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Document #: SD-WM-TP-335

Title/Desc:
VAPOR SAMPLING & ANALYSIS PLAN

COMPLETE

ENGINEERING CHANGE NOTICE

Page 1 of 5

1. ECN 626299

Proj. ECN

2. ECN Category (mark one)	3. Originator's Name, Organization, MSIN, and Telephone No.	3a. USQ Required?	4. Date
Supplemental [ ] Direct Revision [X] Change ECN [ ] Temporary [ ] Standby [ ] Supersedure [ ] Cancel/Void [ ]	C. S. HOMI, 75320, R2-12, 373-1097	[ ] Yes [X] No	10/06/95
	5. Project Title/No./Work Order No. VAPOR SAMPLING AND ANALYSIS PLAN	6. Bldg./Sys./Fac. No. ~~2750E~~/200E 241	7. Approval Designator N/A
	8. Document Numbers Changed by this ECN (includes sheet no. and rev.) WHC-SD-WM-TP-335 REV 1 0 6	9. Related ECN No(s). N/A	10. Related PO No. N/A

11a. Modification Work	11b. Work Package No.	11c. Modification Work Complete	11d. Restored to Original Condition (Temp. or Standby ECN only)
[ ] Yes (fill out Blk. 11b) [X] No (NA Blks. 11b, 11c, 11d)	N/A	N/A Cog. Engineer Signature & Date	N/A Cog. Engineer Signature & Date

12. Description of Change

Complete revision.

13a. Justification (mark one)

Criteria Change	[X]	Design Improvement	[ ]	Environmental	[ ]	Facility Deactivation	[ ]
As-Found	[ ]	Facilitate Const	[ ]	Const. Error/Omission	[ ]	Design Error/Omission	[ ]

13b. Justification Details

Reissue of complete document.

14. Distribution (include name, MSIN, and no. of copies)

See attached Distribution Sheet

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DATE OCT 1 0 1995
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A-7900-013-2 (11/94) GEF095

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15. Design Verification Required	16. Cost Impact				17. Schedule Impact (days)	
	ENGINEERING		CONSTRUCTION			
[] Yes	Additional	[] $	Additional	[] $	Improvement	[]
[X] No	Savings	[] $	Savings	[] $	Delay	[]

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	[]
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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
OPERATIONS AND ENGINEERING			ARCHITECT-ENGINEER		
Cog. Eng. C. S. Homi	C S Homi	10/6/95	PE		
Cog. Mgr. S. J. Eberlein	S J Eberlein	10/6/95	QA		
QA			Safety		
Safety			Design		
Environ.			Environ.		
Other			Other		
Proj. D. R. Bratzel	DR Bratzel	10/10/95			
Proj. D. L. Edwards	See attached Sheet 3 of 5				
Proj. M. W. Ligotke	See attached Sheet 4 of 5		DEPARTMENT OF ENERGY		
Proj. R. A. Jenkins	See attached Sheet 5 of 5		Signature or a Control Number that tracks the Approval Signature		
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1. ECN (use no. from pg. 1) 626299

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Safety		Design	
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Other		Other	
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		ADDITIONAL	

A-7900-013-3 (11/94) GEF096

ENGINEERING CHANGE NOTICE

1. ECN (use no. from pg. 1) 626299

15. Design Verification Required	16. Cost Impact				17. Schedule Impact (days)	
	ENGINEERING		CONSTRUCTION			
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A-7900-013-3 (11/94) GEF096

RELEASE AUTHORIZATION

Document Number:	WHC-SD-WM-TP-335, REV 1
Document Title:	Vapor Sampling and Analysis Plan
Release Date:	10/10/95

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

APPROVED FOR PUBLIC RELEASE

WHC Information Release Administration Specialist:

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SUPPORTING DOCUMENT

1. Total Pages 23

2. Title	3. Number	4. Rev No.
VAPOR SAMPLING AND ANALYSIS PLAN	WHC-SD-WM-TP-335	1

5. Key Words

CHARACTERIZATION, DQO, HEALTH AND SAFETY VAPOR ISSUE, QUALITY CONTROL, VAPOR SAMPLING, ANALYSIS, TANK CHARACTERIZATION PLAN

6. Author

Name: C. S. HOMI

Signature 10/6/95

Organization/Charge Code 75320/N4G6A

7. Abstract

This document is a plan which serves as the contractual agreement between the Characterization Program, Sampling Operations, Oak Ridge National Laboratory, and PNL tank vapor program. The scope of this plan is to provide guidance for the sampling and analysis of vapor samples from both SST and DST tanks.

8. RELEASE STAMP

OFFICIAL RELEASE BY WHC
DATE OCT 10 1995
Sta. 4

WHC-SD-WM-TP-335
Revision 1
UC-2070

Vapor Sampling and Analysis Plan

C. S. Homi
Westinghouse Hanford Company

Date Published
October 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

RECORD OF REVISION	(1) Document Number WHC-SD-WM-TP-335	Page 1

(2) Title
VAPOR SAMPLING AND ANALYSIS PLAN

CHANGE CONTROL RECORD

(3) Revision	(4) Description of Change - Replace, Add, and Delete Pages	Authorized for Release	
		(5) Cog. Engr.	(6) Cog. Mgr. Date
0	(7) WHC-SD-WM-TP-335, REV. 0, EDT 610024 April 17, 1995		
0A	Replaced page 4 (Table 2). ECN 621329		
0B	Replaced pages 2, 3, 4, 6, 7, 8, 9. ECN 621330		
0C	Replaced pages ii, iii, 1, 2, 3, 4, 6, 7, 8, 9, 12, 13, 14 and added Appendix A with tables 1A and 2A. ECN 621331		
0D	Replaced pages ii, 1, 4, and A1. ECN 621332		
0E	Replaced pages ii, iii, 1, 2, 3, 4, 6, 7, 8, 10, 12, 13, 14. Table 2A in appendix deleted. ECN 621333		
0F	Replaced page 4 (Table 2). ECN 621334		
0G	Replaced page 4 (Table 2). ECN 625434		
1 RS	Complete revision ECN 626299	[signature]	[signature] 10-6-95

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APPENDIX

LIST OF ACRONYMS

BEL	Biological Exposure Limit
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CES	Consensus Exposure Standards
CGM	Combustible Gas Meter
DOE	Department of Energy
DOT	Department of Transportation
DQO	Data Quality Objective
ECN	Engineering Change Notice
EPA	Environmental Protection Agency
ESH&QA	Environmental Safety, Health, and Quality Assurance
FAS	Field Analytical Services
GC/MS	Gas Chromatography/Mass Spectrometry
HEPA	High-Efficiency Particulate Air Filters
IC	Ion Chromatography
IDLH	Immediately Dangerous to Life and Health
LFL	Lower Flammability Limit
ORNL	Oak Ridge National Laboratory
PEL	Permissible Exposure Limit
PNL	Pacific Northwest Laboratory
ppbv	parts per billion by volume
ppmv	parts per million by volume
QAPP	Quality Assurance Project Plan
RCRA	Resource Conservation and Recovery Act
REL	Recommended Exposure Limit
SAP	Sampling and Analysis Plan
SML	Sampling and Mobile Laboratories
SUMMA®	Trademark of Molectrics, Inc.
TCP	Tank Characterization Plan
TD	Thermal desorption
TLV	Threshold Limit Value
TRP	Toxicology Review Panel
TO-14	EPA Toxic Organics Protocol 14
TST	Triple Sorbent Trap
TWRS	Tank Waste Remediation System
VSS	Vapor Sampling System
WHC	Westinghouse Hanford Company

1.0 SAMPLING AND ANALYSIS OBJECTIVES

This Sampling and Analysis Plan (SAP) will identify characterization objectives pertaining to sample collection and laboratory analytical evaluation and reporting requirements in accordance with the *Data Quality Objectives for Generic In-Tank Health and Safety Vapor Issue Resolution* (Osborne 1994b) and *Rotary Core Vapor Sampling Data Quality Objective* (Price 1994). These Data Quality Objectives (DQOs) are described in the Tank Characterization reports for tanks listed in Section 2.0. This SAP will also identify procedures and requirements for collecting and characterizing vapor samples from the listed tanks.

2.0 SAMPLING EVENT REQUIREMENTS

Tanks are scheduled to be sampled for flammability and toxicity of vapor in the headspace of the tank. Present vapor sampling systems include Type 2 (In Situ Sampling, or ISS) and Type 3 (the Vapor Sampling System, or VSS). These sampling systems are operated by Sampling and Mobile Laboratories (SML). Both the VSS and ISS collect condensible and non-condensible gases from the tank, they just do it differently. The VSS uses a heated vapor probe and collects the sample out of the tank. The ISS lowers the sorbents and TST into the tank headspace for the condensible gases and collects SUMMA®s out of the tank for permanent gases and organics. This document is intended to address vapor sampling and analysis events for tanks listed in section 2.0 via VSS. Tank specific information will be attached to the appropriate Tank Characterization Plan.

The following sections provide the methodology and procedures to be used in the preparation, retrieval, transport, analysis, and reporting of results from vapor samples retrieved from tanks. The requirements for sampling events, contained within this document are within the scope of work specified in the appropriate laboratory work authorizing documents. Any decisions, observations, or deviations to this sampling and analysis plan made during sample receipt, preparation and analysis shall be documented in controlled notebooks and justified in the deliverable report. The general sampling and analysis scheme for Type 3 vapor sampling is presented as a flowchart and narrative in Figure 1.

Information in Table 2 will apply to the following tanks: S-101, S-110, TX-116, A-102, A-103, BY-102, BX-107, S-103, S-105, S-106, S-107, S-108, and S-109. Information applicable to tank TX-111 is given in the appendix. Future tank SAPs will be added as Engineering Change Notices (ECNs) to this document.

2.1 SAMPLING PREPARATION

The responsibilities of Sampling and Mobile Laboratories (SML) to this sampling event are given in this section. For detailed information regarding applicable operating procedures for the tank vapor sampling activities refer to the appropriate work package. Additional quality control and deliverable requirements are given in Sections 4.0 and 7.0.

Prior to all vapor sampling events and any intrusive work on this tank, an assessment of the flammability of the tank head space gases is required by WHC safety practices. The flammability test is performed by Industrial Hygiene Field Services using a combustible gas meter (CGM).

- If the tank vapor fuel content is greater than or equal to 20% of the lower flammability limit (LFL) under steady state conditions, then all sampling activities must stop until further authorization is given by management.

- If CGM measures a total fuel content between 10% and 20% of the LFL, vapor sampling activity may continue under CGM monitoring to better identify the hazard level.

- If the concentration is below 10% of the LFL, the tank is not considered have a flammability hazard and all sampling work can proceed (Osborne 1994).

The laboratory performing the contracted analytical work shall supply labeled sample containers (SUMMA® canisters and selective sorbent media) to SML at least 48 hours in advance of the scheduled sampling date for each tank. Each sample media container shall be certified as clean and prepared according to procedures called out in Table 1.

2.2 SAMPLING REQUIREMENTS

SML shall provide sample identification numbers to the laboratories according to the format given in Section 4.1. SML shall use labeled sample containers supplied by the laboratory (see Section 4.1) to collect vapor samples. The VSS shall be used to collect vapor from tanks in accordance with procedure WHC-IP-1127(4.10) "Collection of Parallel Sorbent Tube and SUMMA® Canisters Samples Using the Vapor Sampling System (VSS)". The sample type, type of collection media to be used are given in Table 1. The number of samples requested for each tank listed in Section 2.0 are given in Table 2 under the SAMPLE/ACTIVITY DESCRIPTION column.

Table 1. General Sampling Information for Tanks.

Sample Container	Prepared by[1]	Preparation Procedure	Sample Type
SUMMA® Canisters	PNL	PNL-TVP-02	Tank Air
	PNL	PNL-TVP-02	Ambient Air[2]
Triple Sorbent Traps	ORNL and PNL	PNL-TVP-10 CASD-OP-300-WP01[3] CASD-OP-300-WP08	Tank Air
	ORNL and PNL	PNL-TVP-10 CASD-OP-300-WP01[3] CASD-OP-300-WP08	Field Blank
	ORNL and PNL	PNL-TVP-10 CASD-OP-300-WP01[3] CASD-OP-300-WP08	Trip Blank
Sorbent Trap System for NH_3, NO_2, NO, H_2O	PNL	PNL-TVP-09	Tank Air
	PNL	PNL-TVP-09	Field Blank
Tritium Trap	WHC	LA-548-111	Tank Air
HEPA Filters	WHC	N/A	Tank Air

1 ORNL is currently scheduled to provide sample media.
2 One sample taken through the VSS, one sample taken upwind of the tank.
3 Preparation procedure for samples spiked with surrogate(s).

Table 2 (also see Table 1A in appendix) provides a sequence of sampling activities for each tank listed in section 2.0 along with sample collection times and the flow rates through sample collection tubes. A cleanliness check of the sampling system shall be performed in accordance with procedure WHC-IP-1127(4.10) Appendix E. A cleanliness check of the VSS shall also be performed by collecting ambient air SUMMA® samples prior to sampling the tanks using the following conditions: 1) with the VSS manifold and transfer line fully heated, and 2) without the VSS, upwind of the tank to be sampled.

Organic vapors shall be monitored using the GC/FID during the sampling event. The operating procedure for the GC/FID is provided in the procedure WHC-IP-1127(4.10) and Bellus (1993). The sampling team is responsible for documenting any problems and procedural changes affecting the validity of the sample in a field notebook.

All vapor samples shall be stored under chain-of-custody requirements by SML while performing a radiological survey of certain items used during sampling. Surveys are conducted to assure compliance with Department of Transportation (DOT) shipping regulations and laboratory acceptance criteria. Items surveyed include four HEPA filters and one tritium trap and are analyzed following procedures specified in Table 4 (Bratzel 1994).

The results from the radiation screening shall be submitted to and evaluated by Sampling and Mobile Laboratories (SML) to ensure the samples for each tank listed in section 2.0 meet the analytical criteria specified in Table 3. SML shall provide a Format II report to each analytical laboratory to specify survey results (refer to Section 7.2).

Trip blanks and field blanks, when used, are to accompany the waste samples to the laboratory. For specific information concerning sample and blank handling, custody, and transport refer to quality assurance/quality control requirements in Section 4.0.

Table 2. List of Samples and Activities for Each Tank in Section 2.0

SAMPLE CODE	SAMPLE/ACTIVITY DESCRIPTION	SAMPLER POSITION DURING COLLECTION [1]	GAS FLOW RATE	SAMPLE DURATION
--	Adjust VSS temperature setpoint to 60°C [2]	N/A	N/A	N/A
--	Purge VSS with ambient air [3]	N/A	5,450 mL/min	30 min.
01	Collect ambient air sample SUMMA #1	Upwind of tank	N/A	1 min.
--	Perform cleanliness check	N/A	N/A	N/A
02	Collect ambient air sample SUMMA #2	Port 15	N/A	1 min.
--	Leak test	N/A	N/A	N/A
--	Purge VSS with tank gas	N/A	5,450 mL/min	30 min.
--	Measure tank pressure	N/A	N/A	N/A
--	Collect GC sample and initiate GC run [4]	N/A	N/A	N/A
03	Collect SUMMA #3	Port 11	N/A	1 min.
04	Collect INORG Sorbent Trap #1	Sorbent line 1	200 mL/min	15 min.
05	Collect INORG Sorbent Trap #2	Sorbent line 2	200 mL/min	15 min.
06	Collect INORG Sorbent Trap #3	Sorbent line 3	200 mL/min	15 min.
07	Collect INORG Sorbent Trap #4	Sorbent line 4	200 mL/min	15 min.
08	Collect ORNL Triple Sorbent Trap (TST) sample #1	Sorbent line 5	200 mL/min	20 min.
09	Collect ORNL TST sample #2	Sorbent line 6	200 mL/min	20 min.
10	Collect ORNL TST sample #3	Sorbent line 7	200 mL/min	20 min.
11	Collect ORNL TST sample #4	Sorbent line 8	200 mL/min	20 min.
12	Collect SUMMA #4	Port 13	N/A	1 min.
13	Collect INORG Sorbent Trap #5	Sorbent line 1	200 mL/min	15 min.
14	Collect INORG Sorbent Trap #6	Sorbent line 2	200 mL/min	15 min.
15	Collect INORG Sorbent Trap #7	Sorbent line 3	200 mL/min	15 min.
16	Collect INORG Sorbent Trap #8	Sorbent line 4	200 mL/min	15 min.
17	Collect ORNL TST sample #5	Sorbent line 5	50 mL/min	4 min.
18	Collect ORNL TST sample #6	Sorbent line 6	50 mL/min	4 min.
19	Collect ORNL TST sample #7	Sorbent line 7	50 mL/min	4 min.
20	Collect ORNL TST sample #8	Sorbent line 8	50 mL/min	4 min.
21	Collect Tritium Trap	Sorbent line 4	200 mL/min	5 min.
22	Collect ORNL TST sample #9	Sorbent line 5	200 mL/min	5 min.
23	Collect ORNL TST sample #10	Sorbent line 6	200 mL/min	5 min.
24	Collect ORNL TST sample #11	Sorbent line 7	200 mL/min	5 min.
25	Collect ORNL TST sample #12	Sorbent line 8	200 mL/min	5 min.
26	Collect SUMMA #5	Port 15	N/A	1 min.
27, 28	Store TST Trip Blanks #1 & #2	None	None	None
29	Open, close, & store ORNL TST Field Blank #1	In VSS truck	0 mL/min	N/A
30	Open, close, & store ORNL TST Field Blank #2	In VSS truck	0 mL/min	N/A
31	Open, close, & store INORG Field Blanks #1,	In VSS truck	0 mL/min	None
32	Open, close, & store INORG Field Blanks #2,	In VSS truck	0 mL/min	None
33	Open, close, & store INORG Field Blanks #3,	In VSS truck	0 mL/min	None

Table 2. List of Samples and Activities for Each Tank in Section 2.0

SAMPLE CODE	SAMPLE/ACTIVITY DESCRIPTION	SAMPLER POSITION DURING COLLECTION[1]	GAS FLOW RATE	SAMPLE DURATION
34	Remove upstream HEPA Filter from HEPA transfer box	Upstream of box	Continuous	
35	Remove downstream HEPA Filter from HEPA transfer box	Downstream of box	Continuous	
36	Remove upstream HEPA Filter from VSS	Upstream of VSS	Continuous	
37	Remove downstream HEPA Filter from VSS	Downstream of VSS	Continuous	

1 Sample ports and lines may be changed during sampling. Actual port used shall be documented on the samping data sheets.
2 Heating to 60°C will prevent water vapor condensation.
3 Not required if ambient air purge incorporated in VSS setup.
4 Additional GC runs may be performed to obtain organic data and to assure cleanliness of the system at the discretion of the sampling scientist and shall be identified in the deliverable report. Organic data obtained from the on-line GC is developmental.

Table 3. Limits For Acceptable Radionuclide Activity Levels.

Organization	Total α	Total β/γ	Total $\alpha/\beta/\gamma$	Units
PNL Vapor Laboratory	$\leq$ 100	$\leq$ 400	N/A	pCi/g
Oak Ridge National Laboratory	$\leq$ 135	$\leq$ 450	N/A	pCi/g
WHC-CM-2-14	N/A	N/A	$\leq$ 2000	pCi/g

3.0 LABORATORY ANALYSIS REQUIREMENTS

The responsibilities of the analytical laboratories for each sampling event are given in this section. Additional quality control and deliverable requirements are given in Sections 4.0 and 7.0.

3.1 ANALYSIS SCHEME

Sample material retrieved from each tank vapor space and contained within the SUMMA® canisters shall be analyzed for organic compounds following modified EPA procedure TO-14 and for permanent gases CO_2, CO, CH_4, H_2, and N_2O using gas chromatography. The sorbent traps contain analyte-specific sorbent media and shall be analyzed for these specific analytes. The triple sorbent traps contain sorbent media designed to allow a broad range of organic species to be retained. Table 4 identifies the appropriate laboratory procedures used in each analysis.

One SUMMA® canister shall be archived for each tank at the PNL Laboratory following receipt and control procedure PNL-TVP-07 until 30 days after issuance of the final data report or until instructed by the Tank Vapor Program to clean the canister for reuse. If necessary, requirements for further quantification and speciation shall be conveyed through a Letter of Instruction by the Characterization Program and/or revision to this Tank Characterization Plan.

Any analyses prescribed by this document, but not performed, or other deviations, shall be identified and include justification in the appropriate data report and referenced in a laboratory notebook.

3.2 INSUFFICIENT SAMPLES

Unlike a solid sample which may have full or partial recovery, vapor sample media contain either good, bad, or no sample. A sample that is bad or empty may not have a proper seal. Partial recovery of a vapor sample is not an issue, however, the number of good samples may be an issue. All good samples, except the SUMMA® canister archive, shall be analyzed. If there are insufficient good samples to perform all requested analyses, the Characterization Program Office and the Tank Vapor Program shall be notified. The SUMMA® canister archive shall be used if one or more of the SUMMA® canister samples is compromised.

Figure 1. Test Plan Outline and Flowchart for Each Tank Vapor Space Characterization.

Step 1. (Labs) Prepare sample and blank containers at contract laboratories. Label containers using sample identification numbers and sampling data provided by SML.

Step 2. (Labs) Ship Containers to SML at least 48 hours in advance of scheduled sampling event. Shipping, receiving, and control of containers shall be guided by procedures WHC-IP-1127(1.3) (for SML), and either PNL-TVP-07 (for PNL) or CASD-AM-300-WP02 (for ORNL).

Step 3. (SML) If tank is safe with regard to flammability, set up vapor sampling system (VSS) and collect samples following procedure WHC-IP-1127(4.10) and guidelines in Table 2.

Step 4. (SML) Move the vapor sample containers to custody locked storage. Submit the HEPA filters and Tritium trap to the 222-S Laboratory for radiological survey.

Step 5. (SML) Using radiological survey report results, determine if samples are acceptable to ship offsite (see Table 3)

Step 6. (SML) If determined to be acceptable according to offsite laboratory requirements and WHC-CM-2-14, ship sample and blanks. If not acceptable to ship, maintain samples in storage and contact the Tank Vapor Issue Resolution Program for further direction.

Step 7. (LABS) Perform laboratory analyses (see Table 4 for procedure numbers).

A. SUMMA® Canisters (PNL): Perform organic vapor analysis by modified EPA-TO-14. Perform permanent gas analysis for the following: H_2, CO, N_2O, CH_4, CO_2.

B. Sorbent Traps (PNL): Perform gravimetric analysis for moisture. Perform selective electrode analysis for NH_3. Analyze NO and NO_2 Traps.

C. Triple Sorbent Traps (PNL & ORNL): Perform organic vapor analysis.

Step 8. (Labs and SML): Following the Section 7.0 reporting requirements, deliver a Format VI report to the Tank Vapor Issue Resolution Safety Program.

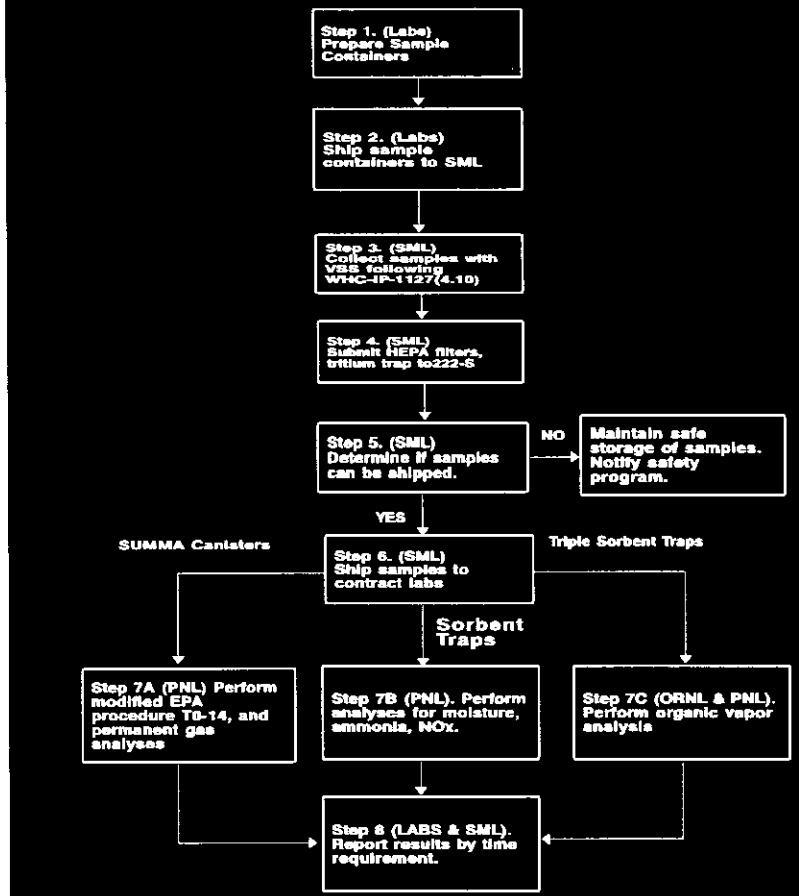

Table 4. Sample Chemical, Physical, And Radiological Analytical Requirements

VAPOR		COMMENTS		SEE TABLE 2 FOR NO. OF SAMPLE/BLANK CONTAINERS			
Plan Number	WHC-SD-WM-TP-335	Type 3 vapor sampling system (VSS) using heated vapor probes.	Early Notify	Organization	WHC	PNL	ORNL
Generic:	Type 3 Vapor SAP for each tanks listed in section 2.0		Process Control	SUMMA® Canister[a]		X	
Program Contact	D. R. Bratzel		Safety Screen	Sorbent Trap System[b]		X	
TWRS Contact	C. S. Homi		Waste Management	Triple Sorbent Trap			X
			RCRA Compliance	HEPA Filter	X		
Lab Project Coordinator	M. W. Ligotke (PNL) R. A. Jenkins (ORNL)		Special	Tritium Trap	X		

PRIMARY ANALYSES							CRITERIA				REPORT FORMAT
ANALYSIS METHOD	PRIMARY ANALYTE	PROCEDURE	LAB	SAMPLE PREP	SAMPLE CONTAINER	SURR SPIKE[c]	NOTIFICATION LIMIT (NL)[d]	EXPECTED RANGE	PRECN at NL	ACCURACY at NL	
EPA TO-14 GC/MS	Organic* Speciation	PNL-TVP-01 PNL-TVP-02 PNL-TVP-03	PNL	Direct	SUMMA®	none	≥ 700 ppmv n-Butanol 50% IDLH for all others*	not available	±25%	70-130%	I, VI
GC/TCD	CO_2 CO CH_4 H_2 N_2O	PNL-TVP-05 PNL-TVP-02	PNL	Direct	SUMMA®	none	N/A ≥ 20% LFL ≥ 20% LFL ≥ 20% LFL not available	not available	±25% ±25% ±25% ±25% ±25%	70-130%	VI I, VI I, VI I, VI I, VI
IC	NO NO_2	PNL-TVP-09 PNL-ALO-212	PNL	H_2O Extraction	Sorbent Trap	none	≥ 50 ppmv ≥ 10 ppmv	≥ 2 ppmv ≥ 0.1 ppmv	±25% ±25%	70-130%	I, VI I, VI
Gravimetric	H_2O	PNL-TVP-09	PNL	Direct	Sorbent Trap	none	N/A	≥ 3 mg/L	±25%	70-130%	VI
Selective Electrode	NH_3	PNL-TVP-09 PNL-ALO-226	PNL	H_2O Extraction	Sorbent Trap	none	≥ 150 ppmv	≥ 2 ppmv	±25%	70-130%	I, VI
GC/MS	Organics**	CASD-10P-300WP01 CASD-OP-300-WP03 CASD-OP-300-WP04 CASD-OP-300-WP06	ORNL	Thermal Desorption (TD)	Triple Sorbent Trap (TST)	all	≥ 700 ppmv n-Butanol, 50% IDLH for all others**	not available	±25%	70-130%	I, VI
GC/MS	Organics*	PNL-TVP-10	PNL	TD	TST	all	Same	not available	±25%	70-130%	I, VI
Total α Total β/γ Total α/β/γ	Radon Daughters	LA-508-110 LA-508-111 LA-508-162	WHC	Direct	HEPA Filter	N/A	≥100 pCi/g α ≥400 pCi/g β/γ ≥2000 pCi/g α/β/γ	<100 pCi/g α <400 pCi/g β/γ <2000 pCi/g α/β/γ	±25% ±25% ±25%	70-130%	I, II
Liq. Scin.	Tritium[e]	LA-548-111	WHC	Direct	Trit. Trap	N/A	N/A	not available	N/A	N/A	II
GC/FID	Organics	WHC-IP-1127(4.10)	SML	Direct	On-line	N/A	N/A	N/A	N/A	N/A	II, VI

N/A: Not Applicable
a No extra canisters, except archive, will be stored by PNL.
b System contains individual sorbent media sections for NO_x, NH_3, & H_2O.
c Samples spiked with surrogates.
d Action required if any compound exceed 50% IDLH.
e Survey purpose only.

*Acetone, acetonitrile, benzene, 1,3-butadiene, butanal, n-butanol, n-hexane, methane, propane nitrile. Other organic species detected at levels deemed sufficient by the Toxicology review Panel to be of potential toxicological concern shall be reported following Format I.
**Acetone, acetonitrile, benzene, butanol, n-dodecane, n-hexane, propane nitrile, tributyl phosphate, n-tridecane. Other organic species detected at level deemed sufficient by the Toxicology Review Panel to be of potential toxicological concern shall be reported following Format I.

4.0 QUALITY ASSURANCE & QUALITY CONTROL

This Sampling and Analysis Plan and analytical laboratory operations are approved by the WHC Environmental Safety, Health, and Quality Assurance (ESH&QA) Program provided the following conditions are met.

1) Each laboratory has a quality assurance program that meets the applicable requirements of DOE order 5700.6C, or 10 CFR 830.120. In addition, it must also meet the requirements of QAPP-013 (Keller 1994). Additional laboratory QA requirements as identified in the *Hanford Analytical Services Quality Assurance Plan (HASQAP)* (DOE 1994) will be implemented by November 30, 1995.

2) Each analysis and media preparation procedure given in Tables 1 and 4 are documented by the laboratory and available to ESH&QA.

3) Any modifications made to, or deviations from, the prescribed procedures are documented in controlled notebooks and justified in the deliverable report.

The ORNL tank vapor program is governed by the "Chemical and Analytical Sciences Division Quality Assurance Plan", QAP-X-94-CASD-001.

The PNL tank vapor program is governed by a QA Plan (Barnes 1995). ESH&QA will qualify laboratories for continued use by the TWRS Characterization Program after receipt of a QA plan, followed by an audit and corrective action phase.

4.1 SAMPLING OPERATIONS

SML shall provide unique sample label and identification numbers to the laboratories. Each sample identification number shall have the following format:

SXXXX-WYY-LLL, where:

XXXX = unique number assigned to the sampling event,
W = a letter code indicating the day of a multi-day sampling event,
YY = a 2-digit sample code found in Table 2, List of Samples and Activities, column one.
LLL = a special lab assigned code.

Once the sample collection media has been received by SML from the laboratory, it shall remain in the physical control of the custodian, locked in a secure area, or prepared for shipping with tamper evident tape under conditions specified on the chain-of-custody form and in accordance with laboratory operating procedure WHC-IP-1127(1.3) "Chain-of-Custody for RCRA and CERCLA Protocol Samples".

Applicable operating procedures for the tank vapor space sampling activities are contained in the appropriate work package. Vapor samples, trip blanks, and field blanks are to be collected in accordance with Tables 1 and 2 and laboratory operating procedure WHC-IP-1127(4.10) "Collection of Parallel Sorbent Tubes and SUMMA® Canister Samples Using the Vapor Sampling System (VSS)" and shipped to the

laboratory in accordance with Hazardous Material Packaging and Shipping, WHC-CM-2-14.

All sampling activities shall be documented in controlled field logbooks maintained by sampling personnel (SML) and shall contain, but are not limited to:

1) identification of tank and riser number and photographs of the sample location in which the sampling is conducted,

2) if any anomalies are observed, corresponding sample identification numbers, flow rates, pressures, temperatures, and other operational parameters affecting the sample,

3) any conditions that the sampler may observe during the sampling event (i. e., odors, nearby machinery in operation, etc.),

4) names and titles of personnel involved in the field activity and their responsibilities,

5) instrument calibration dates.

SML is responsible for documenting any problems and procedural changes affecting the validity of the sample in a controlled field notebook and shall enter this information in the comment section of the chain-of-custody form for addition to the data reports.

4.2 SAMPLE CUSTODY

The laboratory supplying the sample collection media shall initiate the chain-of-custody in accordance with the laboratory operating procedure WHC-IP-1127(1.3), "Chain-of-Custody for RCRA and CERCLA Protocol Samples" using sample label and identification numbers provided by SML.

The sample receipt and control procedure used in the PNL laboratory is PNL-TVP-07. Oak Ridge National Laboratory shipping and receiving is done by procedure CASD-OP-300-WP02.

4.3 LABORATORY OPERATIONS

The SUMMA® canisters and Sorbent Trap Systems shall be prepared, verified, and labeled by the performing laboratories following the laboratory control procedures identified in Table 1. Analyses shall be performed following the procedures in Table 4. Method specific quality control such as calibrations and blanks are also found in the analytical procedures. Sample quality control (duplicates, spikes, standards) specified in the applicable DQO's are identified in Table 4. Due to the developmental work being done with the analysis procedures and potential sample differences (between tanks), changes in procedures may be needed.

5.0 ORGANIZATION AND RESPONSIBILITY

The organization and responsibility of key personnel involved in the tank vapor sampling project are listed in Table 5.

Table 5. Tank Vapor Sampling Project Key Personnel List.

Individual(s)	Organization	Responsibility
M. W. Ligotke	Pacific Northwest Laboratory	Project Manager for Vapor Sample Characterization
R. A. Jenkins	Oak Ridge National Laboratory	Project Manager for Vapor Sample Characterization
D. R. Bratzel	TWRS Tank Vapor Issue Resolution Program	Tank Vapor Issue Resolution Program Manager
N. W. Kirch	Process Control	Technical Evaluation
E. J. Lipke	TWRS Operations Program	Tank Safety Screening Representative
R. S. Viswanath	Special Analytical Studies	Vapor Program Technical Lead
R. D. Mahon	Sampling and Mobile Laboratories	Vapor Sampling Program Lead
E. H. Neilsen	Waste Tank Safety Engineering	Vapor Sampling Cognizant Engineer
D. R. Carls E. R. Hewitt R. D. Mitchell L. M. Calderon	Industrial Hygiene and Safety Program	Industrial Hygiene Points of Contact if Notification Limit is Exceeded (FAX 372-3522)
East & West Area Shift Operations Manager	Tank Farm Operations	East (373-2689), West (373-3475) Tank Farm Points of Contact if Notification Limit is Exceeded

6.0 EXCEPTIONS, CLARIFICATIONS, AND ASSUMPTIONS

Toxicology Review Panel

The Toxicology Review Panel (TRP) is a group of toxicologists, industrial hygienists, and occupational medicine physicians that convene to review quantitative vapor sample data, identify compounds of toxicological concern, and make recommendations to the WHC Tank Vapor Program Manager concerning potential impacts to worker health and safety.

Toxicological Concern

From a list of 160 analytes found in a previous study for tank C-103, the TRP identified 19 analytes of toxicological interest. These analytes and others may

be identified during TRP review of qualitative GC vapor data as being of toxicological concern if they exceed recommended levels inside the tank headspace. Established guidelines for these analytes are base on Consensus Exposure Standards (CES).

Consensus Exposure Standards

A CES is generally defined as the most stringent of known regulatory or recommended toxicological values for the occupational setting including the threshold limit value (TLV), permissible exposure limit (PEL), recommended exposure limit (REL), and biological exposure limit (BEL). For those constituents with unknown toxicological values, the TRP will be responsible for development of a CES.

Trip Blanks and Field Blanks

Trip Blanks are sampling devices prepared and handled in the same manner as samples, except that they are never opened in the field. Field Blanks are sampling devices prepared and handled in the same manner as the samples, but no tank gases are drawn through them. Laboratories supplying blanks may opt to analyze only 1 trip blank unless it is determined to be contaminated, in which case all trip blanks are to be analyzed.

Sample Custodian

The sample custodian is the designated SML cognizant scientist or assisting scientific technician, lead sampler, or laboratory scientist or technician who signs the received by block on the chain-of-custody form. Transfer of custodianship occurs when the custodian signs the relinquished by block on the chain-of-custody form and releases the sample(s) to the new custodian signator.

Physical Control

Physical control of a sample includes being in the sight of the custodian, in a room which shall signal an alarm when entered, or locked in a cabinet.

7.0 DELIVERABLES

The Pacific Northwest Laboratory, Oak Ridge National Laboratory, and Sampling and Mobile Laboratories VSS sampling and analyses of tank vapors shall be reported as Format VI. In addition, the analytical laboratories shall receive Format II reports from Sampling and Mobile Laboratories as described in Section 7.2. Any analyte exceeding the notification limit prescribed in Table 4 shall be reported as Format I. Other organic species detected at levels deemed sufficient by the Toxicology Review Panel to be of potential toxicological concern shall also be reported following Format I. Additional information regarding reporting formats is given in Schreiber (1994a, 1994b).

7.1 FORMAT I REPORTING

Table 4 contains the notification limits for specific analytes. Analytes that exceed notification limits defined in the DQO processes shall be reported by the Project Manager, delegate, or Health Physics Management by calling the East or West Area Shift Manager of Tank Farm Operations immediately. This verbal communication must be followed within 3 working days by written communication to the Vapor Program, the Industrial Hygiene and Safety Program, Process Control, and the Characterization Program Office, documenting the observation(s) (Schreiber 1995). A further review of the data, including quality control results and additional analyses for verification of the exceeded analyte, may be contracted between the performing laboratory and the contacts above.

7.2 FORMAT II REPORTING

Results of the 222-S Laboratory's radiological survey shall be reported by Sampling and Mobile Laboratories as Format II to the vapor analytical laboratories listing the picocuries per sample (pCi/g/sample) for each sample submitted for analysis. This Format II report should also provide the sample collection sequence and volumes, verification of trip and field blank use, and any anomalous sampling conditions to accompany, if possible, the shipment of samples. Alternatively, this sampling report may be transmitted by FAX to the analytical laboratories within 48 hours after the samples have been shipped.

7.3 FORMAT VI REPORTING

All Format VI reports shall be delivered to the Vapor Program, Special Analytical Studies, the Characterization Program Office, Analytical Services, and the Tank Characterization Resource Center.

Each analytical laboratory and SML should deliver three reports. Sampling and analytical data are requested within 5 weeks after receipt of both the samples and supporting data and shall consist of, at a minimum, data tables reporting sample collection data, industrial hygiene tank monitoring data, and radiation screening results obtained by SML, or the results of each analysis performed by the analytical laboratories. A final report shall be delivered within a nine week period after receipt of both the samples and supporting data. A cleared final report shall be delivered after it has completed the proper clearance. Final reports shall be submitted to clearance in parallel to being submitted to the WHC customers identified above.

The final sampling report from Sampling and Mobile Laboratories shall be a WHC supporting document, with public release. It shall include:

1) A description of sampling equipment used;

2) a description of sampling quality controls applied (e.g., leak and cleanliness tests of the sampling manifold, system temperature and pressure monitoring/alarms, instrument calibration details);

3) sampling event chronology and sample collection schedule (complete list of samples, by ID#, time collected, flow rates, etc.);

4) any industrial hygiene tank monitoring data collected before or during sampling event;

5) an evaluation of sources of sampling errors;

6) sample radiation screening results;

7) sample storage and shipment details; and

8) copies of all chain-of-custody forms.

The cleared final report from the analytical laboratories shall be acceptable for distribution to the public. To the extent possible, the final reports shall include:

1) A summary of analytical results;

2) a description of sample device preparation (and manufacturer if appropriate), citing procedures and logbooks used;

3) references providing traceability of sample device cleanliness;

4) a brief description of analytical methods, with procedures cited;

5) a brief explanation of how analytical systems control was demonstratably maintained;

6) a brief description of sample storage and shipment conditions, citing procedures and logbooks used;

7) a listing of analytes of quantitation (target analytes), with analytical method detection limit, range for which instrumentation is calibrated, number of calibration points used, and statistical data on linearity of calibration;

8) quantitative analytical results, expressed as dimensionless (ppmv or ppbv) concentration, and mass concentration ($\mu g/m^3$, mg/L, etc., calculated at 0 °C and 1 atm) of target analytes (identified by name and Chemical Abstract Service number) in each tank air sample;

9) tentative identification and semi-quantitative analytical results, expressed in both mass and dimensionless concentrations (if possible) of non-target organic analytes (identified by name and Chemical Abstract Service number) in each organic vapor sample;

10) a statistical summary (i.e., mean, standard deviation) for multiple analyses and/or multiple samples for all analytes (positively and tentatively identified compounds) in both mass and dimensionless concentrations (if possible);

11) a summary of all exceptional conditions, such as deviations from procedure or protocol, results obtained outside of instrument calibration range, sorbent trap breakthrough of analytes, or poor surrogate recoveries; and

12) Copies of all chain-of-custody forms.

8.0 CHANGE CONTROL

Under certain circumstances, it may become necessary for the performing laboratory to make decisions concerning a sample without review of the data by the customer or the Characterization Program. These changes shall be brought to the attention of the project manager and the Characterization Program as quickly as possible and documented accordingly. Changes must be justified in their documentation and follow the protocols defined in the WHC Quality Assurance Manual, WHC-CM-4-2, Section QR 3.0, Design Control and in Standard Engineering Practices, WHC-CM-6-2, Section EP-2.2, Engineering Document Change Control Requirements. PNL and ORNL shall document changes in accordance with their respective QA program requirements. All changes shall also be clearly documented in the final data package.

Additional analysis of sample material from this vapor space characterization project at the request of the Characterization Program shall be performed according to a revision of this Tank Characterization Plan.

9.0 REFERENCES

Barnes, B. O., 1995, *Quality Assurance Plan for PNL TWRS Tank Vapor Program*, MCS-046, Rev. 0, Pacific Northwest Laboratory, Richland, Washington.

Bratzel, D. R., 1994, *Letter of Instruction for Radiological Analyses to Support Fiscal Year 1995 Tank Vapor Sampling*, (internal memo 74310-94-32 to J. G. Kristofzski, November 30), Westinghouse Hanford Company, Richland, Washington.

Bellus, T. H., 1993, *Configuration of Hewlett Packard (HP) 5890 Series II Gas Chromatograph (GC) for DML1*, (internal memo 12240-SAA93-039 to L. L. Lockrem, July 10), Westinghouse Hanford Company, Richland, Washington.

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Price, D. N., 1994, *Rotary Core Vapor Sampling Data Quality Objective*, WHC-SD-WM-SP-003, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Schreiber, R. D., 1994a, *Format I Reporting Requirement*, (internal memo 7E720-94-128 to J. G. Kristofzski, August 15), Westinghouse Hanford Company, Richland, Washington.

Schreiber, R. D., 1994b, *Revised Interim Tank Characterization Plan Guidance*, (letter 7E720-94-121 to C. S. Haller, May 13), Westinghouse Hanford Company, Richland, Washington.

Schreiber, R. D., 1995, Revision: *Point of Contact/Distribution List*, (internal memo 71520-95-108 to J. G. Kristofzski, March 15), Westinghouse Hanford Company, Richland, Washington.

United States Department of Energy Order 5700.6C, of 08-21-91, *Quality Assurance*.

United States Code of Federal Regulations 10 CFR, Part 830, *Nuclear Safety Management;* Section 120, *Quality Assurance Requirements*.

Whelan, T. E., 1994, *TWRS Characterization Program Quality Assurance Program Plan*, WHC-SD-WM-QAPP-025, Westinghouse Hanford Company, Richland, WA.

APPENDIX

Table 1A. List of Samples and Activities for TX-111

SAMPLE CODE	SAMPLE/ACTIVITY DESCRIPTION[1]	SAMPLER POSITION DURING COLLECTION[2]	GAS FLOW RATE	SAMPLE DURATION
--	Adjust VSS temperature setpoint to 60°C [3]	N/A	N/A	N/A
--	Purge VSS with ambient air [4]	N/A	5,450 mL/min	30 min.
01	Collect ambient air sample SUMMA #1	Upwind of tank	N/A	1 min.
--	Perform cleanliness check	N/A	N/A	N/A
02	Collect ambient air sample SUMMA #2	Port 15	N/A	1 min.
--	Leak test	N/A	N/A	N/A
--	Purge VSS with tank gas	N/A	5,450 mL/min	30 min.
--	Measure tank pressure	N/A	N/A	N/A
--	Collect GC sample and initiate GC run [5]	N/A	N/A	N/A
04	Collect SUMMA #3	Port 11	N/A	1 min.
08	Collect INORG Sorbent Trap #1	Sorbent line 1	200 mL/min	15 min.
09	Collect INORG Sorbent Trap #2	Sorbent line 2	200 mL/min	15 min.
10	Collect INORG Sorbent Trap #3	Sorbent line 3	200 mL/min	15 min.
11	Collect INORG Sorbent Trap #4	Sorbent line 4	200 mL/min	15 min.
40	Collect ORNL Triple Sorbent Trap (TST) sample #1	Sorbent line 5	200 mL/min	20 min.
41	Collect ORNL TST sample #2	Sorbent line 6	200 mL/min	20 min.
42	Collect ORNL TST sample #3	Sorbent line 7	200 mL/min	20 min.
43	Collect ORNL TST sample #4	Sorbent line 8	200 mL/min	20 min.
12	Collect SUMMA #4	Port 13	N/A	1 min.
16	Collect INORG Sorbent Trap #5	Sorbent line 1	200 mL/min	15 min.
17	Collect INORG Sorbent Trap #6	Sorbent line 2	200 mL/min	15 min.
18	Collect INORG Sorbent Trap #7	Sorbent line 3	200 mL/min	15 min.
19	Collect INORG Sorbent Trap #8	Sorbent line 4	200 mL/min	15 min.
44	Collect ORNL TST sample #5	Sorbent line 5	50 mL/min	4 min.
45	Collect ORNL TST sample #6	Sorbent line 6	50 mL/min	4 min.
46	Collect ORNL TST sample #7	Sorbent line 7	50 mL/min	4 min.
47	Collect ORNL TST sample #8	Sorbent line 8	50 mL/min	4 min.
03	Collect Tritium Trap	Sorbent line 4	200 mL/min	5 min.
48	Collect ORNL TST sample #9	Sorbent line 5	200 mL/min	5 min.
49	Collect ORNL TST sample #10	Sorbent line 6	200 mL/min	5 min.
50	Collect ORNL TST sample #11	Sorbent line 7	200 mL/min	5 min.
51	Collect ORNL TST sample #12	Sorbent line 8	200 mL/min	5 min.
20	Collect SUMMA #5	Port 15	N/A	1 min.
52, 53	Store ORNL TST Trip Blanks #1 & #2	None	None	None
54	Open, close, & store ORNL TST Field Blank #1	In VSS truck	0 mL/min	N/A
55	Open, close, & store ORNL TST Field Blank #2	In VSS truck	0 mL/min	N/A
25	Open, close, & store INORG Field Blanks #1,	In VSS truck	0 mL/min	None
26	Open, close, & store INORG Field Blanks #2,	In VSS truck	0 mL/min	None
27	Open, close, & store INORG Field Blanks #3,	In VSS truck	0 mL/min	None

Table 1A. List of Samples and Activities for TX-111

SAMPLE CODE	SAMPLE/ACTIVITY DESCRIPTION[1]	SAMPLER POSITION DURING COLLECTION[2]	GAS FLOW RATE	SAMPLE DURATION
34	Remove upstream HEPA Filter from HEPA transfer box	Upstream of box	Continuous	
35	Remove downstream HEPA Filter from HEPA transfer box	Downstream of box	Continuous	
36	Remove upstream HEPA Filter from VSS	Upstream of VSS	Continuous	
37	Remove downstream HEPA Filter from VSS	Downstream of VSS	Continuous	

1 Sampling sequence will follow the order listed in the "SAMPLE/ACTIVITY DESCRIPTION" column rather than numerical values listed in the "SAMPLE CODE" column.
2 Sample ports and lines may be changed during sampling. Actual port used shall be documented on the samping data sheets.
3 Heating to 60°C will prevent water vapor condensation.
4 Not required if ambient air purge incorporated in VSS setup.
5 Additional GC runs may be performed to obtain organic data and to assure cleanliness of the system at the discretion of the sampling scientist and shall be identified in the deliverable report. Organic data obtained from the on-line GC is developmental.