal Method:

Disposed by:

Date/Time:

A-6000-407 (12/92) WEF061

Figure 1.1c Chain-of-Custody for Organic Samples from Tank C-109

2.0 Inorganic Task

Solid sorbent trains for ammonia, nitrogen dioxide, nitric oxide, hydrogen cyanide, and water were supplied. The traps were inserted into the waste tank and used to sample the headspace. Available information from a radiological survey of the samples indicated the presence of internal contamination; therefore, the samples were not analyzed. To reduce the possibility of contamination in subsequent sample jobs, a wrapped high-efficiency particulate air (HEPA)-filtered inlet manifold has since been designed for use upstream of *in situ* sorbent trains.

3.0 Organic Task

3.1 SUMMA™ Canister Preparation

Before sending SUMMA™ canisters out to the field for sampling, the canisters are cleaned and verified contaminant free according to PNL Technical Procedure PNL-TVP-02^(a). The cleaning procedure uses an EnTech 3000 cleaning system that controls 1) filling the canisters with purified humid air and 2) evacuating, for several cycles with applied heat, before allowing the canister to evacuate overnight. The canister is filled a final time with purified humid air for analysis by PNL Technical Procedure PNL-TVP-01^(b), which is a modification of U.S. Environmental Protection Agency (EPA) compendium Method TO-14. If the canister is verified as clean, free of TO-14 contaminants to a level of 5 parts per billion by volume (ppbv), the canister is evacuated to 30 in. Hg, tagged, and stored for use in the field. Before sending the canisters out to the field for sampling, the canisters are prehumidified with 100 µL of distilled water and labeled with a field-sampling identification. Canisters stored more than 30 but less than 60 days are re-evacuated and rehumidified before use. If stored more than 60 days, the canisters are recleaned and validated before use.

3.2 Sample Analysis Method

The SUMMA™ canister sample was analyzed according to PNL Technical Procedure PNL-TVP-03, *Determination of TO-14 Volatile Organic Compounds in Hanford Waste Tank Headspace Samples Using SUMMA™ Passivated Canister Sampling and Gas Chromatographic-Mass Spectrometry Analysis*, which is a modified version of EPA compendium Method TO-14. The method uses an EnTech cryoconcentration system interfaced with a Hewlett Packard (HP) 5971 GC/MS. The EnTech concentrator is used to pull a metered volume of sample air from the SUMMA™ canister, cryogenically concentrate the air volume, then transfer the volume to the GC/MS for analysis. A 100-mL volume of sample is measured and analyzed from the tank headspace. The organic components in the sampled air are separated on an analytical column, J&W Scientific DB-1 phase, 60-m by 0.32-mm internal diameter with 3-µm film thickness. The GC oven is programmed to run a temperature gradient beginning at 40°C, holding for 5 min, and ramping at 4°C per min to a final temperature of 260°C, with a 5-min hold.

3.3 Quality Assurance/Quality Control

Before the tank sample was analyzed, a diagnostic check was performed on the GC/MS instrument by running an instrument "quick tune," as described in PNL-TVP-03. Upon satisfactory completion of the instrument diagnostic check, a blank volume of purified nitrogen was analyzed to check the cleanliness of the system. The instrument was then calibrated over 6 data points ranging from 2 ppbv to 100 ppbv, using a standard gas mixture containing 40 volatile organic compounds listed in EPA compendium Method TO-14. A gas mixture containing bromochloromethane, 1,4-difluorobenzene, and chlorobenzene-d₅ was used as an internal standard (IS) for all blank, calibration

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- (a) Pacific Northwest Laboratory. 8/94. *Cleaning SUMMA™ Canisters and the Validation of the Cleaning Process*, PNL-TVP-02 (Rev. 0), PNL Technical Procedure, Richland, Washington.
- (b) Pacific Northwest Laboratory. 8/94. *Determination of TO-14 Volatile Organic Compounds in Ambient Air Using SUMMA™ Passivated Canister Sampling and Gas Chromatographic-Mass Spectrometric Analysis*, PNL-TVP-01 (Rev. 0). PNL Technical Procedure, Richland, Washington.

standard, and sample analyses. Analyte response from sample components, ISs, and standards were obtained from the extracted ion plot from their selected mass ion. The calibration curve was generated by calculating the relative response ratios of the IS to calibration standard responses and plotting the ratios against the ratio of the calibration-standard concentration (in ppbv) to the IS concentration. A least-squares linear-regression routine was applied to the data set to generate the best-fit line for each compound. The equation for that line was then used to quantify the TO-14 compounds found in the tank samples.

3.3.1 Quantitation of TO-14 Results. The quantitative-analysis results for the TO-14 volatile organic compounds were calculated directly from the calibration curve generated using the IS method described above and in PNL-TVP-03. The conversion from ppmv to mg/m^3 assumes standard temperature and pressure (STP) conditions of 760 torr and 273K and was calculated directly from the following equation:

$$\text{mg}/\text{m}^3 = \frac{\text{ppmv} \times \text{g mol wt of compound}}{22.4 \text{ L/mole}} \quad (3.1)$$

3.3.2 Identification and Quantitation of Tentatively Identified Compounds. The tentatively identified compounds (TICs) are determined by mass-spectral interpretation and comparison of the spectra with the EPA/NIST/WILEY Library, which is a part of the HP 5971 instrument operating system. Chromatographic peaks with an area count greater than, or equal to, one half of the total area count of the chlorobenzene- d_5 IS peak at the 20-ppbv calibration level are tentatively identified and quantitatively estimated. This standard was chosen to determine the integration cutoff as it is in the middle of the chromatographic range and not in a region typically affected by coelution of other compounds. The quality of the mass-spectral searches was then reviewed by the principal investigators before the identification was assigned to each chromatographic peak.

The concentration of each TIC was estimated using a relative response factor calculated using a corrected total peak area for the IS chlorobenzene- d_5 . Specifically, the total integrated area for the chlorobenzene- d_5 peak had to be corrected for possible coeluting compounds before calculating the response factor. The corrected total peak area for the IS was calculated by multiplying the IS quantitation ion by a correction factor based on the ratio of the total integrated peak area to the quantitation ion as measured in blank runs. The corrected peak area was then used to calculate a response factor using the IS concentration in mg/m^3 :

$$\text{Response Factor} = \frac{\text{IS conc. } (\text{mg}/\text{m}^3)}{\text{IS peak area}} \quad (3.2)$$

The calculated response factor was then multiplied by the TIC peak area to give an estimated concentration for that compound. For methyl benzene, the total peak area was multiplied by the response factor for chlorobenzene- d_5 to give an estimated concentration of $0.034 \text{ mg}/\text{m}^3$ (average of three canisters). Internal standards bromochloromethane and difluorobenzene were not used to quantitate the TICs because coeluting compounds appeared to have greatly altered the signal of the quantitation ions for those two ISs.

The ppmv concentrations are calculated from mg/m^3 and the molecular weight of the analyte.

$$\text{TIC in ppmv} = \frac{\text{TIC (mg/m}^3\text{)} \times 22.4 \text{ L/mole}}{\text{TIC g mol wt}} \quad (3.3)$$

The IS level added to all blank, standard, and sample injections was 18.3 ppbv for bromochloromethane, 20.3 ppbv for 1,4-difluorobenzene, and 18.2 ppbv for chlorobenzene-d₅. The IS concentrations were converted from ppbv to mg/m³ at STP using a molecular weight of 129.39 (g/mol) for bromochloromethane, 114.09 for 1,4-difluorobenzene, and 117.6 for chlorobenzene-d₅.

3.4 Analysis Results

The results from the GC/MS analysis of the tank-headspace samples are presented in Tables 3.1 and 3.2. A representative total ion chromatogram showing the identity of major constituents is given in Figure 3.1.

Table 3.1 lists the quantitative results for compounds listed in Method TO-14. The levels of TO-14 analytes observed in the sample collected from Tank C-109 were significantly low, close to the quantitation limit (2 ppb).

Table 3.2 lists the semi-quantitative results for the TICs. The predominant species observed in this sample were acetonitrile, acetone, methyl nitrate, 1,1,2-trichloro-1,1,2-trifluoroethane, and nonanol. The normal paraffin hydrocarbons (NPH), defined as n-alkanes from C₁₁ to C₁₅, were not seen in the sample. The total concentration of the TIC compounds was found to be 0.48 mg/m³. Methyl nitrate, acetonitrile, and acetone accounted for approximately 56% of the total concentration of all the organic compounds observed.

4.0 Conclusions

The concentrations of selected organic compounds were determined from *in situ* samples of the headspace of Tank C-109.

One TO-14 component and five of the TICs were above detection limits. However, it is believed that dichlorodifluoromethane and trichloromethane, though in concentrations below the calibrated instrumental detection limits, are present in the Tank C-109 headspace, possibly as ambient background levels. Acetaldehyde, acetonitrile, and acetone accounted for approximately 56% of the total concentration of all the organic compounds observed. The TO-14 compound, 1,1,2-trichloro-1,1,2-trifluoroethane (FREON 113) is a contaminant in the EnTech GC/MS system and was observed in all samples, ambient samples, and blanks analyzed.

5.0 Further Reading

Pacific Northwest Laboratory. Quality Assurance Manual, Part 2: Good Practices Standard. PNL-MA-70, Part 2, Richland, Washington.

Pacific Northwest Laboratory. Quality Assurance Plan for Activities Conducted by the Analytical Chemistry Laboratory (ACL). MCS-033, Analytical Chemistry Laboratory, Richland, Washington.

Pacific Northwest Laboratory. 1994. *Determination of TO-14 Volatile Organic Compounds in Hanford Waste Tank Headspace Samples Using SUMMA™ Passivated Canister Sampling and Gas Chromatographic-Mass Spectrometry Analysis*, PNL-TVP-03 (Rev. 0), PNL Technical Procedure, Richland, Washington.

Pacific Northwest Laboratory. 1994. *Sample Shipping and Receiving Procedure - DRAFT for PNL Waste Tank Samples*. PNL-TVP-07 (Rev. 0), PNL Technical Procedure, Richland, Washington.

Table 3.1 TO-14 Analysis Results for in situ Samples S4031-###-097^(a), S4031-###-135^(a), and S4031-###-136^(a) Collected from Hanford Waste
Tank 241-C-109 in SUMMA Canisters on 6/23/94

Table of TO-14 Standard Components			PNL 097 ^(b)		PNL 135 ^(b)		PNL 136 ^(b)		Average	Standard
TO-14 Analyte	Mol Wt	CAS #	Concentration		Concentration		Concentration		concentration	Deviation
			ppbv	mg/cu.m	ppbv	mg/cu.m	ppbv	mg/cu.m	mg/cu.m	mg/cu.m
dichlorodifluoromethane (FREON-12)	120.92	75-71-8	1.48	0.008	1.48	0.008	1.47	0.008	0.008	0.000
methyl chloride (chloromethane)	50.49	74-87-3	2.59	0.014	2.52	0.006	2.46	0.006	0.008	0.005
1,2-dichloro-1,1,2,2-tetrafluoroethane (FREON-114)	170.93	76-14-2	< 2	< 0.02	< 2	< 0.02	< 2	< 0.02	(c)	(c)
chloroethene (vinyl chloride)	62.50	75-01-4	< 2	< 0.006	< 2	< 0.006	< 2	< 0.006	(c)	(c)
methyl bromide (bromomethane)	94.95	74-83-9	< 2	< 0.009	< 2	< 0.009	< 2	< 0.009	(c)	(c)
ethyl chloride	64.52	75-00-3	< 2	< 0.006	< 2	< 0.006	< 2	< 0.006	(c)	(c)
trichlorofluoromethane (FREON-11)	137.38	75-69-4	0.75	0.002	0.83	0.005	0.85	0.005	0.004	0.002
1,1-dichloroethene (1,1-dichloroethylene)	96.95	75-35-4	< 2	< 0.009	< 2	< 0.009	< 2	< 0.009	(c)	(c)
dichloromethane (methylene chloride)	84.94	75-09-2	< 2	< 0.009	< 2	< 0.009	< 2	< 0.009	(c)	(c)
1,1,2-trichloro-1,2,2-trifluoroethane (FREON-113) ^(d)	187.40	76-13-1	< 2	< 0.02	< 2	< 0.02	< 2	< 0.02	(c)	(c)
1,1-dichloroethane	99.00	75-34-3	< 2	< 0.009	< 2	< 0.009	< 2	< 0.009	(c)	(c)
cis-1,2-dichloroethene (cis-1,2-dichloroethylene)	96.90	156-60-5	< 2	< 0.009	< 2	< 0.009	< 2	< 0.009	(c)	(c)
trichloromethane (chloroform)	119.40	67-66-3	< 2	< 0.01	< 2	< 0.01	< 2	< 0.01	(c)	(c)
1,2-dichloroethane	99.00	107-06-2	< 2	< 0.009	< 2	< 0.009	< 2	< 0.009	(c)	(c)
1,1,1-trichloroethane	133.40	71-55-6	< 2	< 0.01	< 2	< 0.01	< 2	< 0.01	(c)	(c)
benzene	78.10	71-43-2	< 2	< 0.009	< 2	< 0.009	< 2	< 0.02	(c)	(c)
carbon tetrachloride	153.80	56-23-5	< 2	< 0.01	< 2	< 0.01	< 2	< 0.01	(c)	(c)
1,2-dichloropropane	113.00	78-87-5	< 2	< 0.01	< 2	< 0.01	< 2	< 0.01	(c)	(c)
trichloroethylene	131.40	79-01-6	< 2	< 0.01	< 2	< 0.01	< 2	< 0.01	(c)	(c)
cis 1,3-dichloropropene	111.00	10061-01-6	< 2	< 0.01	< 2	< 0.01	< 2	< 0.01	(c)	(c)
trans 1,3-dichloropropene	111.00	10061-02-5	< 2	< 0.01	< 2	< 0.01	< 2	< 0.01	(c)	(c)
1,1,2-trichloroethane	133.40	79-00-5	< 2	< 0.01	< 2	< 0.01	< 2	< 0.01	(c)	(c)
methyl benzene (toluene)	92.14	108-88-3	7.63	0.031	8.17	0.034	9.00	0.037	0.034	0.003
1,2-dibromoethane	187.90	106-93-4	< 2	< 0.02	< 2	< 0.02	< 2	< 0.02	(c)	(c)
tetrachloroethene (tetrachloroethylene)	165.83	127-18-4	< 2	< 0.02	< 2	< 0.02	< 2	< 0.02	(c)	(c)
chlorobenzene	112.60	108-90-7	< 2	< 0.01	< 2	< 0.01	< 2	< 0.01	(c)	(c)
ethylbenzene	106.20	100-41-4	< 2	< 0.01	< 2	< 0.01	< 2	< 0.01	(c)	(c)
p/m-xylene (1,3-dimethylbenzene)	106.17	108-38-3	< 2	< 0.009	< 2	< 0.009	< 2	< 0.009	(c)	(c)
styrene	104.20	106-42-3	< 2	< 0.009	< 2	< 0.009	< 2	< 0.009	(c)	(c)
1,1,2,2-tetrachloroethane	137.90	106-42-3	< 2	< 0.02	< 2	< 0.02	< 2	< 0.02	(c)	(c)
o-xylene (1,2-dimethylbenzene)	106.17	100-42-5	< 2	< 0.009	< 2	< 0.009	< 2	< 0.009	(c)	(c)
1,3,5-trimethylbenzene	120.20	79-34-5	< 2	< 0.01	< 2	< 0.01	< 2	< 0.01	(c)	(c)
1,2,4-trimethylbenzene	120.20	95-47-6	< 2	< 0.01	< 2	< 0.01	< 2	< 0.01	(c)	(c)
chloromethylbenzene, alpha (benzyl chloride)	126.60	108-67-8	< 2	< 0.01	< 2	< 0.01	< 2	< 0.01	(c)	(c)
m-dichlorobenzene (1,3-dichlorobenzene)	147.00	95-63-6	< 2	< 0.01	< 2	< 0.01	< 2	< 0.01	(c)	(c)
p-dichlorobenzene (1,4-dichlorobenzene)	147.00	100-44-7	< 2	< 0.01	< 2	< 0.01	< 2	< 0.01	(c)	(c)
o-dichlorobenzene (1,2-dichlorobenzene)	147.00	541-73-1	< 2	< 0.01	< 2	< 0.01	< 2	< 0.01	(c)	(c)
1,2,4-trichlorobenzene	181.45	106-46-7	< 2	< 0.02	< 2	< 0.02	< 2	< 0.02	(c)	(c)
hexachloro-1,3-butadiene	260.80	95-50-1	< 2	< 0.02	< 2	< 0.02	< 2	< 0.02	(c)	(c)

(a) WHC sample identification number.

(b) PNL canister number.

(c) Average and standard deviation data is not meaningful for this analyte.

(d) Analytical system contaminant

Table 3.2 Table of Tentatively Identified Compounds *In-Situ* and Estimated Concentrations^(a) in Hanford Tank 241-C-109 SUMMATM Canister Samples Collected on 6/23/94

Tentatively Identified Compound ^(d)	CAS # ^(d)	Mol. Wt.	Ret Time	S4031-###.135 ^(b)		S4031-###.136 ^(b)		S4031-###.097 ^(b)		Means and Standard Deviations			
				PNL 135 ^(c)		PNL 136 ^(c)		PNL 097 ^(c)		mg/m ³	stddev	ppmv	stddev
				mg/m ³	ppmv	mg/m ³	ppmv	mg/m ³	ppmv				
carbon dioxide	124-38-9	44	3.14	e	e	e	e	e	e	e	e	e	e
acetaldehyde	75-07-0	44	5.14	<0.025	<0.013	<0.025	<0.013	0.051	0.026	0.051	NA	0.026	NA
acetonitrile	75-05-8	41	7.92	0.081	0.045	0.128	0.070	0.092	0.050	0.100	0.026	0.055	0.013
acetone	67-64-1	58	8.51	0.070	0.027	0.096	0.037	0.084	0.032	0.083	0.015	0.032	0.005
methyl nitrate	598-58-3	77	10.5	0.070	0.020	0.128	0.037	0.146	0.042	0.115	0.042	0.033	0.012
1,1,2-trichloro-1,2,2-trifluoroethane ^(a)	76-13-1	187	11.09	0.113	0.014	0.111	0.013	0.104	0.012	0.109	0.006	0.013	0.001
bromochloromethane (IS)	74-97-5	128	14.89	f	f	f	f	f	f				
1,4 difluorobenzene (IS)	540-36-3	114	18.61	f	f	f	f	f	f				
toluene	108-88-3	92	24.04	<0.025	<0.006	0.043	0.011	<0.025	<0.006	0.043	NA	0.011	NA
hexanal	66-25-1	100	24.98	<0.025	<0.006	0.051	0.011	<0.025	<0.006	0.051	NA	0.011	NA
chlorobenzene-d5 (IS)	3114-55-4	117	28.18	f	f	f	f	f	f				
octanal	124-13-0	128	35.26	<0.025	<0.004	0.056	0.010	<0.025	<0.004	0.056	NA	0.010	NA
nonanal	124-19-6	142	39.81	0.064	0.010	0.082	0.013	<0.025	<0.004	0.073	0.012	0.013	0.002

(a) Semi-quantitative estimate calculated using concentration of closest eluting internal standard.

(b) WHC sample number.

(c) PNL SUMMATM canister number.

(d) Obtained by mass spectral interpretation and comparison with the EPA/NIST/WILEY Library.

(e) Carbon Dioxide cannot be determined by the analytical method used.

(f) Concentration information for internal standards are determined by direct calibration.

(g) Analytical system contaminant

Figure 3.1 GC/MS Chromatogram of Hanford Waste Tank C-109 *In Situ* SUMMA™ Canister
Sample S4031-SUM-135 Collected on 6/23/94

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