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# Double-Shell Tank Ventilation System Vapor Sampling and Analysis Plan

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# Double-Shell Tank Ventilation System Vapor Sampling and Analysis Plan

**L. M. Sasaki**
CH2M HILL Hanford Group, Inc.

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Prepared for the U.S. Department of Energy
Office of River Protection

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# LIST OF ABBREVIATIONS

| | |
|---|---|
| CAS | Chemical Abstracts Service |
| cfm | cubic feet per minute |
| CHG | CH2M HILL Hanford Group, Inc. |
| CPO | Characterization Project Operations |
| DBP | dibutyl phosphate |
| DOE | U.S. Department of Energy |
| DQO | data quality objective |
| FH | Fluor Hanford, Inc. |
| GC/ECD | gas chromatography/electron capture detector |
| GC/FID | gas chromatography/flame ionization detector |
| GC/MS | gas chromatography/mass spectrometry |
| GC/TCD | gas chromatography/thermal conductivity detector |
| HASQARD | Hanford Analytical Services Quality Requirements Document |
| hr | hour(s) |
| IC | ion chromatography |
| IDLH | immediately dangerous to life and health |
| ISE | ion specific electrode |
| ISVS | In-situ vapor sampling system |
| L | liter |
| L/min | liters per minute |
| LFL | lower flammability limit |
| N/A | not applicable or not available |
| $mg/m^3$ | milligrams per cubic meter |
| mL/min | milliliters per minute |
| min | minute(s) |
| ppmv | parts per million by volume |
| PCB | Polychlorinated biphenyl |
| PUF | polyurethane foam |
| QA | quality assurance |
| QC | quality control |
| RPP | River Protection Project |
| SAP | Sampling and Analysis Plan |
| STT | sorbent tube train |
| TBP | tributyl phosphate |
| TIC | tentatively identified compound |
| TST | triple sorbent trap |
| VOC | Volatile Organic Compounds |
| WSCF | Waste Sampling and Characterization Facility |
| yr | year |
| $\mu g/m^3$ | micrograms per cubic meter |
| °C | degrees Celsius |
| % | percent |

## 1.0 SAMPLING AND ANALYSIS OBJECTIVES

This sampling and analysis plan (SAP) identifies characterization objectives pertaining to sample collection, laboratory analytical evaluation, and reporting requirements for vapor samples from the primary ventilation systems of the AN, AP, AW, and AY/AZ tank farms. Sampling will be performed in accordance with *Data Quality Objectives for Regulatory Requirements for Hazardous and Radioactive Air Emissions Sampling and Analysis* (Air DQO) (Mulkey 1999). The sampling will verify if current air emission estimates used in the permit application are correct and provide information for future air permit applications.

Vapor samples will be obtained from tank farm ventilation systems, downstream from the tanks and upstream of any filtration. Samples taken in support of the DQO will consist of SUMMA™[1] canisters, triple sorbent traps (TSTs), sorbent tube trains (STTs), polyurethane foam (PUF) samples. Particulate filter samples and tritium traps will be taken for radiation screening to allow the release of the samples for analysis.

The following sections provide the general methodology and procedures to be used in the preparation, retrieval, transport, analysis, and reporting of results from the vapor samples.

[1] SUMMA is a trademark of Molectrics, Cleveland, Ohio

# 2.0 SAMPLING EVENT REQUIREMENTS

## 2.1 TYPE 4 IN-SITU VAPOR SAMPLING SYSTEM DESCRIPTION

The Type 4 in-situ vapor sampling system (ISVS) system includes three major assemblies: sampling cart, tube bundle, and sampling head. The Type 4 ISVS cart (Figure 2-1), consists of an instrumentation cabinet, vacuum air pump components, a manifold, and various valves, flow meters, flow totalizers, rotameters, and filters mounted on a hand truck. A tube bundle connects the cart with the sampling head and provides a separate sampling tube for a SUMMA™ canister sampler. The sampling head shown in Figure 2-2 (Figure 2-2 is considered a typical arrangement of sorption tubes and filters) contains particulate filters, tritium-trap filters, and multiple sorption tubes. The selection and arrangement of the sorption tubes and filters is dependent upon the vapor sampling needs identified in the DQO (Mulkey 1999) document and this SAP that define tank sampling requirements. A thermocouple in the cart's gas manifold is used to measure vapor temperature (Reich 2000).

After sampling is completed, the sample head is disconnected from the tube bundle and the ends of the sorption and filter channels are capped. The sampling head is bagged out with protective plastic for shipment to the laboratory (Reich 2000).

For sampling in the AN, AP, AW, and AY/AZ tank farm ventilation systems, the sampling will be performed via a sampling port on the ventilation system.

**Figure 2-1. Type 4 In-Situ Vapor Sampling System**

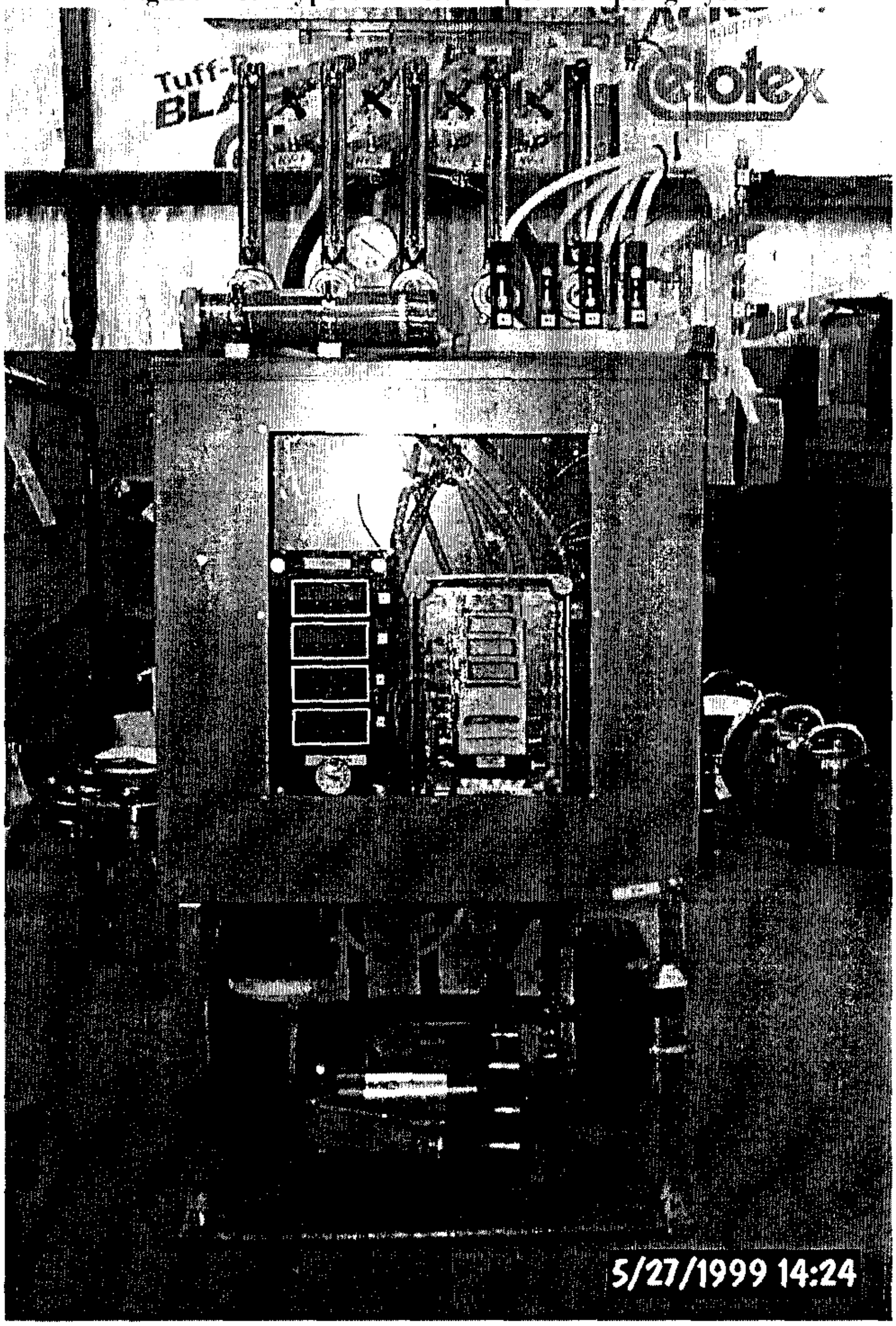
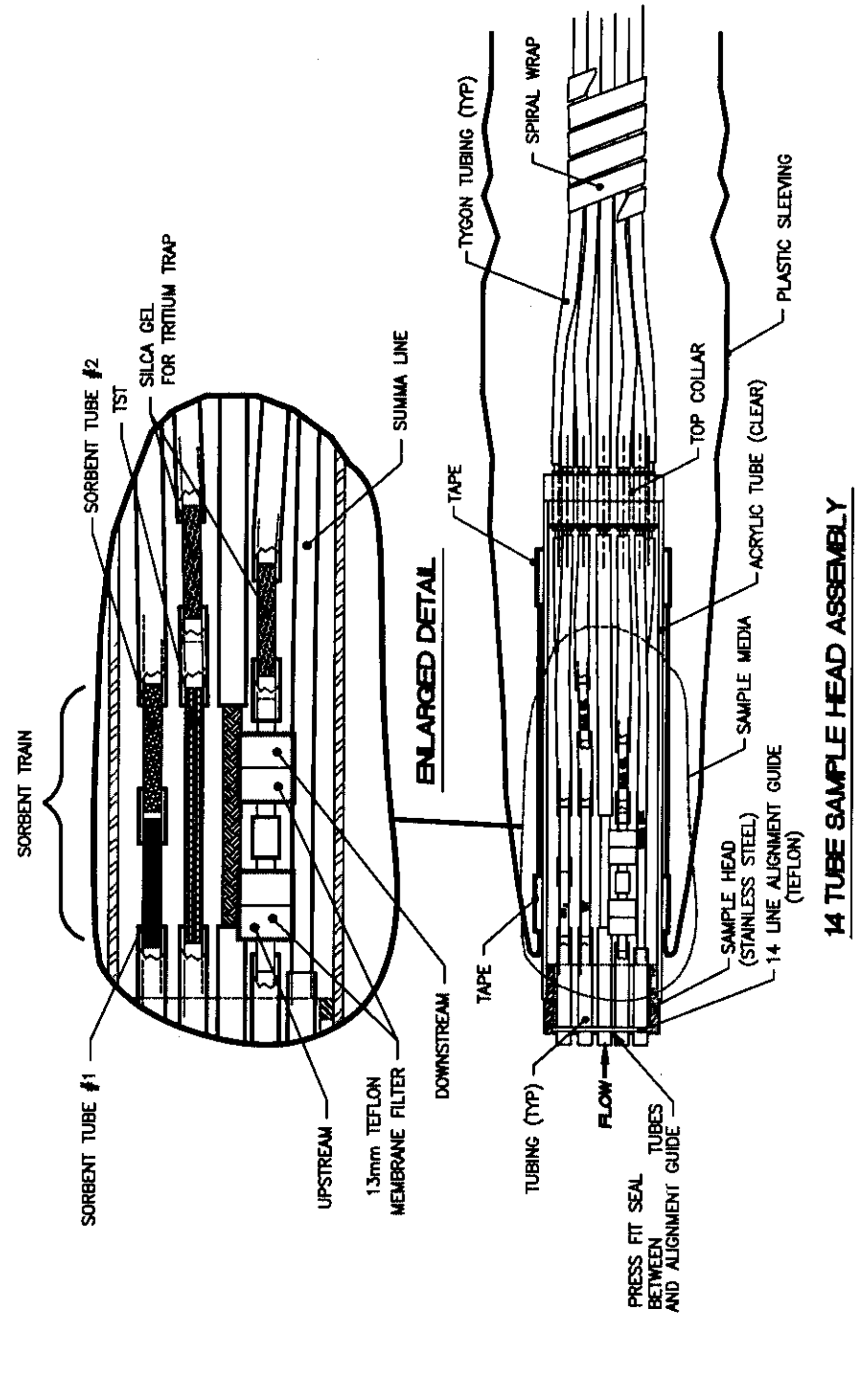


**Figure 2-2. Typical Sampling Head Arrangement of Sorption Tubes and Particulate Filters.**



## 2.2 SAMPLE PREPARATION

The analytical laboratories for these sampling events are the Fluor Hanford (FH) Waste Sampling and Characterization Facility (WSCF) and 222-S Laboratory. SUMMA™ canister samples, TST samples, STT samples, PUF samples, and particulate filter samples will be collected and sent to the laboratory for analysis in support of the Air DQO; field and trip blanks will accompany the samples. Particulate filter samples and tritium traps will be collected for radiation screening of the samples. WSCF shall prepare the SUMMA™ canisters, TSTs, STTs, PUFs, particulate filter assemblies, and tritium traps for sampling. Each particulate filter assembly shall contain two particulate filters mounted in series. Sample preparation procedures are listed in Table 2-1. The sample head assembly shall be assembled in accordance with drawing H-2-825301, current revision, *In Situ Sample Head Assembly and Details* and documented per Section 4.3, "Sample Custody."

**Table 2-1. Sample Preparation Procedures**

| Sample container | Organization | Preparation Procedure |
|---|---|---|
| SUMMA™ canister | WSCF | LO-080-406 |
| TST | WSCF | LA-549-403 |
| STT | WSCF | LA-549-402 |
| PUF | WSCF | N/A |
| Particulate filter assembly | WSCF | N/A |
| Tritium trap | WSCF | N/A |

Notes: N/A = not applicable
PUF = polyurethane foam
STT = sorbent tube train
TST = triple sorbent trap
WSCF = Waste Sampling and Characterization Facility

## 2.3 SAMPLE COLLECTION

Characterization Project Operations (CPO) will be responsible for the collection of all SUMMA™ canister samples, particulate filter, tritium trap, TST, STT, and PUF samples using the Type 4 ISVS cart. Samples will be collected in accordance with procedure TO-080-627, *Vapor Sampling of Waste Tank Using In-Situ Vapor Sampling (ISVS) System.* If the Type 4 ISVS cart is not available, the non-electrical vapor sampling system (NEVS) may be used in accordance with procedure LO-080-400, *Vapor Sampling Using the Non-Electrical Vapor Sampling System (NEVS).* Characterization Project Operations sampling activities will be performed in accordance with work packages prepared for each sampling event.

Tubing used in the collection of vapor samples must be stainless steel, or Teflon[2], and the length of the tubing used should be minimized. No C-flex or tygon tubing can be used upstream of the sample containers.

The samples shall include the following quality control (QC) samples: one each SUMMA™, TST, STT, and PUF ambient air field blank; one system SUMMA™ ambient air field blank taken through the Type 4 ISVS cart; and one each TST, STT, and PUF trip blank. The trip and field blanks are to accompany the vapor samples to the laboratory. For specific information concerning sample and blank handling, custody, and transport, refer to the requirements in Section 4.0.

Characterization Project Operations shall record (or calculate) the following information for each sample collected as appropriate: sample number, start and stop times for the collection of each sample, sample volumes, and any anomalous sampling conditions. The volatile organic compounds (VOC) reading will be collected at the beginning of each sample event. The samples shall be sealed in plastic, stored and shipped in a cooler at a nominal 4 degrees Celsius except the SUMMA™ canisters and the particulate filters.

Particulate filter samples and tritium traps should be shipped by CPO to WSCF or 222-S for radiation screening analysis within one calendar day and must be shipped within three calendar days. The SUMMA™ samples shall be stored by CPO until radiation screening is completed and the samples can be released for analysis. Upon completion of the radiation screening and release of the samples, the samples shall be transferred by CPO to WSCF for analysis.

All other samples should be shipped directly to the receiving laboratory within one calendar day and must be shipped within three calendar days.

Any decisions, observations, or deviations affecting this SAP shall be documented in controlled notebooks, work packages, and justified in the deliverable report.

[2]Teflon is a registered trademark of E. I. du Pont de Nemours and Company, Wilmington, Delaware

**Table 2-2. List of Samples and Activities. (2 Sheets)**

| Sample Code | Sample/Activity Description | Sample Probe Line | Sampler Position During Collection | Sample Volume[2] | Sample Duration or Flow Rate[1] |
|---|---|---|---|---|---|
| **Leak Test** | | | | | |
| --- | Perform leak test of Type 4 ISVS Cart | N/A | N/A | N/A | N/A |
| **Ambient Air Samples** | | | | | |
| 001 | Collect upwind ambient SUMMA™ | N/A | ambient air | 6 L | 2 min |
| 002 | Collect system SUMMA™ | N/A | ambient air | 6 L | 2 min |
| 003 | Collect ambient TST | 1 | ambient air | 0.4 L | 50-200 mL/min |
| 004 | Collect ambient STT | 2 | ambient air | 4 L | 300-500 mL/min |
| 005 | Collect ambient PUF | 3 | ambient air | 25 L | 2.5-5 L/min |
| **Vapor Samples** | | | | | |
| N/A | Purge SUMMA™ line | N/A | tank farm ventilation system | 5 L | 1.0-5.0 L/min |
| 006 | Collect SUMMA™/particulate filter | N/A | tank farm ventilation system | 6 L | 2 min |
| 007 | Collect SUMMA™/particulate filter | N/A | tank farm ventilation system | 6 L | 2 min |
| 008 | Collect SUMMA™/particulate filter | N/A | tank farm ventilation system | 6 L | 2 min |
| 009 | Collect particulate filter and tritium trap sample | 4 | tank farm ventilation system | 1 L | 50-200 mL/min |
| 010 | Collect particulate filter and tritium trap sample | 5 | tank farm ventilation system | 1 L | 50-200 mL/min |
| 011 | Collect TST | 6 | tank farm ventilation system | 0.4 L | 50-200 mL/min |
| 012 | Collect TST | 7 | tank farm ventilation system | 0.4 L | 50-200 mL/min |
| 013 | Collect TST | 8 | tank farm ventilation system | 0.4 L | 50-200 mL/min |
| 014 | Collect TST | 9 | tank farm ventilation system | 0.4 L | 50-200 mL/min |
| 015 | Collect STT | 10 | tank farm ventilation system | 4 L | 300-500 mL/min |
| 016 | Collect STT | 11 | tank farm ventilation system | 4 L | 300-500 mL/min |
| 017 | Collect PUF | 12 | tank farm ventilation system | 25 L | 2.5-5 L/min |
| 018 | Collect PUF | 13 | tank farm ventilation system | 25 L | 2.5-5 L/min |

**Table 2-2. List of Samples and Activities. (2 Sheets)**

| Sample Code | Sample/Activity Description | Sample Probe Line | Sampler Position During Collection | Sample Volume[2] | Sample Duration or Flow Rate[1] |
|---|---|---|---|---|---|
| **Trip Blanks** | | | | | |
| 019 | Store TST trip blank | N/A | --- | --- | --- |
| 020 | Store STT trip blank | N/A | --- | --- | --- |
| 021 | Store PUF trip blank | N/A | --- | --- | --- |

Note:

[1]CPO and WSCF may adjust sample durations and flow rates as necessary to collect the samples.

[2]The actual sample volume collected is to be within plus or minus 10% as listed

N/A = Not applicable

**Table 2-3. Summary of Samples**

| Sample Location | Sample Type | Sample Container | Number of Samples |
|---|---|---|---|
| --- | Trip blank | TST | 1 |
| | | STT | 1 |
| | | PUF | 1 |
| --- | Ambient air | SUMMA™ | 2 |
| | | TST | 1 |
| | | STT | 1 |
| | | PUF | 1 |
| Tank farm ventilation system | Tank vapors | SUMMA™ | 3 |
| | | TST | 4 |
| | | STT | 2 |
| | | PUF | 2 |
| | | Particulate filter assembly[1] | 3 |
| | | Particulate filter/Tritium trap assembly[1] | 2 |

Note:

[1]Each particulate filter assembly contains two particulate filters mounted in series.

## 2.4 RADIATION SCREENING

Surveys of the gases in the tank farm ventilation system will be performed using particulate filter samples and tritium traps. Results of the analysis of the particulate filters and tritium traps will be used to allow the samples to obtain a radiological release and ensure that the samples meet the WSCF acceptance criteria. The particulate filter samples and tritium traps will be collected by CPO and sent to WSCF or 222-S Laboratory for analysis; for the particulate filter assemblies, both the upstream and downstream particulate filters in each particulate filter assembly will be analyzed. Analytical procedures are specified in Section 3.0. The results from the radiation screening shall be submitted to CPO, the WSCF and 222-S Laboratory Organic Chemistry Team Leads, and the Process Engineering point of contact for vapor sampling for evaluation.

## 3.0 LABORATORY ANALYSIS REQUIREMENTS

The responsibilities of the analytical laboratories are given in this section. Additional quality control and deliverable requirements are given in Sections 4.0 and 7.0. All TST, STT, and PUF samples shall be transported and stored at a nominal 4 °C prior to extraction/preparation. One SUMMA™ canister (sample code 008 in Table 2-2) and two TSTs (sample codes 013 and 014) shall be archived for possible analysis at a later date. All other samples shall be analyzed.

Vapor samples shall be analyzed by WSCF or the 222-S Laboratory in accordance with Table 3-1. Samples that cannot meet the WSCF acceptance criteria should be analyzed at the 222-S Laboratory or contracted to another on-site laboratory (Pacific Northwest National Laboratory). Sorbent tube trains shall be analyzed for ammonia and oxides of nitrogen (nitric oxide and nitrogen dioxide). SUMMA™ canisters shall be analyzed for total non-methane hydrocarbons, hydrogen, nitrous oxide, methane, carbon monoxide, carbon dioxide, and selected organic analytes. Triple sorbent trap samples shall be analyzed for selected organic analytes. Polyurethane foam samples shall be analyzed for tributyl phosphate (TBP) and dibutyl phosphate (DBP). Polyurethane foam samples should also be analyzed for polychlorinated biphenyls (PCBs) if laboratory procedures and systems are in place to do so. The following preparation procedures may be used: LA-523-138 (PUF extraction), LA-523-116 (PUF derivitization), and LA-549-402 (STT).

Organic analytes of interest for the SUMMA™ and TST samples are documented in Mulkey (1999) and listed in Table 3-2. Quantitation limit goals for the Class A and B toxic air pollutants are provided in this table. Because of the large number of analytes of interest, a subset was identified as target analytes; these analytes are listed in Table 3-3. Target analytes require confirmation and quantitation through the use of standards. Other analytes in Table 3-2 may be identified as tentatively identified compounds (TICs). For TICs, a determination is to be made for all peaks that are at least 10% of the nearest internal standard. Polychlorinated biphenyls must be reported at any level. All major constituents in the sample should be identified, and the laboratory should attempt to obtain positive identification by analyzing with the appropriate standards. If possible, all constituents whose chromatographs indicate they are at a concentration of 1 ppmv or above should be identified.

Radiation screening analysis of particulate filter samples and tritium traps shall be analyzed at the WSCF or 222-S Laboratory as discussed in Section 2.4 and in accordance with Table 3-1.

If any requested analyses cannot be performed, the Process Engineering point of contact for vapor sampling shall be notified.

# Table 3-1. Chemical and Radiological Analytical Requirements.

VAPOR ANALYSES

| | | | | |
|---|---|---|---|---|
| **Project Name** | DST Ventilation System Vapor Sampling | **Comments** | **Reporting Formats** | |
| **Plan Number** | RPP-6264, Rev. 0 | Field Blank - Required<br>Trip Blank - Required | Format I | Immediate Notification |
| **RPP Contact:** | L. M. Sasaki | | Format II | Process Control |
| **WSCF Lab Contact:** | R. S. Viswanath/K. L. Powell | | Format III | Safety Screen |
| **222-S Lab Contact** | B. A. Crawford/K. L. Powell | | Format IV | Waste Management |
| **A. Environmental** | G. M. Crummel | | Format V | RCRA Compliance |
| **B. Process Control** | L. M. Sasaki | | Format VI | Special |

| PRIMARY ANALYSES | | | | | | | | CRITERIA | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **PROGRAM** | **ANALYSIS METHOD** | **PRIMARY ANALYTE** | **PROCEDURE** | **LAB** | **SAMPLE PREP** | **SAMPLE CONTAINER** | **SURROGATE SPIKE** | **NOTIFICATION LIMIT** | **PRECISION** | **ACCURACY** | **REPORT FORMAT** |
| A | GC/MS | Organic Speciation | LA-523-404 | WSCF | Direct | SUMMA™ | none | ≥ 20% LFL and/or 50% IDLH | ±25% | 70-130% | I, VI |
| A | GC/TCD | $CO_2$, CO, $CH_4$, $H_2$, and $N_2O$ | LA-523-409 | WSCF | Direct | SUMMA™ | none | ≥ 20% LFL and/or 50% IDLH | ±25% | 70-130% | I, VI |
| A | GC/FID | Total nonmethane hydrocarbons | LA-523-407 | WSCF | Direct | SUMMA™ | none | ≥ 20% LFL | ±25% | 70-130% | I, VI |
| A | ISE<br>IC | $NH_3$ | LA-631-001<br>LA-533-402 | 222-S<br>WSCF | $H_2O$ Extraction | STT | none | ≥ 150 ppmv | ±25% | 70-130% | I, VI |
| A | IC | Oxides of nitrogen | LA-533-105<br>LA-533-400 | 222-S<br>WSCF | $H_2O$ Extraction | STT | none | ≥ 150 ppmv | ±25% | 70-130% | I VI |
| A | GC/MS | Organic Preparation | LA-523-109 | 222-S | Tube-to-tube transfer | TST | N/A | N/A | N/A | N/A | I, VI |
| A | GC/MS | Organic Speciation | LA-523-408 | WSCF | Thermal Desorption | TST | all | ≥ 20% LFL and/or 50% IDLH | ±25% | 70-130% | I, VI |
| A | GC/MS | TBP, DBP | LA-523-138<br>LA-523-135<br>LA-523-428 | 222-S<br><br>WSCF | Solvent Extraction | PUF | none | ≥ 20% LFL and/or 50% IDLH | ±25% | 70-130% | I, VI |
| A | GC/ECD | PCBs | LA-523-136<br>LA-523-427 | 222-S<br>WSCF | Solvent Extraction | PUF | none | N/A | ±25% | 70-130% | VI |
| B | α and ß counting | Total α, total ß | LA-508-101<br>LA-508-415 | 222-S<br>WSCF | Direct | Particulate Filter | N/A | N/A | ±25% | 70-130% | II, VI |
| B | GEA | $^{137}Cs$, other γ emitters | LA-548-121<br>LA-548-421<br>LA-508-462 | 222-S<br>WSCF | Direct | Particulate Filter | N/A | N/A | ±25% | 70-130% | II, VI |
| B | Liquid Scint. | Tritium | LA-548-411 and LA-508-421<br>LA-548-111 | WSCF<br><br>222-S | Direct | Tritium trap | N/A | N/A | ±25% | 70-130% | II |

**Table 3-1. Chemical and Radiological Analytical Requirements.**

Notes:
N/A = not applicable
GC/ECD = gas chromatography/electron capture detector
GC/FID = gas chromatography/flame ionization detector
GC/MS = gas chromatography/mass spectrometry
GC/TCD = gas chromatography/thermal conductivity detector
IDLH = immediately dangerous to life and health
GEA = gamma energy analysis
LFL = lower flammability limit
RPP = River Protection Project
RCRA = Resource Conservation and Recovery Act
IC = ion chromatography
ISE = ion-specific electrode

**Table 3-2. Regulated Organic Constituents of Potential Concern as Applicable to the Regulatory Drivers (309 Compounds). (10 Sheets)**

| CAS # | Constituent | WAC 173-401[1] Threshold tons/yr | WAC 173-460[2] TAPs A and B | | Action Limit based on 1,000 cfm mg/m³ |
|---|---|---|---|---|---|
| | | | TAP 10-6 Risk ASIL µg/m³ annual average | TAP ASIL µg/m³ 24-hr average | |
| 100-00-5 | p-Nitrochlorobenzene | | | 2 | 2.6 |
| 100-02-7 | 4-Nitrophenol | 0.5 | N/A | N/A | 2.6 |
| 100-37-8 | Diethylaminoethanol | | | 170 | 346.8 |
| 100-41-4 | Ethyl benzene | 0.5 | | 1000 | 667 |
| 100-42-5 | Styrene | 0.5 | | 1000 | 667 |
| 100-61-8 | N-Methylbenzenamine | | | 7.3 | 2.6 |
| 100-63-0 | Phenylhydrazine | | | 1.5 | 2.6 |
| 100-74-3 | N-Ethylmorpholine | | | 77 | 160 |
| 101-84-8 | Diphenyl ether | | | 23 | 26.6 |
| 101-90-6 | Diglycidyl resorcinol ether | | N/A | N/A | |
| 102-81-8 | 2-N-Dibutylaminoethanol | | | 47 | 80 |
| 105-46-4 | sec-Butyl acetate | | | 3200 | 667 |
| 106-35-4 | 3-Heptanone | | | 780 | 667 |
| 106-44-5 | 4-Methylphenol | 0.5 | | | |
| 106-46-7 | 1,4-Dichlorobenzene | 0.5 | 1.5 | | |
| 106-50-3 | p-Phenylenediamine | 0.5 | | 0.33 | 2.6 |
| 106-87-6 | Vinyl cyclohexene dioxide | | | 200 | 346.8 |
| 106-88-7 | 1,2-Epoxybutane | 0.5 | | 20 | 26.6 |
| 106-92-3 | Allyl glycidyl ether | | | 77 | 160 |
| 106-93-4 | Ethylene dibromide | 0.05 | 0.0045 | | |
| 106-97-8 | Butane | | | 6300 | |
| 106-99-0 | 1,3-Butadiene | 0.035 | 0.0036 | | |
| 107-02-8 | Acrolein | 0.04 | | 0.02 | 2.6 |
| 107-05-1 | 3-Chloropropene | 0.5 | | 1 | 2.6 |
| 107-06-2 | 1,2-Dichloroethane | 0.4 | 0.038 | | |
| 107-07-3 | Ethylene chlorohydrin | | | 11 | 26.6 |
| 107-13-1 | Acrylonitrile | 0.15 | 0.015 | | |
| 107-15-3 | Ethylene diamine | | | 83 | 160 |
| 107-18-6 | 2-Propen-1-ol | | | 17 | 26.6 |
| 107-21-1 | Ethylene glycol | 0.5 | | 420 | 667 |
| 107-31-3 | Formic acid, methyl ester | | | 820 | 667 |
| 107-87-9 | 2-Pentanone | | | 2300 | 667 |
| 107-98-2 | Propylene glycol monomethyl ether | | | 2000 | 667 |

**Table 3-2. Regulated Organic Constituents of Potential Concern as Applicable to the Regulatory Drivers (309 Compounds). (10 Sheets)**

| CAS # | Constituent | WAC 173-401[1] Threshold tons/yr | WAC 173-460[2] TAPs A and B | | Action Limit based on 1,000 cfm mg/m$^3$ |
|---|---|---|---|---|---|
| | | | TAP 10-6 Risk ASIL µg/m$^3$ annual average | TAP ASIL µg/m$^3$ 24-hr average | |
| 108-03-2 | 1-Nitropropane | | | 20 | 26.6 |
| 108-05-4 | Acetic acid vinyl ester | 0.5 | | 200 | 346.8 |
| 108-10-1 | 4-Methyl-2-pentanone (MIBK) | 0.5 | | 680 | 667 |
| 108-11-2 | Methyl isobutyl carbinol | | | 350 | 667 |
| 108-18-9 | Diisopropylamine | | | 67 | 160 |
| 108-20-3 | Bis(isopropyl) ether | | | 3500 | 667 |
| 108-21-4 | Isopropyl acetate | | | 3500 | 667 |
| 108-39-4 | m-Cresol | 0.5 | | | |
| 108-43-0 | Chlorophenols | | 0.18 | | |
| 108-83-8 | Diisobutyl ketone | | | 480 | 667 |
| 108-84-9 | sec-Hexyl acetate | | | 980 | 667 |
| 108-87-2 | Methylcyclohexane | | | 5400 | 667 |
| 108-88-3 | Toluene | 0.5 | | 400 | 667 |
| 108-90-7 | Chlorobenzene | 0.5 | | 150 | 346.8 |
| 108-91-8 | Cyclohexylamine | | | 140 | 346.8 |
| 108-93-0 | Cyclohexanol | | | 690 | 667 |
| 108-94-1 | Cyclohexanone | | | 330 | 667 |
| 108-95-2 | Phenol | 0.1 | | 63 | 160 |
| 109-59-1 | Isopropoxyethanol | | | 350 | 667 |
| 109-60-4 | n-Propyl acetate | | | 2800 | 667 |
| 109-66-0 | n-Pentane | | | 6000 | |
| 109-73-9 | n-Butylamine | | | 50 | 80 |
| 109-79-5 | n-Butyl mercaptan | | | 6 | 2.6 |
| 109-86-4 | 2-Methoxyethanol | 0.5 | | 20 | 26.6 |
| 109-89-7 | Diethylamine | | | 100 | 266.8 |
| 109-94-4 | Ethyl formate | | | 1000 | 667 |
| 109-99-9 | Tetrahydrofuran | | | 2000 | 667 |
| 110-12-3 | 5-Methyl-2-hexanone | | | 780 | 667 |
| 110-19-0 | Isobutyl acetate | | | 2400 | 667 |
| 110-43-0 | 2-Heptanone | | | 780 | 667 |
| 110-49-6 | 2-Methoxyethyl acetate | | | 80 | 160 |
| 110-54-3 | n-Hexane | 0.5 | | | |
| 110-62-3 | n-Valeraldehyde | | | 590 | 667 |
| 110-82-7 | Cyclohexane | | | 3400 | 667 |

**Table 3-2. Regulated Organic Constituents of Potential Concern as Applicable to the Regulatory Drivers (309 Compounds). (10 Sheets)**

| CAS # | Constituent | WAC 173-401[1] Threshold tons/yr | WAC 173-460[2] TAPs A and B: TAP 10-6 Risk ASIL µg/m³ annual average | WAC 173-460[2] TAPs A and B: TAP ASIL µg/m³ 24-hr average | Action Limit based on 1,000 cfm mg/m³ |
|---|---|---|---|---|---|
| 110-83-8 | Cyclohexene | | | 3400 | 667 |
| 110-86-1 | Pyridine | | | 53 | 80 |
| 111-15-9 | 2-Ethoxyethyl acetate | | | 90 | 160 |
| 111-40-0 | Diethylene triamine | | | 14 | 26.6 |
| 111-42-2 | Diethanolamine | 0.5 | | 43 | 80 |
| 111-44-4 | Bis(2-chloroethyl) ether | 0.03 | 0.003 | | |
| 111-65-9 | n-Octane | | | 4700 | 667 |
| 111-76-2 | 2-Butoxyethanol | 0.5 | | 400 | 667 |
| 111-84-2 | n-Nonane | | | 3500 | 667 |
| 117-81-7 | Bis(2-ethylhexyl) phthalate | 0.5 | 2.5 | | |
| 118-74-1 | Hexachlorobenzene | 0.005 | 0.0022 | | |
| 120-82-1 | 1,2,4-Trichlorobenzene | 0.5 | | 120 | 266.8 |
| 121-45-9 | Trimethyl phosphite | | | 33 | 80 |
| 121-69-7 | Dimethylaniline | 0.5 | | 83 | 160 |
| 122-39-4 | N,N-Diphenylamine | | | 33 | 2.6 |
| 122-60-1 | Phenyl glycidyl ether | | | 2000 | 667 |
| 123-19-3 | 4-Heptanone | | | 780 | 667 |
| 123-31-9 | Hydroquinone | 0.5 | | 6.7 | 2.6 |
| 123-38-6 | n-Propionaldehyde | 0.5 | N/A | N/A | 2.6 |
| 123-42-2 | Diacetone alcohol | | | 790 | 667 |
| 123-51-3 | 3-Methyl-1-butanol | | | 1200 | 667 |
| 123-86-4 | Acetic acid n-butyl ester | | | 2400 | 667 |
| 123-91-1 | 1,4-Dioxan | 0.5 | 0.032 | | |
| 123-92-2 | Isoamyl acetate | | | 1700 | 667 |
| 124-40-3 | Dimethylamine | | | 60 | 160 |
| 126-73-8 | Tributyl phosphate | | | 7.3 | 2.6 |
| 126-98-7 | 2-Methyl-2-propenenitrile | | | 9 | 2.6 |
| 127-18-4 | 1,1,2,2-Tetrachloroethene | 0.5 | 1.1 | | |
| 127-19-5 | N,N-Dimethylacetamide | | | 120 | 266.8 |
| 128-37-0 | 2,6-Bis(tert-butyl)-4-methylphenol | | | 33 | 80 |
| 131-11-3 | Dimethyl phthalate | 0.5 | | 17 | 26.6 |
| 1321-64-8 | Pentachloronaphthalene | | | 1.7 | 2.6 |
| 1321-65-9 | Trichloronaphthalene | | | 17 | 26.6 |
| 133-06-2 | Captan | 0.5 | | 17 | 26.6 |

**Table 3-2. Regulated Organic Constituents of Potential Concern as Applicable to the Regulatory Drivers (309 Compounds). (10 Sheets)**

| CAS # | Constituent | WAC 173-401[1] Threshold tons/yr | WAC 173-460[2] TAPs A and B | | Action Limit based on 1,000 cfm $mg/m^3$ |
|---|---|---|---|---|---|
| | | | TAP 10-6 Risk ASIL $\mu g/m^3$ annual average | TAP ASIL $\mu g/m^3$ 24-hr average | |
| 1335-87-1 | Hexachloronaphthalene | | | 0.67 | 2.6 |
| 1335-88-2 | Tetrachloronaphthalene | | | 6.7 | 2.6 |
| 1336-36-3 | Polychlorinated biphenyls (PCBs) | 0.0045 | 0.0045 | | |
| 1338-23-4 | Methyl ethyl ketone peroxide | | | 5 | 2.6 |
| 133-90-4 | Chloramben | 0.5 | N/A | N/A | 2.6 |
| 134-32-7 | alpha-Naphthylamine | | N/A | N/A | |
| 135-20-6 | Cupferron | | N/A | N/A | |
| 137-05-3 | Methyl-2-cyanoacrylate | | | 30 | 80 |
| 138-22-7 | n-Butyl lactate | | | 83 | 160 |
| 139-65-1 | 4,4'-Thiodianiline | | N/A | N/A | |
| 140-88-5 | Ethylacrylate | 0.5 | | 66 | 160 |
| 141-32-2 | Butylacrylate | | | 170 | 346.8 |
| 141-43-5 | Ethanolamine | | | 25 | 26.6 |
| 141-78-6 | Acetic acid ethyl ester | | | 4800 | 667 |
| 141-79-7 | 4-Methyl-3-penten-2-one | | | 200 | 346.8 |
| 142-82-5 | n-Heptane | | | 5500 | 667 |
| 144-62-7 | Oxalic acid | | | 3.3 | 2.6 |
| 148-01-6 | Dinitolamide | | | 17 | 26.6 |
| 150-76-5 | 4-Methoxyphenol | | | 17 | 26.6 |
| 16219-75-3 | Ethylidene norbornene | | | 83 | 160 |
| 1634-04-4 | Methyl tert-butyl ether | 0.5 | | 500 | 667 |
| 1746-01-6 | TCDD | 0.0000003 | 0.00000003 | | |
| 1836-75-5 | Nitrofen | | N/A | N/A | |
| 189-55-9 | Dibenzo[a,i]pyrene | 0.005 | N/A | N/A | |
| 189-64-0 | Dibenzo[a,h]pyrene | | N/A | N/A | |
| 191-30-0 | Dibenzo(a,l)pyrene | | N/A | N/A | |
| 1918-02-1 | Picloram | | | 33 | 80 |
| 192-65-4 | Dibenzo[a,e]pyrene | | N/A | N/A | |
| 2039-87-4 | o-Chlorostyrene | | | 940 | 667 |
| 2234-13-1 | Octachloronaphthalene | | | 0.33 | 2.6 |
| 2238-07-5 | Diglycidyl ether | | | 1.7 | 2.6 |
| 224-42-0 | Dibenz[a,j]acridine | | N/A | N/A | |
| 226-36-8 | Dibenz[a,h]acridine | | N/A | N/A | |
| 2425-06-1 | Captafol | | | 0.33 | 2.6 |

**Table 3-2. Regulated Organic Constituents of Potential Concern as Applicable to the Regulatory Drivers (309 Compounds). (10 Sheets)**

| CAS # | Constituent | WAC 173-401[1] Threshold tons/yr | WAC 173-460[2] TAPs A and B | | Action Limit based on 1,000 cfm mg/m$^3$ |
|---|---|---|---|---|---|
| | | | TAP 10-6 Risk ASIL µg/m$^3$ annual average | TAP ASIL µg/m$^3$ 24-hr average | |
| 25013-15-4 | Vinyl toluene | | | 800 | 667 |
| 2551-13-7 | Trimethyl benzene | | | 420 | 667 |
| 25639-42-3 | Methylcyclohexanol | | | 780 | 667 |
| 26140-60-3 | Terphenyls | | | 16 | 26.6 |
| 26952-21-6 | Iso-ocytl alcohol | | | 890 | 667 |
| 26952-23-8 | Dichloropropene | | | 20 | |
| 2698-41-1 | o-Chlorobenylidene malonitrile | | | 1.3 | 2.6 |
| 287-92-3 | Cyclopentane | | | 5700 | 667 |
| 2921-88-2 | Chlorpyrifos | | | 0.67 | 2.6 |
| 302-01-2 | Hydrazine | 0.002 | 0.0002 | | |
| 3068-88-0 | B-Butyrolactone | | N/A | N/A | |
| 314-40-9 | Bromacil | | | 33 | 80 |
| 319-84-6 | alpha-BHC | | | 1.7 | |
| 319-85-7 | beta-BHC | | | 1.7 | |
| 3333-52-6 | Tetramethyl succinonitrile | | | 9.3 | 2.6 |
| 34590-94-8 | Dipropylene glycol methyl ether | | | 2000 | 667 |
| 3697-24-3 | 5-Methylchrysene | | N/A | N/A | |
| 3825-26-1 | Ammonium perfluorooctanoate | | | 0.33 | 2.6 |
| 4016-14-2 | Isopropyl glycidyl ether (IGE) | | | 790 | 667 |
| 4098-71-9 | Isophorone diisocyanate | | | 0.15 | 2.6 |
| 4170-30-3 | 2-Butenaldehyde | | | 20 | 26.6 |
| 420-04-2 | Cyanamide | | | 6.7 | 2.6 |
| 50-00-0 | Formaldehyde | 0.5 | 0.077 | | |
| 504-29-0 | 2-Aminopyridine | | | 6.3 | 2.6 |
| 5124-30-1 | Methylene-bis-(4-cyclo-hexylisocyanate) | | | 0.18 | 2.6 |
| 51-28-5 | 2,4-Dinitrophenol | 0.5 | N/A | N/A | 2.6 |
| 531-82-8 | N-(4-(5-Nitro-2-furyl)-2-thiazolyl)acetamide | | N/A | N/A | |
| 540-59-0 | 1,2-Dichloroethylene | | | 2600 | 667 |
| 540-84-1 | 2,2,4-Trimethylpentane | 0.5 | N/A | N/A | 2.6 |
| 540-88-5 | tert-Butyl acetate | | | 3200 | 667 |
| 541-85-5 | Ethyl amyl ketone | | | 440 | 667 |
| 542-75-6 | 1,3-Dichloropropene | 0.5 | | | 26.6 |
| 542-92-7 | Cyclopentadiene | | | 680 | 667 |

**Table 3-2. Regulated Organic Constituents of Potential Concern as Applicable to the Regulatory Drivers (309 Compounds). (10 Sheets)**

| CAS # | Constituent | WAC 173-401[1] Threshold tons/yr | WAC 173-460[2] TAPs A and B | | Action Limit based on 1,000 cfm mg/m$^3$ |
|---|---|---|---|---|---|
| | | | TAP 10-6 Risk ASIL µg/m$^3$ annual average | TAP ASIL µg/m$^3$ 24-hr average | |
| 556-52-5 | Glycidol | | | 250 | 346.8 |
| 55738-54-0 | trans-2((Dimethylamino) methylimino)-5-(2-(5-nitro-2-furyl) vinyl-1,3,4-oxadiazole | | N/A | N/A | |
| 56-23-5 | Carbon tetrachloride | 0.5 | 0.067 | | |
| 563-80-4 | 3-Methyl-2-butanone | | | 2300 | 667 |
| 57-14-7 | 1,1-Dimethylhydrazine | 0.004 | | 4 | 2.6 |
| 57-57-8 | B-Propiolactone | 0.1 | | 5 | 2.6 |
| 583-60-8 | o-Methylcyclohexanone | | | 760 | 667 |
| 584-84-9 | 2,4-Toluene diisocyanate | 0.05 | | 0.12 | |
| 58-89-9 | gamma-BHC (Lindane) | 0.005 | 0.0026 | | |
| 591-78-6 | 2-Hexanone | | | 67 | 160 |
| 592-62-1 | Methyl azoxymethyl acetate | | N/A | N/A | |
| 593-60-2 | Vinyl bromide | 0.5 | | 73 | 160 |
| 594-42-3 | Perchloromethyl mercaptan | | | 2.5 | 2.6 |
| 594-72-9 | 1,1-Dichloro-1-nitroethane | | | 40 | 80 |
| 59-89-2 | N-Nitrosomorpholine | 0.05 | N/A | N/A | |
| 600-25-9 | 1-Chloro-1-nitropropane | | | 33 | 80 |
| 602-87-9 | 5-Nitroacenaphthene | | N/A | N/A | |
| 60-29-7 | Ethyl ether | | | 4000 | |
| 603-34-9 | Triphenyl amine | | | 17 | 26.6 |
| 60-34-4 | Methylhydrazine | 0.03 | | 1.2 | 2.6 |
| 60-35-5 | Acetamide | 0.5 | N/A | N/A | 2.6 |
| 624-83-9 | Methyl isocyanate | 0.1 | | 0.16 | 2.6 |
| 626-17-5 | m-Phthalodinitrile | | | 17 | 26.6 |
| 626-38-0 | sec-Amyl acetate | | | 2200 | 667 |
| 627-13-4 | Nitric acid, propyl ester | | | 360 | 667 |
| 62-75-9 | N-Nitroso-N,N-dimethylamine | 0.0005 | 0.000071 | | |
| 628-63-7 | n-Amyl acetate | | | 1800 | 667 |
| 628-96-6 | Ethylene glycol dinitrate | | | 1 | 2.6 |
| 64091-91-4 | 4-(Methylnitrosamino)-1-(3-pyridyl)-1-butanone | | N/A | N/A | |
| 64-17-5 | Ethyl alcohol | | | 6300 | |
| 64-18-6 | Formic acid | | | 31 | 80 |
| 64-19-7 | Acetic acid | | | 83 | 160 |

**Table 3-2. Regulated Organic Constituents of Potential Concern as Applicable to the Regulatory Drivers (309 Compounds). (10 Sheets)**

| CAS # | Constituent | WAC 173-401[1] Threshold tons/yr | WAC 173-460[2] TAPs A and B | | Action Limit based on 1,000 cfm mg/m³ |
|---|---|---|---|---|---|
| | | | TAP 10-6 Risk ASIL µg/m³ annual average | TAP ASIL µg/m³ 24-hr average | |
| 64-67-5 | Diethyl sulfate | 0.5 | N/A | N/A | 2.6 |
| 67-56-1 | Methyl alcohol | 0.5 | | 870 | 667 |
| 67-63-0 | 2-Propyl alcohol | | | 3300 | 667 |
| 67-64-1 | 2-Propanone (Acetone) | | | 5900 | 667 |
| 67-66-3 | Chloroform | 0.45 | 0.043 | | |
| 67-72-1 | Hexachloroethane | 0.5 | | 32 | 80 |
| 68-11-1 | Thioglycolic acid | | | 13 | 26.6 |
| 68-12-2 | Dimethylformamide | 0.5 | | 30 | 80 |
| 681-84-5 | Methyl silicate | | | 20 | 26.6 |
| 684-16-2 | Hexafluoroacetone | | | 2.3 | 2.6 |
| 71-23-8 | n-Propyl alcohol | | | 1600 | 667 |
| 71-36-3 | n-Butanol | | | 500 | 667 |
| 71-43-2 | Benzene | 0.5 | 0.12 | | |
| 71-55-6 | 1,1,1-Trichloroethane | 0.5 | | 6400 | |
| 74-83-9 | Bromomethane | 0.5 | | 5 | 2.6 |
| 74-87-3 | Chloromethane | 0.5 | | 340 | 667 |
| 74-89-5 | Methylamine | | | 43 | 80 |
| 74-96-4 | Ethyl bromide | | | 3000 | 667 |
| 74-97-5 | Bromochloromethane | | | 3500 | 667 |
| 74-99-7 | Methylacetylene | | | 5500 | 667 |
| 75-00-3 | Chloroethane | 0.5 | | 10000 | |
| 75-01-4 | 1-Chloroethene | 0.1 | 0.012 | | |
| 75-04-7 | Ethylamine | | | 60 | 160 |
| 75-05-8 | Acetonitrile | 0.5 | | 220 | 346.8 |
| 75-07-0 | Acetaldehyde | 0.5 | 0.45 | | |
| 75-08-1 | Ethyl mercaptan | | | 4.3 | 2.6 |
| 75-09-2 | Dichloromethane (Methylene Chloride) | 0.5 | 0.56 | | |
| 75-12-7 | Formamide | | | 60 | 160 |
| 75-15-0 | Carbon disulfide | 0.5 | | 100 | 266.8 |
| 75-21-8 | Oxirane | 0.1 | 0.01 | | |
| 75-25-2 | Tribromomethane | 0.5 | 0.91 | | |
| 75-31-0 | Isopropylamine | | | 40 | 80 |
| 75-34-3 | 1,1-Dichloroethane | 0.003 | | 2700 | 667 |

**Table 3-2. Regulated Organic Constituents of Potential Concern as Applicable to the Regulatory Drivers (309 Compounds). (10 Sheets)**

| CAS # | Constituent | WAC 173-401[1] Threshold tons/yr | WAC 173-460[2] TAPs A and B | | Action Limit based on 1,000 cfm mg/m³ |
|---|---|---|---|---|---|
| | | | TAP 10-6 Risk ASIL µg/m³ annual average | TAP ASIL µg/m³ 24-hr average | |
| 75-35-4 | 1,1-Dichloroethene | 0.2 | | 67 | 160 |
| 75-43-4 | Dichlorofluoromethane | | | 130 | 346.8 |
| 75-45-6 | Chlorodifluoromethane | | | 12000 | |
| 75-50-3 | Trimethylamine | | | 80 | 160 |
| 75-52-5 | Nitromethane | | | 830 | 667 |
| 75-55-8 | 2-Methylaziridine | 0.5 | | 16 | 26.6 |
| 75-56-9 | Propylene oxide | 0.5 | 0.27 | | |
| 75-61-6 | Difluorodibromomethane | | | 2900 | 667 |
| 75-63-8 | Trifluorobromomethane | | | 20000 | |
| 75-65-0 | 2-Methyl-2-propanol | | | 1000 | 667 |
| 75-69-4 | Trichlorofluoromethane | | | 19000 | |
| 75-71-8 | Dichlorodifluoromethane | | | 16000 | |
| 7572-29-4 | Dichloroacetylene | | | 1.3 | 2.6 |
| 76-03-9 | Trichloroacetic acid | | | 22 | 26.6 |
| 76-11-9 | 1,1,1,2-Tetrachloro-2,2-difluoroethane | | | 14000 | 667 |
| 76-12-0 | 1,1,2,2-Tetrachloro-1,2-difluoroethane | | | 14000 | 667 |
| 76-13-1 | 1,2,2-Trichlorotrifluoroethane (Freon 113) | | | 27000 | 667 |
| 76-14-2 | 1,2-Dichloro-1,1,2,2-tetrafluoroethane | | | 23000 | |
| 76-15-3 | Chloropentafluoroethane | | | 21000 | |
| 768-52-5 | N-Isopropylaniline | | | 37 | 80 |
| 77-47-4 | Hexachlorocyclopentadiene | 0.1 | | 0.33 | 2.6 |
| 77-73-6 | Dicyclopentadiene | | | 100 | 266.8 |
| 78-10-4 | Ethyl silicate | | | 280 | 667 |
| 78-59-1 | Isophorone | 0.5 | | 93 | 160 |
| 78-83-1 | 2-Methylpropyl alcohol | | | 510 | 667 |
| 78-87-5 | 1,2-Dichloropropane | 0.5 | | 4 | |
| 78-92-2 | 1-Methylpropyl alcohol | | | 1000 | 667 |
| 78-93-3 | 2-Butanone (Methyl ethyl ketone) | 0.5 | | 1000 | 667 |
| 79-00-5 | 1,1,2-Trichloroethane | 0.5 | | 180 | 346.8 |
| 79-01-6 | 1,1,2-Trichloroethylene | 0.5 | 0.59 | | |
| 79-04-9 | Chloroacetyl chloride | | | 0.67 | 2.6 |

**Table 3-2. Regulated Organic Constituents of Potential Concern as Applicable to the Regulatory Drivers (309 Compounds). (10 Sheets)**

| CAS # | Constituent | WAC 173-401[1] Threshold tons/yr | WAC 173-460[2] TAPs A and B | | Action Limit based on 1,000 cfm mg/m³ |
|---|---|---|---|---|---|
| | | | TAP 10-6 Risk ASIL µg/m³ annual average | TAP ASIL µg/m³ 24-hr average | |
| 79-09-4 | Propanoic acid | | | 100 | 266.8 |
| 79-10-7 | 2-Propenoic acid | 0.5 | | 0.3 | 2.6 |
| 79-11-8 | Chloroacetic acid | 0.1 | N/A | N/A | 2.6 |
| 79-20-9 | Methyl acetate | | | 2000 | 667 |
| 79-24-3 | Nitroethane | | | 1000 | 667 |
| 79-27-6 | Acetylene tetrabromide | | | 47 | 80 |
| 79-34-5 | 1,1,2,2-Tetrachloroethane | 0.15 | | 23 | 26.6 |
| 79-41-4 | Methacrylic acid | | | 230 | 346.8 |
| 8003-34-7 | Pyrethrum | | | 1.7 | 2.6 |
| 822-06-0 | Hexamethylene diisocyanate | 0.02 | | 0.11 | |
| 82-68-8 | Pentachloronitrobenzene (PCNB) | 0.15 | | 1.7 | 2.6 |
| 84-66-2 | Diethyl phthalate | | | 17 | 26.6 |
| 84-74-2 | Di-n-butylphthalate | 0.5 | | 17 | 26.6 |
| 87-68-3 | Hexachlorobutadiene | 0.5 | | 0.7 | 2.6 |
| 87-86-5 | Pentachlorophenol | 0.35 | 0.33 | | |
| 88-06-2 | 2,4,6-Trichlorophenol | 0.5 | 0.32 | | |
| 88-72-2 | Nitrotoluene | | | 37 | 80 |
| 88-89-1 | Picric acid | | | 0.33 | 2.6 |
| 89-72-5 | o-sec-Butylphenol | | | 100 | 266.8 |
| 91-20-3 | Naphthalene | 0.5 | | 170 | 346.8 |
| 91-22-5 | Quinoline | 0.003 | N/A | N/A | 2.6 |
| 92-52-4 | 1,1`-Biphenyl | 0.5 | | 4.3 | 2.6 |
| 92-93-3 | 4-Nitrobiphenyl | 0.5 | N/A | N/A | 2.6 |
| 93-76-5 | 2,4,5-T | | N/A | N/A | 80 |
| 94-75-7 | 2,4-D | 0.5 | | 33 | |
| 95-13-6 | Indene | | | 160 | 346.8 |
| 95-48-7 | o-Cresol | 0.5 | | | |
| 95-49-8 | o-Chlorotoluene | | | 860 | 667 |
| 95-50-1 | 1,2-Dichlorobenzene | | | 1000 | 667 |
| 95-95-4 | 2,4,5-Trichlorophenol | 0.5 | N/A | N/A | 2.6 |
| 96-09-3 | Styrene oxide | 0.5 | N/A | N/A | |
| 96-12-8 | 1,2-Dibromo-3-chloropropane | 0.004 | | 0.2 | 2.6 |
| 96-22-0 | 3-Pentanone | | | 2300 | 667 |
| 96-33-3 | Methyl acrylate | | | 120 | 266.8 |

**Table 3-2. Regulated Organic Constituents of Potential Concern as Applicable to the Regulatory Drivers (309 Compounds). (10 Sheets)**

| CAS # | Constituent | WAC 173-401[1] Threshold tons/yr | WAC 173-460[2] TAPs A and B | | Action Limit based on 1,000 cfm mg/m³ |
|---|---|---|---|---|---|
| | | | TAP 10-6 Risk ASIL µg/m³ annual average | TAP ASIL µg/m³ 24-hr average | |
| 96-69-5 | Bis(3-tert-butyl-4-hydroxy-6-methyl-phenyl) sulfide | | | 33 | 80 |
| 97-56-3 | o-Aminoazotoluene | | N/A | N/A | |
| 98-00-0 | Furfuryl alcohol | | | 130 | 346.8 |
| 98-01-1 | Furfural | | | 26 | 26.6 |
| 98-51-1 | p-tert-Butyltoluene | | | 200 | 346.8 |
| 98-82-2 | Cumene | | | 820 | 667 |
| 98-82-8 | (1-Methylethyl)benzene | 0.5 | | | 667 |
| 98-83-9 | Methylstyrene | | | 810 | 667 |
| 98-86-2 | Acetophenone | 0.5 | N/A | N/A | 2.6 |
| 98-95-3 | Nitrobenzene | 0.5 | | 1.7 | 2.6 |
| 999-61-1 | 2-Hydroxypropyl acrylate | | | 9.3 | 2.6 |

Notes:

[1] WAC 173-401, 1993, "Operating Permit Regulation," *Washington Administrative Code*, as amended.

[2] WAC 173-460, 1991, "Controls For New Sources Of Toxic Air Pollutants," *Washington Administrative Code*, as amended.

ASIL = acceptable source impact level.
N/A = Compound is a TAP, however no ASIL value is established for it.
TAP = toxic air pollutant.
WAC = *Washington Administrative Code.*

**Table 3-3. Required Target Analytes**

| CAS # | Constituent | WAC 173-401[1] Threshold tons/yr | WAC 173-460[2] TAPs A and B | | Action Limit based on 1,000 cfm mg/m³ |
|---|---|---|---|---|---|
| | | | TAP 10-6 Risk ASIL ug/m³ annual average | TAP ASIL ug/m³ 24-hr average | |
| 106-99-0 | 1,3-Butadiene | 0.035 | 0.0036 | | |
| 67-66-3 | Chloroform | 0.45 | 0.043 | | |
| 123-91-1 | 1,4-Dioxan | 0.5 | 0.032 | | |
| 71-43-2 | Benzene | 0.5 | 0.12 | | |
| 56-23-5 | Carbon tetrachloride | 0.5 | 0.067 | | |
| 75-09-2 | Dichloromethane (Methylene Chloride) | 0.5 | 0.56 | | |
| 75-07-0 | Acetaldehyde | 0.5 | 0.45 | | |
| 127-18-4 | 1,1,2,2-Tetrachloroethene (Perchloroethylene) | 0.5 | 1.1 | | |

Notes:

[1] WAC 173-401, 1993, "Operating Permit Regulation," *Washington Administrative Code*, as amended.

[2] WAC 173-460, 1991, "Controls For New Sources Of Toxic Air Pollutants," *Washington Administrative Code*, as amended.

ASIL = acceptable source impact level.
N/A = Compound is a TAP, however, no ASIL value is established for it.
TAP = toxic air pollutant.
WAC = *Washington Administrative Code.*

# 4.0 QUALITY ASSURANCE AND QUALITY CONTROL

Processes, services, activities, and conditions adverse to quality which do not conform to requirements specified in this sampling and analysis plan or references herein shall be controlled to prevent inadvertent use. Nonconforming sampling and analysis processes shall be identified, controlled, reported, and dispositioned as required by CHG (1999) or by approved internal procedures. Quality requirements for conducting Characterization Project sampling and analysis are described in *Tank Waste Remediation System Characterization Project, Quality Policies* (Board 1998) and this sampling and analysis plan. Characterization Project sampling and analysis shall be conducted in conformance with these quality assurance (QA) requirements.

## 4.1 LABORATORY OPERATIONS

Laboratories performing analyses in support of this SAP shall have approved and implemented QA plans. These QA plans shall meet the *Hanford Analytical Services Quality Assurance Requirements Document* (HASQARD) (DOE 1998) minimum requirements as the baseline for laboratory quality systems. The *222-S Laboratory Quality Assurance Plan* (Markel 2000) and *Waste Sampling and Characterization Facility Quality Assurance Program Plan* (Meznarich 1999) specify the requirements for assuring the quality of sample analysis conducted at the 222-S and WSCF laboratories, respectively. For any other laboratory, validation of this compliance shall be verified either by a HASQARD assessment stating their quality program satisfactorily meets the appropriate requirements, or the quality program plan and applicable procedures will be submitted and approved prior to work performance on sampling or analytical work.

Analytical QC requirements are identified in Table 3-1. The laboratory shall also use calibration and calibration check standards appropriate for the analytical instrumentation being used (see DOE [1998] for definitions of QC samples and standards). The criteria presented are goals for demonstrating reliable method performance. It is understood that the laboratory will follow its internal QC system for required actions whenever QC failures occur. If sample QC failures occur or if all analyses cannot be performed, analysts shall consult with supervisors/customers to determine the proper action. The laboratory should provide a suggested course of action at that time. All sample QC failures and limitations on the associated data shall be discussed in the narrative of the data report. Proper notification of all data not meeting QC requirements shall be included with the data.

## 4.2 SAMPLE COLLECTION

Sampling shall be performed in accordance with approved procedures and work plans included within the job control system. All data sheets and log entries completed during the performance of sampling shall be copied and included within the job control system package.

Each sample identification number shall have the following format:

**VLXXX-YYY-ZZZZ**

where,

**V** indicates a vapor sample,
**L** = a letter code identifying the organization that prepared the sample container/sample media
W= WSCF,
**XXX** = a two- or three-digit/letter code identifying the sample location
AN = AN tank farm
AP = AP tank farm
AW = AW tank farm
AYZ = AY/AZ tank farms
**YYY** = a three-digit sample code found in Table 2-2
**ZZZZ** = a special lab-assigned code.

## 4.3 SAMPLE CUSTODY

Chain-of-custody will be generated at the time of sample head assembly and carefully maintained to assure sample control at all times. Documents (i.e., SAP), procedures, and drawings (including current revision number) applicable to the sample head assembly will be listed on the chain-of-custody.

# 5.0 EXCEPTIONS, CLARIFICATIONS, AND ASSUMPTIONS

## 5.1 CLARIFICATIONS

### 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.

## 5.2 EXCEPTIONS

The organic analytes required for the vapor analyses are found in Table 3-2. Twenty-one of the 309 organic compounds identified in Table 3-2 are not in the library of mass spectra used by WSCF and therefore may be identified only as unknown compounds in the SUMMA™ and/or TST samples. These 21 compounds are listed in Table 5-1.

**Table 5-1. Organic Compounds Not Analyzed For**

| CAS # | Constituent | Action Limit based on 1,000 cfm ($mg/m^3$) |
|---|---|---|
| 1321-64-8 | Pentachloronaphthalene | 2.6 |
| 1321-65-9 | Trichloronaphthalene | 26.6 |
| 1335-87-1 | Hexachloronaphthalene | 2.6 |
| 1335-88-2 | Tetrachloronaphthalene | 2.6 |
| 1338-23-4 | Methyl ethyl ketone peroxide | |
| 2551-13-7 | Trimethyl benzene | 667 |
| 25639-42-3 | Methylcyclohexanol | 667 |
| 26952-23-8 | Dichloropropene | |
| 3068-88-0 | B-Butyrolactone | |
| 333-52-6 | Tetramethyl succinonitrile | 2.6 |
| 34590-94-8 | Dipropylene glycol methyl ether | 667 |
| 3825-26-1 | Ammonium perfluorooctanoaate | 2.6 |
| 420-04-2 | Cyanamide | 2.6 |
| 5123-30-1 | Methylene-bis-(4-cyclohexylisocyanate) | 2.6 |
| 531-82-8 | N-(4-(5-Nitro-2furyl)-2-thiazolyl)acetamide | |
| 55738-54-0 | trans-2((Dimethylamino)methyliminimo)-5-(2-(5-nitro-2-furyl)vinyl-1,3,4-oxadiazole | |
| 600-25-9 | 1-Chloro-1-nitropropane | 80 |
| 64091-91-4 | 4-(Methylnitrosamino)-1-(3-pyridyl)-1-butanone | |
| 8003-34-7 | Pyrethrum | 2.6 |
| 98-82-2 | Cumene | 667 |
| 999-61-1 | 2-Hydroxypropyl acrylate | |

Mulkey (1999) also requires vapor samples be analyzed for polychlorinated biphenyls (PCBs) (CAS number 1336-36-3). There are a total of 209 PCB congeners. Thirty-three of the 209 PCB congeners are not in the library of mass spectra used by WSCF and, therefore, may be identified only as unknown compounds in the SUMMA™ and/ or TST samples. The PCB congeners which are in the library of mass spectra are listed in Appendix A. Alternatively, analysis of PUF samples for PCBs (aroclors) may be possible.

Mulkey (1999) identifies 62 inorganic and radioactive constituents of potential concern (Table C-2 in Mulkey 1999). Of the 62 constituents, only three are within the scope of this SAP. They are: ammonia, carbon monoxide, and nitrogen dioxide.

# 6.0 ORGANIZATION

The organization and responsibility of key personnel involved with these tank characterization projects are listed in Table 6-1.

**Table 6-1. Project Key Personnel**

| Responsibility | Organization | Individual |
|---|---|---|
| Data Development and Interpretation manager | River Protection Project (RPP) Process Engineering (CHG) | J. G. Field, 376-3753 |
| Process Engineering point of contact for vapor sampling | RPP Process Engineering (CHG) | L. M. Sasaki, 373-1027 |
| Vapor Sampling cognizant engineer | Characterization Field Engineering (CHG) | D. D. Wanner, 373-3297 |
| Vapor Sampling manager | Characterization Project Operations (CHG) | J. F. Sickels, 373-0259<br>R. J. Praznik, 373-7751 |
| Client Services | Analytical Services Project (FH) | K. L. Powell, 372-0939 |
| WSCF Organic Chemistry Team Lead | WSCF (FH) | R. S. Viswanath, 373-9223 |
| Analytical Production | WSCF (FH) | K. J. Greenough, 373-7194 |
| Analytical Production | 222-S Laboratory (FH) | W. I. Winters, 373-1951 |
| 222-S Laboratory Organic Chemistry Team Lead | 222-S Laboratory (FH) | B. A. Crawford, 373-1972 |
| Industrial Hygiene and Safety points of contact | Tank Farm Facilities Operations, Field Safety Services (CHG) | R. J. Fogg, 373-0630 |
| Double-Shell Tank Farm point of contact | Tank Farm Operations (CHG) | Double-Shell Tank Farm Operations shift manager, 373-2689 |
| Environmental point of contact | Environmental Services (CHG) | G. M. Crummel, 373-5175<br>C. H. Mulkey, 373-0956 |

Note:
CHG = CH2M HILL Hanford Group, Inc.

# 7.0 DELIVERABLES

Sampling and analytical results shall be reported as Format VI reports. Any analyte exceeding the notification limit prescribed in Table 3-1 shall also be reported as a Format I report. In addition, Format II reports shall be provided by CPO, and WSCF as described in Section 7.2.

## 7.1 FORMAT I REPORTING

Table 3-1 contains the notification limits for specific analytes. Analytes that exceed notification limits shall be reported by the Project Manager or delegate by calling the Double-Shell Tank Farms Operations shift manager as soon as the data are obtained and reviewed by the responsible scientist. This verbal notification must be followed within one hour by electronic notification to the Double-Shell Tank Farms Operations shift manager, the Industrial Hygiene and Safety point of contact, the RPP Process Engineering Data Development and Interpretation manager, and the Process Engineering point of contact for vapor sampling. A further review of the data, including quality control results and additional analyses for verification purposes may be contracted with the performing laboratory by either a revision to this sampling and analysis plan or by a letter.

## 7.2 FORMAT II REPORTING

The performing laboratory shall provide the results of radiological screening analyses using the standard analytical laboratory report format. The results shall be faxed to the vapor analysis team at WSCF and the Process Engineering vapor sampling point of contact within 48 hours of receipt of the samples and followed by transmittal of a copy of the results via plant mail.

Characterization Project Operations shall provide information on its sampling activities (copies of sampling data sheets, J-5 forms, chain of custody forms, and other pertinent documentation) to WSCF, the 222-S Project Coordinator, and the Process Engineering vapor sampling point of contact. The information provided shall include: the sample collection sequence and volumes, start and stop times for the collection of each sample, the VOC reading at the start of the collection of each sample event, and any anomalous sampling conditions. This information shall be provided within 48 hours of the collection of the last set of samples.

## 7.3 FORMAT VI REPORTING

The Format VI report shall consist of two deliverables, preliminary analytical results, and a final data package.

Preliminary sampling and analytical data shall be delivered within three weeks of the receipt of the samples at the laboratory. The receipt at the laboratory is defined as after radiological screening results are complete and the samples are released to the laboratory for headspace vapor analysis. In regards to any vapor analysis or extraction performed at 222-S Laboratory the turnaround for preliminary data will be 5 weeks after delivery to the 222-S Laboratory. The preliminary data shall consist of, at a minimum, data tables reporting sample collection data, particulate filter analysis results, and the results of each analysis performed by the analytical laboratory. The following individuals shall be on distribution for the preliminary results: G. M. Crummel, C. H. Mulkey, and L. M. Sasaki.

A data package shall be issued as a supporting document within ten weeks of the receipt of the samples at the laboratory. The data package shall contain the elements listed in Table 7-1. The following individuals shall be on distribution for the entire data package: R. A. Bechtold, C. H. Mulkey, G. M. Crummel, L. M. Sasaki, and A. E. Young. The following individuals require only the engineering data transmittal: I. H. Wright and J. Y. Smith.

In addition to the data package, an electronic version of the analytical results shall be provided to the Tank Vapor Database representative within 4 calendar days from the day that the final data package is issued. The data must be available to the Washington State Department of Ecology within 7 calendar days of release of the data package. The electronic version shall be in the standard electronic format specified in Bobrowski and Simonen (1999).

**Table 7-1. Data Package Required Elements (2 Sheets).**[1]

| **Prefatory Elements** |
|---|
| Executive summary |
| Table of contents |
| List of abbreviations and acronyms |
| Quality assurance data package review results |
| Non-conformance reports |
| **Sampling Elements** |
| Sampling case narrative |
| Sample summary and event chronology |
| Sampling procedures table |
| Sampling logbook table |
| Field data |
| Radiation screening results |
| Chain of custody forms |

**Table 7-1. Data Package Required Elements (2 Sheets).[1]**

| Analysis Elements |
|---|
| Analytical case narrative |
| Analytical procedures table |
| Data qualifier flag translation table |
| Target analytes concentration table |
| Tentatively identified compound concentration table |
| Laboratory blank summary |
| Field blank summary |
| Trip blank summary |
| Mass spectrometer instrument tune report |
| Target analyte initial calibration table |
| Internal standards area counts table |
| Laboratory control sample results table |
| Surrogate compounds results table |
| Quantitation reports |
| Chromatograms |
| Mass spectra of reported tentatively identified compounds |

Note:

[1]Include all elements as applicable.

## 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 Project. All significant changes shall be documented by RPP Process Engineering via a characterization change notice (see Appendix A), an engineering change notice to this sampling and analysis plan or by a letter. All changes shall also be clearly documented in the final data report. Insignificant changes may be made by placing a notation in the permanent record (i.e., note change in logbook or memorandum to file). Significance is determined by the Process Engineering point of contact for vapor sampling.

## 9.0 REFERENCES

Board, D. C., 1998, *Tank Waste Remediation System, Characterization Project, Quality Policies*, HNF-SD-WM-QAPP-025, Rev. 4, Lockheed Martin Hanford Corp. for Fluor Daniel Hanford, Inc., Richland, Washington.

Bobrowski, S. F., and C. A. Simonen, 1999, *Standard Electronic Format Specification for Tank Vapor Data MSEXCEL Spreadsheets: Version 1.0*, HNF-3815, Rev. 0, prepared by Pacific Northwest National Laboratory for Lockheed Martin Hanford Corp, Richland, Washington.

CHG, 1999, *Nonconforming Item Reporting and Control*, RPP-PRO-298, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

DOE, 1998, *Hanford Analytical Services Quality Assurance Requirements Document*, DOE/RL-96-68, Rev. 2, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Markel, L. P., 2000, *222-S Laboratory QA Plan*, HNF-SD-CP-QAPP-016, Rev. 4, Fluor Hanford, Inc, Richland, Washington.

Meznarich H. K., 1999, *Waste Sampling and Characterization Facility Quality Assurance Program Plan*, HNF-SD-CP-QAPP-017, Rev. 3, Waste Management Hanford, Inc., Richland, Washington.

Mulkey, C. H., 1999, *Data Quality Objectives for Regulatory Requirements for Hazardous and Radioactive Air Emissions Sampling and Analysis*, WHC-SD-WM-DQO-021, Rev. 1, Lockheed Martin Hanford Corp., Richland, Washington.

Reich, F. R., 2000, *Operations Test Plan for the Type 4 In-Situ Vapor Sampler (ISVS) System*, RPP-5659, Rev. 0, Prepared by COGEMA Engineering Corporation for CH2M HILL Hanford Group, Inc., Richland, Washington.

# APPENDIX A

# PCB CONGENERS IN MASS SPECTRA LIBRARY

**Table A-1. PCB Congeners in Mass Spectra Library. (5 Sheets)**

| PCB Congener | CAS Number |
|---|---|
| Biphenyl | 92-52-4 |
| 1,1'-Biphenyl, 2,2'-dichloro- | 13029-08-8 |
| 1,1'-Biphenyl, 2-chloro- | 02051-60-7 |
| 3-Chlorobiphenyl | 02051-61-8 |
| 1,1 '-Biphenyl, 4-chloro | 02051-62-9 |
| 1,1'-Biphenyl, 2,2'-dichloro- | 13029-08-8 |
| 1,1 '-Biphenyl, 2,3 -dichloro- | 16605-91-7 |
| 1,1'-Biphenyl, 2,4'-dichloro- | 34883-43-7 |
| 1,1'-Biphenyl, 2,5'-dichloro | 34883-39-1 |
| 1,1'-Biphenyl, 2,4-dichloro | 33284-50-3 |
| 1,1'-Biphenyl, 2,6-dichloro- | 33146-45-1 |
| 1,1'-Biphenyl, 3,3'-dichloro- | 02050-67-1 |
| 1,1'-Biphenyl, 3,4-dichloro- | 02974-92-7 |
| 11,1'-Biphenyl, 3,5-dichloro- | 34883-41-5 |
| 1,1'-Biphenyl, 4,4'-dichloro | 02050-68-2 |
| 1,1'-Biphenyl, trichloro- | 25323-68-6 |
| 1,1'-Biphenyl, 2,3',5-trichloro- | 38444-81-4 |
| 1,1,'-Biphenyl,2,4,4'-trichloro- | 07012-37-5 |
| 1,1'-Biphenyl, 2,4,5-trichloro- | 15862-07-4 |
| 1,1'-Biphenyl, 2,4,6-trichloro- | 35693-92-6 |
| 1,1'-Biphenyl, 2,4,5-trichloro- | 16606-02-3 |
| 1,1'-Biphenyl, 2,2,',5-trichloro- | 37680-65-2 |
| 1,1'-Biphenyl, 2,2',6-trichloro- | 38444-73-4 |
| 1,1'-Biphenyl, 2,3,3'-trichloro- | 38444-84-7 |
| 1,1'-Biphenyl, 2,3,4-trichloro- | 55702-46-0 |
| 1,1'-Biphenyl, 2,3,4'-trichloro- | 38444-85-8 |
| 1,1'-Biphenyl, 2',3,4-trichloro- | 38444-86-9 |
| 1,1'-Biphenyl, 3,4,4'-Trichloro- | 38444-90-5 |
| 1,1'-Biphenyl, tetrachloro- | 12674-11-2 |
| Biphenyl, tetrachloro- | 12672-29-6 |
| 1,1'-Biphenyl, 2,2',3,3'-tetrachloro | 38444-93-8 |
| 1,1'-Biphenyl, 2,2',4,6-Tetrachloro | 62796-65-0 |
| 1,1'-Biphenyl, 2,2',3,3'-tetrachloro | 38444-93-8 |
| 1,1'-Biphenyl, 2,2',3,5'-tetrachloro | 41464-39-5 |
| 1,1'-Biphenyl, 2,2', 3,4'-tetrachloro | 36559-22-5 |
| 1,1'-Biphenyl, 2,2',3,6'-tetrachloro- | 41464-47-5 |
| 1,1'-Biphenyl, 2,2',3,5-tetrachloro- | 70362-46-8 |
| 1,1'-Biphenyl, 2,3,4',6-tetrachloro- | 52663-58-8 |
| 1,1'-Biphenyl, 2,2',3,4-tetrachloro | 52663-59-9 |
| 1,1'-Biphenyl, 2,2',4,5'-tetrachloro- | 41464-40-8 |
| 1,1'-Biphenyl, 2,2',5,6-tetrachloro- | 41464-41-9 |

**Table A-1. PCB Congeners in Mass Spectra Library. (5 Sheets)**

| PCB Congener | CAS Number |
|---|---|
| 1,1'-Biphenyl, 2,3,3',4'-tetrachloro | 41464-43-1 |
| 1,1'-Biphenyl, 2,3',4',6-tetrachloro | 41464-46-4 |
| 1,1'-Biphenyl, 2,2',5,5'-tetrachloro | 35693-99-3 |
| 1,1'-Biphenyl, 2,3,3',5-tetrachloro | 41464-49-7 |
| 1,1'-Biphenyl, 2,3',4,6-tetrachloro | 60233-24-1 |
| 1,1'-Biphenyl, 2,2',6,6'-tetrachloro | 15968-05-5 |
| 1,1'-Biphenyl, 2,3',4,4'-tetrachloro | 32598-10-0 |
| 1,1'-Biphenyl, 2,3',4',5-tetrachloro | 32598-11-1 |
| 1,1'-Biphenyl, 2,3',5,5'-tetrachloro | 41464-42-0 |
| 1,1'-Biphenyl, 2,4,4',6-tetrachloro | 32598-12-2 |
| 1,1'-Biphenyl, 3,3',4,4'-tetrachloro | 32598-13-3 |
| 1,1'-Biphenyl, 2,3,4,4'-tetrachloro | 33025-41-1 |
| 1,1'-Biphenyl, 3,3',4,5'-tetrachloro | 41464-48-6 |
| 1,1'-Biphenyl, 3,3',5,5'-tetrachloro | 33284-52-5 |
| 1,1'-Biphenyl, 2,3,4,5-tetrachloro | 33284-53-6 |
| 1,1'-Biphenyl, 2,3,5,6-tetrachloro | 33284-54-7 |
| 1,1'-Biphenyl, 2,2',4,4'-tetrachloro | 02437-79-8 |
| 1,1'-Biphenyl, 2,2',3,3'-tetrachloro | 38444-93-8 |
| 1,1'-Biphenyl, 2,2',5,5'-tetrachloro | 35693-99-3 |
| 1,1'-Biphenyl, 2,2',4,5'-tetrachloro | 41464-40-8 |
| 1,1'-Biphenyl, 2,2',5,6'-tetrachloro | 41464-41-9 |
| 1,1'-Biphenyl, 2,3',4',5-tetrachloro | 32598-11-1 |
| 1,1'-Biphenyl, 2,3',4',5-tetrachloro | 32598-11-1 |
| 1,1'-Biphenyl, 2,3',5,5'-tetrachloro | 41464-42-0 |
| 1,1'-Biphenyl, 2,4,4',6-tetrachloro | 32598-12-2 |
| 1,1'-Biphenyl, 3,3',4,4'-tetrachloro | 32598-13-3 |
| 1,1'-Biphenyl, 2,2',3,3',6-pentachloro | 52663-60-2 |
| 1,1'-Biphenyl, 2,2',3,3',4-pentachloro | 52663-62-4 |
| 1,1'-Biphenyl, pentachloro | 25429-29-2 |
| 1,1'-Biphenyl, 2,2',3,4,5-Pentachloro | 55312-69-1 |
| 1,1'-Biphenyl, 2,2',3,4,5'-Pentachloro | 38380-02-8 |
| 1,1'-Biphenyl, 2,3,3',4',6-pentachloro | 38380-03-9 |
| 1,1'-Biphenyl, 2,2',4,5,6'-pentachloro | 68194-06-9 |
| 1,1'-Biphenyl, 2,2',3',4,6-pentachloro | 60233-25-2 |
| 1,1'-Biphenyl,pentachloro | 25429-29-2 |
| 1,1'-Biphenyl, 2,2,',3,3',5-pentachloro | 60145-20-2 |
| 1,1'-Biphenyl, 2,2',3,5,5'-pentachloro | 52663-61-3 |
| 1,1'-Biphenyl, 2,2',3,5,6-pentachloro | 73575-56-1 |
| 1,1'-Biphenyl, 2,2',4,4',5-pentachloro | 38380-01-7 |
| 1,1'-Biphenyl, 2,2',4,5',6-pentachloro | 60145-21-3 |
| 1,1'-Biphenyl, 2,2',3,4,6-pentachloro | 55215-17-3 |
| 1,1'-Biphenyl, 2,2',4,5,5'-pentachloro | 37680-73-2 |

**Table A-1. PCB Congeners in Mass Spectra Library. (5 Sheets)**

| PCB Congener | CAS Number |
|---|---|
| 1,1'-Biphenyl, 2,2',3',4,5-pentachloro | 41464-51-1 |
| 1,1'-Biphenyl, 2,2',3,5',6-pentachloro | 38379-99-6 |
| 1,1'-Biphenyl, 2,2',4,6,6'-pentachloro | 56558-16-8 |
| 1,1'-Biphenyl, 2,3',4,5',6-pentachloro | 56558-18-0 |
| 1,1'-Biphenyl, 2,3,4,5,6-pentachloro | 18259-05-7 |
| 1,1'-Biphenyl, 2',3,4,5,5'-pentachloro | 70424-70-3 |
| 1,1'-Biphenyl, 2,3,3',4,4'-pentachloro | 32598-14-4 |
| 1,1'-Biphenyl, 2,3,3',4,6-pentachloro | 74472-35-8 |
| 1,1'-Biphenyl, 2,3',4,4',5-pentachloro | 31508-00-6 |
| 1,1'-Biphenyl, 2,3,4',5,6-pentachloro | 68194-11-6 |
| 1,1'-Biphenyl, 2,3',4,5,5'-pentachloro | 68194-12-7 |
| 1,1-Biphenyl, 2,3',4,4',6-pentachloro | 56558-17-9 |
| 1,1'-Biphenyl, 2,2',4,4',6-pentachloro | 39485-83-1 |
| 1,1'-Biphenyl, 2,3,4,4',5-pentachloro | 74472-37-0 |
| 1,1'-Biphenyl, 2,3,4,4',6-pentachloro | 74472-38-1 |
| 1,1'-Biphenyl, 2,2',3,5',6-pentachloro | 38379-99-6 |
| 1,1'-Biphenyl, 2,2',3,4,5'-Pentachloro | 38380-02-8 |
| 1,1'-Biphenyl,pentachloro | 25429-29-2 |
| 1,1'-Biphenyl, 2,2',4,5,5'-pentachloro | 37680-73-2 |
| 1,1'-Biphenyl, 2,2',3',4,5-pentachloro | 41464-51-1 |
| 1,1'-Biphenyl, 2,3,3',4,4'-pentachloro | 32598-14-4 |
| 1,1'-Biphenyl, 2,2',4,5,5'-pentachloro | 37680-73-2 |
| 1,1'-Biphenyl, hexachloro | 26601-64-9 |
| 1,1'-Biphenyl, 2,2',3,3',4,6-Hexachloro | 61798-70-7 |
| 1,1'-Biphenyl, 2,2',3,5,5',6-hexachloro | 52663-63-5 |
| 1,1'-Biphenyl, 2,2',3,4,4',5'-hexachloro | 35065-28-2 |
| 1,1'-Biphenyl, 2,2',3,3',5,6'-hexachloro | 52744-13-5 |
| 1,1'-Biphenyl, 2,2',3,3',4,5-hexachloro | 55215-18-4 |
| 1,1'-Biphenyl, 2,2',3,3',4,5'-hexachloro | 52663-66-8 |
| 1,1'-Biphenyl, 2,2',3,4',5',6-hexachloro | 38380-04-0 |
| 1,1'-Biphenyl, 2,2',3,3',4,6'-hexachloro | 38380-05-1 |
| 1,1'-Biphenyl, 2,2',3,3',6,6'-hexachloro | 38411-22-2 |
| 1,1'-Biphenyl, 2,2',3,3',4,4'-hexachloro | 38380-07-3 |
| 1,1'-Biphenyl, 2,3,3',4,5,6-hexachloro | 41411-62-5 |
| 1,1'-Biphenyl, 2,3,3',4,4',5-hexachloro | 38380-08-4 |
| 1,1'-Biphenyl, 2,2',4,4',5',6-hexachloro | 60145-22-4 |
| 1,1'-Biphenyl, 2,2',4,4',5,5'-hexachloro | 35065-27-1 |
| 1,1'-Biphenyl, 2,2',3,3',5,5'-hexachloro | 35694-04-3 |
| 1,1'-Biphenyl, 2,2',3,4',5,5'-hexachloro | 51908-16-8 |
| 1,1'-Biphenyl, 2,2',3,4,5,6'-hexachloro | 68194-15-0 |
| 1,1'-Biphenyl, 2,2',3,4,4',6-hexachloro | 56030-56-9 |
| 1,1'-Biphenyl, 2,2',3'4,5,5'-hexcachloro | 52712-04-6 |

**Table A-1. PCB Congeners in Mass Spectra Library. (5 Sheets)**

| PCB Congener | CAS Number |
|---|---|
| 1,1'-Biphenyl, 2,3,3',4,4',5'-hexachloro | 69782-90-7 |
| 1,1'-Biphenyl, 2,3',4,4',5,5'-hexachloro | 52663-72-6 |
| 1,1'-Biphenyl, 2,2',3,4,4',5-hexachloro | 35694-06-5 |
| 1,1'-Biphenyl, 3,3',4,4',5,5'-hexachloro | 32774-16-6 |
| 1,1'-Biphenyl, 2,2',4,4',6,6'-hexachloro | 33979-03-2 |
| 1,1'-Biphenyl, 2,2',3,3',4,4'-hexachloro | 38380-07-3 |
| 1,1'-Biphenyl, 2,2',3,3',4,5-hexachloro | 55215-18-4 |
| 1,1'-Biphenyl, 2,2',3,5,5',6-hexachloro | 52663-63-5 |
| 1,1'-Biphenyl, 2,2',3,4,5,5'-hexachloro | 52712-04-6 |
| 1,1'-Biphenyl, 2,2',3,4,4',5'-hexachloro | 35065-28-2 |
| 1,1'-Biphenyl, 2,2',3,3',4,4'-hexachloro | 38380-07-3 |
| 1,1'-Biphenyl, 2,3,3',4,4',5-hexachloro | 38380-08-4 |
| 1,1'-Biphenyl, 2,2',4,4',5,5-hexachloro | 35065-27-1 |
| 1,1'-Biphenyl, 2,2',3,4,4',5'-hexachloro | 35065-28-2 |
| 1,1'-Biphenyl, heptachloro- | 28655-71-2 |
| 1,1'-Biphenyl, 2,2',3,3',4,5',6'-heptacloro | 52663-70-4 |
| 1,1'-Biphenyl, 2,2',3,4,4',5,6'-heptachloro | 60145-23-5 |
| 1,1'-Biphenyl, 2,2',3,3',4,5,5'-heptachloro | 52663-74-8 |
| 1,1'-Biphenyl, 2,3,3',4,4',5,6-heptachloro | 41411-64-7 |
| 1,1'-Biphenyl, 2,2',3,3',5,6,6'-heptachloro | 52663-64-6 |
| 1,1'-Biphenyl, 2,2',3,3',4,6,6'-heptachloro | 52663-65-7 |
| 1,1'-Biphenyl, 2,2',3,4',5,5',6-heptachloro | 52663-68-0 |
| 1,1'-Biphenyl, 2,2',3,4,4',5',6-heptachloro | 52663-69-1 |
| 1,1'-Biphenyl, 2,2',3,3',4,4',6-heptachloro | 52663-71-5 |
| 1,1'-Biphenyl, 2,2',3,3',4,5,6'-heptachloro | 38411-25-5 |
| 1,1'-Biphenyl, 2,2',3,4,4',5,6-heptachloro | 74472-47-2 |
| 1,1'-Biphenyl, 2,2',3,4,5,6,6'-heptachloro | 74472-49-4 |
| 1,1'-Biphenyl, 2,3,3',4,5,5',6-heptachloro | 74472-51-8 |
| 1,1'-Biphenyl, 2,3,3',4,4',5,5'-heptachloro | 39635-31-9 |
| 1,1'-Biphenyl, 2,2',3,4,5,5',6-heptachloro | 52712-05-7 |
| 1,1'-Biphenyl, 2,2',3,4,4',5,5'-heptachloro | 35065-29-3 |
| 1,1'-Biphenyl, 2,2',3,3',4,4',5-heptachloro | 35065-30-6 |
| 1,1'-Biphenyl, 2,3,3',4',5,5',6-heptachloro | 69782-91-8 |
| 1,1-Biphenyl, 2,2',3,3',4,4',5,5'-octachloro | 35694-08-7 |
| 1,1'-Biphenyl, 2,2',3,3',4,4',5,6'-octachloro | 42740-50-1 |
| 1,1'-Biphenyl, 2,2',3,3',4,5,5',6-octachloro | 68194-17-2 |
| 1,1'-Biphenyl, 2,2',3,3',5,5',6,6'-octachloro | 2136-99-4 |
| 1,1'-Biphenyl, 2,2',3,3',4,5,5',6'-octachloro | 52663-75-9 |
| 1,1'-Biphenyl, 2,2',3,3',4,5',6,6'-octachloro | 40186-71-8 |
| 1,1'-Biphenyl, 2,2',3,3',4,4',5,6'-octachloro | 52663-78-2 |
| 1,1'-Biphenyl, 2,2',3,4,4',5,6,6'-octachloro | 74472-52-9 |
| 1,1'-Biphenyl, 2,2',3,3',4,4',6,6'-octachloro | 33091-17-7 |

**Table A-1. PCB Congeners in Mass Spectra Library. (5 Sheets)**

| PCB Congener | CAS Number |
|---|---|
| 1,1'-Biphenyl, 2,2',3,3',4,5,6,6'-octachloro | 52663-73-7 |
| 1,1'-Biphenyl, 2,2',3,3',4,4',5,5'-octachloro | 35694-08-7 |
| 1,1'-Biphenyl, 2,2,',3,3',4,4',5,5'-octachloro | 35694-08-7 |
| 1,1'-Biphenyl, 2,2',3,3',4,5',6,6'-octachloro | 40186-71-8 |
| 1,1'-Biphenyl, 2,2',3,3',4,4',5,5',6-octachloro | 40186-72-9 |
| 1,1'-Biphenyl, 2,2',3,3',4,5,5',6,6'-nonachloro | 52663-77-1 |
| 1,1'-Biphenyl, 2,2',3,3',4,4',5,6,6'-nonachloro | 52663-79-3 |
| 1,1'-Biphenyl, 2,2',3,3',4,4',5,5',6-nonachloro | 40186-72-9 |
| Decachlorobiphenyl | 02051-24-3 |

# APPENDIX B

# CHARACTERIZATION CHANGE NOTICE FORM

# CHARACTERIZATION CHANGE NOTICE

**Document:** ______________________________________________
______________________________________________

**Change Number:** ______________

**ECN to TSAP Required?** ______________

**Requestor:** ______________________ **Date:** ____________________

**Samples Impacted:**

**Proposed Change:**

**Reason for Change:**

**Date Change Effective:**

**Schedule Impact:**

**Authorization:**

| | | |
|---|---|---|
| **Tank Coordinator:** | ________________________ | **Date:**__________ |
| **Project Coordinator:** | ________________________ | **Date:**__________ |
| **222-S Client Services:** | ________________________ | **Date:**__________ |
| **Other:** | ________________________ | **Date:**__________ |

# DISTRIBUTION SHEET

| To | From | Page 1 of 2 |
|---|---|---|
| Distribution | Data Development and Interpretation | Date 05/18/00 |
| **Project Title/Work Order** | | **EDT No.** EDT-628397 |
| RPP-6264, Rev. 0, "Double-Shell Tank Ventilation System Vapor Sampling and Analysis Plan" | | **ECN No.** N/A |

| Name | MSIN | Text With All Attach. | Text Only | Attach./ Appendix Only | EDT/ECN Only |
|---|---|---|---|---|---|
| <u>CH2M Hill Hanford Group, Inc.</u> | | | | | |
| W. L. Adams | S6-15 | X | | | |
| D. G. Baide | S5-05 | X | | | |
| C. M. Crummel | R1-51 | X | | | |
| C. DeFigh-Price | R2-12 | X | | | |
| J. G. Field | R2-12 | X | | | |
| N. L. Hulse | R2-12 | X | | | |
| S. G. McKinney | R2-12 | X | | | |
| C. H. Mulkey | R1-51 | X | | | |
| D. M. Nguyen | R2-12 | X | | | |
| J. H. Rasmussen | R2-12 | X | | | |
| L. M. Sasaki | R2-12 | X | | | |
| J. F. Sickels | S7-03 | X | | | |
| A. M. Templeton | R2-12 | X | | | |
| R. R. Thompson | R2-12 | X | | | |
| D. D. Wanner | S7-12 | X | | | |
| T.C.S.R.C. | R1-10 | X | | | |
| <u>Cogema</u> | | | | | |
| L. A. Pingel | S3-31 | X | | | |
| <u>Fluor Hanford</u> | | | | | |
| R. Akita | T6-50 | X | | | |
| M. W. Barnes | S3-30 | X | | | |
| K. E. Bell | T6-12 | X | | | |
| L. A. Burchfield | T6-12 | X | | | |
| G. A. Clark | T6-12 | X | | | |
| B. A. Crawford | T6-50 | X | | | |
| R. A. Esch | T6-12 | X | | | |
| R. K. Fuller | T6-12 | X | | | |
| K. J. Greenough | S3-30 | X | | | |
| C. L. Ma | S3-30 | X | | | |
| K. L. Powell | S3-30 | X | | | |
| F. H. Steen | T6-12 | X | | | |
| R. S. Viswanath | S3-30 | X | | | |
| <u>Lockheed Martin Services, Inc.</u> | | | | | |
| Central Files | B1-07 | X | | | |
| <u>Numatec</u> | | | | | |
| L. L. Lockrem | T6-07 | X | | | |
| W. I. Winters | T6-07 | X | | | |

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| Project Title/Work Order | | EDT No. EDT-628397 |
| RPP-6264, Rev. 0, "Double-Shell Tank Ventilation System Vapor Sampling and Analysis Plan" | | ECN No. N/A |

| Name | MSIN | Text With All Attach. | Text Only | Attach./ Appendix Only | EDT/ECN Only |
|---|---|---|---|---|---|
| <u>Office of River Protection</u> | | | | | |
| W. Liou | H6-60 | X | | | |
| DOE Reading Room | H2-53 | X | | | |
| <u>Waste Management Services of Hanford</u> | | | | | |
| S. N. Bakhtiar | T6-12 | X | | | |